ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD
Revision 1

CRIB HOUSE/FOREBAY BASEMENT
SURVEY UNIT 08100

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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
AMCG	Average Member of the Critical Group
BFM	Basement Fill Model
DQA	Data Quality Assessment
DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
EMC	Elevated Measurement Comparison
FOV	Field of View
FSS	Final Status Survey
GPS	Global Positioning System
HTD	Hard-to-Detect
IC	Insignificant Contributor
ISOCS	In Situ Object Counting System
LTP	License Termination Plan
LBGR	Lower Bound of the Gray Region
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NAD	North American Datum
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
QAPP	Quality Assurance Project Plan
QC	Quality Control
RE	Radiological Engineer
ROC	Radionuclides of Concern
SOF	Sum of Fractions
TEDE	Total Effective Dose Equivalent

UBGR	Upper Bound of the Gray Region
UCL	Upper Confidence Level
USNRC	United States Nuclear Regulatory Commission
VSP	Visual Sample Plan
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for survey unit 08100, "Crib House/Forebay" basement survey unit, has been generated for the Zion Station Restoration Project (ZSRP) in accordance with Zion*Solutions* procedure ZS-LT-300-001-005, *"Final Status Survey Data Reporting"* (Reference 1) and satisfies the requirements of Section 5.11 of the *"Zion Station Restoration Project License Termination Plan"* (LTP) (Reference 2). The FSS package for basement survey unit 08100, "Crib House/Forebay," includes FSS design and results for the following:

- B3-08101A Crib House/Forebay Structural Surfaces
- B3-08102A Unit 1 Circulating Water Intake Pipe
- B3-08102B Unit 2 Circulating Water Intake Pipe
- B3-08401A Forebay Submerged Surfaces

FSS sample plans for each of these survey units were developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and with guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

In accordance with ZSRP LTP, Section 5.5.2.1.2 and Table 5-19, the Crib House/Forebay basement 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 (α) and Type II (β) decision error rates were set at 0.05. The Canberra *In Situ* Object Counting System (ISOCS) was selected as the primary instrument used to perform FSS of the Crib House/Forebay basement survey unit. As a random sample population, fourteen (14) randomly located static ISOCS measurement locations were designated on accessible structural surfaces within the survey unit. The surface area of the Forebay was deemed as not accessible at the time of the initial FSS of the Crib House as it was flooded and hydraulically connected to Lake Michigan. Based on a measurement Field of View (FOV) of 28 m^2 for each random ISOCS measurement, the areal scan surface coverage for the measurements equated to 392 m^2, or approximately 3% of the total surface area of the Crib House/Forebay basement survey unit (18,254 m^2). In addition, two (2) judgmental ISOCS measurements were taken inside each of the Unit 1 and Unit 2 Circulating Water Intake Pipes, each with a FOV of 78 m^2 per measurement, or an additional 312 m^2 of areal scan surface coverage.

The Forebay surface area that was, and continues to be, submerged equated to a surface area of 5,407 m^2, or 30% of the total surface area of the Crib House/Forebay basement survey unit. Zion*Solutions* TSD 17-006, "*Underwater Survey Methodology for Zion Nuclear*

Station Crib House/Forebay Basement Final Status Survey Unit" (Reference 5) was developed for the use of scintillation detectors in dry tubes to acquire radiological data for FSS of the submerged wall surfaces. Fourteen (14) judgmental measurements were taken at biased locations within the Forebay using this survey approach.

The results for all ISOCS and gross gamma measurements (random and judgmental) taken in the Crib House/Forebay basement survey unit indicate that the Sum of Fractions (SOF) for each measurement, considering the concentration of all applicable Radionuclides of Concern (ROC), either by direct measurement or by inference, is less than 0.1 when applying the respective Operational Derived Concentration Guideline Levels (OpDCGL) for the Crib House/Forebay from Zion*Solutions* TSD 17-004, "*Operational Derived Concentration Guideline Levels for Final Status Survey*" (Reference 6). Therefore, the null hypothesis is rejected and the Crib House/Forebay basement survey unit is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

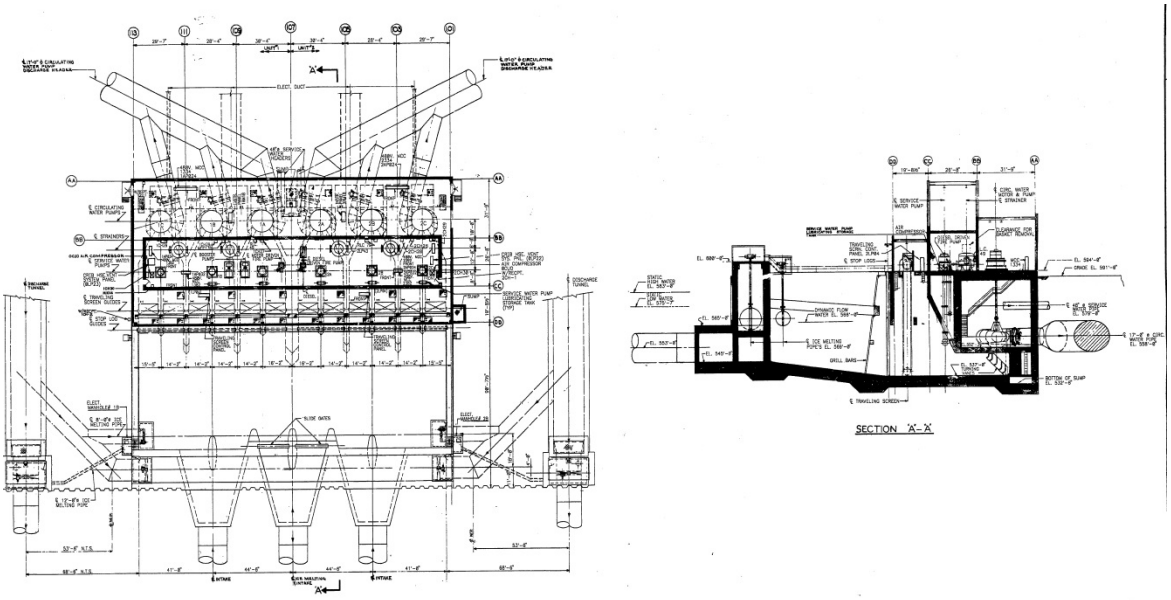
The Crib House/Forebay basement survey unit is a Class 3 basement FSS unit. A basement FSS unit is comprised of the combined internal wall and floor surfaces of each remaining building basement below the 588-foot elevation following demolition. The Crib House/Forebay basement structure is located within Class 1 open land survey units 12204A, 12204B and 12204C.

PICTURE 1 CRIB HOUSE 559 FT ELEVATION

The 552 foot and 559 foot elevations of the Crib House contained the upper pump housings of the six (6) circulatory pumps, three (3) for Unit 1 and three (3) for Unit 2 that provided cooling water from Lake Michigan to various heat exchangers and condensers in the Turbine Building and Auxiliary Building. In addition, the intake/outtake plenum under the Crib House contained the cooling water outlet from these systems back into the lake. The 552 foot elevation also contained the Crib House sumps and sump system components which served as the collection point for the Crib House drain piping.

Prior to demolition, the Crib House was comprised of two main elevations, the 594-foot elevation, which was constructed using cinderblock walls and the 559-foot elevation, which was constructed of concrete walls and floors. The basement 559-foot elevation consisted of a room measuring 171 feet long by 37.5 feet wide, resulting in a floor surface area of 6,412.5 ft^2 or 595.74 m^2. The basement was accessed by two stairways, one to the north and one to the south from the Crib House 594-foot elevation. The room could also be accessed by a hoist-well from the 594-foot elevation that was located between Circulation Pumps 1A and 2A. The west portion of the basement was sunken to a depth of 552-foot elevation, which housed the sumps and sump pump system valves. The remainder of the 559 foot elevation was mostly unencumbered with the exception of the pump housings from each of the circulation pumps protruding from the floor.

PICTURE 2 CRIB HOUSE ENGINEERING PRINT



The engineering drawings of the 559-foot and 552-foot elevations indicated that the concrete walls were 4 feet thick and the floor was 2 feet and 6 inches think. The concrete floor was covered with a grey paint. Standing water, to a depth of approximately ¼ inch,

surrounded several of the sumps on the 552-foot elevation. In addition, the floor paint at several locations was discolored, indicating frequent contact with water. The 559-foot elevation was dry and relatively free of discoloration. Several catwalks and system piping were suspended from the ceiling of the room. All utilities, including electrical and drain systems were external from the concrete structure and were not embedded.

The Forebay structure was built to house and protect offshore water intakes providing cooling water from Lake Michigan to the Circulating Water Pumps, which in turn supplied various heat exchangers and condensers in the Turbine Building. It consisted of poured concrete walls, plate steel reinforcements and steel flow restriction gates along with associated conduits, piping and mechanical actuators. These walls and components began at approximately 596-foot elevation and extended to approximately 537-foot elevation with a mean Lake Michigan level of 577-foot elevation.

PICTURE 3 FOREBAY

The Circulating Water Pumps took suction on the Forebay and pumped cooling water into the Circulating Water Intake Pipes. The Circulating Water Intake Pipes entered the east side of the Turbine Building beneath the Condenser Water Boxes. The interior surface area of the Circulating Water Intake piping was 4,412 m^2, but the only portions that were accessible were the two vertical lengths of 9 feet diameter piping (in each unit) from the 588-foot elevation to the 558-foot elevation (approximate surface area of 158 m^2).

The Circulating Water Intake Pipes are also located within Class 1 open land Survey Units 12205A, 12205B, 12205C, 12205D and 12205E. The boundaries of the Crib House

basement footprint were defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East.

3. CLASSIFICATION BASIS

The Crib House/Forebay survey unit 08100 was initially classified in the *"Zion Station Historical Site Assessment"* (HSA) (Reference 7). The interior 552-foot and 559-foot elevation concrete surfaces in the basement structure survey unit were originally designated as non-impacted. The Crib House/Forebay survey unit was not located in a radiologically controlled area. In addition, no radiological postings or labeled radioactive material were identified in or around the Crib House/Forebay structure, and a Radiation Work Permit (RWP) was not required for entry. The HSA classified the exterior of the building as well as the grounds surrounding the building as MARSSIM Class 2. The HSA classified the Circulating Water Intake Pipe interior surfaces as Class 3.

Fixed residual radioactive material was discovered on the 594-foot elevation of the Crib House in 1985. In addition, the Circulatory Water system was the normal effluent release pathway for the facility during operation. Based upon use, location and previous findings, the MARSSIM classification for the interior of the Crib House was changed from its original classification of non-impacted to a MARSSIM impacted Class 2 classification in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 8).

As part of Site Characterization, Zion*Solutions* acquired and analyzed twenty (20) concrete core samples taken from the 559-foot elevation of the Crib House in March and April of 2012. Sixteen (16) 6-inch concrete core samples were taken from the floors, and four (4) 6-inch concrete core samples were taken from the lower walls. Sample locations were selected at random. Prior to acquiring the core samples, the area was scanned to ensure the absence of surface radioactive contamination at each sample location. Scans were performed with a Ludlum 43-93 100 cm^2 alpha-beta scintillation detector. Gross beta background ranged from 150 cpm to 300 cpm. No activity greater than background was observed by scan. All concrete core samples were analyzed by the on-site gamma spectroscopy system for gamma-emitting radionuclides. Only natural activity expected in background was detected during the analysis. No licensed materials were identified in the samples.

A summary of the analyses results for the concrete core 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)
Maximum Value :	9.24E-02	1.44E-01
Mean :	7.00E-02	1.20E-01
Standard Deviation :	1.07E-02	1.84E-02

On November 17 and 18, 2014, six (6) samples were taken of sediment from the Forebay and Crib House basement while divers were used to install cofferdams and plugs. Analysis of the samples indicated the presence of Cs-137 at concentrations ranging from less than Minimum Detectable Concentration (MDC) to 1.09E-01 pCi/g. No other plant-derived radionuclides were detected.

The Crib House above the 588-foot elevation was surveyed for unconditional release in January and February of 2015. Once it was demonstrated that the Crib House internal surfaces were suitable for unconditional release, a demolition contractor salvaged clean equipment out of the Crib House. Unrestricted release surveys were performed in March of 2015 on equipment removed prior to and during the demolition of the upper levels of the Crib House, including the Circulating Water pumps 1A and 1B, Butterfly Disk 1C, Turning Vanes, Rotating Assembly and the interior of the Circulating Water Intake Pipes from the 552 foot elevation of the Crib House. All smear and direct readings were less than MDC. The Crib House structural concrete and cinder block above the 588-foot elevation was also surveyed to demonstrate that the material was free of plant-derived radionuclides at concentrations greater than background. The concrete and cinderblock Crib House structure above the 588 foot elevation was demolished and stockpiled to be used as clean hard fill.

Consistent with Section 5.5.2.1 of the LTP, the classification for this survey unit was changed from its original classification to Class 3. The survey units and classifications designated for structures below 588-foot elevation from the HSA that were presented in LTP, Table 2-2 were based on screening values and source term assumptions that are significantly different from the Basement Fill Model (BFM) and were therefore not applicable. At the time of LTP submittal, the Forebay and the Circulating Water Intake Piping were completely underwater and not accessible. Process knowledge and the results of environmental monitoring of radiological conditions at effluent outfalls in the past indicate that the probability of residual radioactivity in these FSS units exceeding 50% of the $OpDCGL_B$ for the Crib House/Forebay was very low.

The FSS unit for the basement of the Crib House/Forebay and the Circulating Water Intake Pipe were designated as Class 3 as defined in MARSSIM, Section 2.2 in that the FSS unit was not expected to contain any residual radioactivity, or expected to contain levels of

residual radioactivity at a small fraction of the DCGLs, based on site operating history and previous radiation surveys. The Crib House/Forebay basement FSS unit would be subjected to an areal coverage commensurate with the guidance pertaining to Class 3 scan coverage as presented in MARSSIM, Table 5.9, which states that the scan coverage guidance is "judgmental." In this context, judgmental areal coverage was defined as sufficient ISOCS measurements to ensure that at least 1% of the surface area in each survey unit was subjected to FSS.

A Radiological Engineer (RE) performed a visual inspection and walk-down of the survey unit on June 25, 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 at concentrations greater than 50% of the OpDCGLs, justifying a final survey unit classification of Class 3.

At the time of FSS, the Forebay was still submerged. Following completion of FSS and once compliance with the unrestricted release criteria was successfully demonstrated, the Forebay walls were demolished to the 588-foot elevation and the Forebay was backfilled with clean fill. The Circulating Water Intake piping has also been filled with grout.

4. DATA QUALITY OBJECTIVES (DQO)

FSS planning and design hinges on coherence with the Data Quality Objective (DQO) process to ensure, through compliance with explicitly defined inputs and boundaries, that the primary objective of the survey is satisfied. The DQO process, utilized in accordance with MARSSIM is described in the ZSRP LTP. The appropriate design for a given survey was developed using the DQO process as outlined in Appendix D of MARSSIM.

The DQO process incorporated hypothesis testing and probabilistic sampling distributions to control decision errors during data analysis. Hypothesis testing is a process based on the scientific method that compares a baseline condition to an alternate condition. The baseline condition is technically known as the null hypothesis. Hypothesis testing rests on the premise that the null hypothesis is true and that sufficient evidence must be provided for rejection. In designing the survey plan, the underlying assumption, or null hypothesis, was that residual activity in the survey unit exceeded the release criteria. Rejection of the null hypothesis would indicate that residual activity within the survey unit does not exceed the

release criteria. Therefore, the survey unit would satisfy the primary objective of the FSS sample plan.

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in survey unit 08100 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).

Zion*Solutions* TSD 11-001, *"Technical Support Document for Potential Radionuclides of Concern During the Decommissioning of the Zion Station"* (Reference 9) 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 described contamination levels in the basements. The survey data for basements is based on core samples obtained at biased locations with elevated contact dose rates and/or evidence of leaks/spills and analyzed for the presence of plant-derived radionuclides. Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 10) evaluates the results of the concrete core analysis data from the Containments and Auxiliary Building and refines the initial suite of potential ROC by evaluating the dose significance of each radionuclide.

LTP, 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 Crib House/Forebay structural surfaces and the normalized mixture fractions based on the radionuclide mixture.

Table 2 - Dose Significant Radionuclides and Mixture

Radionuclide	% of Total Activity (normalized)(1)(2)
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 structures.

The end state basements will be comprised of steel and/or concrete structures which will be covered by at least three feet of clean soil and physically altered to a condition which would not realistically allow the remaining structures, if excavated, to be occupied. The exposure pathways in the BFM are associated with residual radioactivity in floors and walls that is released through leaching into water contained in the interstitial spaces of the fill material. The BFM assumes that the inventory of residual radioactivity in a given building is released either instantly or over time by diffusion, depending on whether the activity is surficial or volumetric, respectively. The activity released into the fill water will adsorb onto the clean fill, as a function of the radionuclide-specific distribution coefficients, resulting in equilibrium concentrations between the fill and the water. Consequently, the only potential exposure pathways after backfilling, assuming the "as-left" geometry, are associated with the residual radioactivity in the water contained in the fill.

The final outputs of the BFM are the Basement Derived Concentration Guideline Levels (DCGL), in units of pCi/m^2, which are calculated using the BFM Groundwater (GW) and BFM Drilling Spoils Dose Factors. DCGLs are calculated separately for the GW and Drilling Spoils scenarios and for the summation of both scenarios. The summation DCGL is designated as the Base Case DCGL (BcDCGL) and is used during FSS to demonstrate compliance (analogous to the $DCGL_W$ as defined in MARSSIM). The BcDCGLs are radionuclide-specific concentrations that represent the 10 CFR 20.1402 dose criterion of 25 mrem/year and are calculated for each ROC and each backfilled basement.

When applied to structures, the DCGLs are expressed in units of activity per unit of area (pCi/m^2). 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 BcDCGLs for the unrestricted release of the Crib House/Forebay basement survey unit are provided in Table 3. The IC dose percentage of 5% was used to adjust the Crib House/Forebay Basement BcDCGLs to account for the dose from the eliminated IC radionuclides.

Table 3 - Base Case DCGLs for Crib House/Forebay Structural Surfaces ($BcDCGL_B$) from LTP Chapter 5, Table 5-3

Radionuclide	Base Case DCGL (pCi/m^2)
Co-60	5.52E+07
Cs-134	2.13E+07
Cs-137	2.96E+07
Ni-63	3.25E+09
Sr-90	1.16E+06

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

The OpDCGLs for the unrestricted release of the Crib House/Forebay basement survey unit are provided in Table 4.

Table 4 - Operational DCGLs for Crib House/Forebay Structural Surfaces ($OpDCGL_B$) from LTP Chapter 5, Table 5-4

Radionuclide	Operational DCGL (pCi/m^2)
Co-60	2.13E+07
Cs-134	8.20E+06
Cs-137	1.14E+07
Ni-63	1.25E+09
Sr-90	4.47E+05

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest relative to the OpDCGL. The Canberra ISOCS was selected as the primary instrument used to perform FSS of basement surfaces. 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." For radionuclides less than MDC, the value representing the highest abundance was selected. Results were not reported as "less than MDC." Sample report summaries included unique sample identification, analytical method, radionuclide, result, uncertainty, laboratory data qualifiers, units, and the observed MDC.

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

5. SURVEY DESIGN

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

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 08100. During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63 and Sr-90 are inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90, and Co-60 is the principle surrogate radionuclide for Ni-63. The

mean, maximum and 95% Upper Confidence Level (UCL) of the surrogate ratios for concrete core samples taken in the Auxiliary Building basement were calculated in TSD 14-019 and are presented in Table 5. The maximum ratios will be used in the surrogate calculations during FSS unless area specific ratios are determined by continuing characterization.

Table 5 - 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 08100, the surrogate OpDCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 5.

The equation for calculating a surrogate DCGL is as follows:

Equation 1

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

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

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

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

Using the Operational DCGLs presented in Table 4 and the maximum ratios from Table 5, the following surrogate calculations were performed:

Equation 2

$$Surrogate_{DCGL\ (Cs-137)} = \frac{1}{\left[\left(\frac{1}{1.14E+07_{(Cs-137)}}\right) + \left(\frac{0.002}{4.47E+05_{(Sr-90)}}\right)\right]} = 1.08E+07\ pCi/m2$$

The surrogate OpDCGL that was used for Cs-137 in this survey unit for direct comparison of measurement results to demonstrate compliance is 1.08E+07 pCi/m^2.

Equation 3

$$Surrogate_{DCGL\,(Co-60)} = \frac{1}{\left[\left(\frac{1}{2.13E+07_{(Co-60)}}\right)+\left(\frac{180.45}{1.25E+09_{(Ni-63)}}\right)\right]} = 5.23E+06\ pCi/m2$$

The surrogate OpDCGL that was used for Co-60 in this survey unit for direct comparison of measurement results to demonstrate compliance is 5.23E+06 pCi/m^2.

The action level for investigation in a Class 3 basement structure survey unit is 50% of the OpDCGL. The action levels for survey unit 08100 are presented in Table 6.

Table 6 - Action Levels for Survey Unit 08100

ROC	DCGL (pCi/m^2)
Co-60 (1)	2.61E+06
Cs-134 (2)	4.10E+06
Cs-137 (3)	5.40E+06

(1) Based on 50% of surrogate adjusted DCGL of 5.23E+06 pCi/m^2 for Co-60 while inferring Ni-63
(2) Based on 50% of Operational DCGL
(3) Based on 50% of surrogate adjusted DCGL of 1.08E+07 pCi/m^2 for Cs-137 while inferring Sr-90

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. At the ZSRP, EMC only applies to soils as all other media (structural surfaces, embedded pipe, buried pipe and penetrations) will be remediated to their applicable BcDCGL. In addition, survey unit 08100 is a Class 3 basement survey unit and discrete, elevated areas of contamination were not expected.

Sample size determination for FSS of basement surfaces is addressed in LTP, Section 5.5.2.2. To ensure that the number of ISOCS measurements based on the necessary areal coverage in a basement surface FSS unit was sufficient to satisfy a statistically based sample design, a calculation was performed to determine sample size. If the sample size based on the statistical design required more ISOCS measurements than the number of ISOCS measurement required by the areal coverage, then the number of ISOCS measurements was adjusted to meet the larger sample size.

Following the guidance in MARSSIM, the Type I decision error that was used for this calculation was set at 0.05 and the Type II decision error was set at 0.05. The Upper Bound of the Gray Region (UBGR) was set at the $OpDCGL_B$. The Lower Bound of the Gray Region (LBGR) was set at the expected fraction of the $OpDCGL_B$. The expected fraction of the $OpDCGL_B$ in a Class 3 FSS basement unit was set at 1%. The standard deviation of the concrete core samples taken in the Crib House was used for sigma (σ) for the Crib House/Forebay.

The relative shift (Δ/σ) was calculated as discussed in LTP, Section 5.6.4.1.6. The Δ/σ for the survey unit data set is defined as shift (Δ), which is the UBGR, or the $OpDCGL_B$ (SOF of 1), minus the LBGR (SOF of 0.01), divided by sigma (σ), which is the standard deviation of the data set used for survey design. The optimal value for Δ/σ should range between 1 and 3. The largest value the Δ/σ can have is 3. If the Δ/σ exceeds 3, then the value of 3 will be used for Δ/σ.

The Δ/σ was greater than three (3). Consequently, a value of three was used as the adjusted Δ/σ. From Table 5-5 of MARSSIM, the required number of measurements (N) for use with the Sign Test, using a value of 0.05 for the Type I and Type II decision errors, is fourteen (14) measurements for a Δ/σ value of three. Consequently, the number of ISOCS measurements in Crib House/Forebay basement surface FSS unit was adjusted to meet the larger sample size. Table 7 presents the Crib House/Forebay basement surface FSS unit from LTP, Table 5-19 and the adjusted number of ISOCS measurements required.

Table 7 - Adjusted Minimum Number of ISOCS Measurements

FSS Unit	Classification	Required Areal Coverage (m^2)	Adjusted # of ISOCS Measurements (FOV-28 m^2)	Adjusted Areal Coverage (m^2)	Adjusted Areal Coverage (% of Area)
Crib House/Forebay	Class 3	138	14	392	3%

A Prospective Power Curve was generated using MARSSIM 2000, a software package developed for the implementation of MARSSIM in support of the decommissioning license termination rule (10CFR20, Subpart E). The result of the MARSSIM 2000 computer run showed adequate power for the survey design. The survey design specified fourteen (14) ISOCS measurements for non-parametric statistical testing.

As the survey unit was classified as Class 3, sample locations were selected at random. The random locations were selected using Visual Sample Plan (VSP), in accordance with ZS-LT-300-001-001. Input parameters included use of a grid layout and the random sampling tool set with a predetermined number (14) of sample points. Measurement locations for the

ISOCS measurements taken for random design are listed with the grid coordinates in Table 8.

Revision 2 of ZSRP LTP, Section 5.1 states that concrete core samples will be collected during FSS to confirm the HTD to surrogate radionuclide ratios. The FSS of the Crib House/Forebay basement walls and floors were completed prior to issuance of Revision 2 of the LTP when this commitment was made. The upper levels of the Crib House were demolished and removed, and the basement below the 588-foot elevation was backfilled and is no longer accessible. Therefore, no concrete core samples were acquired during FSS of the Crib House/Forebay. However, as previously stated, Zion*Solutions* acquired and analyzed twenty (20) concrete core samples taken from the 559-foot elevation of the Crib House in March and April of 2012 during site characterization. No plant-derived radioactivity was positively identified at detectable concentrations in any of these samples.

Table 8 - Random ISOCS Measurement Locations

MEASUREMENT ID	GRID NO.
B3-08101A-FRWC-001-GM	666
B3-08101A-FRWC-002-GM	70
B3-08101A-FRWC-003-GM	1046
B3-08101A-FRFC-004-GM	208
B3-08101A-FRWC-005-GM	150
B3-08101A-FRWC-006-GM	742
B3-08101A-FRWC-007-GM	32
B3-08101A-FRWC-008-GM	251
B3-08101A-FRFC-009-GM	172
B3-08101A-FRWC-010-GM	1149
B3-08101A-FRWC-011-GM	286
B3-08101A-FRFC-012-GM	830
B3-08101A-FRWC-013-GM	429
B3-08101A-FRWC-014-GM	13
B3-08101A-FQWC-014-GM	13

Fourteen (14) ISOCS measurements were required for the non-parametric statistical test (sample size N = 14). The activity in the Unit 1 and Unit 2 Circulating Water Intake Pipes are included with the Crib House/Forebay basement survey unit through the DCGL

calculation. The Circulating Water Intake Pipes are located on the south end of the Turbine Building, beneath the Condenser Water Boxes, on the 583-foot elevation. Access to the Circulating Water Intake Pipes was limited; therefore, these areas were surveyed as biased areas using judgmental measurements. The area-weighted mean activity of the judgmental sample population in the Unit 1 and Unit 2 Circulating Water Intake Pipes was added to the random mean activity of the Crib House/Forebay FSS unit results (see Section 14). Sample plans B3-08102A-S and B3-08102B-S were generated for the acquisition of the judgmental ISOCS measurements in these pipes.

The survey units for the Circulating Water Intake Pipes consisted of the east and west sections of both Unit 1 and Unit 2 Intake Pipes. The interior of each pipe had a surface area of 440 m^2, but the only accessible portions of the survey unit were the two vertical lengths of 9-foot diameter piping from the 588-foot elevation to the 558-foot elevation (approximate surface area of 158 m^2). In order to allow access for the ISOCS, a hole was cut into each of the two pipes at the 588-foot elevation. The ISOCS was secured at 90 degrees looking down the 30-foot length of pipe, resulting in a FOV of 78 m^2. Locations for the ISOCS measurements taken in the Circulating Water Intake Pipes are listed in Table 9.

Table 9 - Circulating Water Intake Pipe Judgmental Measurement Locations

MEASUREMENT ID	GRID NO.
B3-08102AS-FJSM-001-GD	01
B3-08102AS-FJSM-002-GD	02
B3-08102AS-FQSM-002-GD	02
B3-08102BS-FJSM-001-GD	01
B3-08102BS-FJSM-002-GD	02

A map of the judgmental ISOCS measurement locations for the Circulating Water Intake Pipes is provided in Attachment 1.

The Forebay surface area that was submerged equated to a surface area of 5,407 m^2, or 30% of the total surface area of the Crib House/Forebay basement survey unit. While the surfaces of the Forebay were not accessible for random measurements, due to the large surface area involved, additional judgmental measurements were acquired of the submerged wall surfaces using scintillation detectors in dry tubes for FSS. Sample plan B3-08401A-F was generated for the acquisition of 14 judgmental measurements at biased locations within the Forebay using this survey approach. The mechanics of the survey approach are further described in TSD 17-006. Judgmental locations for the measurements taken with scintillation detectors inside the Forebay are listed with a description of the location in Table 10.

The implementation of quality control measures as referenced by LTP, Section 5.9 and Zion*Solutions* ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (QAPP) (Reference 11) includes the collection of a replicate measurement at 5% of the measurements taken in a survey unit with the locations selected at random. One ISOCS measurement, B3-08101A-FQWC-014-GM was selected randomly for the replicate measurement. An additional replicate ISOCS measurement, B3-08102AS-FQSM-002-GD was selected for the judgmental measurements taken in the Circulating Water Intake Pipe. As part of the Forebay survey, an additional replicate measurement was also acquired at location B3-08401A-FJQC-014-GD.

Table 10 - Forebay Judgmental Measurement Locations

MEASUREMENT ID	DESCRIPTION
B3-08401A-FJWC-001-GD	Pier 1, South Side, 2 feet below water line
B3-08401A-FJWC-002-GD	Pier 2, North Side, 2 feet below water line
B3-08401A-FJWC-003-GD	Pier 2, South Side, 2 feet below water line
B3-08401A-FJWC-004-GD	Pier 3, North Side, 2 feet below water line
B3-08401A-FJWC-005-GD	Pier 3, South Side, 2 feet below water line
B3-08401A-FJWC-006-GD	Pier 4, North Side, 2 feet below water line
B3-08401A-FJWC-007-GD	Pier 4, South Side, 2 feet below water line
B3-08401A-FJWC-008-GD	Pier 5, North Side, 2 feet below water line
B3-08401A-FJWC-009-GD	5th Screen Box, NW, 2 ft. below water line
B3-08401A-FJWC-010-GD	Southeast Wall corner, 2 ft. below water line
B3-08401A-FJWC-011-GD	East Wall Platform, 2 ft. below water line
B3-08401A-FJWC-012-GD	East Wall Platform, 2 ft. below water line
B3-08401A-FJWC-013-GD	East Wall Platform, 2 ft. below water line
B3-08401A-FJWC-014-GD	Northeast Wall corner, 2 ft. below water line
B3-08401A-FJQC-014-GD	Northeast Wall corner, 2 ft. below water line

The areal coverage requirements for FSS of structures as specified in the LTP is commensurate with the probability that a small area of elevated activity could exist within a FSS unit in a concentration exceeding the BcDCGL and the likelihood that such an area would not be detected by the FSS ISOCS measurements. It is highly unlikely that the ISOCS, with a nominal FOV of approximately 28 m^2, would not detect and account for elevated areas. The primary basis used to determine reasonable areal coverage for the ISOCS measurements is the potential for the OpDCGL to be exceeded. The criterion for

selecting reasonable and risk-informed areal coverage is based on a graded approach similar to the guidance for scan surveys during FSS provided in MARSSIM, where the coverage is based on the expected fraction of the DCGL (in this case, OpDCGL).

As a Class 3 survey unit, LTP, Table 5-19, reproduced as Table 7, specifies that a minimum of 392 m^2 or 3% of the accessible surface area in this structural basement survey unit will be subjected to scan coverage. The surface area covered by a single ISOCS measurement is large (a nominal range of 10-30 m^2), and the FOV of the measurement becomes a substitute for scanning that is typically performed by moving a hand-held detector over the surface in question. Fourteen (14) random ISOCS measurements were taken of Crib House basement surfaces at a stand-off distance of 3 meters. This resulted in a FOV for each measurement of 28 m^2. The total areal coverage represented by the 14 ISOCS measurements was 392 m^2. In addition, 4 judgmental measurements were taken with the ISOCS secured at 90 degrees looking down the 30-foot length of Circulating Water Intake Pipe, resulting in a FOV for each measurement of 78 m^2. These measurements added an additional surface area of 312 m^2 to the surface area in this survey unit that was subjected to areal scan coverage. The 704 m^2 area actually scanned (by ISOCS FOV) represents approximately 4% of the total surface area (18,254 m^2) of the survey unit. A map of the surface area scanned by the ISOCS FOV is provided in Attachment 1.

For this Class 3 basement structure survey unit, the "Investigation Levels" for ISOCS measurement results are those levels specified in LTP, Table 5-25, and are reproduced below in Table 11.

Table 11 - Investigation Levels

Classification	Direct Measurement
Class 3	>0.5 OpDCGL

Table 12 provides a synopsis of the survey design for survey unit 08100.

Table 12 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Surface Area	18,254 m^2	LTP, Table 5-23
Number of Measurements (N)	14 (random)	• σ = 3.66E-09 • UBGR = SOF of 1 • LBGR = SOF of 0.01 • Type I error = 0.05 • Type II error = 0.05 • Δ/σ = 3 (adjusted) MARSSIM Table 5.5
Grid Spacing	Random	LTP, section 5.6.4.5.2
DCGLs	Co-60 – 2.13E+07 pCi/m^2 Cs-134 – 8.20E+06 pCi/m^2 Cs-137 – 1.14E+07 pCi/m^2 Ni-63 – 1.25E+09 pCi/m^2 Sr-90 – 4.47E+05 pCi/m^2	Operational DCGLs for Crib House/Forebay, LTP, Table 5-4
Investigation Level	>0.5 Operational DCGL	LTP, Table 5-25
Scan Areal Coverage	704 m^2 or ~4% areal coverage	Judgmental areal coverage, LTP, Table 5-19
QC	3 measurements selected randomly for replicate measurement analysis	LTP, Section 5.9

6. SURVEY IMPLEMENTATION

For survey unit 08100, compliance with the unrestricted release criteria was demonstrated through a combination of direct measurements using the ISOCS and direct measurements using scintillation detectors in dry tubes. LTP, Section 5.1 states that if the concentration of residual gamma radioactivity in an individual measurement exceeds a SOF of 0.1, then a sample will be acquired of the elevated media and analyzed for HTD ROC. This threshold was not encountered during the FSS of survey unit 08100. Consequently, no additional samples were acquired for assessment of HTD ROC.

CRIB HOUSE BASEMENT STRUCTURE

FSS field activities commenced in the Crib House basement under FSS Sample Plan B3-08101A-F, which 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 four (4) working days to complete. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. The survey required field activities were performed during normal working hours starting on June 24, 2015, and concluding on June 27, 2015.

Zion*Solutions* TSD 14-022, "*Use of In-Situ Gamma Spectroscopy for Final Status Survey of End State Structures*" (Reference 12) provides the initial justification for the selection of reasonably conservative geometries for efficiency calibrations for the ISOCS based on the physical conditions of the remediated surface and the anticipated depth and distribution of activity. Prior to implementing the sample plan for the FSS of the Crib House basement structure, the physical condition of the concrete surfaces to be surveyed were assessed to ensure that the geometry was not significantly changed from that assumed in TSD 14-022. All ISOCS measurements were acquired using the geometry labeled as "CRIBHOUSE_3M," which assumed a circular plane source with a contaminant depth of ½ inch. With the 90-degree collimation shield installed and a stand-off distance of 3 meters, this orientation corresponded to a nominal FOV of 28 m^2. A stand-off guide attached to the detector was used to establish a consistent source to detector distance and center the detector over the selected measurement location. No additional adjustments to ISOCS geometry were deemed necessary.

The fourteen (14) random ISOCS measurement locations were marked based on grid coordinates provided by VSP. A replicate measurement was also acquired in the Crib House basement at location B3-08101A-FQWC-014-GM at grid #13. The ISOCS detector was oriented perpendicular to the surface of interest represented by the grid coordinate.

UNIT 1 AND UNIT 2 CIRCULATING WATER INTAKE PIPES

Subsequent FSS field activities were conducted starting on September 16, 2015, under FSS Sample Plans B3-08102A-S and B3-08102B-S, which included the requisite DQOs, survey design, detailed FSS instructions, job safety analysis, and related procedures for obtaining ISOCS measurements within the Unit 1 and Unit 2 Circulating Water Intake Pipes for FSS. A "Field Log" (ZS-LT-300-001-001 Attachment 14) was used to document field activities and other information pertaining to the performance of the FSS.

FSS field activities were projected to take four (4) working days to complete. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. The survey required field activities were performed during normal working hours starting on September 16, 2015, and concluding on September 17, 2015.

The Circulating Water Intake Pipes are located on the south end of the Turbine Building, beneath the Condenser Water Boxes, on the 583-foot elevation. During facility operation, the Unit 1 and Unit 2 Circulating Water Intake Pipes provided cooling water from Lake Michigan to various heat exchangers and condensers in the Turbine Building. The area to be surveyed consisted of the east and west portions of both Intake Pipes. The only access to the interior of the pipe were the two vertical lengths of 9-foot diameter pipe that ran from 588 foot elevation to the 558 foot elevation (approximate surface area of 158 m^2). In order to allow access for insertion of the ISOCS, a hole was cut into each of these two pipes at the 588 foot elevation. The ISOCS was then secured at 90 degrees looking down the 30 foot length of pipe.

Prior to implementing this sample plan, the physical geometry of the ISOCS measurements in the Circulating Water Intake Pipe were assessed to determine if the geometry were significantly different from that assumed in TSD 14-022. In accordance with the general approach and methods described in TSD 14-022, the efficiency calibrations for the ISOCS measurements in the Intake Pipe were modified to meet the unique geometry encountered in the pipes. The geometry assumed that the detector was positioned perpendicular inside of a cylinder with the exposed face of the detector positioned at a distance of 9.1 meters from the bottom of the pipe surface. The depth of contamination was assumed at ½ inch. All measurements were taken using Efficiency ID "3M_TURBINE," which assumed a FOV of 78 m^2.

Two (2) judgmental ISOCS measurement locations were selected within the Unit 1 Circulating Water Intake Pipe, and two (2) judgmental ISOCS measurement locations were selected within the Unit 2 Circulating Water Intake Pipe. A replicate measurement was also acquired in the Unit 1 Circulating Water Intake Pipe at location B3-08102AS-FQSM-002-GD.

FOREBAY STRUCTURE

FSS field activities were conducted in the Forebay under FSS Sample Plan B3-08401A-F, which included DQOs, survey design, detailed FSS instructions, job safety analysis, and related procedures for reference. The Forebay is considered part of the Crib House basement structure. During the FSS of the Crib House basement, the surface area of the Forebay was deemed as not accessible as it was flooded and directly hydraulically connected to Lake Michigan. Consequently, the selection of a Forebay surface for the acquisition of a random measurement was not possible. The 14 judgmental measurements taken under sample plan B3-08401A-F in the Forebay were intended to supplement the FSS that was performed in the Crib House basement in June of 2015.

The radiological survey data that was acquired by the implementation of sample plan B3-08401A-F was the result of specialized measurement methodology using scintillation detectors deployed in dry tubes. TSD 17-006 describes the basis for this methodology. Prior to implementing this sample plan, the physical condition of the surfaces to be surveyed in the Forebay were assessed to determine if the geometry was significantly different from that assumed in TSD 17-006. The assessment confirmed that the geometry used for the efficiency calibrations was valid.

The scintillation detector was deployed vertically in a dry tube positioned adjacent to the surface of each designated measurement location. The FOV was equivalent to the surface area of the conformal source utilized during the detector's efficiency determination. Each survey measurement location was made reproducible by utilizing permanent markings on the Forebay walls above the waterline.

Measurements were acquired using this approach at fourteen (14) biased locations selected within the Forebay. A replicate measurement was also acquired at location B3-08401A-FJQC-014-GD.

7. SURVEY RESULTS

Direct measurements were acquired at each random location in the Crib House basement and at the four judgmental locations in the Circulating Water Intake Pipe using the ISOCS. A summary of the results of the fourteen (14) ISOCS measurements taken for non-parametric statistical testing results is provided in Table 13. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 5. The complete ISOCS gamma spectroscopy reports are presented in Attachment 7. The basic statistics for the random measurements are summarized in Table 14.

Table 13 - Summary of Gamma Spectroscopy Results for ISOCS Measurements Comprising the Statistical Sample Population

MEASUREMENT ID	Co-60 (pCi/m^2)	Cs-134 (pCi/m^2)	Cs-137 (pCi/m^2)	Ni-63 (pCi/m^2)	Sr-90 (pCi/m^2)
B3-08101A-FRWC-001-GM	0.00E+00	1.74E+02	2.78E+02	0.00E+00	5.56E-01
B3-08101A-FRWC-002-GM	0.00E+00	4.99E+01	1.73E+01	0.00E+00	3.46E-01
B3-08101A-FRWC-003-GM	1.02E+02	1.07E+01	5.54E+01	1.84E+04	1.11E-01
B3-08101A-FRFC-004-GM	1.84E+02	3.88E+01	1.00E+02	3.33E+04	2.01E-01
B3-08101A-FRWC-005-GM	0.00E+00	1.23E+02	0.00E+00	0.00E+00	0.00E+00
B3-08101A-FRWC-006-GM	1.52E+02	0.00E+00	1.75E+02	2.74E+04	3.49E-01
B3-08101A-FRWC-007-GM	0.00E+00	9.15E+01	9.17E+01	0.00E+00	1.83E-01
B3-08101A-FRWC-008-GM	3.44E+01	2.69E+02	0.00E+00	6.20E+03	0.00E+00
B3-08101A-FRFC-009-GM	1.44E+02	0.00E+00	0.00E+00	2.59E+04	0.00E+00
B3-08101A-FRWC-010-GM	9.72E+01	2.13E+01	0.00E+00	1.75E+04	0.00E+00
B3-08101A-FRWC-011-GM	5.30E+01	2.22E+01	6.57E+01	9.57E+03	1.31E-01
B3-08101A-FRFC-012-GM	5.53E+01	9.56E+00	3.24E+01	9.97E+03	6.48E-02
B3-08101A-FRWC-013-GM	2.86E+01	1.68E+02	0.00E+00	5.16E+03	0.00E+00
B3-08101A-FRWC-014-GM	7.28E+00	0.00E+00	0.00E+00	1.31E+03	0.00E+00

Table 14 - Basic Statistical Properties of Random ISOCS Measurements

ROC	Mean (pCi/m^2)	Median (pCi/m^2)	Max (pCi/m^2)	Min (pCi/m^2)	Std. Dev. (pCi/m^2)	BcDCGL (pCi/m^2)	Avg. SOF per ROC	Avg. Dose Per ROC
Co-60	6.12E+01	4.37E+01	1.84E+02	0.00E+00	6.38E+01	5.52E+07	1.11E-06	2.77E-05
Cs-134	6.98E+01	3.05E+01	2.69E+02	0.00E+00	8.37E+01	2.13E+07	3.28E-06	8.19E-05
Cs-137	5.82E+01	2.49E+01	2.78E+02	0.00E+00	8.20E+01	2.96E+07	1.97E-06	4.92E-05
Ni-63	1.10E+04	7.88E+03	3.33E+04	0.00E+00	1.15E+04	3.25E+09	3.40E-06	8.50E-05
Sr-90	1.16E-01	4.97E-02	5.56E-01	0.00E+00	1.64E-01	1.16E+06	1.00E-07	2.51E-06

The mean SOF compared against the BcDCGLs (BcSOF) from random measurements taken on basement structural surfaces in survey unit 08100 is 9.85E-06. This equates to a dose of 2.46E-04 mrem/year. This is derived by summing the average BcSOF per ROC resulting from the average concentration in Table 14. There were no identified elevated areas.

The implementation of required QC measures included the collection of one additional ISOCS measurement at location #14 (B3-08101A-FQWC-014-GM) for "replicate measurement" analysis. The replicate ISOCS measurement results are provided in Table 15.

The concentration for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 5.

Table 15 - Summary of ISOCS Replicate Measurement for QC

MEASUREMENT ID	Co-60 (pCi/m^2)	Cs-134 (pCi/m^2)	Cs-137 (pCi/m^2)	Ni-63 (pCi/m^2)	Sr-90 (pCi/m^2)
B3-08101A-FQWC-014-GM	7.95E+01	7.98E+01	4.89E+01	1.44E+04	9.78E+05

Acknowledging that no concrete cores were taken during the FSS of the Crib House, two of the twenty concrete core samples taken during characterization (concrete cores B2-08101A-BJFC-007-CV and B2-08201-CJWC-A018-CV) were retrieved from the archives and analyzed for the full suite of radionuclides to ensure compliance with the FSS material sampling requirements of the approved LTP Revision 2. The results are provided in Table 16. The Eberline reports for the sample analysis are also provided in Attachment 8. Residual concentrations of Eu-155 were positively detected but at concentrations with derived dose substantially less than the IC dose adjustments of 5% made to the DCGLs. All other potential plant-derived radionuclides were less than MDC.

Table 16 - Summary of Full Suite Concrete Core Analysis by Eberline

Nuclides	B2-08101A-BJFC-007-CV (0.5-1.0 in)			B2-08101A-BJFC-007-CV (0.0-0.5 in)			B2-08201A-CJWC-018-CV (0.0-0.5 in)			B2-08201A-CJWC-018-CV (0.5-1.0 in)		
	Result (pCi/g)	Uncert. (pCi/g)	MDC (pCi/g)	Result (pCi/g)	Uncert. (pCi/g)	MDC (pCi/g)	Result (pCi/g)	Uncert. (pCi/g)	MDC (pCi/g)	Result (pCi/g)	Uncert. (pCi/g)	MDC (pCi/g)
H-3	6.35E+00	5.68E+00	9.48E+00	4.97E+00	3.43E+00	5.67E+00	4.02E+00	3.34E+00	5.56E+00	6.41E+00	3.46E+00	5.64E+00
C-14	0.00E+00	4.03E-01	6.91E-01	0.00E+00	3.63E-01	6.28E-01	0.00E+00	3.91E-01	6.81E-01	0.00E+00	3.69E-01	6.41E-01
Mn-54	0.00E+00	1.23E+02	1.52E+02	0.00E+00	1.31E+02	1.78E+02	0.00E+00	2.03E+02	3.28E+02	0.00E+00	1.56E+02	1.90E+02
Fe-55	0.00E+00	2.08E+00	3.04E+00	7.56E-01	2.76E+00	4.46E+00	0.00E+00	3.22E+00	5.12E+00	1.34E+00	2.55E+00	4.30E+00
Ni-59	7.38E-02	1.97E-01	3.17E-01	1.10E-02	2.98E-01	4.67E-01	1.08E-01	3.31E-01	5.28E-01	3.79E-02	2.76E-01	4.38E-01
Co-60	1.19E-01	4.80E-01	7.55E-01	0.00E+00	5.59E-01	7.34E-01	0.00E+00	1.52E+00	1.60E+00	6.65E-02	1.81E-01	8.74E-01
Ni-63	7.46E-01	1.42E+00	2.41E+00	4.56E-01	1.39E+00	2.36E+00	0.00E+00	1.41E+00	2.44E+00	5.54E-01	1.41E+00	2.38E+00
Sr-90	0.00E+00	3.25E-02	6.96E-02	2.48E-02	3.32E-02	6.82E-02	0.00E+00	2.69E-02	6.12E-02	3.48E-03	2.83E-02	6.04E-02
Nb-94	1.51E-01	1.20E-01	2.46E-01	1.74E-02	1.98E-01	2.70E-01	2.62E-01	3.39E-01	5.03E-01	0.00E+00	2.12E-01	2.82E-01
Tc-99	1.29E+00	7.36E-01	1.21E+00	2.07E+00	6.99E-01	1.13E+00	9.57E-01	5.63E-01	9.30E-01	1.71E+00	6.65E-01	1.08E+00
Ag-108m	0.00E+00	1.41E-01	2.06E-01	0.00E+00	2.77E-01	2.37E-01	0.00E+00	3.91E-01	4.55E-01	1.31E-01	1.19E-01	2.29E-01
Sb-125	1.05E+00	2.55E+00	4.60E+00	0.00E+00	3.40E+00	4.75E+00	0.00E+00	6.44E+00	9.17E+00	0.00E+00	3.21E+00	4.56E+00
Cs-134	0.00E+00	1.27E+00	3.23E+00	4.82E-01	1.88E+00	3.99E+00	0.00E+00	6.77E+00	7.60E+00	0.00E+00	1.33E+00	4.46E+00
Cs-137	0.00E+00	2.28E-01	3.10E-01	1.15E-01	2.37E-01	3.78E-01	8.97E-02	4.50E-01	6.93E-01	2.52E-01	2.28E-01	4.02E-01
Eu-152	0.00E+00	8.27E-01	9.63E-01	2.89E-01	8.81E-01	9.93E-01	0.00E+00	2.31E+00	1.19E+00	8.30E-02	6.27E-01	1.02E+00
Eu-154	0.00E+00	8.76E-01	6.04E-01	4.41E-01	9.70E-01	6.53E-01	0.00E+00	1.86E+00	8.00E-01	4.39E-01	8.07E-01	6.61E-01
Eu-155	1.69E+00	1.08E+00	1.65E+00	6.54E-02	1.28E+00	1.85E+00	4.58E-01	1.26E+00	1.94E+00	0.00E+00	1.16E+00	1.69E+00
Np-237	4.84E-02	6.93E-02	1.14E-01	7.53E-02	7.65E-02	1.03E-01	4.18E-02	5.04E-02	6.17E-02	4.72E-02	7.22E-02	1.23E-01
Pu-238	0.00E+00	4.37E-02	1.25E-01	0.00E+00	4.81E-02	1.14E-01	0.00E+00	5.91E-02	1.75E-01	0.00E+00	6.72E-02	1.83E-01
Pu-239/240	0.00E+00	3.89E-02	8.16E-02	0.00E+00	6.21E-02	1.34E-01	1.72E-02	5.27E-02	1.25E-01	4.02E-02	8.70E-02	1.72E-01
Pu-241	2.44E+00	7.59E+00	1.29E+01	0.00E+00	7.51E+00	1.29E+01	7.81E+00	9.44E+00	1.59E+01	0.00E+00	1.01E+01	1.76E+01
Am-241	2.06E-02	5.15E-02	1.07E-01	4.23E-02	5.13E-02	6.24E-02	0.00E+00	4.50E-02	1.27E-01	1.73E-02	5.61E-02	1.16E-01
Am-243	5.82E-02	7.03E-02	8.58E-02	2.02E-01	3.46E-01	6.07E-01	1.14E-01	1.16E-01	1.56E-01	6.77E-02	7.96E-02	1.17E-01
Cm-243/244	8.35E-02	7.99E-02	8.57E-02	1.24E-02	2.98E-02	6.24E-02	4.05E-02	6.63E-02	1.16E-01	6.71E-02	7.25E-02	1.05E-01

Two (2) judgmental ISOCS measurements were taken within the Unit 1 Circulating Water Intake Pipe, and 2 judgmental ISOCS measurements were taken within the Unit 2 Circulating Water Intake Pipe. A summary of the results of the 4 judgmental ISOCS measurements taken within the Circulating Water Intake Pipes are provided in Table 17. The concentration for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 5. The complete ISOCS gamma spectroscopy reports are presented in Attachment 7.

Table 17 - Summary of Gamma Spectroscopy Results for Judgmental ISOCS Measurements Taken in Circulating Water Intake Pipes

MEASUREMENT ID	Co-60 (pCi/m^2)	Cs-134 (pCi/m^2)	Cs-137 (pCi/m^2)	Ni-63 (pCi/m^2)	Sr-90 (pCi/m^2)
B3-08102AS-FJSM-001-GD	1.20E+02	1.38E+03	1.90E+02	2.16E+04	3.80E-01
B3-08102AS-FJSM-002-GD	0.00E+00	4.59E+02	2.64E+02	0.00E+00	5.28E-01
B3-08102BS-FJSM-001-GD	4.20E+03	2.30E+02	6.16E+02	7.58E+05	1.23E+00
B3-08102BS-FJSM-002-GD	3.16E+04	2.78E+02	2.08E+03	5.71E+06	4.15E+00

A replicate ISOCS measurement was also acquired in Unit 1 Circulating Water Intake Pipe at location B3-08102AS-FQSM-002-GD. A summary of the results for the QC replicate measurement is provided in Table 18. The concentration for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 5.

Table 18 - Summary of ISOCS Replicate Measurement for QC

MEASUREMENT ID	Co-60 (pCi/m^2)	Cs-134 (pCi/m^2)	Cs-137 (pCi/m^2)	Ni-63 (pCi/m^2)	Sr-90 (pCi/m^2)
B3-08102AS-FQSM-002-GD	3.61E+01	0.00E+00	0.00E+00	6.52E+04	0.00E+00

Fourteen (14) judgmental measurements were taken within the Forebay using scintillation detectors deployed in dry tubes. A summary of the results of the 14 judgmental measurements taken within the Forebay are provided in Table 19. Each measurement represents the net gamma result at that location in units of pCi/m^2. Using the normalized gamma mixture from Table 2, a concentration for each of the gamma-emitting ROC was calculated. The concentrations for Ni-63 and Sr-90 were then inferred based on the maximum ratios as specified in Table 5.

Table 19 - Summary of Results for Judgmental Measurements Taken in the Forebay

MEASUREMENT ID	Co-60 (pCi/m^2)	Cs-134 (pCi/m^2)	Cs-137 (pCi/m^2)	Ni-63 (pCi/m^2)	Sr-90 (pCi/m^2)
B3-08401A-FJWC-001-GD	6.48E+03	7.08E+01	5.33E+05	1.17E+06	1.07E+03
B3-08401A-FJWC-002-GD	6.65E+03	7.27E+01	5.48E+05	1.20E+06	1.10E+03
B3-08401A-FJWC-003-GD	6.46E+03	7.06E+01	5.32E+05	1.17E+06	1.06E+03
B3-08401A-FJWC-004-GD	6.74E+03	7.37E+01	5.55E+05	1.22E+06	1.11E+03
B3-08401A-FJWC-005-GD	5.78E+03	6.32E+01	4.76E+05	1.04E+06	9.52E+02
B3-08401A-FJWC-006-GD	6.15E+03	6.73E+01	5.07E+05	1.11E+06	1.01E+03
B3-08401A-FJWC-007-GD	6.65E+03	7.27E+01	5.48E+05	1.20E+06	1.10E+03
B3-08401A-FJWC-008-GD	5.96E+03	6.51E+01	4.90E+05	1.08E+06	9.81E+02
B3-08401A-FJWC-009-GD	7.11E+03	7.77E+01	5.85E+05	1.28E+06	1.17E+03
B3-08401A-FJWC-010-GD	7.11E+03	7.77E+01	5.85E+05	1.28E+06	1.17E+03
B3-08401A-FJWC-011-GD	6.96E+03	7.61E+01	5.73E+05	1.26E+06	1.15E+03
B3-08401A-FJWC-012-GD	7.15E+03	7.82E+01	5.89E+05	1.29E+06	1.18E+03
B3-08401A-FJWC-013-GD	6.52E+03	7.13E+01	5.37E+05	1.18E+06	1.07E+03
B3-08401A-FJWC-014-GD	8.22E+03	8.98E+01	6.77E+05	1.48E+06	1.35E+03

A replicate measurement was acquired in the Forebay at location B3-08401A-FJQC-014-GD. A summary of the results for the QC replicate measurement is provided in Table 20.

Table 20 - Summary of Replicate Measurement Taken in Forebay for QC

MEASUREMENT ID	Co-60 (pCi/m^2)	Cs-134 (pCi/m^2)	Cs-137 (pCi/m^2)	Ni-63 (pCi/m^2)	Sr-90 (pCi/m^2)
B3-08401A-FJQC-014-GD	8.61E+03	9.41E+01	7.09E+05	1.55E+06	1.42E+03

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 4

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

Where: C_n = concentration of radionuclide *n*

$DCGL_n$ = DCGL of radionuclide *n*.

The results of the unity rule calculation (OpSOF) for the ROC for the random ISOCS measurements for survey unit 08100 using OpDCGLs are provided in Table 21.

Table 21 - Sum of Fractions for Random ISOCS Measurements

MEASUREMENT ID	FRACTION OF OpDCGL					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
B3-08101A-FRWC-001-GM	0.00E+00	2.12E-05	2.44E-05	0.00E+00	1.24E-06	4.68E-05
B3-08101A-FRWC-002-GM	0.00E+00	6.08E-06	1.52E-06	0.00E+00	7.74E-08	7.68E-06
B3-08101A-FRWC-003-GM	4.78E-06	1.30E-06	4.86E-06	1.47E-05	2.48E-07	2.59E-05
B3-08101A-FRFC-004-GM	8.65E-06	4.73E-06	8.81E-06	2.66E-05	4.49E-07	4.92E-05
B3-08101A-FRWC-005-GM	0.00E+00	1.50E-05	0.00E+00	0.00E+00	0.00E+00	1.50E-05
B3-08101A-FRWC-006-GM	7.12E-06	0.00E+00	1.53E-05	2.19E-05	7.81E-07	4.51E-05
B3-08101A-FRWC-007-GM	0.00E+00	1.12E-05	8.04E-06	0.00E+00	4.10E-07	1.96E-05
B3-08101A-FRWC-008-GM	1.61E-06	3.28E-05	0.00E+00	4.96E-06	0.00E+00	3.94E-05
B3-08101A-FRFC-009-GM	6.75E-06	0.00E+00	0.00E+00	2.07E-05	0.00E+00	2.75E-05
B3-08101A-FRWC-010-GM	4.56E-06	2.59E-06	0.00E+00	1.40E-05	0.00E+00	2.12E-05
B3-08101A-FRWC-011-GM	2.49E-06	2.70E-06	5.77E-06	7.66E-06	2.94E-07	1.89E-05
B3-08101A-FRFC-012-GM	2.60E-06	1.17E-06	2.84E-06	7.89E-06	1.45E-07	1.47E-05
B3-08101A-FRWC-013-GM	1.34E-06	2.05E-05	0.00E+00	4.13E-06	0.00E+00	2.59E-05
B3-08101A-FRWC-014-GM	3.42E-07	0.00E+00	0.00E+00	1.05E-06	0.00E+00	1.39E-06
B3-08101A-FQWC-014-GM	3.73E-06	9.73E-06	4.29E-06	1.15E-05	2.19E-07	2.94E-05

Number of Random Measurements = 14 # of Random Measurements with OpSOF ≥ 1 = 0

Max Individual Random Measurement OpSOF = 4.92E-05 Mean Random Measurement OpSOF = 2.56E-05

The results of the unity rule calculation (OpSOF) for the judgmental ISOCS measurements taken in the Circulating Water Intake Pipe using OpDCGLs are provided in Table 22.

Table 22 - Sum of Fractions for Judgmental ISOCS Measurements Taken in the Circulating Water Intake Pipe

MEASUREMENT ID	FRACTION OF OpDCGL					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
B3-08102AS-FJSM-001-GD	5.26E-06	1.68E-04	1.67E-05	1.73E-05	8.50E-07	2.08E-04
B3-08102AS-FJSM-002-GD	0.00E+00	5.60E-05	2.31E-05	0.00E+00	1.18E-06	8.03E-05
B3-08102AS-FQSM-002-GD	1.70E-05	0.00E+00	0.00E+00	5.21E-05	0.00E+00	6.91E-05
B3-08102BS-FJSM-001-GD	1.97E-04	2.80E-05	5.40E-05	6.07E-04	2.75E-06	8.89E-04
B3-08102BS-FJSM-002-GD	1.49E-03	3.39E-05	1.82E-04	4.57E-03	9.28E-06	6.28E-03

Number of Judgmental Measurements = 4 # of Judgmental Measurements with OpSOF ≥ 1 = 0

Max Judgmental Measurement OpSOF = 6.28E-03 Mean Judgmental Measurement OpSOF = 1.86E-03

The results of the unity rule calculation (OpSOF) for the judgmental measurements taken in the Forebay using the OpDCGLs are provided in Table 23.

Table 23 - Sum of Fractions for Judgmental Gamma Measurements Taken in the Forebay

MEASUREMENT ID	FRACTION OF OpDCGL					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
B3-08401A-FJWC-001-GD	3.04E-04	8.64E-06	4.68E-02	9.35E-04	2.39E-03	5.04E-02
B3-08401A-FJWC-002-GD	3.12E-04	8.87E-06	4.80E-02	9.60E-04	2.45E-03	5.18E-02
B3-08401A-FJWC-003-GD	3.03E-04	8.61E-06	4.66E-02	9.32E-04	2.38E-03	5.03E-02
B3-08401A-FJWC-004-GD	3.16E-04	8.98E-06	4.87E-02	9.73E-04	2.48E-03	5.25E-02
B3-08401A-FJWC-005-GD	2.72E-04	7.71E-06	4.18E-02	8.35E-04	2.13E-03	4.50E-02
B3-08401A-FJWC-006-GD	2.89E-04	8.20E-06	4.44E-02	8.88E-04	2.27E-03	4.79E-02
B3-08401A-FJWC-007-GD	3.12E-04	8.87E-06	4.80E-02	9.60E-04	2.45E-03	5.18E-02
B3-08401A-FJWC-008-GD	2.80E-04	7.94E-06	4.30E-02	8.60E-04	2.19E-03	4.64E-02
B3-08401A-FJWC-009-GD	3.34E-04	9.48E-06	5.13E-02	1.03E-03	2.62E-03	5.53E-02
B3-08401A-FJWC-010-GD	3.34E-04	9.48E-06	5.13E-02	1.03E-03	2.62E-03	5.53E-02
B3-08401A-FJWC-011-GD	3.27E-04	9.27E-06	5.02E-02	1.00E-03	2.56E-03	5.42E-02
B3-08401A-FJWC-012-GD	3.36E-04	9.54E-06	5.17E-02	1.03E-03	2.64E-03	5.57E-02
B3-08401A-FJWC-013-GD	3.06E-04	8.69E-06	4.71E-02	9.42E-04	2.40E-03	5.08E-02
B3-08401A-FJWC-014-GD	3.86E-04	1.10E-05	5.94E-02	1.19E-03	3.03E-03	6.40E-02
B3-08401A-FJQC-014-GD	4.04E-04	1.15E-05	6.22E-02	1.24E-03	3.17E-03	6.70E-02

Number of Judgmental Measurements = 14 # of Judgmental Measurements with OpSOF ≥ 1 = 0

Max Judgmental Measurement OpSOF = 6.40E-02 Mean Judgmental Measurement OpSOF = 5.32E-02

In order to assess the dose contribution from the Circulating Water Intake Pipe and the Forebay, the concentration of each ROC in each judgmental measurement was also compared against the respective BcDCGLs. This was accomplished using the same method that was used to calculate the mean BcSOF for the random measurements. The calculation of the mean BcSOF for the Circulating Water Intake Pipes is presented in Table 24 and the calculation of the mean BcSOF for the Forebay is presented in Table 25.

Table 24 - Calculation of Mean BcSOF for Judgmental Measurements Taken in the Circulating Water Intake Pipes Using BcDCGLs

ROC	Mean (pCi/m^2)	BcDCGL (pCi/m^2)	Avg SOF per ROC
Co-60	8.99E+03	5.52E+07	1.63E-04
Cs-134	5.86E+02	2.13E+07	2.75E-05
Cs-137	7.86E+02	2.96E+07	2.66E-05
Ni-63	1.62E+06	3.25E+09	4.99E-04
Sr-90	1.57E+00	1.16E+06	1.36E-06
			7.17E-04 Mean BcSOF

Table 25 - Calculation Mean BcSOF for Judgmental Measurements Taken in the Forebay Using BcDCGLs

ROC	Mean (pCi/m^2)	BcDCGL (pCi/m^2)	Avg SOF per ROC
Co-60	6.71E+03	5.52E+07	1.22E-04
Cs-134	7.34E+01	2.13E+07	3.44E-06
Cs-137	5.52E+05	2.96E+07	1.87E-02
Ni-63	1.21E+06	3.25E+09	3.73E-04
Sr-90	1.10E+03	1.16E+06	9.53E-04
			2.01E-02 Mean BcSOF

8. QUALITY CONTROL

Three (3) replicate measurements were taken during the FSS of this basement structure. Measurement B3-08101A-FQWC-014-GM was taken with the random measurement population acquired in the Crib House basement, measurement B3-08102AS-FQSM-002-GD was taken with the judgmental measurements taken in the Circulating Water Intake Pipes and measurement B3-08401A-FJQC-014-GD was taken with the judgmental gamma measurements taken in the Forebay. The measurement results were evaluated using USNRC acceptance criteria specified in Inspection Procedure No. 84750, *"Radioactive Waste Treatment, and Effluent and Environmental Monitoring"* (Reference 13). There was

acceptable agreement between replicate measurement results taken in the Crib House basement and in the Forebay. Comparison of the replicate ISOCS measurements collected from measurement location #2 inside the Unit 1 Circulating Water Intake Pipe was inconclusive. The Cs-137 concentration for both measurements was less than instrument MDC. The reported result for the comparison measurement was a negative value (-1.76E+02 pCi/m^2, thus resulting in a reported concentration of 0.00E+00 pCi/m^2). K-40 could not be substituted as the comparison measurement was also negative. As two additional QC samples were taken in this survey unit with acceptable comparison, no further action was deemed necessary. Refer to Attachment 5 for data and quality control analysis results.

9. INVESTIGATIONS AND RESULTS

No measurements were taken for an investigation during the performance of FSS in this survey unit.

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 basement concrete 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 Zion*Solutions* procedure ZS-LT-300-001-004, *"Final Status Survey Data Assessment"* (Reference 14) for completeness and consistency. Documentation was complete and legible. Surveys and the collection of measurements were consistent with the DQOs and were sufficient to ensure that the survey unit was properly designated as Class 3.

The analytical results of all samples were less than a OpSOF of one. Additionally, the maximum activity for each ROC did not exceed 10% of their respective OpDCGL for the Crib House/Forebay.

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 (Attachment 3) 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 OpDCGLs. Also, the retrospective power curve showed 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. COMPLIANCE EQUATION

There are four distinct source terms for the end-state at Zion: backfilled basements, soil, buried piping and groundwater. Demonstrating compliance with the dose criterion requires the summation of dose from the four source terms (see Equation 6-11 from LTP, Section 6-17).

The final compliance dose will be calculated using LTP Equation 6-11 after FSS has been completed in all survey units. The results of the FSS performed for each FSS unit will be reviewed to determine the maximum dose from each of the four source terms (e.g., basement, soil, buried pipe and existing groundwater if applicable) using the mean BcSOF of FSS systematic and random results plus the dose from any identified elevated areas. The compliance dose must be less than 25 mrem/year. The dose contribution from each ROC is accounted for using the BcSOF to ensure that the total dose from all ROC does not exceed the dose criterion.

The term for each basement includes the dose contributions from wall and floor surfaces within the basement, the dose contribution from embedded pipe within the basement, the dose contribution from penetrations within the basement and the dose contribution from concrete fill in the basement when clean concrete debris was used as fill. Each (structural surfaces, embedded pipe, and penetrations) are surveyed separately during FSS. The dose from clean concrete fill is predetermined in accordance with LTP, Table 5-16, which is

conservatively based on a maximum allowable MDC of 5,000 dpm/100cm^2. The dose from fill assigned to the Crib House/Forebay is 1.57 mrem/year, which equates to a SOF of 0.063.

Basement surface area adjustments (i.e., increases) were applied to the structure surface DCGL calculation for certain basements to ensure that the DCGLs accounted for the contribution of residual radioactivity from basements/structures that cannot, on their own, support a water supply well but were hydraulically connected to a basement that could support a well. One of these structures is the Circulating Water Intake Pipes. The surface area adjustments resulted in lowering the DCGL concentrations (pCi/m^2) in the Crib House/Forebay by requiring the allowable total activity to be uniformly distributed over the larger, combined surface areas. The activity in the Circulating Water Intake Pipes is included in both the Crib House/Forebay and the Turbine Building basement. The Intake Pipe was grouted which essentially eliminated the hydraulic connections, however, in calculating the BcDCGLs, the hydraulic connections to the Intake Pipe were assumed to be fully regained in the future after degradation of the isolation barriers and grout.

The BcDCGL for the Crib House/Forebay accounts for the activity in the Circulating Water Intake Pipes by summing the surface areas. In accordance with LTP, Table 6-23, the combined summed surface area of the Crib House/Forebay and Circulating Water Intake Pipe is 18,254 m^2. The total area is broken down as follows: the Crib House has a surface area of 8,435 m^2, the Circulating Water Intake Pipe has a surface area of 4,412 m^2 and the Forebay has a surface area of 5,407 m^2. Equation 5-9 from LTP Chapter 5 was used to sum the residual activity in the Crib House structure, Forebay structure and Circulating Water Intake Pipes on an area-weighted basis. The result is provided in Equation 5.

Equation 5

$$\left\{\left(\frac{8{,}435}{18{,}254}\right)(9.85E^{-06})\right\}+\left\{\left(\frac{4{,}412}{18{,}254}\right)(7.17E^{-04})\right\}+\left\{\left(\frac{5{,}407}{18{,}254}\right)(2.01E^{-02})\right\}=0.006$$

The adjusted BcSOF for the Crib House/Forebay basement structure is 0.006. This equates to a dose of 0.153 mrem/year. The adjusted BcSOF for the Crib House/Forebay is then used in the following equation to calculate $BcSOF_{BASEMENT}$ for the Crib House/Forebay.

Equation 6

$$BcSOF_{BASEMENT} = BcSOF_B + BcSOF_{EP} + BcSOF_{PN} + BcSOF_{CF}$$

where:

$BcSOF_{BASEMENT}$	=	BcSOF (mean of FSS systematic results plus the dose from any identified elevated areas) for backfilled basements
$BcSOF_B$	=	BcSOF for structural survey unit(s) within the basement (mean of FSS systematic results plus the dose from any identified elevated areas)
$BcSOF_{EP}$	=	BcSOF for embedded pipe survey unit(s) within the basement (mean of FSS systematic results plus the dose from any identified elevated areas)
$BcSOF_{PN}$	=	BcSOF for penetration survey unit(s) within the basement (mean of FSS systematic results plus the dose from any identified elevated areas)
$BcSOF_{CF}$	=	BcSOF for clean concrete fill (if applicable) based on maximum MDC during Unrestricted Release Survey (URS)

There are no penetrations or embedded pipe associated with the Crib House/Forebay basement. Consequently, the dose contribution from both (variables $BcSOF_{EP}$ and $BcSOF_{PN}$) are zero.

The $BcSOF_{BASEMENT}$ value for the Crib House/Forebay is then derived as follows:

Equation 7

$$BcSOF_{BASEMENT} = 0.006 + 0.000 + 0.000 + 0.063 = 0.069$$

The $BcSOF_{BASEMENT}$ for the Crib House/Forebay basement is 0.069. This SOF equates to a dose of 1.723 mrem/year TEDE to an AMCG from residual radioactivity in the Crib House/Forebay basement.

15. CONCLUSION

Survey unit 08100 has met the DQOs of the FSS plan. The ALARA criteria as specified in Chapter 4 of the LTP were achieved. The EMC is not applicable to structural surfaces 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 was properly classified as Class 3.

The dose contribution from structural surfaces in Survey Unit 08100, Crib House/Forebay Basement, is 0.153 mrem/year TEDE, based on the average concentration of the ROC in measurements used for non-parametric statistical sampling as well as judgmental measurements taken in the Forebay and the Circulating Water Intake Pipes on an area-weighted basis (mean BcSOF = 0.006). The dose from embedded pipe and penetrations in the Crib House/Forebay is zero and the dose from clean fill is 1.57 mrem/yr. The total dose attributed to the Crib House/Forebay as a summation of all dose components is 1.723 mrem/year.

Survey Unit 08100, Crib House/Forebay Basement, is acceptable for unrestricted release.

16. REFERENCES

1. Zion*Solutions* procedure ZS-LT-300-001-005, Final Status Survey Data Reporting
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, Final Status Survey Package Development
4. NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual
5. Zion*Solutions* TSD 17-006, Underwater Survey Methodology for Zion Nuclear Station Crib House/Forebay Basement Final Status Survey Unit
6. Zion*Solutions* TSD 17-004, Operational Derived Concentration Guideline Levels for Final Status Survey
7. Zion Station Historical Site Assessment
8. Zion*Solutions* procedure ZS-LT-300-001-002, Survey Unit Classification
9. Zion*Solutions* TSD 11-001, Technical Support Document for Potential Radionuclides of Concern During the Decommissioning of the Zion Station
10. Zion*Solutions* TSD 14-019, Radionuclides of Concern for Soil and Basement Fill Model Source Terms
11. Zion*Solutions* ZS-LT-01, Quality Assurance Project Plan (for Characterization and FSS)

12. Zion*Solutions* TSD 14-022, Use of In-Situ Gamma Spectroscopy for Final Status Survey of End State Structures

13. U.S. NRC Inspection Procedure No. 84750, Radioactive Waste Treatment, and Effluent and Environmental Monitoring

14. Zion*Solutions* procedure ZS-LT-300-001-004, Final Status Survey Data Assessment

17. ATTACHMENTS

Attachment 1 – Figures and Maps

Attachment 2 – ISOCS Geometry

Attachment 3 – Sign Test

Attachment 4 – Forebay Judgmental Measurements

Attachment 5 – QC Measurement Assessments

Attachment 6 – Graphical Presentations

Attachment 7 – ISOCS Reports

Attachment 8 – Eberline Analytical Reports

ATTACHMENT 1
FIGURES AND MAPS

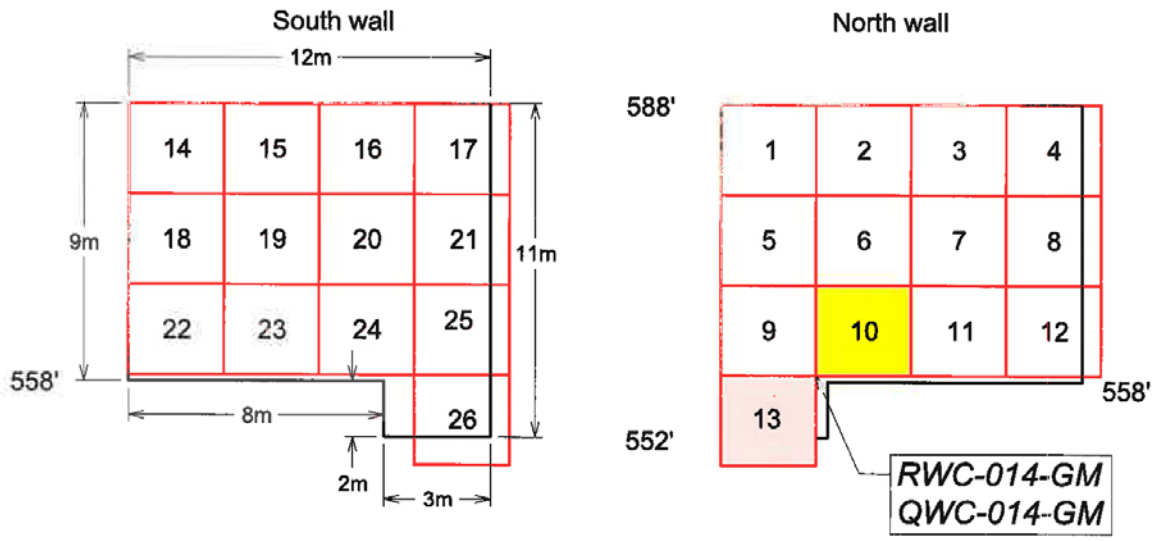
ZION SOLUTIONS

Legend

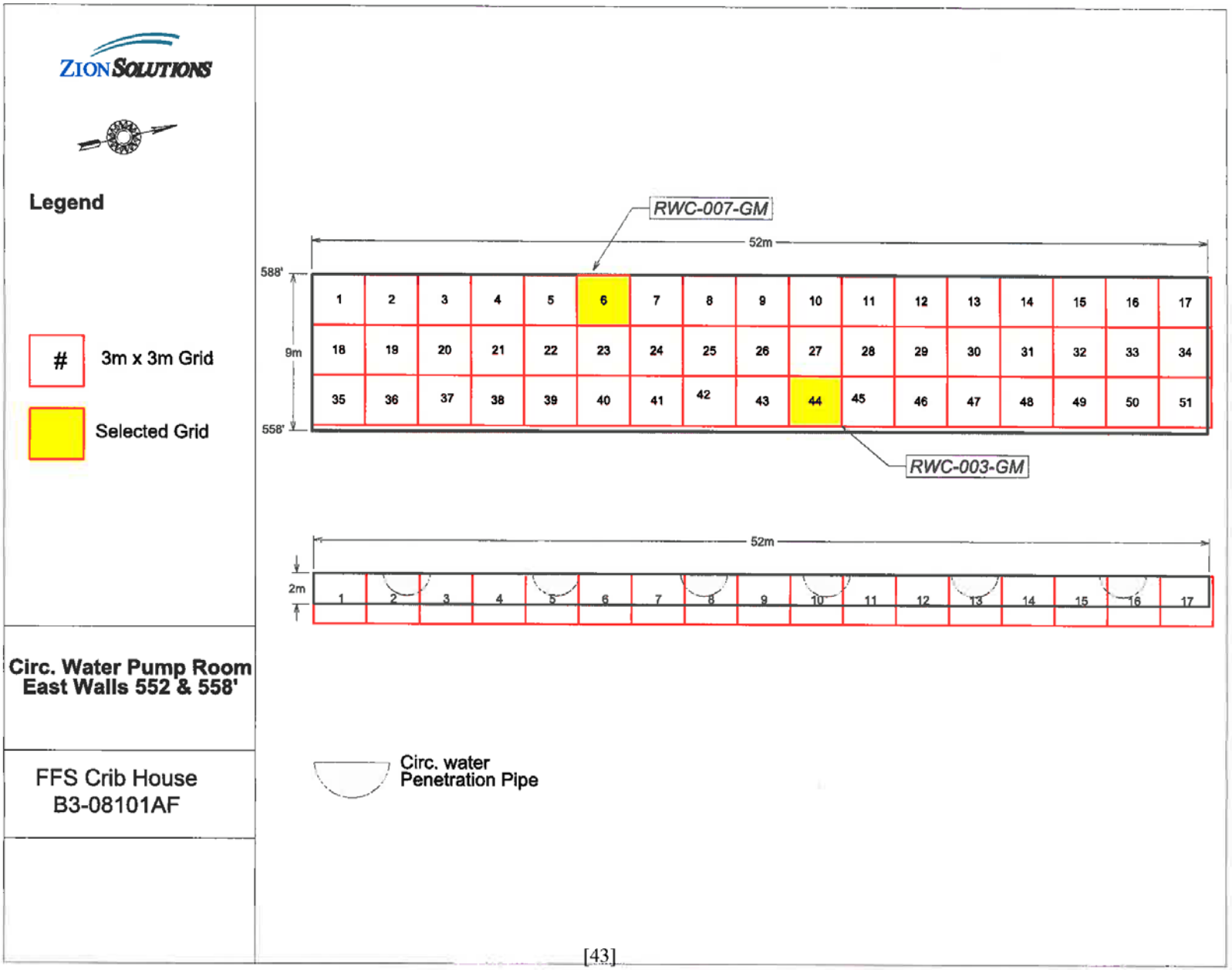
#	3m x 3m Grid
	Original Grid
	Alternate Grid

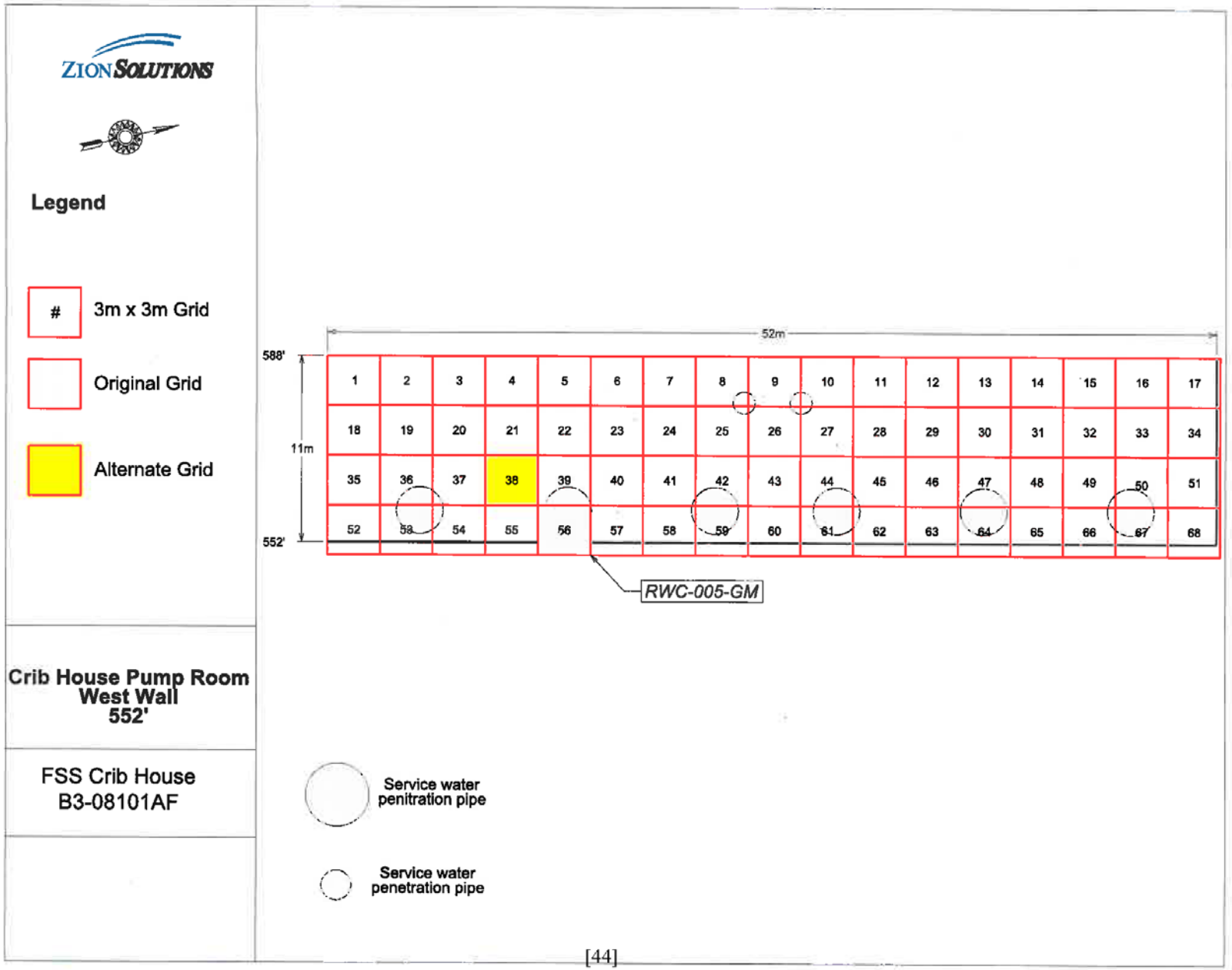
Crib House
North & South Wall
Circ. Water Pump Room
552'

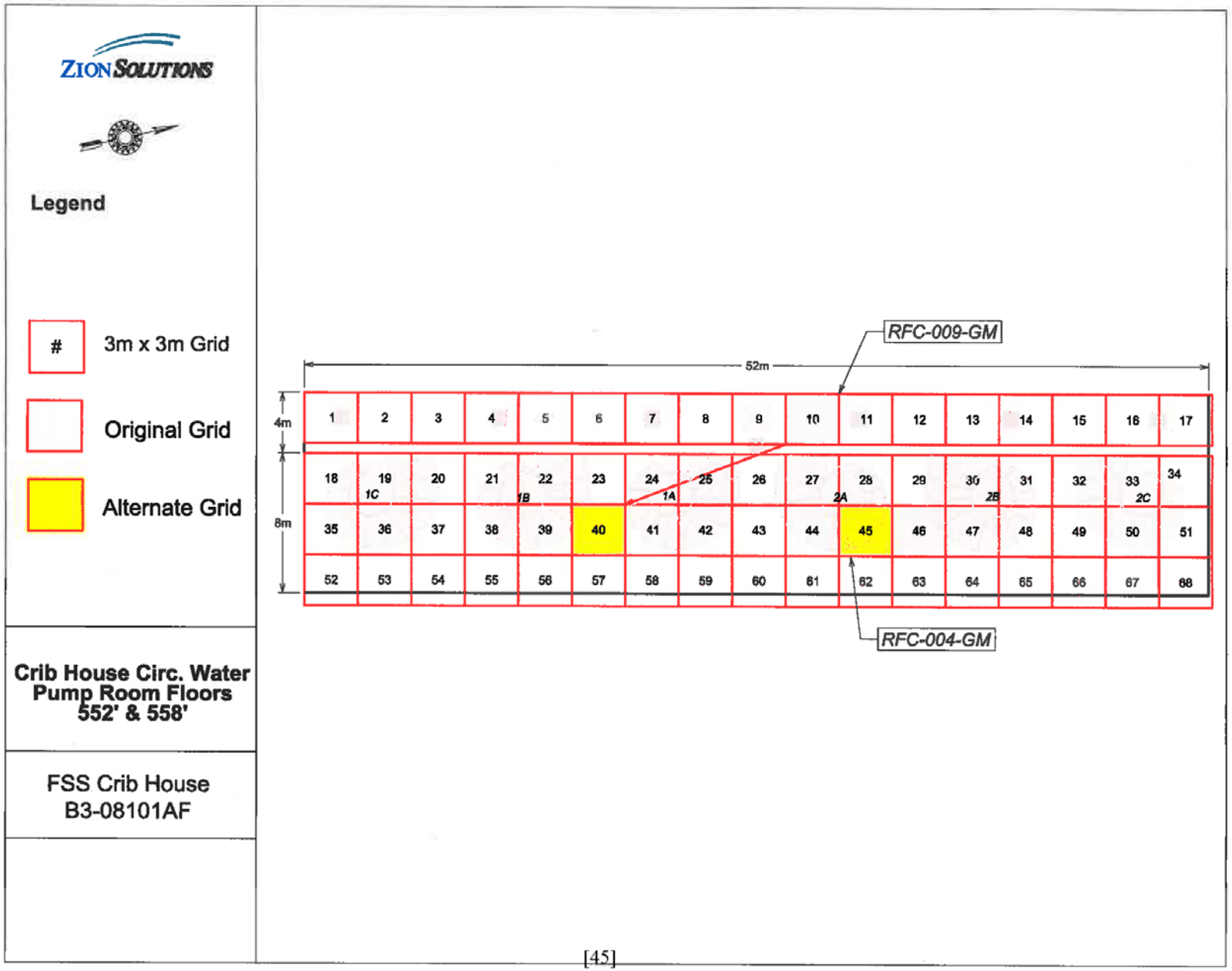
FSS Crib House
B3-08101AF

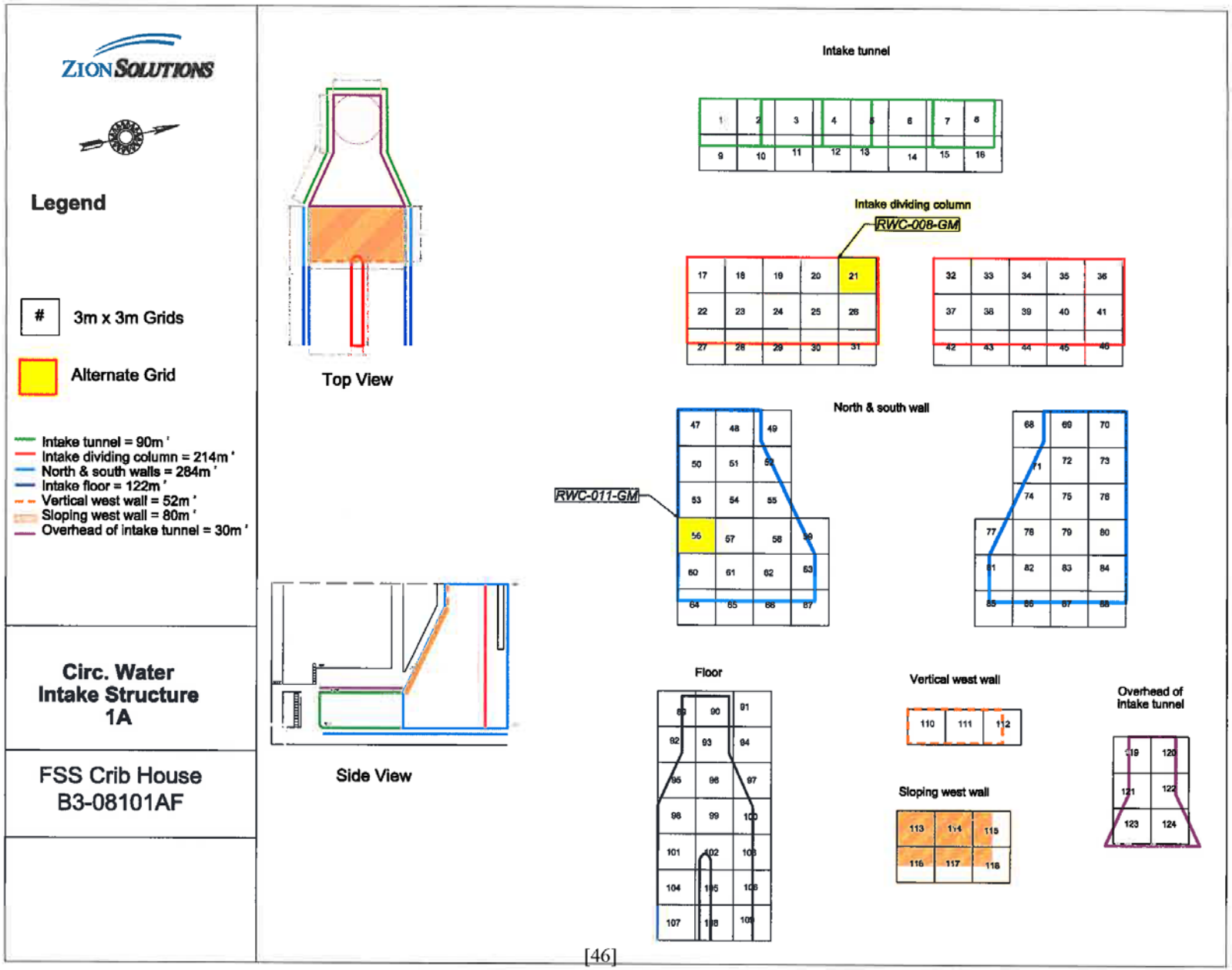


Crib house north & south wall
circ. water pump room 552'


ZION SOLUTIONS
Legend
3m x 3m Grid
Selected Grid
Circ. Water Pump Room
East Walls 552 & 558'
FFS Crib House
B3-08101AF
RWC-007-GM
52m
588'
9m
558'
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51
RWC-003-GM
52m
2m
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Circ. water
Penetration Pipe


ZION SOLUTIONS
Legend
3m x 3m Grid
Original Grid
Alternate Grid
Crib House Pump Room
West Wall
552'
FSS Crib House
B3-08101AF
52m
588'
11m
552'
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51
52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68
RWC-005-GM
Service water penitration pipe
Service water penetration pipe


ZION SOLUTIONS
Legend
3m x 3m Grid
Original Grid
Alternate Grid
Crib House Circ. Water Pump Room Floors 552' & 558'
FSS Crib House B3-08101AF
RFC-009-GM
52m
4m
8m
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
1C 1B 1A 2A 2B 2C
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51
52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68
RFC-004-GM


ZION SOLUTIONS
Legend
3m x 3m Grids
Alternate Grid
Intake tunnel = 90m '
Intake dividing column = 214m '
North & south walls = 284m '
Intake floor = 122m '
Vertical west wall = 52m '
Sloping west wall = 80m '
Overhead of intake tunnel = 30m '
Circ. Water Intake Structure 1A
FSS Crib House B3-08101AF
Top View
Side View
Intake tunnel
Intake dividing column
RWC-008-GM
North & south wall
RWC-011-GM
Floor
Vertical west wall
Sloping west wall
Overhead of intake tunnel

ZION SOLUTIONS

Legend

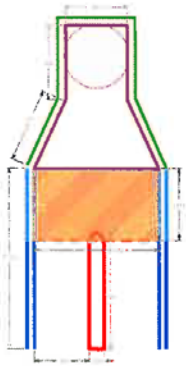
3m x 3m Grid

Alternate Grid

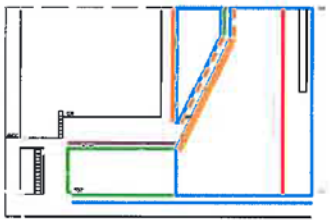
- Intake tunnel = 90m '
- Intake dividing column = 214m '
- North & south walls = 284m '
- Intake floor = 122m '
- Vertical west wall = 52m '
- Sloping west wall = 80m '
- Overhead of intake tunnel = 30m '

Circ. Water Intake Structure 1B

FSS Crib House B3-08101AF

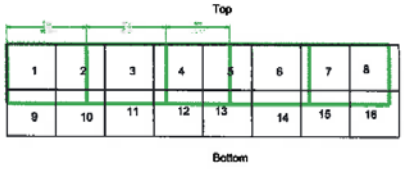


Top View

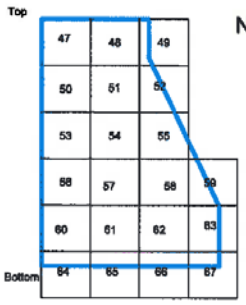


Side View

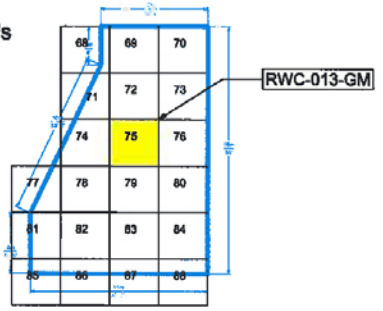
Intake tunnel



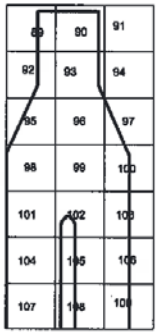
Intake dividing column



North & south walls

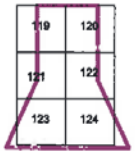


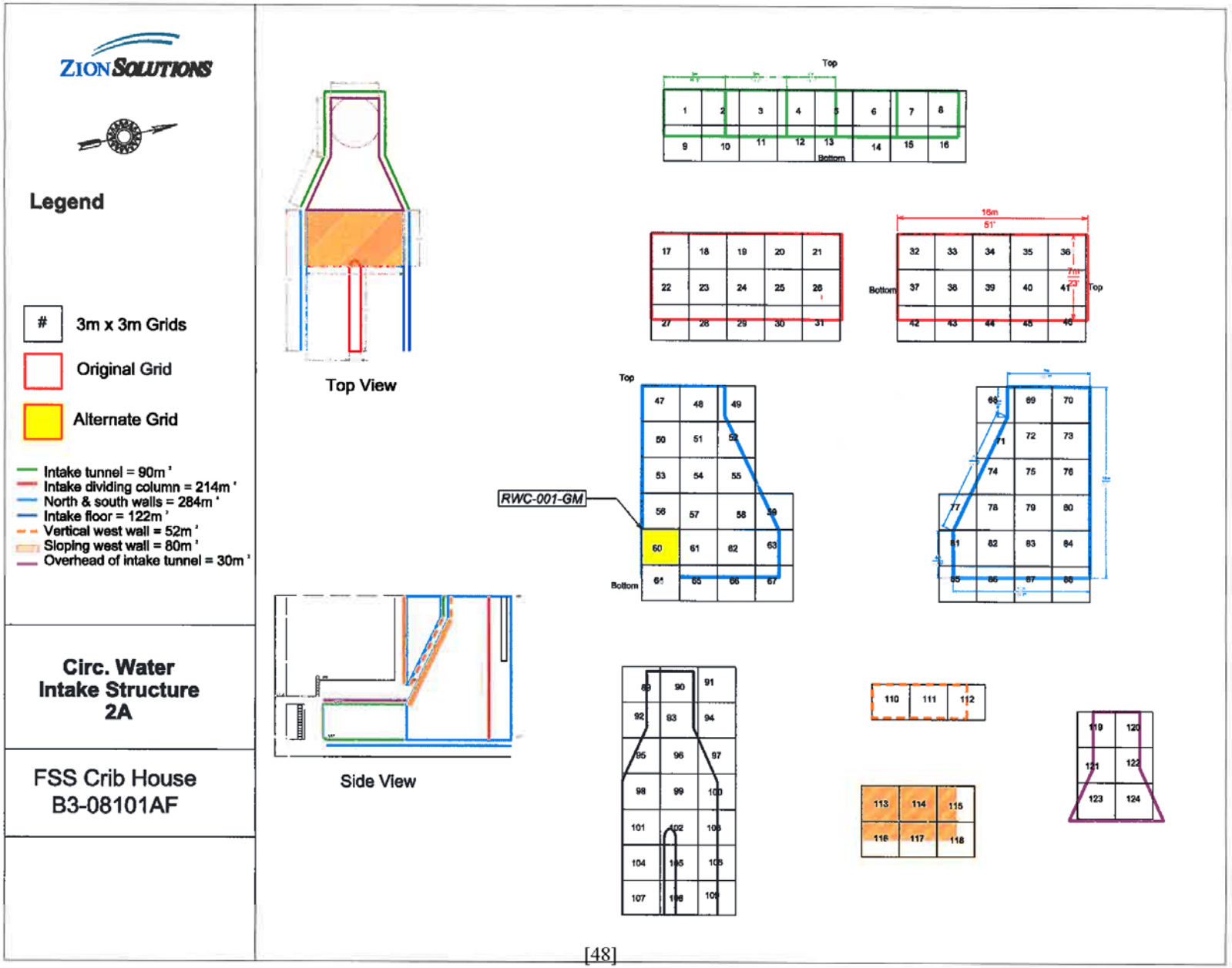
Floor

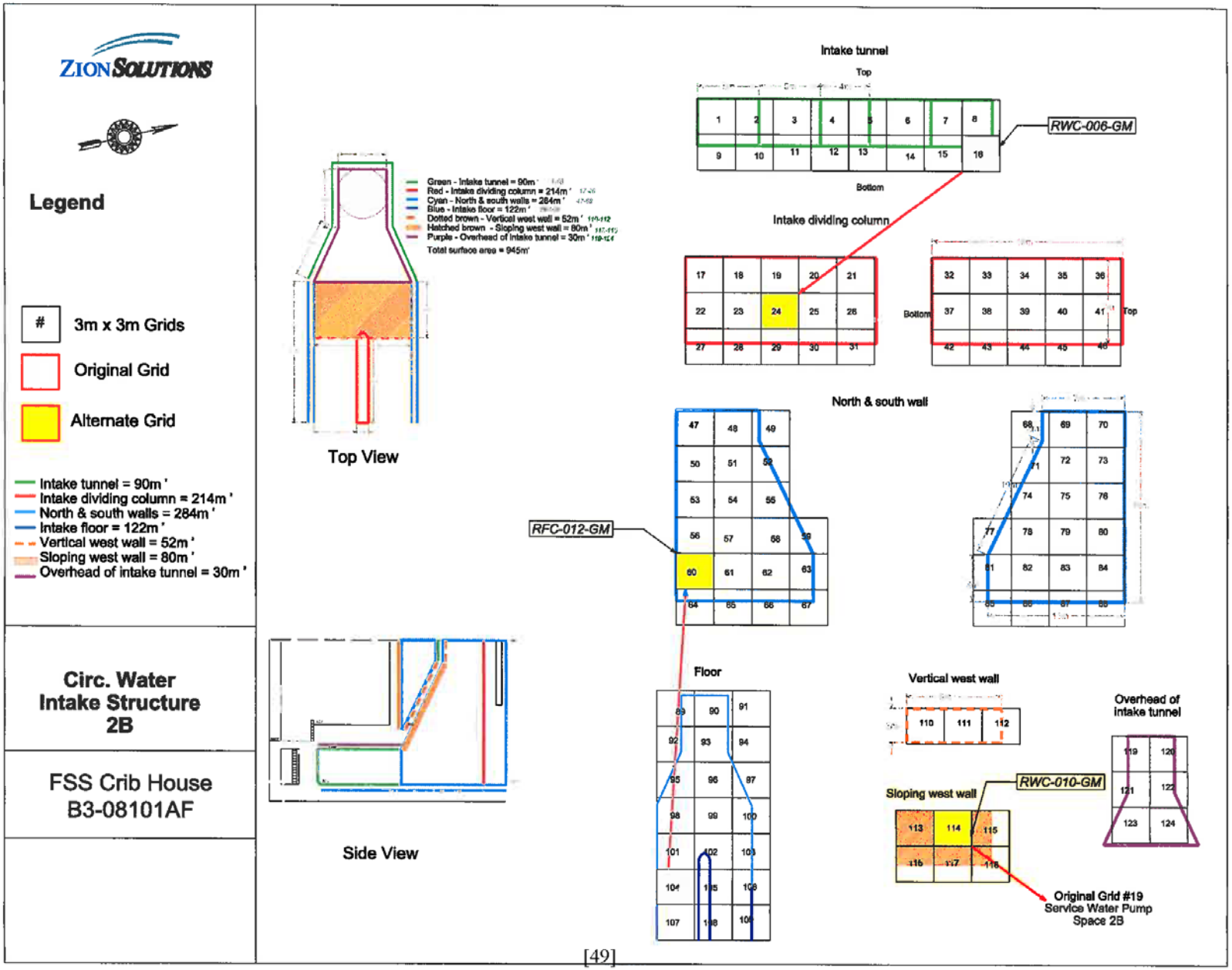


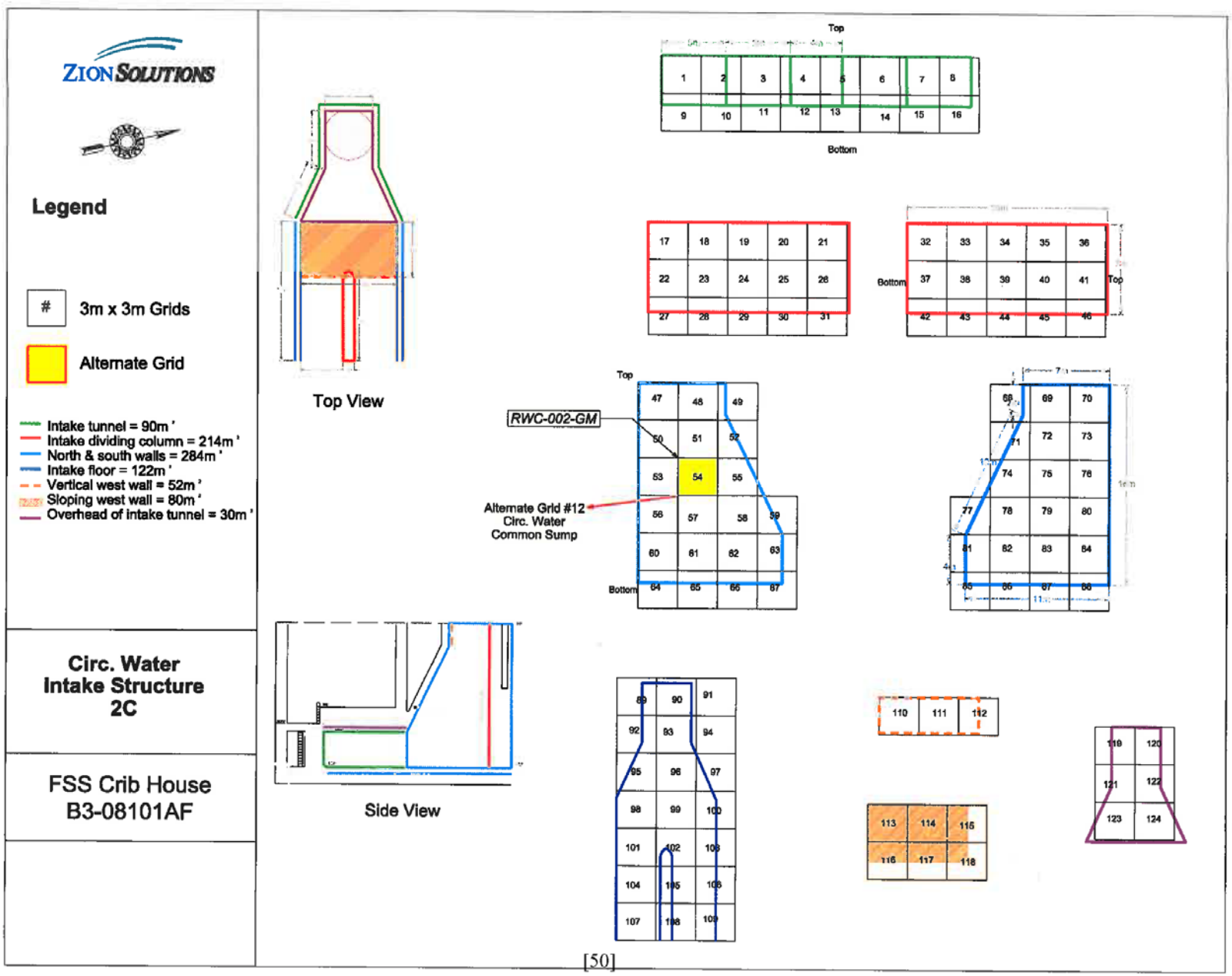
Vertical west wall

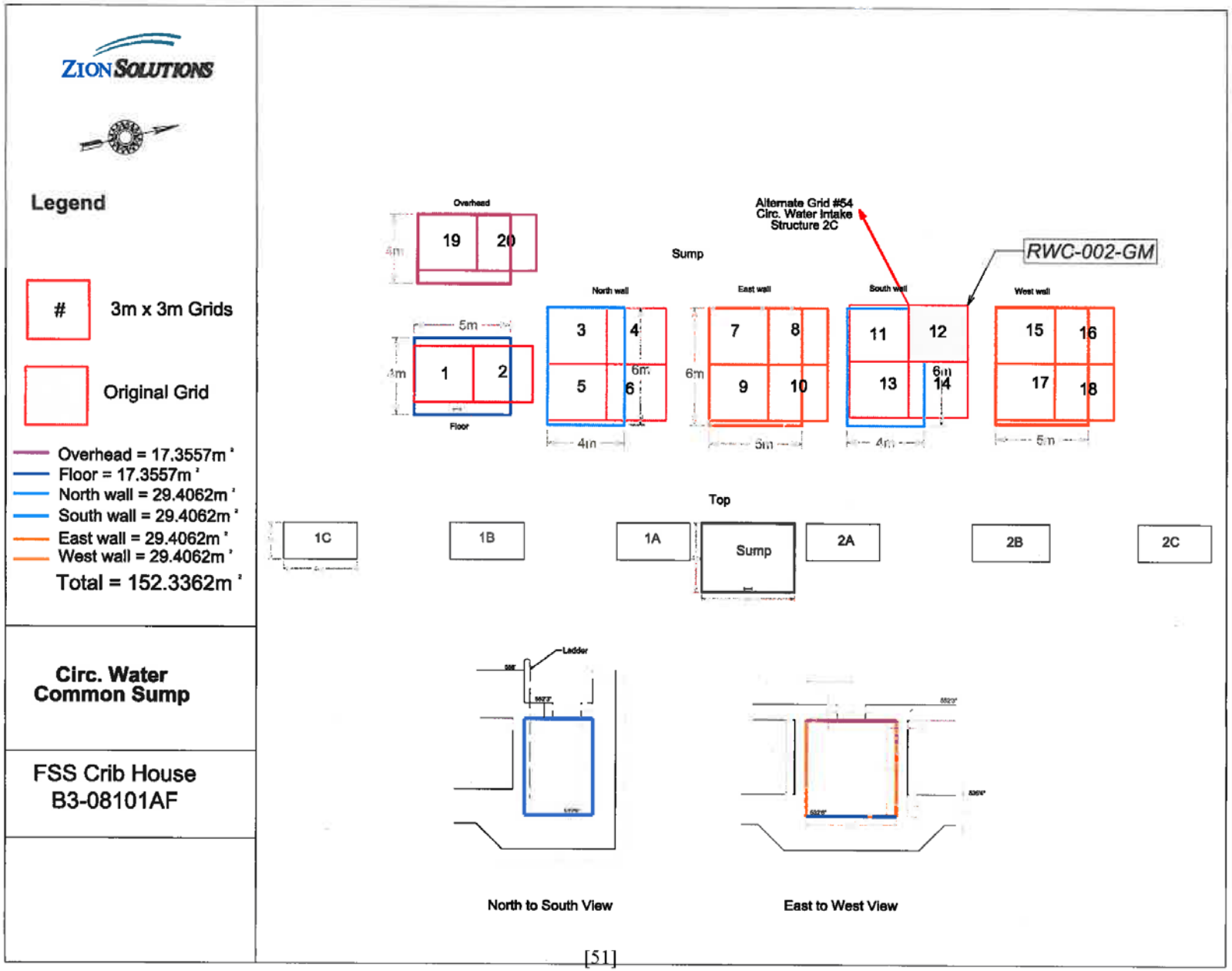
Sloping west wall

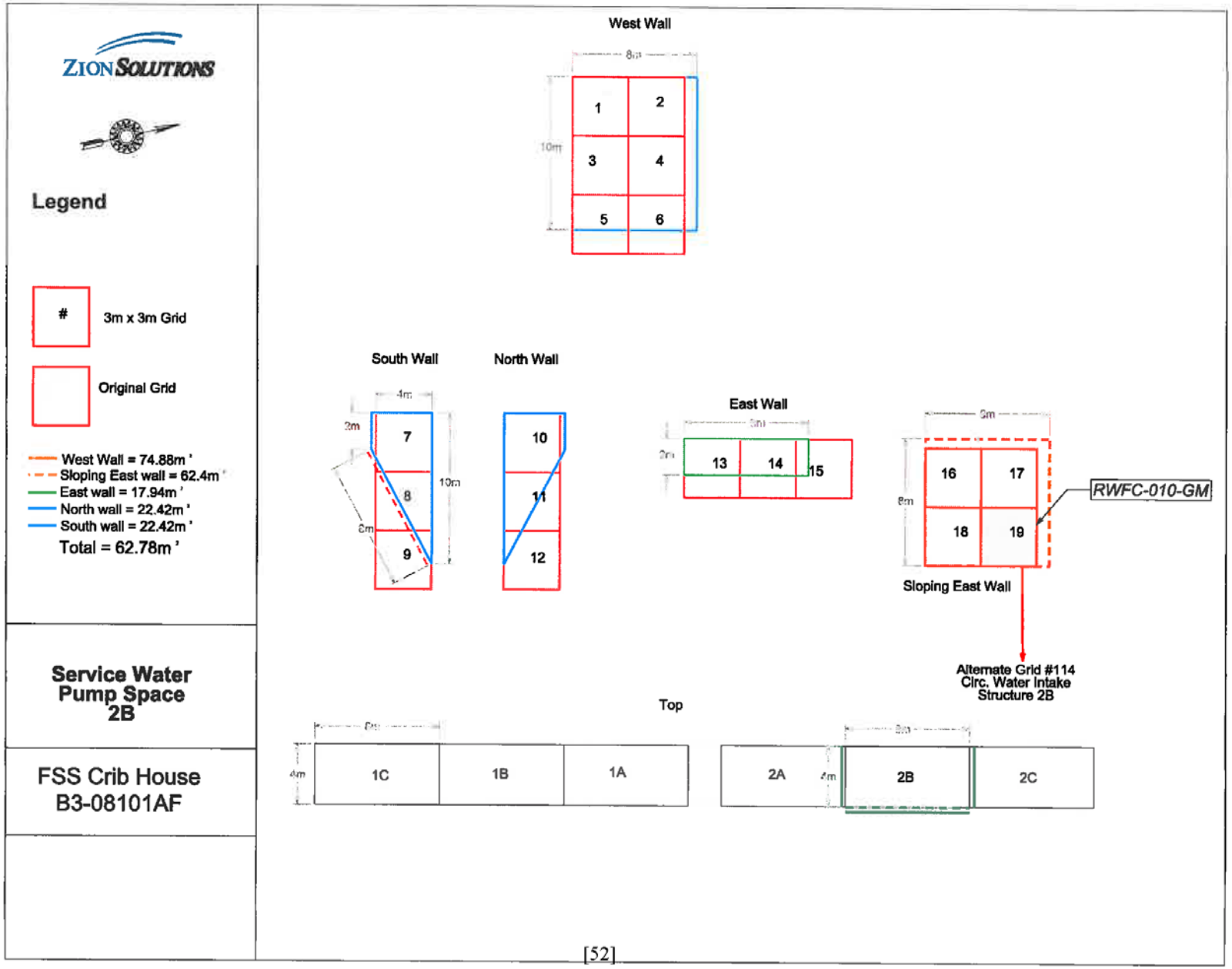



ZION SOLUTIONS
Legend
3m x 3m Grids
Original Grid
Alternate Grid
Intake tunnel = 90m '
Intake dividing column = 214m '
North & south walls = 284m '
Intake floor = 122m '
Vertical west wall = 52m '
Sloping west wall = 80m '
Overhead of intake tunnel = 30m '
Circ. Water Intake Structure 2A
FSS Crib House B3-08101AF
Top View
Side View
RWC-001-GM
Top
Bottom


ZION SOLUTIONS
Legend
3m x 3m Grids
Original Grid
Alternate Grid
Intake tunnel = 90m '
Intake dividing column = 214m '
North & south walls = 284m '
Intake floor = 122m '
Vertical west wall = 52m '
Sloping west wall = 80m '
Overhead of intake tunnel = 30m '
Circ. Water Intake Structure 2B
FSS Crib House B3-08101AF
Green - Intake tunnel = 90m '
Red - Intake dividing column = 214m '
Cyan - North & south walls = 284m '
Blue - Intake floor = 122m '
Dotted brown - Vertical west wall = 52m '
Hatched brown - Sloping west wall = 80m '
Purple - Overhead of intake tunnel = 30m '
Total surface area = 945m'
Top View
Side View
Intake tunnel
Top
Bottom
RWC-006-GM
Intake dividing column
Bottom
Top
North & south wall
RFC-012-GM
Floor
Vertical west wall
Overhead of intake tunnel
Sloping west wall
RWC-010-GM
Original Grid #19
Service Water Pump
Space 2B


ZION SOLUTIONS
Legend
3m x 3m Grids
Alternate Grid
Intake tunnel = 90m '
Intake dividing column = 214m '
North & south walls = 284m '
Intake floor = 122m '
Vertical west wall = 52m '
Sloping west wall = 80m '
Overhead of intake tunnel = 30m '
Circ. Water Intake Structure 2C
FSS Crib House B3-08101AF
Top View
Side View
Top
Bottom
RWC-002-GM
Alternate Grid #12
Circ. Water
Common Sump


ZION SOLUTIONS
Legend
3m x 3m Grids
Original Grid
Overhead = 17.3557m ²
Floor = 17.3557m ²
North wall = 29.4062m ²
South wall = 29.4062m ²
East wall = 29.4062m ²
West wall = 29.4062m ²
Total = 152.3362m ²
Circ. Water Common Sump
FSS Crib House B3-08101AF
Overhead
19
20
Sump
Alternate Grid #54 Circ. Water Intake Structure 2C
RWC-002-GM
North wall
East wall
South wall
West wall
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
1
2
Floor
5m
4m
6m
Top
1C
1B
1A
Sump
2A
2B
2C
Ladder
North to South View
East to West View


ZION SOLUTIONS
Legend
#
3m x 3m Grid
Original Grid
West Wall = 74.88m '
Sloping East wall = 62.4m '
East wall = 17.94m '
North wall = 22.42m '
South wall = 22.42m '
Total = 62.78m '
Service Water Pump Space 2B
FSS Crib House B3-08101AF
West Wall
8m
10m
1
2
3
4
5
6
South Wall
North Wall
4m
2m
7
8
9
10m
10
11
12
East Wall
3m
2m
13
14
15
3m
8m
16
17
18
19
RWFC-010-GM
Sloping East Wall
Alternate Grid #114
Circ. Water Intake
Structure 2B
Top
6m
4m
1C
1B
1A
2A
4m
2B
2C

Forebay – Figure 1

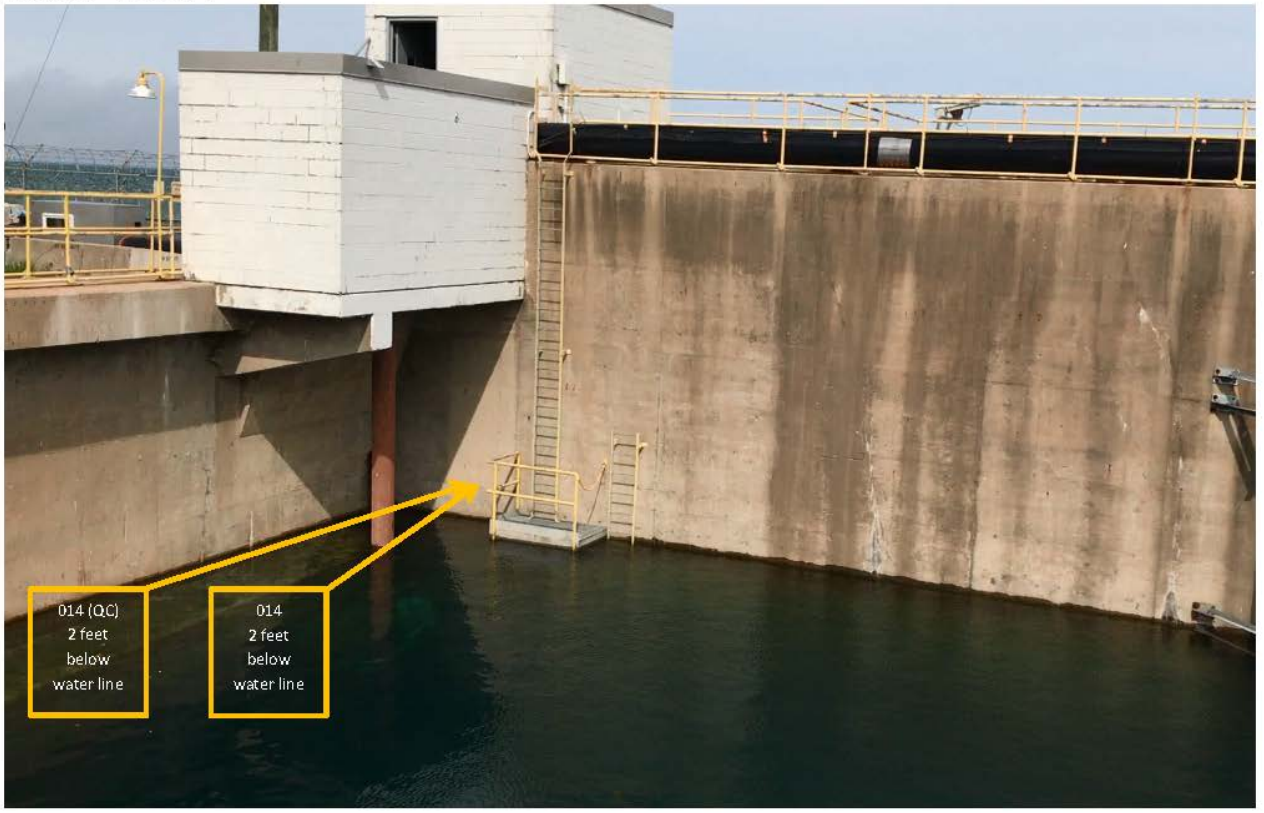
Forebay – Figure 2

Forebay – Figure 3

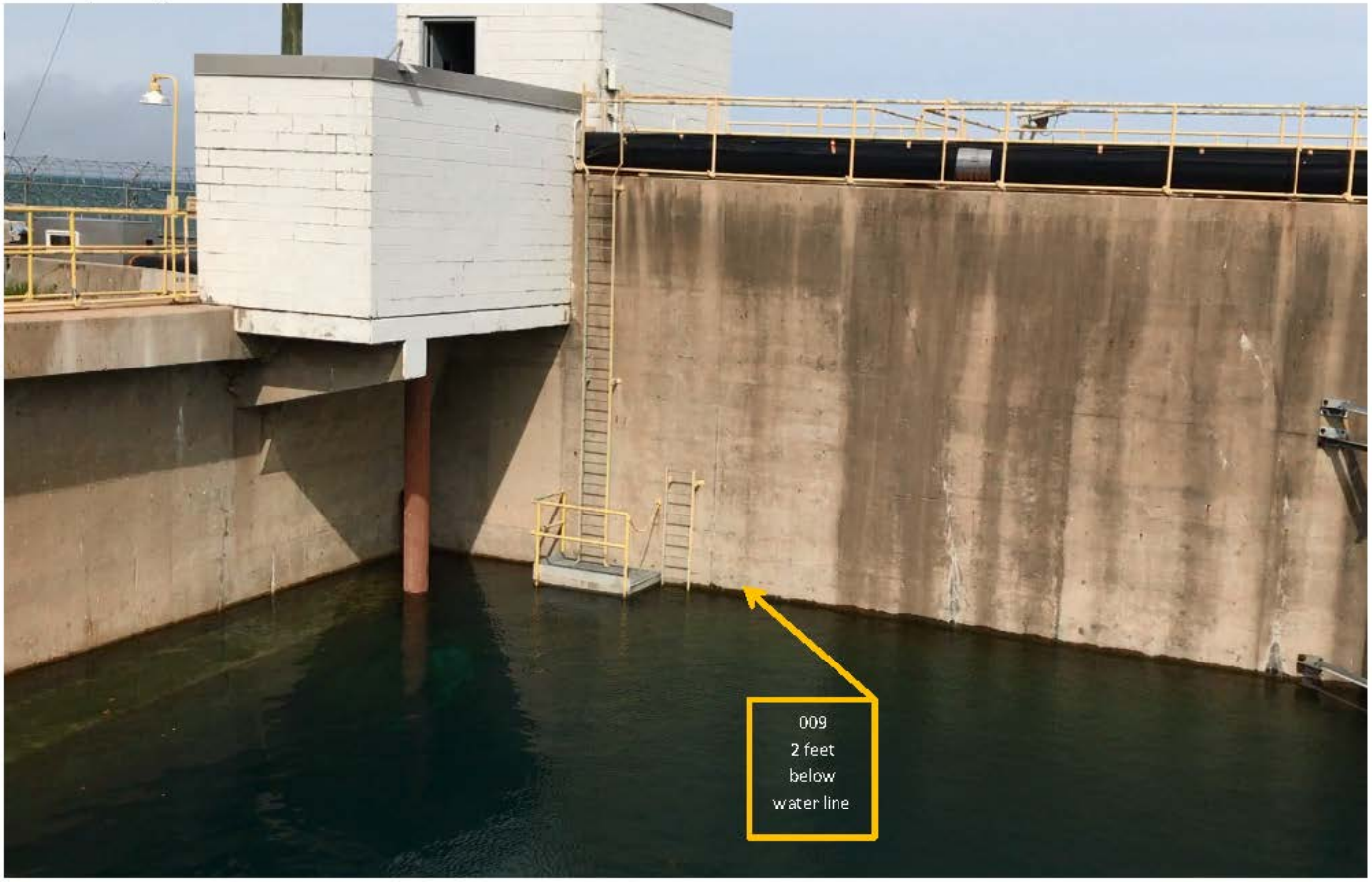
Forebay – Figure 4

Forebay – Figure 5

Forebay – Figure 6



Forebay – Figure 7



ATTACHMENT 2
ISOCS GEOMETRY

Geometry Composer Report

CANBERRA

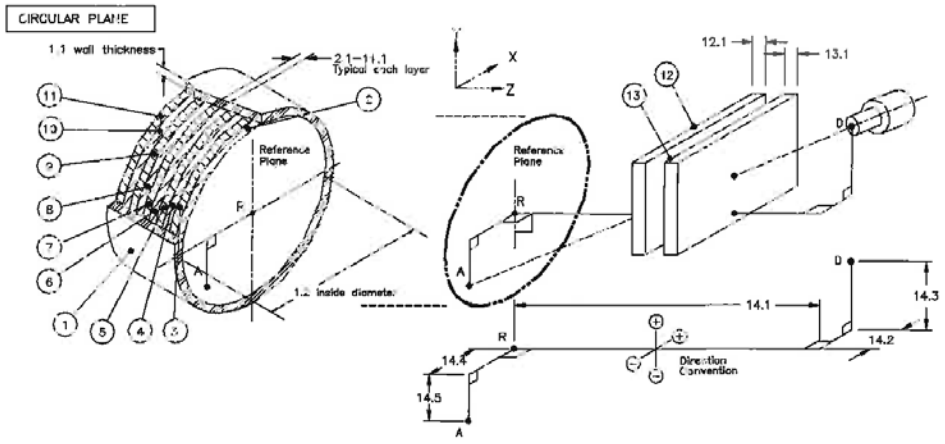
Date: Thursday, October 26, 2017 - 09:47:16
Description: CRIBHOUSE 3M
Comment: CRIBHOUSE 3M
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\CRIBHOUSE 3M.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: (default)
Detector: 5456
Collimator: 50mm-90d new (newISOCS 50mm side 90deg collimation [large hole collimator])
Environment: Temperature = 22 °C, Pressure = 760 mm Hg, Relative Humidity = 30%
Integration: Convergence = 1.00%, MDRPN = 2^4 (16), CRPN = 2^4 (16)

Dimensions (m)

No.	Description	d.1	d.2	d.3	d.4	d.5	d.6	Material	Density	Rel. Conc.
1	Side Walls	0	6					none		
2	Layer 1	0.0127						concrete	2.3	1.00
3	Layer 2	0						<none>		
4	Layer 3	0						<none>		
5	Layer 4	0						<none>		
6	Layer 5	0						<none>		
7	Layer 6	0						<none>		
8	Layer 7	0						<none>		
9	Layer 8	0						<none>		
10	Layer 9	0						<none>		
11	Layer 10	0						<none>		
12	Absorber1									
13	Absorber2									
14	Source-Detector	3	0	0	0	0				

List of energies for efficiency curve generation

59.5	63.3	88.0	122.1	143.8	165.9	185.7	238.6
351.9	391.7	583.2	661.7	898.0	911.6	1001.0	1173.2
1332.5	1460.7	1764.5	1836.1				



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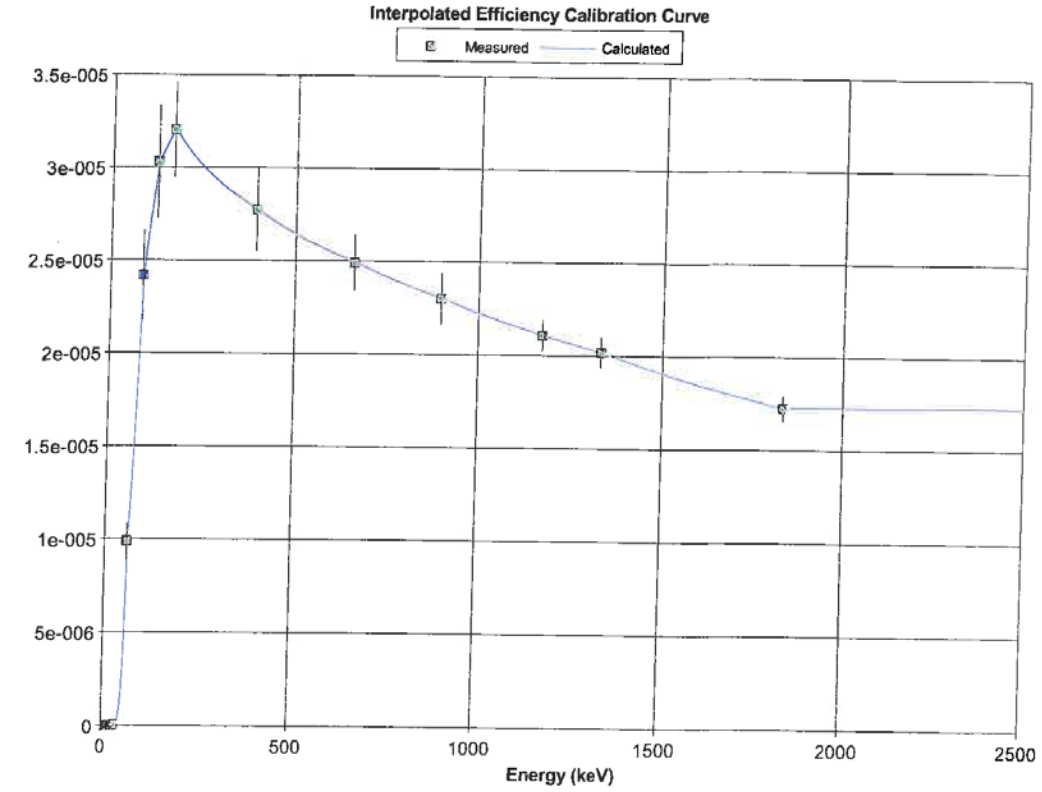
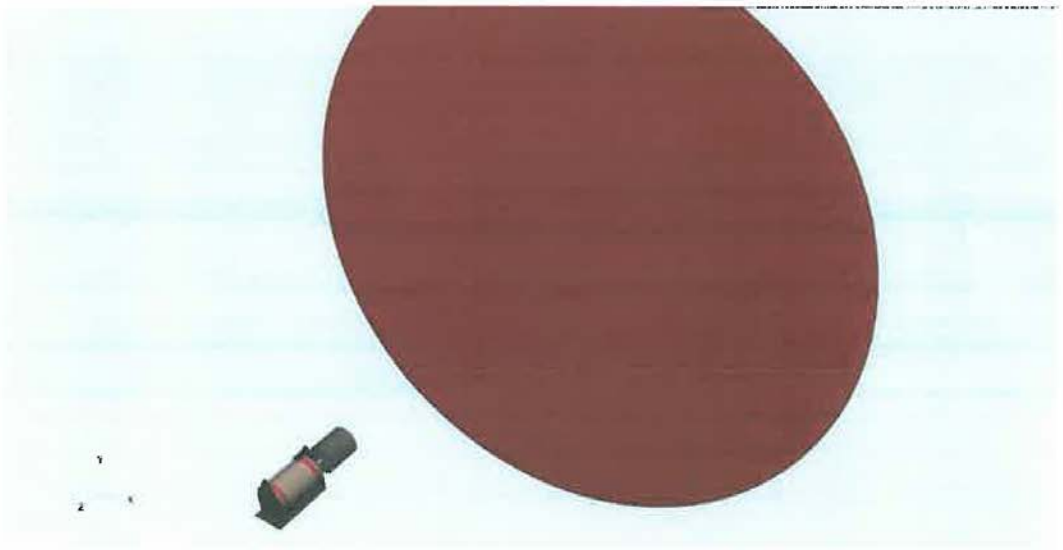


Datasource: C:\GENIE2K\CAMFILES\CERNIPF.CNF

Geometry Composer Report

CANBERRA

Date:	Thursday, October 26, 2017 - 09:47:16
Description:	CRIBHOUSE 3M
Comment:	CRIBHOUSE 3M
File Name:	C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\CRIBHOUSE 3M.geo
Software:	ISOCS
Template:	CIRCULAR_PLANE, Version: (default)



[61]

Geometry Composer Report

CANBERRA

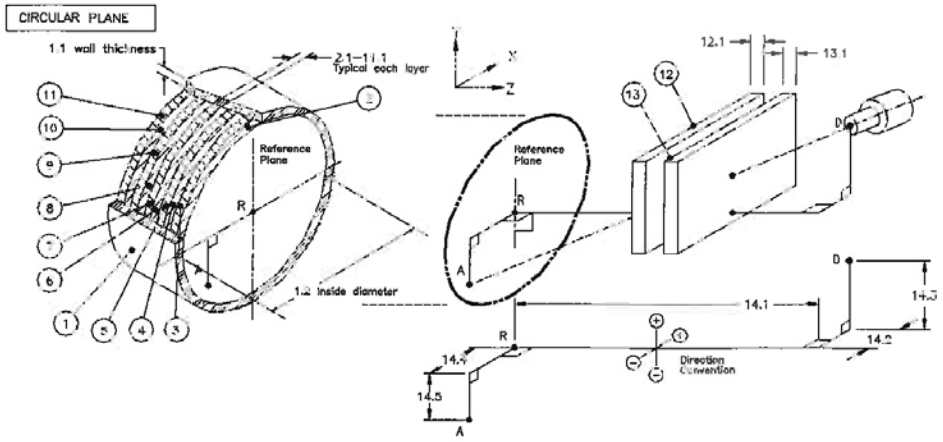
Date: Wednesday, October 18, 2017 - 10:03:19
Description: 3M TURBINE
Comment: 3M TURBINE
File Name: C:\GENIE2K\isocs\data\GEOMETRY\In-Situ\CIRCULAR_PLANE\3M TURBINE.geo
Software: ISOCS
Template: CIRCULAR_PLANE, Version: (default)
Detector: 5456
Collimator: 50mm-90d old (oldISOCS 50mm side 90deg collimation [large hole collimator])
Environment: Temperature = 22 °C, Pressure = 760 mm Hg, Relative Humidity = 30%
Integration: Convergence = 1.00%, MDRPN = 2^4 (16), CRPN = 2^4 (16)

Dimensions (m)

No.	Description	d.1	d.2	d.3	d.4	d.5	d.6	Material	Density	Rel. Conc.
1	Side Walls	0.016002	2.7432					csteel	7.9	
2	Layer 1	9.144						dryair	0.0013	0.90
3	Layer 2	0.016002						csteel	7.9	0.10
4	Layer 3	0						<none>		
5	Layer 4	0						<none>		
6	Layer 5	0						<none>		
7	Layer 6	0						<none>		
8	Layer 7	0						<none>		
9	Layer 8	0						<none>		
10	Layer 9	0						<none>		
11	Layer 10	0						<none>		
12	Absorber1									
13	Absorber2									
14	Source-Detector	0.3048	0	0	0	0				

List of energies for efficiency curve generation

59.5	63.3	88.0	122.1	143.8	165.9	185.7	238.6
351.9	391.7	583.2	661.7	898.0	911.6	1001.0	1173.2
1332.5	1460.7	1764.5	1836.1				



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Geometry Composer Report

CANBERRA

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Comment:	3M TURBINE
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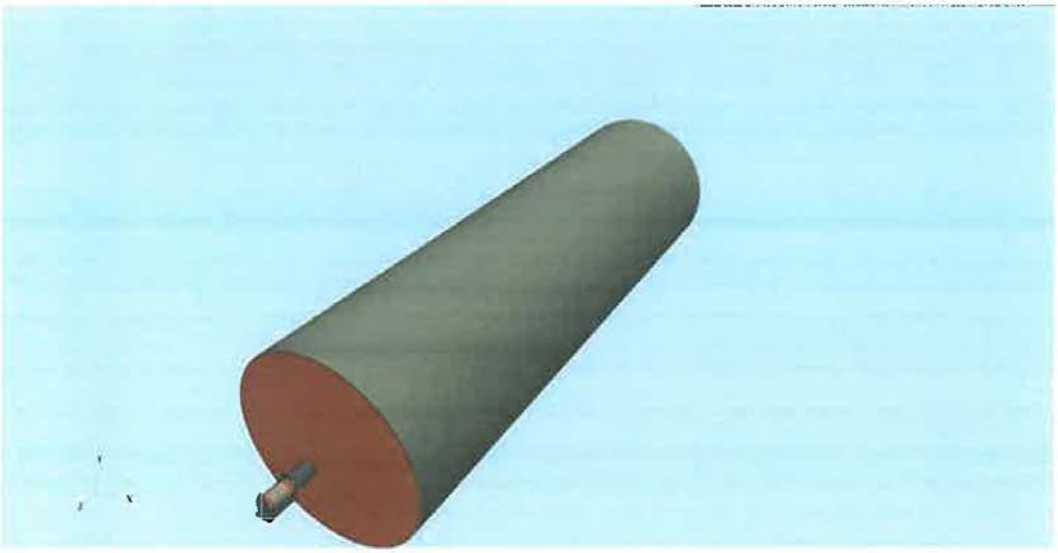
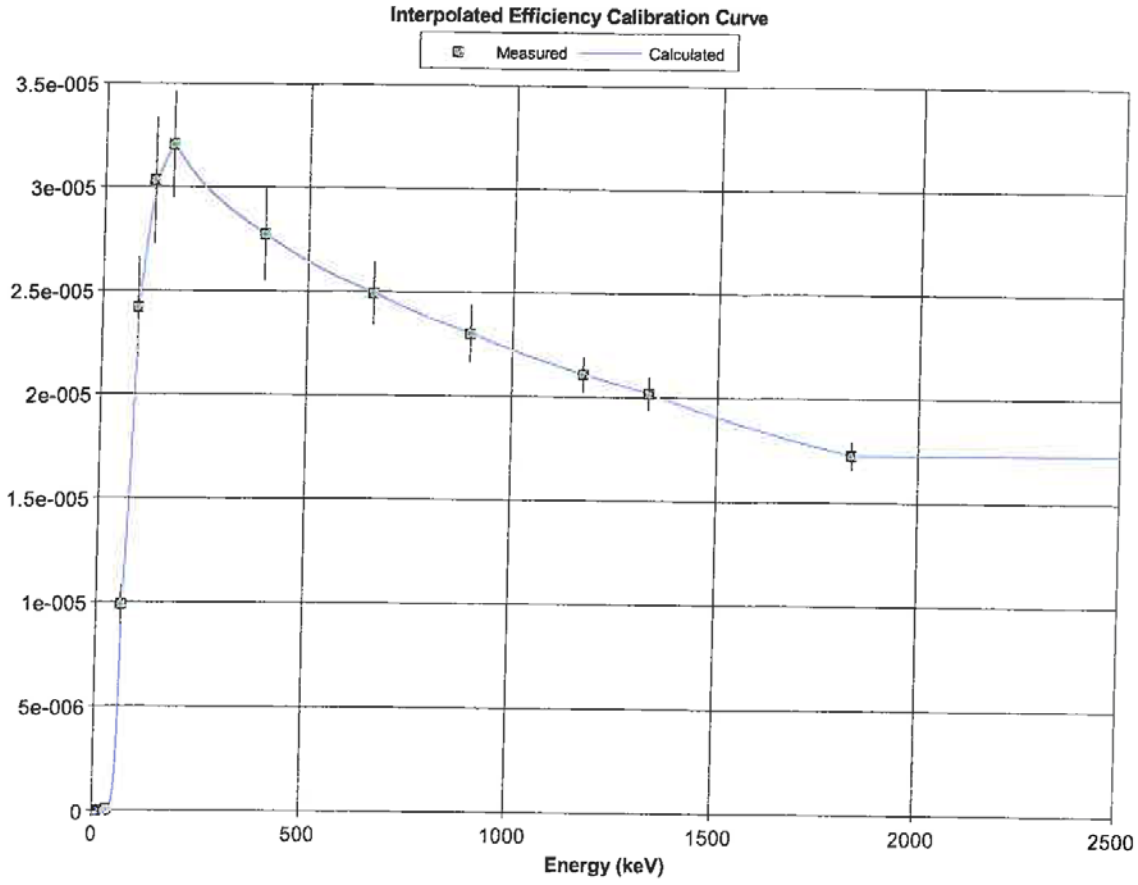
Software:	ISOCS
Template:	CIRCULAR_PLANE, Version: (default)



[64]

Page 2 of 2



Datasource: C:\GENIE2K\CAMFILES\CERNIPF.CNF

ATTACHMENT 3
SIGN TEST

Sign Test – Crib House/Forebay

Survey Area	08000		Survey Area	Crib House/Forebay	
Survey Unit	08101		Survey Unit	Structural Surfaces	
Classification	3	Type I Error	0.05	Number of Measurements	14

#	SOF (Ws)	1-Ws	Sign
1	0.00005	1.00	+1
2	0.00001	1.00	+1
3	0.00003	1.00	+1
4	0.00005	1.00	+1
5	0.00002	1.00	+1
6	0.00005	1.00	+1
7	0.00002	1.00	+1
8	0.00004	1.00	+1
9	0.00003	1.00	+1
10	0.00002	1.00	+1
11	0.00002	1.00	+1
12	0.00001	1.00	+1
13	0.00003	1.00	+1
14	0.00000	1.00	+1

Number of positive differences (S+) 14

Critical Value 10

The Survey Unit MEETS the Acceptance Criteria

ATTACHMENT 4
FOREBAY JUDGMENTAL MEASUREMENTS

Forebay Judgmental Measurements

Measurement Location	MDC		Bkgd	Measurement						Co-60 (1)	Cs-134 (1)	Cs-137 (1)
	(dpm/cm²)	(pCi/m²)	(cpm)	Gross cpm	Net cpm	Eff.	Net dpm	dpm/cm²	(pCi/m²)	(pCi/m²)	(pCi/m²)	(pCi/m²)
B3-08401A-FJWC-001-GD	58	260935	72	370	298	0.003	116270	120	5.40E+05	6.48E+03	7.08E+01	5.33E+05
B3-08401A-FJWC-002-GD	58	260935	72	378	306	0.003	119391	123	5.54E+05	6.65E+03	7.27E+01	5.48E+05
B3-08401A-FJWC-003-GD	58	260935	72	369	297	0.003	115880	119	5.38E+05	6.46E+03	7.06E+01	5.32E+05
B3-08401A-FJWC-004-GD	58	260935	72	382	310	0.003	120952	125	5.62E+05	6.74E+03	7.37E+01	5.55E+05
B3-08401A-FJWC-005-GD	58	260935	72	338	266	0.003	103785	107	4.82E+05	5.78E+03	6.32E+01	4.76E+05
B3-08401A-FJWC-006-GD	52	235568	65	348	283	0.003	110417	114	5.13E+05	6.15E+03	6.73E+01	5.07E+05
B3-08401A-FJWC-007-GD	52	235568	65	371	306	0.003	119391	123	5.54E+05	6.65E+03	7.27E+01	5.48E+05
B3-08401A-FJWC-008-GD	52	235568	65	339	274	0.003	106906	110	4.97E+05	5.96E+03	6.51E+01	4.90E+05
B3-08401A-FJWC-009-GD	52	235568	65	392	327	0.003	127585	132	5.93E+05	7.11E+03	7.77E+01	5.85E+05
B3-08401A-FJWC-010-GD	58	260935	72	399	327	0.003	127585	132	5.93E+05	7.11E+03	7.77E+01	5.85E+05
B3-08401A-FJWC-011-GD	52	235568	65	385	320	0.003	124854	129	5.80E+05	6.96E+03	7.61E+01	5.73E+05
B3-08401A-FJWC-012-GD	52	235568	65	394	329	0.003	128365	132	5.96E+05	7.15E+03	7.82E+01	5.89E+05
B3-08401A-FJWC-013-GD	52	235568	65	365	300	0.003	117050	121	5.44E+05	6.52E+03	7.13E+01	5.37E+05
B3-08401A-FJWC-014-GD	58	260935	72	450	378	0.003	147483	152	6.85E+05	8.22E+03	8.98E+01	6.77E+05
B3-08401A-FJQC-014-GD	52	235568	65	461	396	0.003	154506	159	7.18E+05	8.61E+03	9.41E+01	7.09E+05

(1) Inferred using normalized gamma mixture

ATTACHMENT 5
QC MEASUREMENT ASSESSMENTS

Replicate Measurement Assessment

Survey Unit # 08000 Survey Unit Name Crib House/Forebay Basement

Sample Plan # B308101A

Sample Description: Comparison of duplicate ISOCS measurements collected from measurement location #10. The standard measurement was B3-08101AF-RWC-014-GM, the comparison sample was B3-08101AF-QWC-014-GM.

STANDARD					COMPARISON			
ROC	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Cs-137	0.00E+00	2.38E+02	0.00	0.5 - 2.0	7.83E+01	1.76E+02	0	N
K-40	4.12E+04	6.36E+03	6.47	0.5 - 2.0	3.71E+04	5.63E+03	0.9	Y

Comments/Corrective Actions: The Cs-137 concentration for both measurements was less than instrument MDC. The reported result for the standard measurement was a negative value (-1.035E+02 pCi/m^2, thus resulting in a reported concentration of 0.00E+00 pCi/m^2). Consequently, as insufficient data was reported for Cs-137, K-40 was substituted for the comparison. There was acceptable agreement when using K-40. No further action is necessary.

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

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

Replicate Measurement Assessment

Survey Unit # 08000 Survey Unit Name Circ Water Intake Pipe

Sample Plan # B308102S

Sample Description: Comparison of duplicate ISOCS measurements collected from measurement location #2 inside the Unit 1 Circ Water Intake Pipe. The standard measurement was B3-08102AS-FJSM-002-GD, the comparison sample was B3-08102AS-FQSM-002-GD.

STANDARD					COMPARISON			
ROC	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Cs-137	2.64E+02	2.54E+03	0.10	0.5 - 2.0	0.00E+00	2.27E+03	0	N

Comments/Corrective Actions: The Cs-137 concentration for both measurements was less than instrument MDC. The reported result for the comparison measurement was a negative value (-1.759E+02 pCi/m^2, thus resulting in a reported concentration of 0.00E+00 pCi/m^2). Consequently, as insufficient data was reported for Cs-137, K-40 could not be substituted as the comparison measurement was also negative. As two additional QC samples were taken in this survey unit with acceptable comparison, no further action was deemed necessary

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

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

Replicate Measurement Assessment

Survey Unit # 08000 Survey Unit Name Forebay

Sample Plan # B308401AF

Sample Description: Comparison of duplicate NaI measurements collected from measurement location #14 in the Forebay. The standard measurement was B3-08401A-FJWC-014-GD, the comparison sample was B3-08401A-FJQC-014-GD.

STANDARD					COMPARISON			
ROC	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Gross γ	6.85E+05	N/A	N/A	+20%	7.18E+05	N/A	N/A	Y

Comments/Corrective Actions: The Cs-137 concentration for both measurements was inferred from gross gamma results using the non-activated mixture from LTP Table 5-2. As the standard agreement method was not applicable to gross gamma results, the samples were in agreement if the gross gamma values were with + 20%. The gross gamma values were within 6%. Consequently, the agreement between the two measurements were deemed acceptable.

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

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

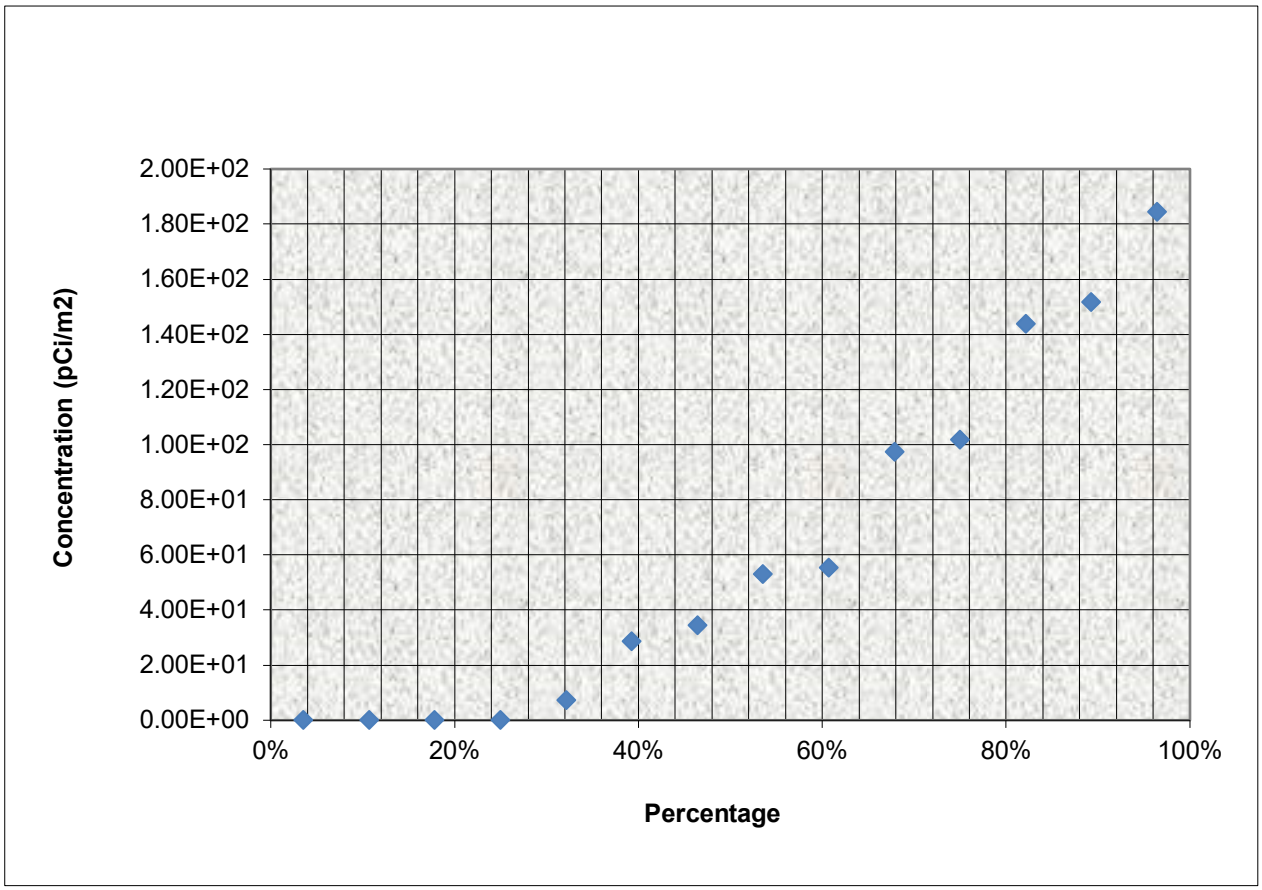
ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Quantile Plot for Co-60

Survey Unit: 08101

Description: CRIB HOUSE/FOREBAY STRUCTURAL

Mean: 6.12E+01 pCi/m^2

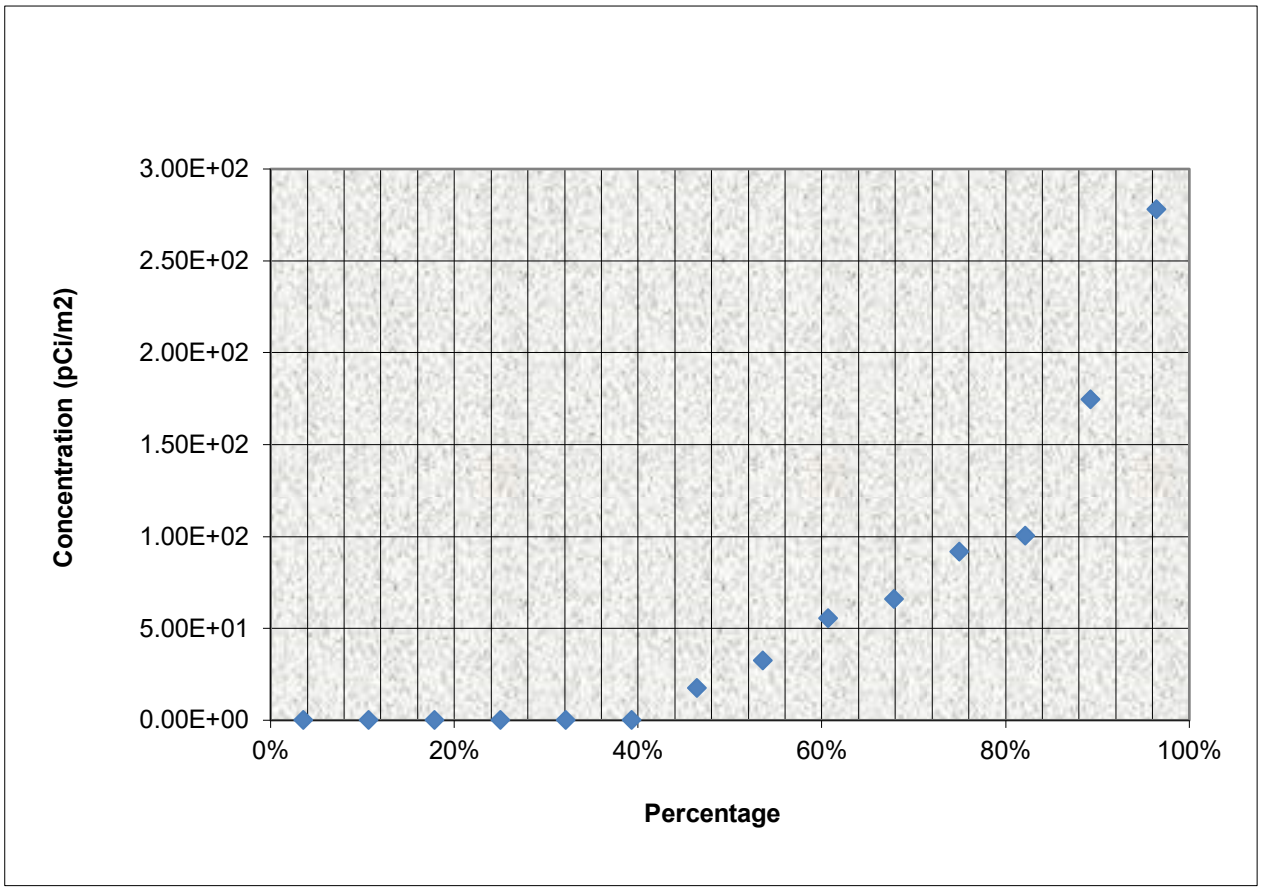


Quantile Plot for Cs-137

Survey Unit: 08101

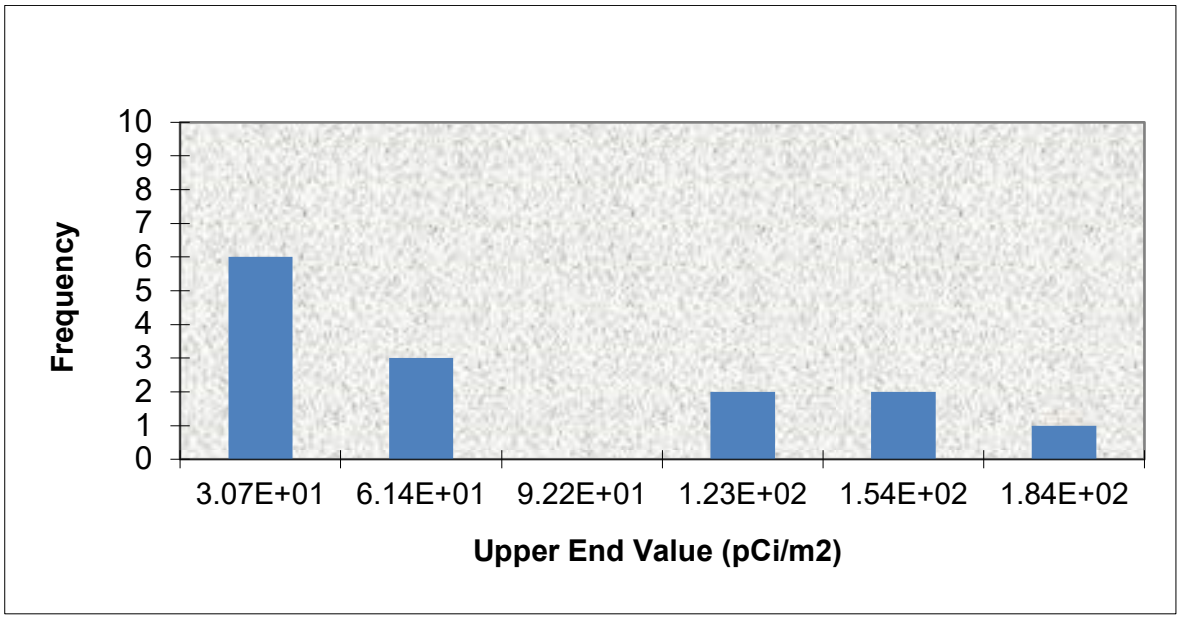
Description: CRIB HOUSE/FOREBAY STRUCTURAL

Mean: 5.82E+01 pCi/m^2



Histogram for Co-60

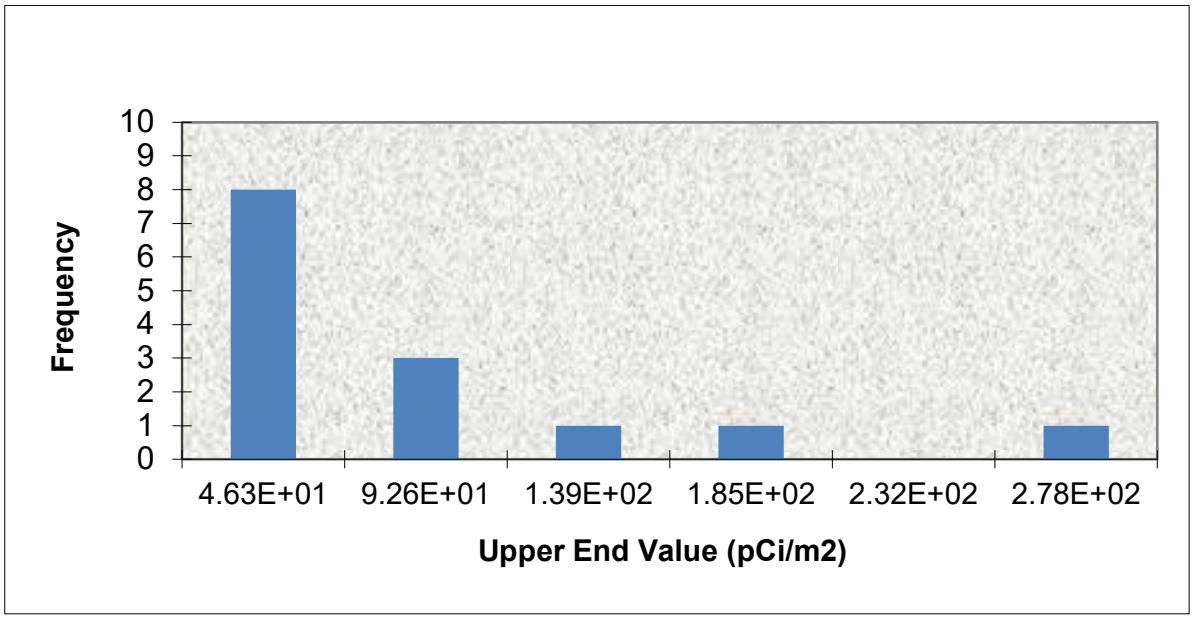
Survey Unit: 08101
Description: CRIB HOUSE/FOREBAY STRUCTURAL
Mean: 6.12E+01 pCi/m2
Median: 4.37E+01 pCi/m2
ST Dev.: 63.762445
Skew: 0.743206



Upper Value	Observation Frequency	Observation %
3.07E+01	6	43%
6.14E+01	3	21%
9.22E+01	0	0%
1.23E+02	2	14%
1.54E+02	2	14%
1.84E+02	1	7%
TOTAL	14	

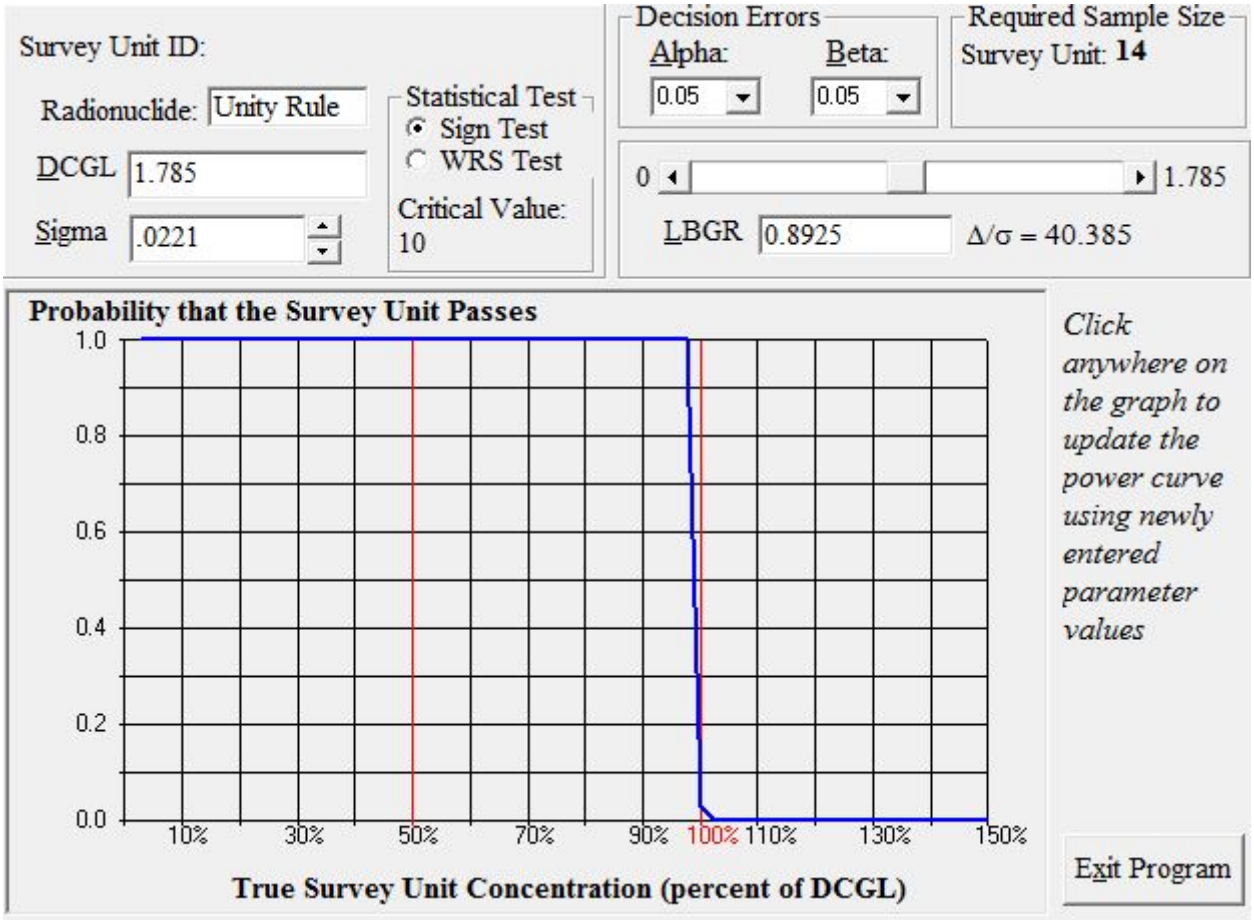
Histogram for Cs-137

Survey Unit: 08101
Description: CRIB HOUSE/FOREBAY STRUCTURAL
Mean: 5.82E+01 pCi/m2
Median: 2.49E+01 pCi/m2
ST Dev.: 82.014195
Skew: 1.791894



Upper Value	Observation Frequency	Observation %
4.63E+01	8	57%
9.26E+01	3	21%
1.39E+02	1	7%
1.85E+02	1	7%
2.32E+02	0	0%
2.78E+02	1	7%
TOTAL	14	

Retrospective Power Curve for Survey Unit



ATTACHMENT 7
ISOCS REPORTS

Filename: C:\GENIE2K\CAMFILES\RWC001.CNF

Report Generated On : 6/30/2015 10:56:16 AM

Sample Title : RWC001
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 1.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 1:24:59 PM

Live Time : 600.0 seconds
Real Time : 600.6 seconds
Dead Time : 0.10 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 6/30/2015
Efficiency ID : CRIB_HOUSE_3M_AR

Report Date : 6/30/2015 10:56:17 AM
Sample Title: RWC001
Peak Analysis Performed on: 6/30/2015 10:56:16 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	1401	1414	1408.91	352.10	0.96	1.913E+001
2	2431	2444	2438.09	609.43	0.72	1.370E+001
3	5836	5858	5848.09	1461.33	1.73	1.150E+001

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC001
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 6/30/2015 10:56:17 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	0.959	1460.82*	10.66	5.94640E+004	1.21905E+004
Bi-214	0.999	609.32*	45.49	2.22087E+003	1.01222E+003
		768.36	4.89		
		806.18	1.26		
		934.06	3.11		
		1120.29	14.92		
		1155.21	1.63		
		1238.12	5.83		
		1280.98	1.43		
		1377.67	3.99		
		1385.31	0.79		
		1401.52	1.33		
		1407.99	2.39		
		1509.21	2.13		
		1661.27	1.05		
		1729.59	2.88		
		1764.49	15.30		
		1847.43	2.03		
		2118.51	1.16		
Pb-214	0.997	241.99	7.25		
		295.22	18.42		
		351.93*	35.60	2.36524E+003	1.07547E+003
		785.96	1.06		

* = Energy line found in the spectrum.

! = Nuclide was corrected for parent/daughter
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	0.959	5.946404E+004	1.219048E+004
Bi-214	0.999	2.220870E+003	1.012223E+003
Pb-214	0.997	2.365241E+003	1.075474E+003

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 6/30/2015 10:56:16 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC001
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 6/30/2015 10:56:17 AM

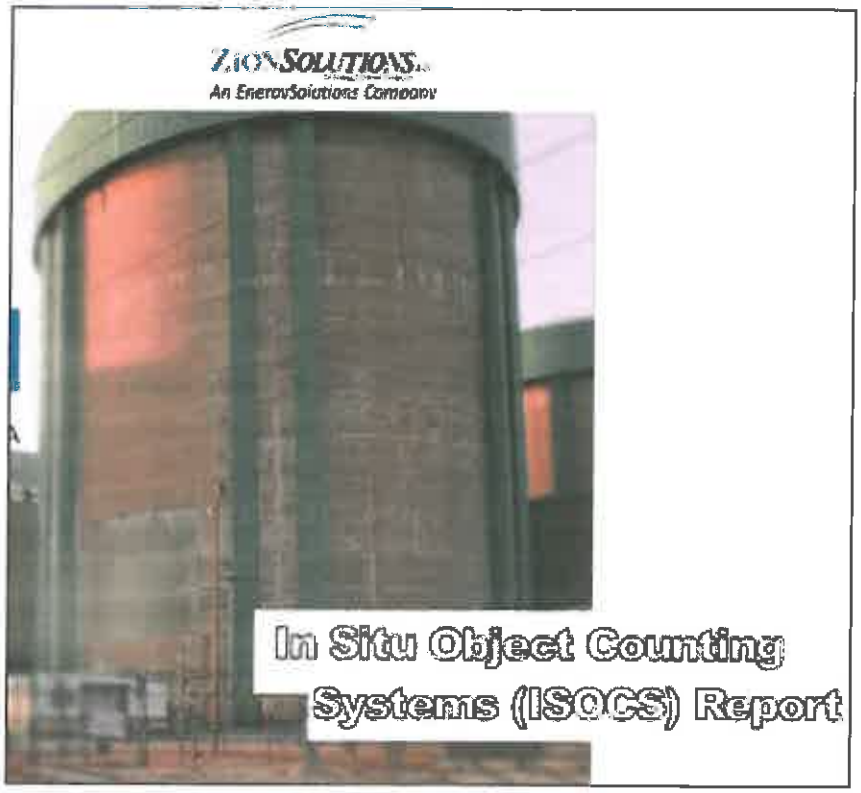
	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+	K-40	1460.82*	10.66	9.768E+003	9.77E+003	5.946E+004	4.350E+003
	Cr-51	320.08	9.91	1.189E+013	1.19E+013	-3.113E+012	5.057E+012
	Mn-54	834.85	99.98	1.567E+003	1.57E+003	-5.324E+002	4.954E+002
	Co-58	810.76	99.45	1.785E+006	1.78E+006	4.421E+005	6.681E+005
	Co-60	1173.23	99.85	7.601E+002	6.55E+002	5.966E+001	3.116E+002
		1332.49	99.98	6.552E+002		9.204E+001	2.538E+002
	Nb-94	702.65	99.81	4.090E+002	4.04E+002	7.490E+001	1.676E+002

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	871.09	99.89	4.037E+002		-9.853E+001	1.602E+002
Sn-113	255.13	2.11	3.374E+006	1.09E+005	-7.193E+005	1.493E+006
	391.70	64.97	1.085E+005		-3.795E+004	4.618E+004
Cs-134	475.36	1.48	5.472E+004	8.63E+002	1.487E+004	2.292E+004
	563.25	8.34	1.170E+004		2.462E+003	4.976E+003
	569.33	15.37	6.133E+003		1.144E+003	2.590E+003
	604.72	97.62	8.626E+002		-6.360E+001	3.536E+002
	795.86	85.46	1.219E+003		4.035E+002	5.057E+002
	801.95	8.69	8.173E+003		-4.555E+003	3.059E+003
	1038.61	0.99	1.233E+005		5.175E+004	5.115E+004
	1167.97	1.79	5.538E+004		5.763E+003	2.145E+004
	1365.19	3.02	2.791E+004		-1.315E+004	9.889E+003
Cs-137	661.66	85.10	6.356E+002	6.36E+002	3.018E+002	2.737E+002
Eu-152	121.78	28.67	1.976E+003	1.63E+003	1.149E+003	9.247E+002
	244.70	7.61	5.729E+003		2.855E+002	2.571E+003
	295.94	0.45	1.241E+005		3.609E+004	5.649E+004
	344.28	26.60	1.650E+003		2.073E+002	7.229E+002
	367.79	0.86	4.033E+004		7.194E+003	1.689E+004
	411.12	2.24	1.200E+004		-9.987E+003	4.647E+003
	443.96	2.83	1.167E+004		-5.653E+003	4.714E+003
	488.68	0.42	1.112E+005		1.773E+004	4.762E+004
	563.99	0.49	1.000E+005		3.434E+004	4.255E+004
	586.26	0.46	8.497E+004		-3.264E+004	3.433E+004
	678.62	0.47	8.375E+004		-7.985E+003	3.323E+004
	688.67	0.86	6.166E+004		6.903E+003	2.604E+004
	719.35	0.28	1.576E+005		3.632E+004	6.368E+004
	778.90	12.96	3.025E+003		-1.889E+003	1.172E+003
	810.45	0.32	2.815E+004		0.000E+000	0.000E+000
	867.37	4.26	1.293E+004		-1.655E+003	5.362E+003
	919.33	0.43	1.334E+005		2.102E+004	5.533E+004
	964.08	14.65	4.213E+003		4.916E+002	1.764E+003
	1085.87	10.24	3.606E+003		9.707E+001	1.278E+003
	1089.74	1.73	3.248E+004		2.111E+003	1.312E+004
	1112.07	13.69	3.539E+003		0.000E+000	1.371E+003
	1212.95	1.43	3.577E+004		7.446E+002	1.386E+004
Eu-152	1249.94	0.19	2.463E+005	1.63E+003	-1.106E+005	9.219E+004
	1299.14	1.63	3.271E+004		2.042E+003	1.267E+004
	1408.01	21.07	1.625E+003		-1.104E+003	5.139E+002
	1457.64	0.50	1.334E+005		3.500E+004	5.391E+004
	1528.10	0.28	1.281E+005		1.741E+004	4.050E+004
Eu-154	123.07	40.40	1.404E+003	1.40E+003	4.461E+001	6.538E+002
	247.93	6.89	6.844E+003		9.014E+002	3.072E+003
	591.76	4.95	7.923E+003		-1.269E+003	3.144E+003
	692.42	1.78	3.342E+004		9.759E+003	1.422E+004
	723.30	20.06	1.802E+003		-1.130E+003	6.745E+002
	756.80	4.52	1.145E+004		1.688E+003	4.693E+003
	873.18	12.08	3.720E+003		-1.316E+003	1.441E+003
	996.29	10.48	5.811E+003		1.935E+002	2.382E+003
	1004.76	18.01	3.192E+003		-3.112E+002	1.290E+003
	1274.43	34.80	1.621E+003		1.012E+002	6.279E+002
	1596.48	1.80	8.171E+003		0.000E+000	0.000E+000
Eu-155	45.30	1.31	6.261E+004	2.87E+003	1.493E+004	2.893E+004
	60.01	1.22	7.956E+004		5.968E+003	3.725E+004
	86.55	30.70	2.868E+003		-6.650E+002	1.354E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	105.31	21.10	3.356E+003		-4.964E+002	1.567E+003
Tl-208	583.19	85.00	8.455E+002	8.46E+002	4.955E+002	3.839E+002
Bi-211	351.07	13.02	4.761E+003	4.76E+003	3.037E+003	2.195E+003
Pb-211	404.85	3.78	7.770E+003	6.26E+003	1.294E+002	3.185E+003
	427.09	1.76	2.082E+004		2.609E+001	8.858E+003
	832.01	3.52	6.262E+003		8.510E+002	1.980E+003
Bi-212	39.86	1.06	3.513E+004	9.77E+003	-1.128E+004	1.550E+004
	727.33	6.67	9.775E+003		5.254E+003	4.325E+003
	785.37	1.10	4.950E+004		1.107E+004	2.119E+004
	1620.50	1.47	3.303E+004		9.206E+003	1.236E+004
Pb-212	115.18	0.60	8.324E+004	1.30E+003	1.773E+004	3.890E+004
	238.63	43.60	1.297E+003		8.027E+002	6.037E+002
	300.09	3.30	1.193E+004		1.489E+003	5.291E+003
Pb212-XR	74.82	10.28	8.987E+003	3.99E+003	1.025E+004	4.311E+003
	77.11	17.10	3.985E+003		-8.920E+002	1.885E+003
	87.35	3.97	1.603E+004		1.727E+003	7.584E+003
	89.78	1.46	3.843E+004		-1.099E+004	1.805E+004
+ Bi-214	609.32*	45.49	1.269E+003	1.27E+003	2.221E+003	5.601E+002
	768.36	4.89	1.314E+004		4.804E+003	5.777E+003
	806.18	1.26	3.286E+004		-1.553E+003	1.328E+004
	934.06	3.11	1.802E+004		4.656E+003	7.611E+003
	1120.29	14.92	6.456E+003		5.426E+003	2.903E+003
	1155.21	1.63	3.152E+004		1.862E+003	1.273E+004
	1238.12	5.83	1.086E+004		1.413E+003	4.550E+003
	1280.98	1.43	3.548E+004		3.519E+003	1.408E+004
	1377.67	3.99	1.335E+004		5.090E+001	5.296E+003
	1385.31	0.79	6.171E+004		2.055E+004	2.390E+004
	1401.52	1.33	3.322E+004		3.858E+003	1.244E+004
	1407.99	2.39	1.265E+004		-9.026E+003	4.001E+003
	1509.21	2.13	3.523E+004		2.022E+004	1.488E+004
	1661.27	1.05	4.072E+004		8.769E+003	1.443E+004
	1729.59	2.88	2.599E+004		1.311E+004	1.078E+004
+ Bi-214	1764.49	15.30	5.664E+003	1.27E+003	2.442E+003	2.410E+003
	1847.43	2.03	2.905E+004		9.674E+003	1.125E+004
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
+ Pb-214	241.99	7.25	5.552E+003	1.34E+003	6.896E+001	2.505E+003
	295.22	18.42	2.734E+003		1.443E+003	1.248E+003
	351.93*	35.60	1.341E+003		2.365E+003	6.021E+002
	785.96	1.06	4.769E+004		5.133E+003	2.014E+004
Pb214-XR	74.82	5.80	1.595E+004	7.03E+003	1.819E+004	7.649E+003
	77.11	9.70	7.033E+003		-1.574E+003	3.326E+003
	87.35	2.24	2.845E+004		3.065E+003	1.346E+004
	89.78	0.82	6.850E+004		-1.959E+004	3.217E+004
Ra-226	186.21	3.64	1.168E+004	1.17E+004	2.879E+003	5.365E+003
Ac-228	129.07	2.42	1.862E+004	3.13E+003	1.837E+003	8.643E+003
	209.25	3.89	1.050E+004		4.286E+003	4.779E+003
	270.24	3.46	1.001E+004		-3.264E+003	4.401E+003
	328.00	2.95	1.404E+004		4.381E+003	6.228E+003
	338.32	11.27	4.184E+003		2.205E+003	1.881E+003
	409.46	1.92	2.063E+004		4.982E+003	8.929E+003
	463.00	4.40	9.079E+003		1.115E+003	3.887E+003
	794.95	4.25	1.031E+004		2.109E+003	4.226E+003
	911.20	25.80	3.127E+003		1.630E+003	1.397E+003
	964.77	4.99	1.190E+004		6.532E+003	5.063E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	968.97	15.80	4.306E+003		1.776E+003	1.872E+003
	1588.20	3.22	1.660E+004		1.382E+003	6.432E+003
Pa-231	27.36	10.30	4.565E+003	4.56E+003	6.745E+002	2.070E+003
	283.69	1.70	2.042E+004		-1.002E+003	8.950E+003
	300.07	2.47	1.593E+004		1.989E+003	7.069E+003
	302.65	2.20	1.458E+004		-3.654E+003	6.275E+003
	330.06	1.40	2.325E+004		9.265E+002	9.955E+003
Th-234	92.38	2.13	3.070E+015	3.07E+015	1.350E+015	1.452E+015
	92.80	2.10	3.111E+015		1.447E+015	1.472E+015
	112.81	0.21	2.147E+016		-5.447E+015	9.925E+015
U-235	143.76	10.96	4.209E+003	7.09E+002	1.126E+003	1.956E+003
	163.33	5.08	7.499E+003		8.334E+001	3.422E+003
	185.71	57.20	7.092E+002		1.238E+002	3.244E+002
	202.11	1.08	3.079E+004		-9.844E+003	1.373E+004
	205.31	5.01	6.814E+003		-3.613E+003	3.046E+003
Am-241	59.54	35.90	1.872E+003	1.87E+003	1.986E+002	8.748E+002

\+ = 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



Filename: C:\GENIE2K\CAMFILES\RWC002.CNF

Report Generated On : 6/30/2015 10:57:38 AM

Sample Title : RWC002
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 1.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 2:41:55 PM

Live Time : 600.0 seconds
Real Time : 600.7 seconds
Dead Time : 0.12 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 6/30/2015
Efficiency ID : CRIB_HOUSE_3M_AR

Report Date : 6/30/2015 10:57:38 AM
Sample Title: RWC002
Peak Analysis Performed on: 6/30/2015 10:57:37 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	299	307	301.07	75.00	0.78	1.718E+002
2	1400	1416	1407.72	351.81	1.13	3.591E+001
3	2430	2446	2437.35	609.24	1.70	1.700E+001
4	5835	5856	5844.98	1460.56	1.27	5.500E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC002
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 6/30/2015 10:57:38 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	0.989	1460.82*	10.66	5.49356E+004	1.10517E+004
Bi-211	0.917	351.07*	13.02	8.23241E+003	3.83729E+003
Bi-214	1.000	609.32*	45.49	4.73054E+003	1.41824E+003
		768.36	4.89		
		806.18	1.26		
		934.06	3.11		
		1120.29	14.92		
		1155.21	1.63		
		1238.12	5.83		
		1280.98	1.43		
		1377.67	3.99		
		1385.31	0.79		
		1401.52	1.33		
		1407.99	2.39		
		1509.21	2.13		
		1661.27	1.05		
		1729.59	2.88		
		1764.49	15.30		
		1847.43	2.03		
		2118.51	1.16		
Pb-214	0.513	241.99	7.25		
		295.22	18.42		
		351.93*	35.60	3.01399E+003	1.40383E+003

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	0.989	5.493562E+004	1.105171E+004
? Bi-211	**0.917**	**8.232408E+003**	**3.837286E+003**
Bi-214	1.000	4.730540E+003	1.418244E+003
? Pb-214	**0.513**	**3.013994E+003**	**1.403832E+003**

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 6/30/2015 10:57:37 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
1	75.00	1.4202E-001	50.52

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

NUCLIDE MDA REPORT

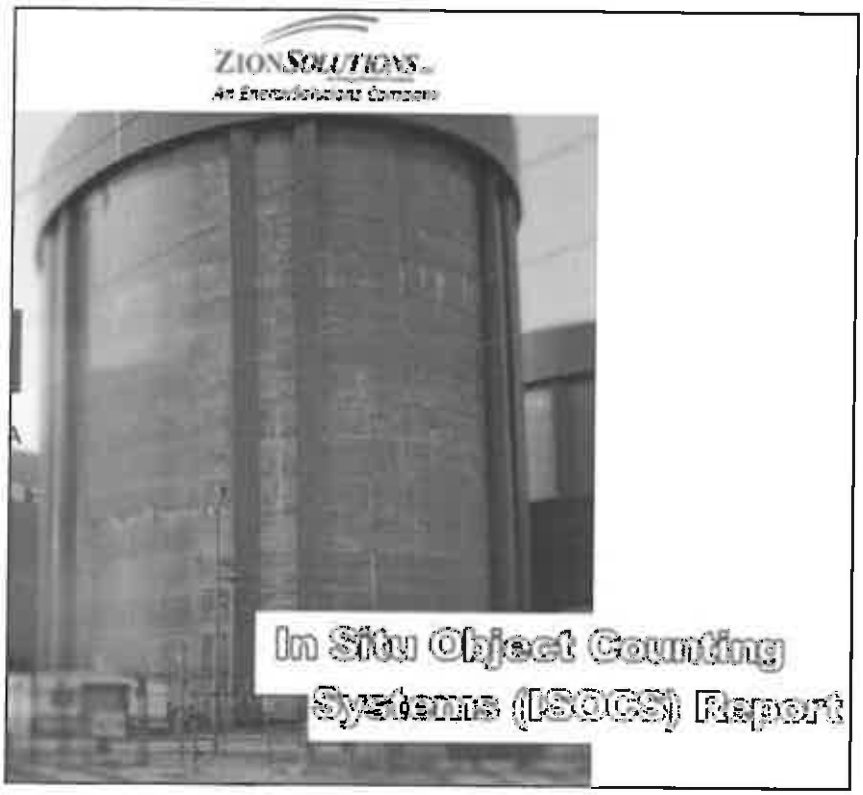
Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC002
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 6/30/2015 10:57:39 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	6.962E+003	6.96E+003	5.494E+004	2.948E+003
Cr-51	320.08	9.91	1.426E+013	1.43E+013	-4.444E+012	6.247E+012
Mn-54	834.85	99.98	3.394E+003	3.39E+003	-1.852E+003	1.408E+003
Co-58	810.76	99.45	2.184E+006	2.18E+006	6.663E+005	8.665E+005
Co-60	1173.23	99.85	6.627E+002	4.01E+002	-2.528E+002	2.630E+002
	1332.49	99.98	4.009E+002		-1.907E+002	1.267E+002
Nb-94	702.65	99.81	5.137E+002	3.72E+002	2.524E+002	2.199E+002
	871.09	99.89	3.716E+002		-3.848E+002	1.439E+002
Sn-113	255.13	2.11	4.205E+006	1.16E+005	-2.576E+005	1.909E+006
	391.70	64.97	1.159E+005		-2.733E+004	4.988E+004
Cs-134	475.36	1.48	6.153E+004	9.99E+002	-6.877E+003	2.634E+004
	563.25	8.34	1.020E+004		1.125E+003	4.230E+003
	569.33	15.37	4.215E+003		-2.193E+003	1.633E+003
	604.72	97.62	9.987E+002		1.433E+000	4.218E+002
	795.86	85.46	1.011E+003		1.736E+002	4.013E+002
	801.95	8.69	9.157E+003		-1.906E+003	3.547E+003
	1038.61	0.99	1.019E+005		-3.887E+003	4.044E+004
	1167.97	1.79	7.306E+004		5.324E+003	3.030E+004
	1365.19	3.02	3.604E+004		6.188E+003	1.396E+004
Cs-137	661.66	85.10	4.279E+002	4.28E+002	2.774E+001	1.698E+002
Eu-152	121.78	28.67	1.765E+003	1.30E+003	-9.535E+002	8.196E+002
	244.70	7.61	5.514E+003		-3.144E+003	2.464E+003
	295.94	0.45	1.409E+005		1.017E+005	6.492E+004
	344.28	26.60	1.305E+003		-6.780E+002	5.511E+002
	367.79	0.86	5.128E+004		1.458E+004	2.239E+004
	411.12	2.24	2.228E+004		2.398E+003	9.796E+003
	443.96	2.83	9.882E+003		-4.936E+003	3.828E+003
	488.68	0.42	1.254E+005		3.309E+004	5.474E+004
	563.99	0.49	7.751E+004		-1.168E+004	3.132E+004
	586.26	0.46	1.090E+005		1.584E+004	4.635E+004
	678.62	0.47	1.114E+005		2.878E+004	4.705E+004
	688.67	0.86	5.625E+004		7.976E+003	2.333E+004
	719.35	0.28	1.682E+005		2.720E+004	6.895E+004
	778.90	12.96	3.313E+003		-1.403E+003	1.315E+003
	810.45	0.32	1.124E+005		-7.834E+003	4.209E+004
	867.37	4.26	1.073E+004		-5.281E+003	4.259E+003
	919.33	0.43	9.075E+004		-5.901E+004	3.397E+004
	964.08	14.65	4.219E+003		1.582E+003	1.767E+003
	1085.87	10.24	4.661E+003		-2.037E+003	1.806E+003
	1089.74	1.73	4.009E+004		2.020E+004	1.693E+004
	1112.07	13.69	4.905E+003		2.256E+003	2.054E+003
	1212.95	1.43	4.194E+004		1.784E+004	1.695E+004
Eu-152	1249.94	0.19	2.744E+005	1.30E+003	-3.997E+004	1.063E+005
	1299.14	1.63	3.835E+004		1.631E+004	1.549E+004
	1408.01	21.07	3.107E+003		-2.020E+002	1.256E+003
	1457.64	0.50	1.711E+005		-2.830E+004	7.278E+004
	1528.10	0.28	1.610E+005		8.671E+003	5.706E+004
Eu-154	123.07	40.40	1.460E+003	9.91E+002	-1.630E+002	6.821E+002
	247.93	6.89	6.202E+003		-3.196E+003	2.752E+003
	591.76	4.95	8.500E+003		-1.808E+003	3.435E+003
	692.42	1.78	1.714E+004		-1.384E+003	6.072E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	723.30	20.06	2.520E+003		1.001E+003	1.033E+003
	756.80	4.52	1.079E+004		-8.287E+002	4.359E+003
	873.18	12.08	4.673E+003		3.334E+001	1.915E+003
	996.29	10.48	5.076E+003		7.744E+001	2.014E+003
	1004.76	18.01	2.437E+003		-9.057E+002	9.124E+002
	1274.43	34.80	9.915E+002		1.347E+002	3.134E+002
	1596.48	1.80	3.237E+004		3.007E+003	1.212E+004
Eu-155	45.30	1.31	6.483E+004	3.06E+003	-6.913E+004	2.910E+004
	60.01	1.22	9.287E+004		-3.291E+004	4.389E+004
	86.55	30.70	3.057E+003		9.148E+002	1.450E+003
	105.31	21.10	3.546E+003		1.146E+003	1.664E+003
Tl-208	583.19	85.00	8.429E+002	8.43E+002	5.449E+002	3.827E+002
+ Bi-211	351.07*	13.02	5.154E+003	5.15E+003	8.232E+003	2.392E+003
Pb-211	404.85	3.78	1.034E+004	1.03E+004	6.702E+002	4.475E+003
	427.09	1.76	2.296E+004		-3.281E+003	9.934E+003
	832.01	3.52	1.205E+004		-1.923E+003	4.870E+003
Bi-212	39.86	1.06	6.399E+004	8.12E+003	-2.695E+004	2.846E+004
	727.33	6.67	8.119E+003		2.941E+003	3.496E+003
	785.37	1.10	3.963E+004		-1.885E+002	1.625E+004
	1620.50	1.47	2.838E+004		6.113E+003	1.006E+004
Pb-212	115.18	0.60	7.753E+004	1.47E+003	-2.194E+004	3.608E+004
	238.63	43.60	1.468E+003		1.531E+003	6.895E+002
	300.09	3.30	1.408E+004		5.292E+003	6.376E+003
Pb212-XR	74.82	10.28	9.803E+003	4.01E+003	-2.678E+003	4.723E+003
	77.11	17.10	4.012E+003		4.957E+002	1.900E+003
	87.35	3.97	1.649E+004		7.063E+003	7.819E+003
	89.78	1.46	4.383E+004		3.078E+004	2.076E+004
+ Bi-214	609.32*	45.49	1.472E+003	1.47E+003	4.731E+003	6.617E+002
	768.36	4.89	1.181E+004		2.633E+003	5.113E+003
	806.18	1.26	4.075E+004		5.380E+003	1.721E+004
	934.06	3.11	1.557E+004		3.592E+003	6.381E+003
	1120.29	14.92	6.003E+003		3.500E+003	2.677E+003
	1155.21	1.63	3.888E+004		-2.232E+003	1.642E+004
	1238.12	5.83	1.387E+004		3.946E+003	6.057E+003
	1280.98	1.43	4.288E+004		-6.756E+003	1.778E+004
	1377.67	3.99	1.433E+004		6.095E+003	5.789E+003
	1385.31	0.79	6.158E+004		-1.666E+004	2.385E+004
	1401.52	1.33	2.859E+004		6.157E+003	1.013E+004
	1407.99	2.39	2.576E+004		2.634E+003	1.056E+004
	1509.21	2.13	3.197E+004		1.228E+004	1.326E+004
	1661.27	1.05	4.057E+004		8.738E+003	1.437E+004
	1729.59	2.88	2.143E+004		8.173E+003	8.503E+003
+ Bi-214	1764.49	15.30	5.871E+003	1.47E+003	2.671E+003	2.513E+003
	1847.43	2.03	2.263E+004		-1.218E+003	8.017E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
+ Pb-214	241.99	7.25	6.771E+003	1.89E+003	5.104E+003	3.115E+003
	295.22	18.42	2.997E+003		1.462E+003	1.380E+003
	351.93*	35.60	1.887E+003		3.014E+003	8.756E+002
	785.96	1.06	3.876E+004		-2.061E+003	1.566E+004
Pb214-XR	74.82	5.80	1.739E+004	7.08E+003	-4.752E+003	8.380E+003
	77.11	9.70	7.079E+003		8.748E+002	3.354E+003
	87.35	2.24	2.926E+004		1.253E+004	1.387E+004
	89.78	0.82	7.812E+004		5.486E+004	3.701E+004
Ra-226	186.21	3.64	1.226E+004	1.23E+004	4.726E+003	5.652E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
Ac-228	129.07	2.42	1.837E+004	3.30E+003	-7.590E+003	6.524E+003
	209.25	3.89	9.932E+003		-2.324E+002	4.496E+003
	270.24	3.46	1.170E+004		1.086E+003	5.253E+003
	328.00	2.95	1.364E+004		-4.929E+002	6.034E+003
	338.32	11.27	5.025E+003		2.029E+003	2.303E+003
	409.46	1.92	2.288E+004		5.804E+002	1.006E+004
	463.00	4.40	9.033E+003		-5.599E+002	3.867E+003
	794.95	4.25	9.036E+003		3.446E+001	3.596E+003
	911.20	25.80	3.305E+003		2.690E+003	1.486E+003
	964.77	4.99	1.042E+004		1.643E+003	4.323E+003
	968.97	15.80	4.053E+003		7.201E+002	1.745E+003
	1588.20	3.22	1.482E+004		1.836E+003	5.547E+003
Pa-231	27.36	10.30	1.651E+004	1.65E+004	2.899E+003	7.462E+003
	283.69	1.70	2.529E+004		-2.298E+003	1.139E+004
	300.07	2.47	1.882E+004		7.070E+003	8.518E+003
	302.65	2.20	1.961E+004		3.246E+003	8.802E+003
	330.06	1.40	3.242E+004		1.237E+004	1.455E+004
Th-234	92.38	2.13	3.222E+015	3.18E+015	2.791E+015	1.530E+015
	92.80	2.10	3.185E+015		1.728E+015	1.510E+015
	112.81	0.21	2.669E+016		6.848E+015	1.255E+016
U-235	143.76	10.96	3.790E+003	8.16E+002	-1.102E+003	1.747E+003
	163.33	5.08	7.157E+003		-2.544E+003	3.250E+003
	185.71	57.20	8.160E+002		5.192E+002	3.775E+002
	202.11	1.08	3.525E+004		5.594E+003	1.596E+004
	205.31	5.01	6.943E+003		-2.206E+003	3.110E+003
Am-241	59.54	35.90	2.234E+003	2.23E+003	-7.833E+002	1.056E+003

\+ = 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



Filename: C:\GENIE2K\CAMFILES\RWC003.CNF

Report Generated On : 7/9/2015 7:27:49 AM

Sample Title : RWC003
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/25/2015 2:43:07 PM

Live Time : 1000.0 seconds
Real Time : 1001.8 seconds
Dead Time : 0.18 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:27:49 AM
Sample Title: RWC003
Peak Analysis Performed on: 7/9/2015 7:27:48 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

PEAK ANALYSIS REPORT

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	80	87	83.44	20.55	0.92	3.129E+002
2	297	312	301.46	75.10	0.94	3.846E+002
3	952	962	955.72	238.76	0.52	8.282E+001
4	1401	1414	1408.04	351.89	0.74	4.521E+001
5	2431	2446	2438.67	609.58	0.99	2.218E+001
6	3640	3652	3645.51	911.20	0.64	1.325E+001
7	4479	4490	4484.42	1120.78	0.79	1.485E+001
8	5836	5858	5846.91	1461.04	1.48	8.766E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC003
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:27:49 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.838088E+004	6.001378E+003
Bi-214	1.000	609.32*	45.49	2.151756E+003	5.218706E+002
		768.36	4.89		
		806.18	1.26		
		934.06	3.11		
		1120.29*	14.92	1.453444E+003	1.340446E+003
		1155.21	1.63		
		1238.12	5.83		
		1280.98	1.43		
		1377.67	3.99		
		1385.31	0.79		
		1401.52	1.33		
		1407.99	2.39		
		1509.21	2.13		
		1661.27	1.05		
		1729.59	2.88		
		1764.49	15.30		
		1847.43	2.03		
		2118.51	1.16		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
		295.22	18.42		
		351.93*	35.60	1.64489E+00	6.65353E+00
		785.96	1.06		
Ac-228	1.000	129.07	2.42		
		209.25	3.89		
		270.24	3.46		
		328.00	2.95		
		338.32	11.27		
		409.46	1.92		
		463.00	4.40		
		794.95	4.25		
		911.20*	25.80	1.54207E+00	7.89958E+00
		964.77	4.99		
		968.97	15.80		
		1588.20	3.22		
Th-231	0.935	25.64*	14.10	8.23784E+00	3.34062E+00
		84.21*	6.60	1.10130E+00	6.37986E+00
		89.95	1.00		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.838879E+004	6.001366E+003
X Bi-211	0.999		
X Pb-212	1.000		
Bi-214	1.000	2.028145E+003	5.639693E+002
Pb-214	0.515	1.729289E+003	6.465386E+002
Ac-228	1.000	1.542066E+003	7.899576E+002
X Pa-231	0.565		
Th-231	0.935	8.834993E+003	2.959459E+003

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:27:48 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

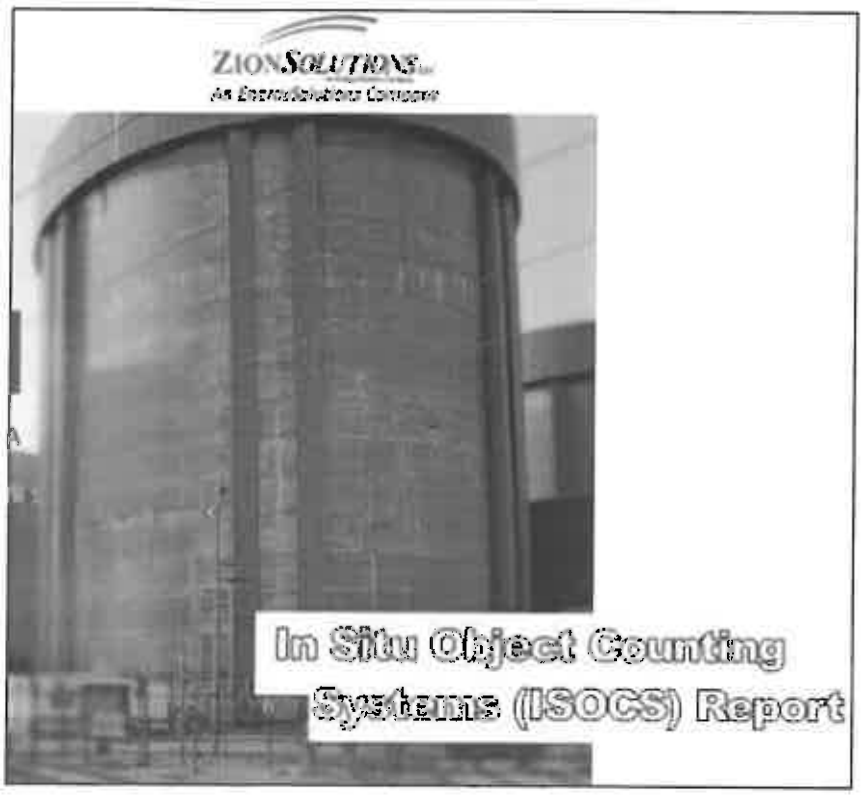
Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC003
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:27:50 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	3.164E+003	3.16E+003	3.339E+004	1.387E+003
Cr-51	320.08	9.91	7.984E+012	7.98E+012	-1.489E+011	3.648E+012
Mn-54	834.85	99.98	1.362E+003	1.36E+003	-4.996E+001	5.706E+002
Co-58	810.76	99.45	1.166E+006	1.17E+006	2.375E+005	4.993E+005
Co-60	1173.23	99.85	3.280E+002	3.00E+002	1.365E+002	1.385E+002
	1332.49	99.98	2.997E+002		1.397E+002	1.228E+002
Nb-94	702.65	99.81	2.347E+002	2.07E+002	2.980E+001	1.029E+002
	871.09	99.89	2.069E+002		2.078E+001	8.737E+001
Sn-113	255.13	2.11	2.035E+006	6.14E+004	1.286E+005	9.347E+005
	391.70	64.97	6.136E+004		3.839E+003	2.736E+004
Cs-134	475.36	1.48	2.862E+004	4.87E+002	2.979E+003	1.249E+004
	563.25	8.34	4.867E+003		-1.056E+003	2.083E+003
	569.33	15.37	1.988E+003		-6.285E+002	8.033E+002
	604.72	97.62	4.873E+002		-2.857E+001	2.127E+002
	795.86	85.46	6.848E+002		2.391E+001	3.021E+002
	801.95	8.69	3.533E+003		-9.007E+002	1.368E+003
	1038.61	0.99	4.646E+004		-1.647E+003	1.927E+004
	1167.97	1.79	2.571E+004		7.276E+003	1.054E+004
	1365.19	3.02	1.179E+004		5.476E+002	4.413E+003
Cs-137	661.66	85.10	2.598E+002	2.60E+002	5.858E+001	1.124E+002
Eu-152	121.78	28.67	1.001E+003	7.54E+002	-9.932E+000	4.735E+002
	244.70	7.61	3.417E+003		-1.118E+003	1.580E+003
	295.94	0.45	7.844E+004		6.050E+004	3.682E+004
	344.28	26.60	7.537E+002		-4.167E+001	3.335E+002
	367.79	0.86	2.350E+004		-5.878E+003	1.037E+004
	411.12	2.24	9.118E+003		-1.611E+003	3.996E+003
	443.96	2.83	7.088E+003		-6.098E+002	3.081E+003
	488.68	0.42	4.547E+004		-1.469E+004	1.947E+004
	563.99	0.49	4.726E+004		7.933E+003	2.063E+004
	586.26	0.46	4.699E+004		-8.117E+003	2.023E+004
	678.62	0.47	4.574E+004		0.000E+000	1.946E+004
	688.67	0.86	2.531E+004		-1.411E+004	1.077E+004
	719.35	0.28	8.259E+004		-1.444E+004	3.536E+004

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	778.90	12.96	1.709E+003		-3.680E+002	7.218E+002
	810.45	0.32	6.063E+004		-3.317E+004	2.485E+004
	867.37	4.26	4.986E+003		-5.598E+002	2.068E+003
	919.33	0.43	5.616E+004		4.030E+002	2.372E+004
	964.08	14.65	1.939E+003		-1.033E+001	8.389E+002
	1085.87	10.24	2.315E+003		2.098E+002	9.602E+002
	1089.74	1.73	1.220E+004		5.191E+003	4.930E+003
	1112.07	13.69	1.658E+003		-3.193E+002	6.794E+002
	1212.95	1.43	1.557E+004		-1.794E+003	6.291E+003
Eu-152	1249.94	0.19	1.191E+005	7.54E+002	-3.590E+004	4.814E+004
	1299.14	1.63	1.312E+004		-2.651E+003	5.205E+003
	1408.01	21.07	1.460E+003		3.825E+002	6.213E+002
	1457.64	0.50	5.456E+004		-1.805E+004	2.263E+004
	1528.10	0.28	6.788E+004		1.892E+004	2.541E+004
Eu-154	123.07	40.40	7.494E+002	5.35E+002	-1.980E+001	3.542E+002
	247.93	6.89	3.473E+003		-1.998E+003	1.583E+003
	591.76	4.95	4.861E+003		1.208E+002	2.103E+003
	692.42	1.78	1.414E+004		-2.750E+003	6.089E+003
	723.30	20.06	1.094E+003		-1.514E+002	4.583E+002
	756.80	4.52	4.963E+003		-4.302E+003	2.078E+003
	873.18	12.08	2.079E+003		-3.103E+002	8.779E+002
	996.29	10.48	2.206E+003		3.095E+002	9.042E+002
	1004.76	18.01	1.430E+003		-1.550E+002	5.990E+002
	1274.43	34.80	5.349E+002		-3.354E+002	2.002E+002
	1596.48	1.80	8.020E+003		-7.356E+003	2.535E+003
Eu-155	45.30	1.31	2.608E+004	1.38E+003	-8.281E+003	1.216E+004
	60.01	1.22	3.455E+004		1.531E+004	1.634E+004
	86.55	30.70	1.378E+003		-5.451E+002	6.578E+002
	105.31	21.10	1.738E+003		3.007E+001	8.235E+002
Tl-208	583.19	85.00	4.391E+002	4.39E+002	4.572E+002	2.040E+002
Bi-211	351.07*	13.02	2.325E+003	2.32E+003	4.493E+003	1.083E+003
Pb-211	404.85	3.78	4.735E+003	4.74E+003	-1.148E+003	2.075E+003
	427.09	1.76	1.096E+004		-1.475E+003	4.837E+003
	832.01	3.52	6.206E+003		1.209E+003	2.657E+003
Bi-212	39.86	1.06	3.959E+004	3.92E+003	1.187E+004	1.903E+004
	727.33	6.67	3.920E+003		1.439E+003	1.739E+003
	785.37	1.10	2.184E+004		5.122E+003	9.532E+003
	1620.50	1.47	1.330E+004		-1.107E+003	5.152E+003
Pb-212	115.18	0.60	4.400E+004	7.16E+002	6.151E+003	2.086E+004
	238.63*	43.60	7.164E+002		5.248E+002	3.386E+002
	300.09	3.30	6.294E+003		3.107E+003	2.858E+003
Pb212-XR	74.82	10.28	4.379E+003	1.95E+003	6.570E+003	2.119E+003
	77.11	17.10	1.947E+003		-5.734E+002	9.320E+002
	87.35	3.97	7.502E+003		2.941E+003	3.581E+003
	89.78	1.46	2.009E+004		7.055E+003	9.581E+003
+ Bi-214	609.32*	45.49	6.532E+002	6.53E+002	2.152E+003	2.968E+002
	768.36	4.89	5.826E+003		2.606E+003	2.604E+003
	806.18	1.26	1.577E+004		1.132E+003	6.660E+003
	934.06	3.11	7.457E+003		1.486E+003	3.192E+003
	1120.29*	14.92	2.090E+003		1.453E+003	9.233E+002
	1155.21	1.63	1.728E+004		5.629E+003	7.514E+003
	1238.12	5.83	6.034E+003		2.954E+003	2.691E+003
	1280.98	1.43	2.066E+004		1.004E+004	8.982E+003
	1377.67	3.99	6.747E+003		2.883E+003	2.870E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	1385.31	0.79	2.020E+004		4.222E+003	7.561E+003
	1401.52	1.33	1.787E+004		7.038E+003	7.410E+003
	1407.99	2.39	1.045E+004		-4.704E+002	4.378E+003
	1509.21	2.13	1.164E+004		3.530E+003	4.827E+003
	1661.27	1.05	2.227E+004		6.711E+003	8.999E+003
	1729.59	2.88	8.297E+003		2.574E+003	3.352E+003
+ Bi-214	1764.49	15.30	3.472E+003	6.53E+002	3.458E+003	1.584E+003
	1847.43	2.03	8.033E+003		6.488E+002	2.846E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
+ Pb-214	241.99*	7.25	4.312E+003	8.51E+002	3.159E+003	2.038E+003
	295.22	18.42	1.735E+003		1.734E+003	8.161E+002
	351.93*	35.60	8.511E+002		1.645E+003	3.965E+002
	785.96	1.06	2.334E+004		1.095E+004	1.023E+004
Pb214-XR	74.82	5.80	7.769E+003	3.44E+003	1.166E+004	3.760E+003
	77.11	9.70	3.437E+003		-1.012E+003	1.645E+003
	87.35	2.24	1.331E+004		5.218E+003	6.353E+003
	89.78	0.82	3.580E+004		1.257E+004	1.708E+004
Ra-226	186.21	3.64	6.683E+003	6.68E+003	4.239E+003	3.133E+003
+ Ac-228	129.07	2.42	1.068E+004	1.05E+003	4.905E+003	5.057E+003
	209.25	3.89	5.282E+003		3.751E+002	2.434E+003
	270.24	3.46	6.511E+003		2.557E+002	2.993E+003
	328.00	2.95	7.742E+003		3.504E+003	3.533E+003
	338.32	11.27	2.005E+003		3.388E+002	9.129E+002
	409.46	1.92	1.072E+004		1.210E+002	4.778E+003
	463.00	4.40	4.770E+003		1.158E+003	2.116E+003
	794.95	4.25	6.282E+003		2.378E+003	2.779E+003
	911.20*	25.80	1.052E+003		1.542E+003	4.623E+002
	964.77	4.99	5.478E+003		1.185E+003	2.401E+003
	968.97	15.80	2.486E+003		2.114E+003	1.136E+003
	1588.20	3.22	7.501E+003		1.677E+003	3.075E+003
Pa-231	27.36*	10.30	5.646E+003	5.65E+003	1.128E+004	2.744E+003
	283.69	1.70	1.189E+004		-1.910E+003	5.400E+003
	300.07	2.47	8.409E+003		4.151E+003	3.818E+003
	302.65	2.20	8.801E+003		-2.249E+003	3.965E+003
	330.06	1.40	1.294E+004		-4.533E+003	5.758E+003
Th-234	92.38	2.13	1.298E+015	1.30E+015	5.705E+014	6.195E+014
	92.80	2.10	1.312E+015		7.557E+014	6.263E+014
	112.81	0.21	1.185E+016		4.697E+015	5.622E+015
U-235	143.76	10.96	1.956E+003	4.45E+002	-3.076E+002	9.139E+002
	163.33	5.08	4.614E+003		-7.763E+002	2.163E+003
	185.71	57.20	4.447E+002		3.917E+002	2.091E+002
	202.11	1.08	1.757E+004		-1.114E+004	8.055E+003
	205.31	5.01	4.182E+003		9.102E+002	1.932E+003
Am-241	59.54	35.90	7.583E+002	7.58E+002	-2.268E+002	3.565E+002

+ = 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



Filename: C:\GENIE2K\CAMFILES\RFC004.CNF

Report Generated On : 7/9/2015 7:24:48 AM

Sample Title : RFC004
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 10:44:35 AM

Live Time : 600.0 seconds
Real Time : 600.4 seconds
Dead Time : 0.07 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:24:48 AM
Sample Title: RFC004
Peak Analysis Performed on: 7/9/2015 7:24:47 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	5832	5851	5844.81	1460.51	1.60	8.317E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RFC004
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:24:48 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	1.763755E+004	5.031873E+003

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	1.763755E+004	5.031873E+003

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:24:47 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RFC004
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:24:49 AM

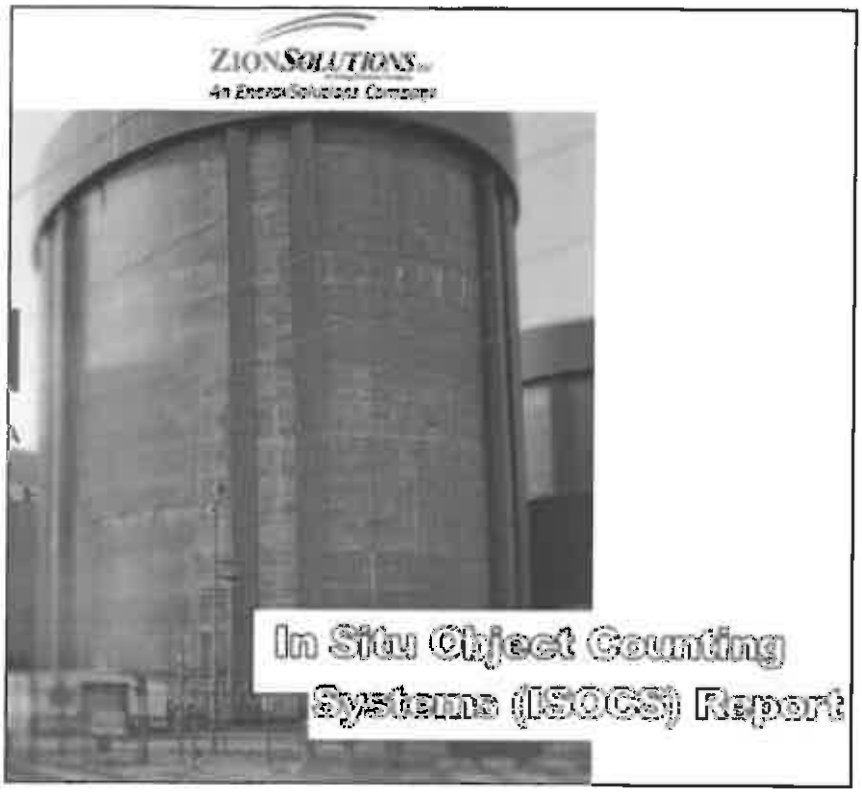
Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	4.706E+003	4.71E+003	1.764E+004	2.029E+003
Cr-51	320.08	9.91	1.047E+013	1.05E+013	4.200E+012	4.606E+012
Mn-54	834.85	99.98	1.802E+003	1.80E+003	6.871E+001	7.149E+002
Co-58	810.76	99.45	1.154E+006	1.15E+006	-5.628E+005	4.320E+005
Co-60	1173.23	99.85	6.122E+002	5.80E+002	1.934E+002	2.636E+002
	1332.49	99.98	5.803E+002		2.532E+002	2.451E+002
Nb-94	702.65	99.81	2.684E+002	1.46E+002	5.617E+001	1.100E+002
	871.09	99.89	1.457E+002		-1.880E+002	4.605E+001
Sn-113	255.13	2.11	2.615E+006	6.97E+004	1.067E+006	1.166E+006
	391.70	64.97	6.971E+004		-1.325E+004	2.919E+004
Cs-134	475.36	1.48	4.517E+004	6.07E+002	1.628E+004	1.955E+004
	563.25	8.34	4.655E+003		-1.045E+003	1.742E+003
	569.33	15.37	2.538E+003		1.768E+002	9.500E+002
	604.72	97.62	6.066E+002		1.314E+001	2.516E+002
	795.86	85.46	8.679E+002		8.719E+001	3.665E+002
	801.95	8.69	7.386E+003		1.616E+003	3.028E+003
	1038.61	0.99	5.272E+004		-2.041E+003	1.974E+004
	1167.97	1.79	3.754E+004		6.443E+003	1.490E+004
	1365.19	3.02	1.701E+004		3.664E+003	6.027E+003
Cs-137	661.66	85.10	3.233E+002	3.23E+002	1.061E+002	1.325E+002
Eu-152	121.78	28.67	8.904E+002	8.90E+002	-2.938E+002	4.004E+002
	244.70	7.61	3.810E+003		1.907E+002	1.690E+003
	295.94	0.45	7.525E+004		3.354E+004	3.363E+004
	344.28	26.60	1.041E+003		1.552E+002	4.483E+002
	367.79	0.86	3.209E+004		6.393E+003	1.374E+004
	411.12	2.24	1.353E+004		7.588E+003	5.827E+003
	443.96	2.83	1.111E+004		4.321E+003	4.783E+003
	488.68	0.42	6.049E+004		-3.309E+003	2.479E+004
	563.99	0.49	4.441E+004		2.773E+003	1.720E+004
	586.26	0.46	3.735E+004		-1.307E+004	1.323E+004
	678.62	0.47	5.514E+004		3.995E+003	2.188E+004
	688.67	0.86	2.795E+004		2.036E+003	1.083E+004
	719.35	0.28	7.876E+004		-4.024E+004	2.948E+004

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	778.90	12.96	1.965E+003		-5.113E+001	7.613E+002
	810.45	0.32	9.495E+004		2.637E+004	3.837E+004
	867.37	4.26	3.857E+003		-4.979E+003	1.219E+003
	919.33	0.43	6.458E+004		-1.176E+004	2.502E+004
	964.08	14.65	2.267E+003		3.549E+002	9.159E+002
	1085.87	10.24	2.923E+003		9.733E+002	1.132E+003
	1089.74	1.73	1.733E+004		3.246E+003	6.713E+003
	1112.07	13.69	2.413E+003		9.204E+001	9.575E+002
	1212.95	1.43	1.355E+004		1.841E+003	4.283E+003
Eu-152	1249.94	0.19	1.308E+005	8.90E+002	-1.233E+005	4.635E+004
	1299.14	1.63	4.515E+003		0.000E+000	0.000E+000
	1408.01	21.07	1.894E+003		1.231E+002	7.652E+002
	1457.64	0.50	1.117E+005		0.000E+000	4.810E+004
	1528.10	0.28	2.846E+004		0.000E+000	0.000E+000
Eu-154	123.07	40.40	7.540E+002	7.54E+002	-7.396E+001	3.428E+002
	247.93	6.89	5.001E+003		1.081E+003	2.244E+003
	591.76	4.95	6.052E+003		1.008E+002	2.481E+003
	692.42	1.78	2.018E+004		2.422E+003	8.451E+003
	723.30	20.06	1.825E+003		3.834E+002	7.644E+002
	756.80	4.52	4.613E+003		-2.608E+003	1.634E+003
	873.18	12.08	2.391E+003		4.105E+002	9.261E+002
	996.29	10.48	3.213E+003		5.514E+002	1.275E+003
	1004.76	18.01	1.541E+003		3.579E+001	5.769E+002
	1274.43	34.80	9.956E+002		6.216E+001	3.856E+002
	1596.48	1.80	4.919E+003		0.000E+000	0.000E+000
Eu-155	45.30	1.31	2.488E+004	1.34E+003	-2.365E+003	1.098E+004
	60.01	1.22	3.053E+004		-1.167E+004	1.370E+004
	86.55	30.70	1.342E+003		-4.849E+002	6.187E+002
	105.31	21.10	1.658E+003		-4.238E+002	7.529E+002
Tl-208	583.19	85.00	4.511E+002	4.51E+002	2.880E+002	1.996E+002
Bi-211	351.07	13.02	2.437E+003	2.44E+003	2.223E+001	1.087E+003
Pb-211	404.85	3.78	7.024E+003	7.02E+003	3.675E+002	3.024E+003
	427.09	1.76	1.325E+004		4.284E+003	5.548E+003
	832.01	3.52	8.250E+003		-2.747E+002	3.382E+003
Bi-212	39.86	1.06	2.399E+004	4.08E+003	6.174E+003	1.072E+004
	727.33	6.67	4.083E+003		1.068E+002	1.673E+003
	785.37	1.10	2.709E+004		6.295E+003	1.123E+004
	1620.50	1.47	1.358E+004		-4.152E+003	4.293E+003
Pb-212	115.18	0.60	4.517E+004	8.28E+002	-6.757E+003	2.069E+004
	238.63	43.60	8.279E+002		3.794E+002	3.813E+002
	300.09	3.30	8.381E+003		1.087E+003	3.708E+003
Pb212-XR	74.82	10.28	3.945E+003	1.67E+003	1.104E+003	1.855E+003
	77.11	17.10	1.669E+003		-5.979E+002	7.651E+002
	87.35	3.97	7.413E+003		1.930E+001	3.422E+003
	89.78	1.46	1.832E+004		-5.686E+003	8.387E+003
Bi-214	609.32	45.49	1.150E+003	1.15E+003	9.410E+002	5.257E+002
	768.36	4.89	5.371E+003		-8.568E+002	2.170E+003
	806.18	1.26	1.624E+004		-1.257E+003	6.079E+003
	934.06	3.11	7.107E+003		-1.926E+003	2.660E+003
	1120.29	14.92	3.016E+003		1.221E+003	1.305E+003
	1155.21	1.63	2.087E+004		1.688E+003	8.555E+003
	1238.12	5.83	8.085E+003		2.390E+003	3.499E+003
	1280.98	1.43	2.178E+004		8.307E+003	8.643E+003
	1377.67	3.99	9.310E+003		3.654E+003	3.816E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	1385.31	0.79	4.100E+004		-4.691E+003	1.627E+004
	1401.52	1.33	2.254E+004		4.340E+003	8.733E+003
	1407.99	2.39	1.570E+004		5.227E+002	6.435E+003
	1509.21	2.13	1.316E+004		-1.223E+003	4.926E+003
	1661.27	1.05	1.937E+004		-3.948E+003	6.123E+003
	1729.59	2.88	1.285E+004		4.902E+003	5.100E+003
Bi-214	1764.49	15.30	4.189E+003	1.15E+003	2.478E+003	1.842E+003
	1847.43	2.03	1.339E+004		7.209E+002	4.744E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
Pb-214	241.99	7.25	4.065E+003	9.91E+002	1.434E+003	1.835E+003
	295.22	18.42	1.617E+003		9.130E+002	7.228E+002
	351.93	35.60	9.912E+002		2.216E+002	4.473E+002
	785.96	1.06	2.962E+004		6.221E+003	1.240E+004
Pb214-XR	74.82	5.80	6.999E+003	2.95E+003	1.959E+003	3.292E+003
	77.11	9.70	2.946E+003		-1.055E+003	1.350E+003
	87.35	2.24	1.315E+004		3.424E+001	6.072E+003
	89.78	0.82	3.265E+004		-1.013E+004	1.495E+004
Ra-226	186.21	3.64	7.578E+003	7.58E+003	3.023E+002	3.441E+003
Ac-228	129.07	2.42	9.723E+003	1.48E+003	4.619E+002	4.388E+003
	209.25	3.89	7.172E+003		2.065E+003	3.242E+003
	270.24	3.46	7.076E+003		-3.280E+002	3.101E+003
	328.00	2.95	9.109E+003		1.640E+003	3.991E+003
	338.32	11.27	2.357E+003		-3.973E+002	1.029E+003
	409.46	1.92	1.007E+004		-5.889E+003	4.067E+003
	463.00	4.40	5.250E+003		-2.202E+003	2.177E+003
	794.95	4.25	8.381E+003		4.119E+003	3.588E+003
	911.20	25.80	1.477E+003		3.139E+002	6.324E+002
	964.77	4.99	5.468E+003		6.257E+001	2.170E+003
	968.97	15.80	2.095E+003		7.426E+001	8.686E+002
	1588.20	3.22	1.174E+004		4.995E+003	4.744E+003
Pa-231	27.36	10.30	2.603E+003	2.60E+003	-5.701E+002	1.170E+003
	283.69	1.70	1.618E+004		5.820E+003	7.179E+003
	300.07	2.47	1.120E+004		1.452E+003	4.954E+003
	302.65	2.20	1.144E+004		-6.509E+003	4.995E+003
	330.06	1.40	1.595E+004		-8.435E+003	6.786E+003
Th-234	92.38	2.13	1.432E+015	1.43E+015	4.298E+014	6.611E+014
	92.80	2.10	1.439E+015		5.032E+014	6.637E+014
	112.81	0.21	1.252E+016		2.839E+014	5.698E+015
U-235	143.76	10.96	2.288E+003	4.88E+002	6.066E+002	1.037E+003
	163.33	5.08	5.270E+003		1.660E+003	2.396E+003
	185.71	57.20	4.877E+002		1.326E+002	2.217E+002
	202.11	1.08	2.119E+004		-8.765E+003	9.377E+003
	205.31	5.01	4.992E+003		-2.875E+002	2.231E+003
Am-241	59.54	35.90	8.204E+002	8.20E+002	1.653E+002	3.725E+002

\+ = 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

GAMMA SPECTRUM ANALYSIS



Filename: C:\GENIE2K\CAMFILES\RWC005.CNF

Report Generated On : 7/9/2015 7:29:31 AM

Sample Title : RWC005
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 9:32:20 AM

Live Time : 600.0 seconds
Real Time : 600.6 seconds
Dead Time : 0.10 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:29:32 AM
Sample Title: RWC005
Peak Analysis Performed on: 7/9/2015 7:29:31 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	2431	2444	2438.15	609.44	1.50	1.367E+001
2	5834	5855	5844.48	1460.43	1.32	2.934E+000
3	7056	7067	7061.98	1764.34	0.36	0.000E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC005
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:29:32 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.56809E+004	6.81341E+003
Bi-214	1.000	609.32*	45.49	1.73494E+003	7.05769E+002
		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	3.17235E+003	1.55965E+003
		1847.43	2.03		
		2118.51	1.16		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.568092E+004	6.813408E+003
X Cs-134	0.390		
Bi-214	1.000	1.979829E+003	6.437546E+002

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:29:31 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC005
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:29:32 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	3.330E+003	3.33E+003	3.568E+004	1.341E+003
Cr-51	320.08	9.91	1.046E+013	1.05E+013	1.418E+012	4.600E+012
Mn-54	834.85	99.98	1.479E+003	1.48E+003	-5.840E+002	5.537E+002
Co-58	810.76	99.45	1.786E+006	1.79E+006	-7.143E+004	7.478E+005
Co-60	1173.23	99.85	4.431E+002	3.09E+002	-1.440E+001	1.791E+002
	1332.49	99.98	3.093E+002		-5.413E+001	1.096E+002
Nb-94	702.65	99.81	3.113E+002	2.79E+002	2.681E+000	1.315E+002
	871.09	99.89	2.791E+002		-8.000E+001	1.128E+002
Sn-113	255.13	2.11	2.761E+006	9.39E+004	1.081E+006	1.239E+006
	391.70	64.97	9.387E+004		-2.718E+004	4.128E+004
Cs-134	475.36	1.48	3.167E+004	7.48E+002	-7.298E+003	1.280E+004

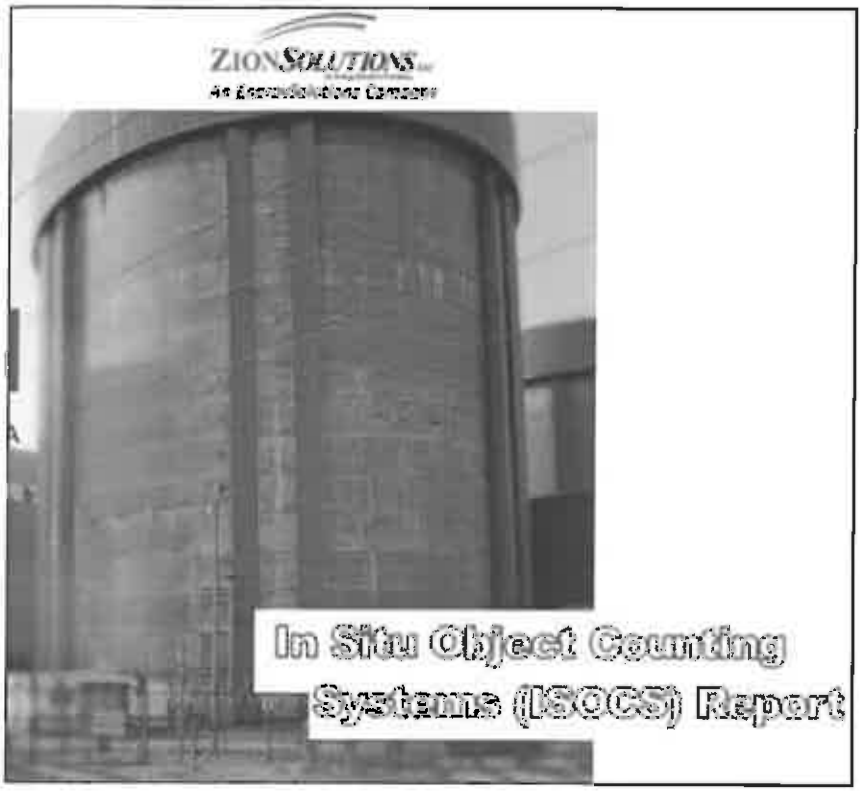
Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	563.25	8.34	7.206E+003		5.285E+002	3.018E+003
	569.33	15.37	2.832E+003		2.358E+002	1.097E+003
	604.72*	97.62	8.771E+002		1.816E+003	3.866E+002
	795.86	85.46	7.481E+002		-1.655E+002	3.067E+002
	801.95	8.69	8.197E+003		3.074E+003	3.433E+003
	1038.61	0.99	5.272E+004		4.898E+003	1.973E+004
	1167.97	1.79	2.659E+004		5.011E+003	9.420E+003
	1365.19	3.02	1.701E+004		-1.374E+003	6.026E+003
Cs-137	661.66	85.10	2.823E+002	2.82E+002	-9.581E+001	1.120E+002
Eu-152	121.78	28.67	1.123E+003	1.08E+003	5.695E+002	5.169E+002
	244.70	7.61	3.890E+003		1.946E+002	1.730E+003
	295.94	0.45	7.525E+004		1.967E+004	3.363E+004
	344.28	26.60	1.075E+003		2.673E+001	4.653E+002
	367.79	0.86	2.404E+004		-8.097E+003	9.714E+003
	411.12	2.24	1.308E+004		5.210E+002	5.598E+003
	443.96	2.83	8.042E+003		-2.899E+003	3.249E+003
	488.68	0.42	6.391E+004		-1.951E+004	2.650E+004
	563.99	0.49	5.866E+004		-1.548E+004	2.433E+004
	586.26	0.46	4.831E+004		-1.911E+004	1.871E+004
	678.62	0.47	6.315E+004		-7.961E+003	2.589E+004
	688.67	0.86	2.795E+004		-6.545E+003	1.083E+004
	719.35	0.28	1.032E+005		-4.451E+004	4.169E+004
	778.90	12.96	2.308E+003		2.454E+002	9.324E+002
	810.45	0.32	1.068E+005		-2.104E+003	4.430E+004
	867.37	4.26	7.391E+003		-2.118E+003	2.987E+003
	919.33	0.43	7.582E+004		8.961E+003	3.064E+004
	964.08	14.65	2.678E+003		2.902E+002	1.122E+003
	1085.87	10.24	2.923E+003		1.369E+002	1.132E+003
	1089.74	1.73	1.891E+004		3.246E+003	7.505E+003
	1112.07	13.69	3.206E+003		1.086E+003	1.354E+003
	1212.95	1.43	2.921E+004		5.178E+003	1.211E+004
Eu-152	1249.94	0.19	1.987E+005	1.08E+003	7.044E+003	8.028E+004
	1299.14	1.63	2.187E+004		2.920E+003	8.679E+003
	1408.01	21.07	1.445E+003		-2.238E+001	5.410E+002
	1457.64	0.50	1.188E+005		0.000E+000	5.167E+004
	1528.10	0.28	7.738E+004		1.052E+004	2.446E+004
Eu-154	123.07	40.40	7.739E+002	7.74E+002	-2.766E+002	3.527E+002
	247.93	6.89	5.720E+003		3.375E+003	2.604E+003
	591.76	4.95	5.284E+003		-7.054E+002	2.097E+003
	692.42	1.78	1.708E+004		2.573E+003	6.900E+003
	723.30	20.06	1.179E+003		-8.580E+002	4.413E+002
	756.80	4.52	7.459E+003		-1.260E+003	3.057E+003
	873.18	12.08	2.989E+003		2.986E+002	1.225E+003
	996.29	10.48	3.680E+003		5.251E+001	1.508E+003
	1004.76	18.01	1.720E+003		-6.264E+001	6.661E+002
	1274.43	34.80	8.922E+002		8.288E+001	3.340E+002
	1596.48	1.80	1.338E+004		-4.545E+003	4.229E+003
Eu-155	45.30	1.31	3.142E+004	1.50E+003	-7.848E+003	1.425E+004
	60.01	1.22	5.120E+004		6.028E+003	2.404E+004
	86.55	30.70	1.503E+003		-1.389E+003	6.991E+002
	105.31	21.10	2.149E+003		1.824E+002	9.981E+002
Tl-208	583.19	85.00	5.327E+002	5.33E+002	3.593E+002	2.404E+002
Bi-211	351.07	13.02	3.270E+003	3.27E+003	2.637E+003	1.503E+003
Pb-211	404.85	3.78	6.008E+003	6.01E+003	4.206E+002	2.516E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	427.09	1.76	1.496E+004		4.372E+003	6.407E+003
	832.01	3.52	8.717E+003		-2.060E+002	3.615E+003
Bi-212	39.86	1.06	3.091E+004	5.64E+003	1.142E+004	1.418E+004
	727.33	6.67	5.635E+003		1.604E+003	2.450E+003
	785.37	1.10	3.096E+004		8.575E+003	1.317E+004
	1620.50	1.47	1.987E+004		5.536E+003	7.436E+003
Pb-212	115.18	0.60	5.052E+004	9.44E+002	1.573E+004	2.336E+004
	238.63	43.60	9.435E+002		7.993E+002	4.391E+002
	300.09	3.30	8.000E+003		-1.604E+003	3.518E+003
Pb212-XR	74.82	10.28	5.030E+003	2.34E+003	4.285E+003	2.398E+003
	77.11	17.10	2.342E+003		-8.600E+002	1.102E+003
	87.35	3.97	8.512E+003		-1.579E+003	3.972E+003
	89.78	1.46	2.309E+004		-5.575E+003	1.077E+004
+ Bi-214	609.32*	45.49	8.379E+002	5.05E+002	1.735E+003	3.693E+002
	768.36	4.89	6.907E+003		1.748E+003	2.938E+003
	806.18	1.26	1.812E+004		2.923E+003	7.020E+003
	934.06	3.11	9.914E+003		2.594E+002	4.064E+003
	1120.29	14.92	3.108E+003		1.837E+003	1.351E+003
	1155.21	1.63	1.960E+004		2.954E+003	7.920E+003
	1238.12	5.83	6.698E+003		2.311E+003	2.805E+003
	1280.98	1.43	2.178E+004		4.901E+003	8.643E+003
	1377.67	3.99	1.033E+004		5.580E+003	4.327E+003
	1385.31	0.79	3.367E+004		4.170E+003	1.260E+004
	1401.52	1.33	2.461E+004		3.191E+003	9.764E+003
	1407.99	2.39	1.125E+004		3.485E+002	4.212E+003
	1509.21	2.13	1.603E+004		3.790E+003	6.360E+003
	1661.27	1.05	2.444E+004		5.264E+003	8.659E+003
	1729.59	2.88	1.178E+004		2.574E+003	4.562E+003
+ Bi-214	1764.49*	15.30	5.050E+002	5.05E+002	3.172E+003	0.000E+000
	1847.43	2.03	1.061E+004		1.442E+003	3.354E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
Pb-214	241.99	7.25	4.128E+003	1.25E+003	2.563E+002	1.866E+003
	295.22	18.42	1.788E+003		9.904E+002	8.081E+002
	351.93	35.60	1.248E+003		1.115E+003	5.755E+002
	785.96	1.06	3.224E+004		6.463E+003	1.371E+004
Pb214-XR	74.82	5.80	8.925E+003	4.13E+003	7.603E+003	4.255E+003
	77.11	9.70	4.133E+003		-1.518E+003	1.944E+003
	87.35	2.24	1.510E+004		-2.802E+003	7.047E+003
	89.78	0.82	4.115E+004		-9.936E+003	1.920E+004
Ra-226	186.21	3.64	7.147E+003	7.15E+003	4.838E+002	3.225E+003
Ac-228	129.07	2.42	1.176E+004	1.92E+003	-2.867E+003	5.404E+003
	209.25	3.89	6.365E+003		6.277E+002	2.838E+003
	270.24	3.46	6.700E+003		-3.857E+003	2.913E+003
	328.00	2.95	9.998E+003		4.627E+003	4.436E+003
	338.32	11.27	2.481E+003		-2.917E+002	1.091E+003
	409.46	1.92	1.189E+004		-1.090E+003	4.982E+003
	463.00	4.40	7.243E+003		1.552E+003	3.174E+003
	794.95	4.25	6.686E+003		3.180E+001	2.741E+003
	911.20	25.80	1.925E+003		1.518E+003	8.563E+002
	964.77	4.99	6.951E+003		4.403E+002	2.911E+003
	968.97	15.80	2.655E+003		1.268E+003	1.149E+003
	1588.20	3.22	1.321E+004		5.828E+003	5.478E+003
Pa-231	27.36	10.30	2.064E+003	2.06E+003	-2.390E+002	9.009E+002
	283.69	1.70	1.652E+004		4.347E+003	7.348E+003

Nuclide Name	Energy (keV)	Yield ( )	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	300.07	2.47	1.069E+004		-2.143E+003	4.700E+003
	302.65	2.20	1.113E+004		-1.244E+003	4.837E+003
	330.06	1.40	1.595E+004		-7.295E+003	6.786E+003
Th-234	92.38	2.13	1.765E+015	1.76E+015	3.231E+014	8.275E+014
	92.80	2.10	1.801E+015		3.812E+014	8.449E+014
	112.81	0.21	1.233E+016		-3.265E+015	5.608E+015
U-235	143.76	10.96	2.352E+003	4.81E+002	-7.442E+002	1.069E+003
	163.33	5.08	5.409E+003		1.222E+003	2.465E+003
	185.71	57.20	4.811E+002		7.937E+001	2.184E+002
	202.11	1.08	2.166E+004		-8.305E+003	9.608E+003
	205.31	5.01	6.290E+003		3.702E+003	2.880E+003
Am-241	59.54	35.90	1.228E+003	1.23E+003	2.858E+002	5.763E+002

\+ = 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

GAMMA SPECTRUM ANALYSIS



Filename: C:\GENIE2K\CAMFILES\RWC006.CNF

Report Generated On : 7/9/2015 7:30:28 AM

Sample Title : RWC006
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 2:02:22 PM

Live Time : 600.0 seconds
Real Time : 600.7 seconds
Dead Time : 0.11 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:30:28 AM
Sample Title: RWC006
Peak Analysis Performed on: 7/9/2015 7:30:27 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	1174	1187	1180.57	295.00	0.85	3.150E+001
2	1402	1415	1408.31	351.95	0.87	2.771E+001
3	2325	2339	2333.11	583.19	0.85	3.750E+000
4	2429	2444	2437.50	609.28	0.43	2.800E+001
5	3872	3881	3876.95	969.02	0.74	2.525E+000
6	4477	4488	4482.09	1120.20	0.79	1.030E+001
7	5837	5858	5845.86	1460.78	2.11	2.334E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC006
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:30:28 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.58594E+004	6.77246E+003
Tl-208	1.000	583.19*	85.00	9.47271E+002	3.19082E+002
Bi-214	1.000	609.32*	45.49	2.20494E+003	9.21146E+002
		768.36	4.89		
		806.18	1.26		
		934.06	3.11		
		1120.29*	14.92	3.69679E+003	2.14821E+003
		1155.21	1.63		
		1238.12	5.83		
		1280.98	1.43		
		1377.67	3.99		
		1385.31	0.79		
		1401.52	1.33		
		1407.99	2.39		
		1509.21	2:13		
		1661.27	1.05		
		1729.59	2.88		
		1764.49	15.30		
		1847.43	2.03		
		2118.51	1.16		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
		295.22*	18.42	2.69317E+00	1.49897E+00
		351.93*	35.60	2.08138E+00	8.92727E+00
		785.96	1.06		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.585936E+004	6.772464E+003
X Ba-133	0.418		
X Cs-134	0.391		
Tl-208	1.000	9.472712E+002	3.190822E+002
X Bi-211	0.999		
Bi-214	1.000	2.436637E+003	8.465972E+002
Pb-214	1.000	2.238944E+003	7.670049E+002

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:30:27 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
5	969.02	2.9125E-002	55.56

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

NUCLIDE MDA REPORT

Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC006
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:30:29 AM

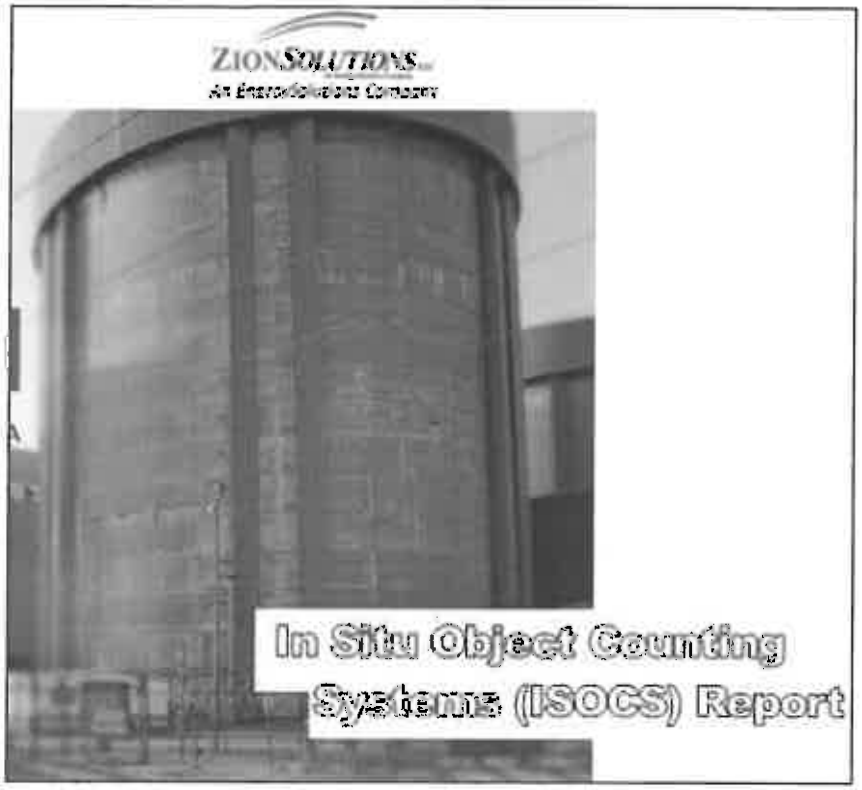
Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	2.857E+003	2.86E+003	3.586E+004	1.104E+003
Cr-51	320.08	9.91	1.213E+013	1.21E+013	3.942E+012	5.433E+012
Mn-54	834.85	99.98	2.184E+003	2.18E+003	6.711E+002	9.057E+002
Co-58	810.76	99.45	1.516E+006	1.52E+006	-3.629E+005	6.126E+005
Co-60	1173.23	99.85	5.469E+002	5.30E+002	1.986E+002	2.310E+002
	1332.49	99.98	5.304E+002		2.089E+002	2.200E+002
Nb-94	702.65	99.81	2.985E+002	2.98E+002	1.294E+002	1.250E+002
	871.09	99.89	2.975E+002		7.783E+000	1.219E+002
Sn-113	255.13	2.11	3.061E+006	1.07E+005	-5.106E+005	1.390E+006
	391.70	64.97	1.067E+005		5.198E+004	4.771E+004
Cs-134	475.36	1.48	3.571E+004	7.50E+002	-4.221E+002	1.481E+004
	563.25	8.34	5.684E+003		-1.995E+003	2.256E+003
	569.33	15.37	4.118E+003		2.955E+002	1.739E+003
	604.72*	97.62	1.265E+003		2.309E+003	5.803E+002
	795.86	85.46	7.495E+002		-1.070E+001	3.072E+002
	801.95	8.69	7.818E+003		-3.388E+002	3.242E+003
	1038.61	0.99	6.406E+004		1.222E+004	2.542E+004
	1167.97	1.79	3.436E+004		1.144E+004	1.331E+004
	1365.19	3.02	1.977E+004		1.837E+003	7.401E+003
Cs-137	661.66	85.10	4.342E+002	4.34E+002	1.850E+002	1.879E+002
Eu-152	121.78	28.67	1.415E+003	1.41E+003	8.547E+001	6.632E+002
	244.70	7.61	4.578E+003		1.232E+002	2.075E+003
	295.94	0.45	1.046E+005		5.808E+004	4.835E+004
	344.28	26.60	1.412E+003		8.332E+002	6.337E+002
	367.79	0.86	3.919E+004		1.290E+004	1.729E+004
	411.12	2.24	9.802E+003		-9.383E+003	3.961E+003
	443.96	2.83	9.518E+003		-2.792E+003	3.986E+003
	488.68	0.42	9.495E+004		4.220E+004	4.201E+004
	563.99	0.49	4.860E+004		-2.317E+004	1.928E+004
	586.26	0.46	4.843E+004		-4.083E+004	1.876E+004
	678.62	0.47	7.345E+004		1.191E+004	3.102E+004
	688.67	0.86	4.232E+004		1.543E+004	1.800E+004
	719.35	0.28	1.034E+005		-9.167E+003	4.179E+004
	778.90	12.96	2.601E+003		8.606E+002	1.079E+003
	810.45	0.32	9.510E+004		-2.697E+004	3.843E+004
	867.37	4.26	6.878E+003		-8.132E+002	2.729E+003
	919.33	0.43	7.036E+004		5.635E+003	2.792E+004
	964.08	14.65	2.908E+003		8.819E+002	1.237E+003
	1085.87	10.24	2.917E+003		6.526E+002	1.130E+003
	1089.74	1.73	1.337E+004		-3.239E+003	4.737E+003
	1112.07	13.69	2.409E+003		4.134E+002	9.558E+002
	1212.95	1.43	2.596E+004		2.301E+003	1.049E+004
Eu-152	1249.94	0.19	2.237E+005	1.41E+003	2.071E+004	9.278E+004

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
		1299.14	1.63	2.192E+004		6.021E+003	8.700E+003
		1408.01	21.07	2.343E+003		1.086E+003	9.895E+002
		1457.64	0.50	8.094E+004		-1.578E+004	3.271E+004
		1528.10	0.28	9.756E+004		2.101E+004	3.456E+004
	Eu-154	123.07	40.40	1.133E+003	1.13E+003	5.750E+002	5.323E+002
		247.93	6.89	5.539E+003		4.961E+002	2.515E+003
		591.76	4.95	6.068E+003		-3.175E+002	2.487E+003
		692.42	1.78	2.115E+004		1.882E+003	8.930E+003
		723.30	20.06	1.548E+003		-4.300E+002	6.256E+002
		756.80	4.52	7.898E+003		-3.111E+001	3.275E+003
		873.18	12.08	3.882E+003		1.774E+003	1.671E+003
		996.29	10.48	3.878E+003		1.955E+003	1.608E+003
		1004.76	18.01	1.872E+003		-4.855E+002	7.429E+002
		1274.43	34.80	1.247E+003		3.113E+002	5.110E+002
		1596.48	1.80	4.909E+003		0.000E+000	0.000E+000
	Eu-155	45.30	1.31	4.315E+004	2.12E+003	-8.023E+003	1.964E+004
		60.01	1.22	6.141E+004		1.051E+002	2.915E+004
		86.55	30.70	2.124E+003		-3.568E+002	1.010E+003
		105.31	21.10	2.504E+003		5.701E+002	1.177E+003
+	Tl-208	583.19*	85.00	2.599E+002	2.60E+002	9.473E+002	1.039E+002
	Bi-211	351.07*	13.02	3.065E+003	3.07E+003	5.685E+003	1.401E+003
	Pb-211	404.85	3.78	6.283E+003	6.28E+003	-1.226E+003	2.653E+003
		427.09	1.76	1.498E+004		-1.194E+003	6.414E+003
		832.01	3.52	7.213E+003		2.751E+002	2.862E+003
	Bi-212	39.86	1.06	4.014E+004	5.65E+003	-1.287E+004	1.805E+004
		727.33	6.67	5.648E+003		1.839E+003	2.455E+003
		785.37	1.10	2.568E+004		2.565E+003	1.053E+004
		1620.50	1.47	1.355E+004		-9.206E+002	4.283E+003
	Pb-212	115.18	0.60	5.824E+004	1.09E+003	-4.453E+003	2.724E+004
		238.63	43.60	1.090E+003		1.097E+003	5.126E+002
		300.09	3.30	1.016E+004		2.462E+002	4.599E+003
	Pb212-XR	74.82	10.28	5.869E+003	2.71E+003	4.438E+003	2.819E+003
		77.11	17.10	2.714E+003		-1.696E+003	1.289E+003
		87.35	3.97	1.131E+004		6.598E+002	5.370E+003
		89.78	1.46	2.808E+004		-2.542E+003	1.327E+004
+	Bi-214	609.32*	45.49	1.208E+003	1.21E+003	2.205E+003	5.543E+002
		768.36	4.89	8.972E+003		4.927E+003	3.970E+003
		806.18	1.26	2.518E+004		5.583E+003	1.055E+004
		934.06	3.11	1.442E+004		5.397E+003	6.320E+003
		1120.29*	14.92	2.907E+003		3.697E+003	1.251E+003
		1155.21	1.63	2.202E+004		-6.507E+003	9.134E+003
		1238.12	5.83	7.005E+003		2.835E+003	2.958E+003
		1280.98	1.43	3.243E+004		1.082E+004	1.396E+004
		1377.67	3.99	1.036E+004		2.624E+003	4.337E+003
		1385.31	0.79	2.910E+004		-1.567E+003	1.031E+004
		1401.52	1.33	5.088E+003		0.000E+000	0.000E+000
		1407.99	2.39	1.824E+004		8.717E+003	7.703E+003
		1509.21	2.13	1.835E+004		2.793E+003	7.521E+003
		1661.27	1.05	1.932E+004		6.563E+002	6.108E+003
		1729.59	2.88	1.283E+004		2.544E+003	5.089E+003
+	Bi-214	1764.49	15.30	5.171E+003	1.21E+003	4.796E+003	2.334E+003
		1847.43	2.03	2.175E+004		7.810E+003	8.914E+003
>		2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
+	Pb-214	241.99	7.25	5.374E+003	1.12E+003	2.581E+003	2.490E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	295.22*	18.42	2.107E+003		2.683E+003	9.679E+002
	351.93*	35.60	1.122E+003		2.031E+003	5.128E+002
	785.96	1.06	2.674E+004		-5.087E+002	1.096E+004
Pb214-XR	74.82	5.80	1.041E+004	4.79E+003	7.875E+003	5.002E+003
	77.11	9.70	4.790E+003		-2.993E+003	2.274E+003
	87.35	2.24	2.007E+004		1.171E+003	9.527E+003
	89.78	0.82	5.004E+004		-4.531E+003	2.365E+004
Ra-226	186.21	3.64	1.003E+004	1.00E+004	6.082E+003	4.663E+003
Ac-228	129.07	2.42	1.458E+004	2.14E+003	7.585E+002	6.821E+003
	209.25	3.89	7.474E+003		-2.020E+002	3.393E+003
	270.24	3.46	9.593E+003		2.151E+003	4.361E+003
	328.00	2.95	9.767E+003		-1.973E+003	4.321E+003
	338.32	11.27	2.763E+003		-7.046E+002	1.232E+003
	409.46	1.92	1.480E+004		1.071E+003	6.435E+003
	463.00	4.40	6.459E+003		1.071E+003	2.781E+003
	794.95	4.25	7.432E+003		1.127E+003	3.113E+003
	911.20	25.80	2.141E+003		1.332E+003	9.644E+002
	964.77	4.99	6.935E+003		1.491E+003	2.904E+003
	968.97	15.80	3.097E+003		1.638E+003	1.370E+003
	1588.20	3.22	1.172E+004		3.150E+003	4.735E+003
Pa-231	27.36	10.30	9.291E+003	9.29E+003	-1.560E+003	4.185E+003
	283.69	1.70	1.771E+004		4.163E+003	7.950E+003
	300.07	2.47	1.357E+004		3.290E+002	6.144E+003
	302.65	2.20	1.364E+004		-1.293E+003	6.096E+003
	330.06	1.40	2.197E+004		-5.001E+003	9.795E+003
Th-234	92.38	2.13	2.072E+015	2.07E+015	-1.471E+014	9.812E+014
	92.80	2.10	2.173E+015		5.966E+014	1.031E+015
	112.81	0.21	1.808E+016		1.417E+015	8.485E+015
U-235	143.76	10.96	2.830E+003	5.85E+002	-8.933E+002	1.308E+003
	163.33	5.08	6.401E+003		2.691E+003	2.962E+003
	185.71	57.20	5.851E+002		4.371E+001	2.703E+002
	202.11	1.08	2.298E+004		-6.138E+003	1.027E+004
	205.31	5.01	6.063E+003		1.215E+003	2.767E+003
Am-241	59.54	35.90	1.421E+003	1.42E+003	-1.520E+002	6.728E+002

+ = 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

GAMMA SPECTRUM ANALYSIS



Filename: C:\GENIE2K\CAMFILES\rwc007.CNF

Report Generated On : 7/9/2015 7:31:16 AM

Sample Title : RWC007
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/25/2015 2:03:11 PM

Live Time : 1000.0 seconds
Real Time : 1001.6 seconds
Dead Time : 0.16 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:31:16 AM
Sample Title: RWC007
Peak Analysis Performed on: 7/9/2015 7:31:15 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	297	308	301.47	75.10	0.64	2.652E+002
2	1399	1416	1408.91	352.10	1.47	3.112E+001
3	2037	2049	2044.51	511.03	1.23	2.745E+001
4	2429	2445	2437.92	609.39	0.65	1.689E+001
5	3641	3651	3645.87	911.29	0.49	1.410E+001
6	5837	5860	5847.45	1461.17	1.76	1.394E+001
7	7058	7071	7065.07	1765.11	1.01	1.716E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC007
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:31:16 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.72171E+004	8.02116E+003
Sr-85	0.994	514.01*	96.00	4.27902E+006	2.53348E+006
Bi-211	0.999	351.07*	13.02	5.96272E+003	1.92431E+003
Bi-214	1.000	609.32*	45.49	1.87183E+003	5.63421E+002
		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	3.95152E+003	1.45229E+003
		1847.43	2.03		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
Pb-214	0.517	241.99	7.25		
		295.22	18.42		
		351.93*	35.60	2.18302E+00	7.03413E+00
		785.96	1.06		
Ac-228	1.000	129.07	2.42		
		209.25	3.89		
		270.24	3.46		
		328.00	2.95		
		338.32	11.27		
		409.46	1.92		
		463.00	4.40		
		794.95	4.25		
		911.20*	25.80	1.26681E+00	7.46214E+00
		964.77	4.99		
		968.97	15.80		
		1588.20	3.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.721708E+004	6.021164E+003
Sr-85	0.394	4.279017E+006	2.533477E+006
X Cs-134	0.390		
? Bi-211	**0.998**	**5.962717E+003**	**1.924308E+003**
Bi-214	1.000	2.143898E+003	5.252765E+002
? Pb-214	**0.517**	**2.183019E+003**	**7.034133E+002**
Ac-228	1.000	1.266807E+003	7.462138E+002

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:31:15 AM

Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
1	75.10	1.3779E-001	41.29

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

NUCLIDE MDA REPORT

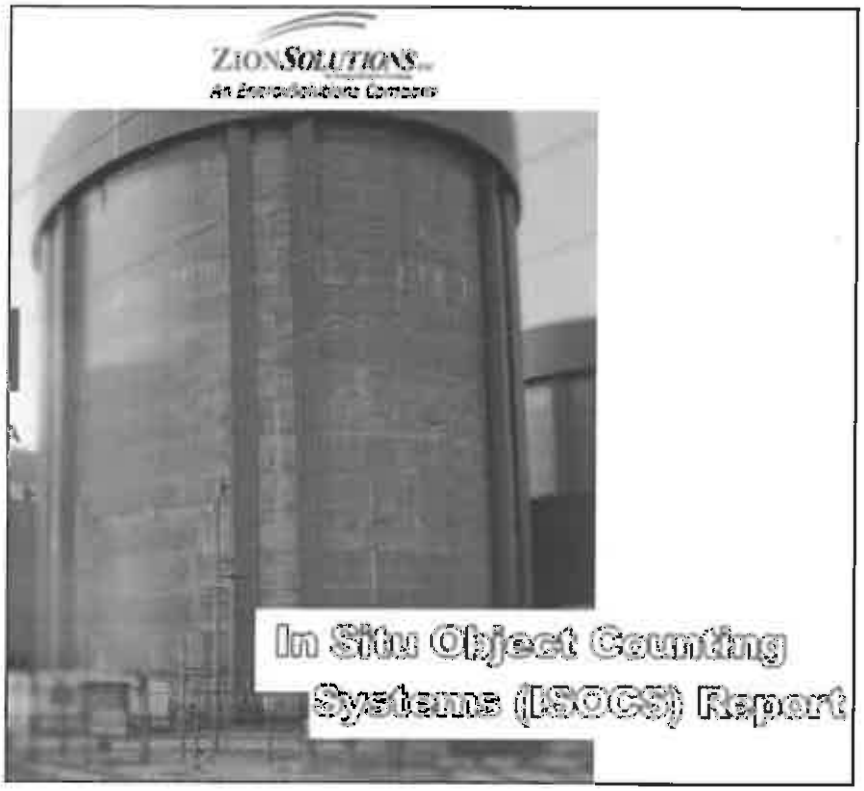
Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC007
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:31:17 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	3.849E+003	3.85E+003	3.722E+004	1.730E+003
Cr-51	320.08	9.91	6.719E+012	6.72E+012	-7.381E+011	3.015E+012
Mn-54	834.85	99.98	1.539E+003	1.54E+003	2.691E+002	6.588E+002
Co-58	810.76	99.45	1.284E+006	1.28E+006	3.324E+005	5.581E+005
Co-60	1173.23	99.85	2.655E+002	2.40E+002	-4.236E+001	1.073E+002
	1332.49	99.98	2.397E+002		-4.990E+001	9.286E+001
Nb-94	702.65	99.81	2.347E+002	2.07E+002	1.955E+001	1.029E+002
	871.09	99.89	2.069E+002		7.244E+001	8.737E+001
Sn-113	255.13	2.11	1.991E+006	5.89E+004	2.268E+005	9.126E+005
	391.70	64.97	5.892E+004		-1.077E+004	2.614E+004
Cs-134	475.36	1.48	3.226E+004	6.11E+002	1.461E+004	1.431E+004
	563.25	8.34	5.943E+003		2.687E+002	2.622E+003
	569.33	15.37	2.237E+003		-1.410E+002	9.275E+002
	604.72*	97.62	6.105E+002		1.953E+003	2.742E+002
	795.86	85.46	6.848E+002		2.050E+002	3.021E+002
	801.95	8.69	6.760E+003		1.381E+003	2.982E+003
	1038.61	0.99	4.130E+004		-1.135E+004	1.669E+004
	1167.97	1.79	3.105E+004		3.113E+003	1.321E+004
	1365.19	3.02	1.738E+004		4.347E+003	7.206E+003
Cs-137	661.66	85.10	2.753E+002	2.75E+002	9.687E+001	1.202E+002
Eu-152	121.78	28.67	9.733E+002	7.86E+002	3.586E+001	4.598E+002
	244.70	7.61	3.713E+003		7.081E+002	1.728E+003
	295.94	0.45	7.704E+004		7.125E+004	3.613E+004
	344.28	26.60	7.862E+002		-4.735E+000	3.498E+002
	367.79	0.86	2.508E+004		1.371E+003	1.115E+004
	411.12	2.24	1.082E+004		1.558E+003	4.845E+003
	443.96	2.83	7.485E+003		1.478E+003	3.280E+003
	488.68	0.42	6.160E+004		1.228E+004	2.753E+004
	563.99	0.49	4.726E+004		-9.423E+003	2.063E+004
	586.26	0.46	3.622E+004		-4.221E+004	1.485E+004
	678.62	0.47	5.073E+004		-6.305E+003	2.195E+004

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	688.67	0.86	2.893E+004		5.582E+003	1.257E+004
	719.35	0.28	1.054E+005		3.176E+004	4.677E+004
	778.90	12.96	1.847E+003		2.330E+002	7.907E+002
	810.45	0.32	7.600E+004		-6.140E+003	3.254E+004
	867.37	4.26	4.432E+003		-2.750E+002	1.791E+003
	919.33	0.43	5.848E+004		1.488E+004	2.488E+004
	964.08	14.65	2.411E+003		1.363E+003	1.075E+003
	1085.87	10.24	2.432E+003		1.131E+003	1.018E+003
	1089.74	1.73	1.373E+004		4.434E+003	5.693E+003
	1112.07	13.69	2.150E+003		6.942E+002	9.259E+002
	1212.95	1.43	2.221E+004		8.280E+003	9.610E+003
Eu-152	1249.94	0.19	1.340E+005	7.86E+002	7.920E+002	5.559E+004
	1299.14	1.63	1.502E+004		2.430E+003	6.158E+003
	1408.01	21.07	1.460E+003		6.240E+002	6.213E+002
	1457.64	0.50	5.164E+004		5.846E+003	2.117E+004
	1528.10	0.28	4.641E+004		-1.419E+004	1.467E+004
Eu-154	123.07	40.40	7.097E+002	7.10E+002	-5.109E+001	3.344E+002
	247.93	6.89	3.925E+003		-4.682E+002	1.809E+003
	591.76	4.95	4.209E+003		1.148E+002	1.778E+003
	692.42	1.78	1.317E+004		1.188E+003	5.601E+003
	723.30	20.06	1.191E+003		-2.731E+002	5.066E+002
	756.80	4.52	5.606E+003		9.244E+002	2.400E+003
	873.18	12.08	1.285E+003		-1.283E+003	4.808E+002
	996.29	10.48	2.331E+003		7.712E+002	9.666E+002
	1004.76	18.01	1.289E+003		3.372E+001	5.283E+002
	1274.43	34.80	7.461E+002		1.242E+001	3.058E+002
	1596.48	1.80	8.020E+003		5.449E+002	2.535E+003
Eu-155	45.30	1.31	2.108E+004	1.35E+003	-4.856E+003	9.661E+003
	60.01	1.22	2.919E+004		-2.636E+003	1.366E+004
	86.55	30.70	1.347E+003		-8.583E+002	6.420E+002
	105.31	21.10	1.700E+003		4.801E+002	8.045E+002
Tl-208	583.19	85.00	4.284E+002	4.28E+002	4.062E+002	1.986E+002
+ Bi-211	351.07*	13.02	2.094E+003	2.09E+003	5.963E+003	9.679E+002
Pb-211	404.85	3.78	4.611E+003	4.61E+003	-1.102E+003	2.013E+003
	427.09	1.76	1.017E+004		-2.027E+003	4.439E+003
	832.01	3.52	5.230E+003		-1.236E+002	2.169E+003
Bi-212	39.86	1.06	2.083E+004	2.96E+003	1.369E+004	9.650E+003
	727.33	6.67	2.959E+003		-1.609E+003	1.259E+003
	785.37	1.10	1.784E+004		1.024E+002	7.536E+003
	1620.50	1.47	1.192E+004		9.227E+002	4.462E+003
Pb-212	115.18	0.60	3.910E+004	7.27E+002	-8.776E+003	1.841E+004
	238.63	43.60	7.272E+002		7.271E+002	3.440E+002
	300.09	3.30	7.327E+003		4.380E+003	3.374E+003
Pb212-XR	74.82	10.28	4.123E+003	1.79E+003	4.587E+003	1.991E+003
	77.11	17.10	1.786E+003		-3.481E+002	8.513E+002
	87.35	3.97	7.332E+003		4.524E+002	3.495E+003
	89.78	1.46	1.989E+004		6.322E+003	9.481E+003
+ Bi-214	609.32*	45.49	5.853E+002	5.85E+002	1.872E+003	2.629E+002
	768.36	4.89	5.490E+003		6.283E+002	2.436E+003
	806.18	1.26	1.577E+004		1.403E+003	6.660E+003
	934.06	3.11	9.106E+003		5.640E+003	4.017E+003
	1120.29	14.92	2.611E+003		1.265E+003	1.184E+003
	1155.21	1.63	1.323E+004		1.016E+003	5.487E+003
	1238.12	5.83	6.034E+003		3.625E+003	2.691E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	1280.98	1.43	1.582E+004		2.492E+002	6.559E+003
	1377.67	3.99	7.002E+003		3.425E+003	2.998E+003
	1385.31	0.79	2.977E+004		6.157E+003	1.235E+004
	1401.52	1.33	1.588E+004		-1.267E+003	6.417E+003
	1407.99	2.39	1.093E+004		3.262E+003	4.614E+003
	1509.21	2.13	1.102E+004		4.401E+003	4.515E+003
	1661.27	1.05	2.506E+004		1.263E+004	1.039E+004
	1729.59	2.88	9.334E+003		1.691E+003	3.871E+003
+ Bi-214	1764.49*	15.30	1.107E+003	5.85E+002	3.952E+003	4.019E+002
	1847.43	2.03	1.220E+004		5.191E+003	4.930E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
+ Pb-214	241.99	7.25	3.682E+003	7.67E+002	1.870E+003	1.722E+003
	295.22	18.42	1.646E+003		1.438E+003	7.717E+002
	351.93*	35.60	7.667E+002		2.183E+003	3.543E+002
	785.96	1.06	2.145E+004		7.712E+003	9.283E+003
Pb214-XR	74.82	5.80	7.316E+003	3.15E+003	8.139E+003	3.533E+003
	77.11	9.70	3.152E+003		-6.143E+002	1.502E+003
	87.35	2.24	1.301E+004		8.027E+002	6.202E+003
	89.78	0.82	3.545E+004		1.127E+004	1.690E+004
Ra-226	186.21	3.64	6.806E+003	6.81E+003	3.130E+003	3.194E+003
+ Ac-228	129.07	2.42	9.792E+003	1.04E+003	4.017E+003	4.612E+003
	209.25	3.89	5.583E+003		4.226E+002	2.585E+003
	270.24	3.46	6.906E+003		2.558E+003	3.191E+003
	328.00	2.95	6.599E+003		-7.490E+002	2.962E+003
	338.32	11.27	2.180E+003		8.513E+002	1.000E+003
	409.46	1.92	1.007E+004		-3.517E+003	4.456E+003
	463.00	4.40	4.770E+003		1.411E+003	2.116E+003
	794.95	4.25	6.141E+003		2.893E+003	2.709E+003
	911.20*	25.80	1.038E+003		1.267E+003	4.552E+002
	964.77	4.99	6.262E+003		2.544E+003	2.792E+003
	968.97	15.80	2.129E+003		1.149E+003	9.575E+002
	1588.20	3.22	7.501E+003		9.455E+002	3.075E+003
Pa-231	27.36	10.30	2.216E+003	2.22E+003	-4.875E+002	1.029E+003
	283.69	1.70	1.253E+004		4.041E+002	5.718E+003
	300.07	2.47	9.789E+003		5.852E+003	4.508E+003
	302.65	2.20	9.349E+003		9.512E+002	4.239E+003
	330.06	1.40	1.370E+004		-2.042E+003	6.138E+003
Th-234	92.38	2.13	1.197E+015	1.20E+015	2.199E+014	5.692E+014
	92.80	2.10	1.210E+015		1.112E+014	5.751E+014
	112.81	0.21	1.160E+016		2.271E+015	5.497E+015
U-235	143.76	10.96	1.902E+003	4.30E+002	-3.116E+002	8.870E+002
	163.33	5.08	4.383E+003		9.692E+002	2.048E+003
	185.71	57.20	4.295E+002		1.488E+002	2.015E+002
	202.11	1.08	1.853E+004		-3.871E+003	8.532E+003
	205.31	5.01	4.480E+003		1.270E+003	2.081E+003
Am-241	59.54	35.90	6.868E+002	6.87E+002	-2.524E+002	3.208E+002

+ = 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



Filename: C:\GENIE2K\CAMFILES\RWC008.CNF

Report Generated On : 7/9/2015 7:31:55 AM

Sample Title : RWC008
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 12:51:56 PM

Live Time : 600.0 seconds
Real Time : 600.9 seconds
Dead Time : 0.15 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:31:55 AM
Sample Title: RWC008
Peak Analysis Performed on: 7/9/2015 7:31:54 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	299	305	301.99	75.23	0.73	1.525E+002
2	2326	2338	2332.59	583.06	0.97	1.625E+001
3	2431	2444	2437.55	609.29	0.87	1.206E+001
4	5836	5857	5845.99	1460.81	0.71	7.951E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC008
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:31:55 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.95125E+004	7.50539E+003
Cs-134	0.391	475.36	1.48		
		563.25	8.34		
		569.33	15.37		
		604.72*	97.62	2.72232E+003	8.48429E+002
		795.86	85.46		
		801.95	8.69		
		1038.61	0.99		
		1167.97	1.79		
		1365.19	3.02		
Tl-208	1.000	583.19*	85.00	5.70737E+002	3.34206E+002
Bi-214	1.000	609.32*	45.49	2.60020E+003	8.10552E+002
		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		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
		1661.27	1.05		
		1729.59	2.88		
		1764.49	15.30		
		1847.43	2.03		
		2118.51	1.16		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.951253E+004	7.505393E+003
? Cs-134	**0.391**	**2.722323E+003**	**8.464287E+002**
Tl-208	1.000	5.707371E+002	3.342061E+002
? Bi-214	**1.000**	**2.600197E+003**	**8.105523E+002**

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:31:54 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty
1	75.23	8.7518E-002	70.58

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

NUCLIDE MDA REPORT

Detector Name: 5456

Sample Geometry: Cribhouse 3m
Sample Title: RWC008
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:31:56 AM

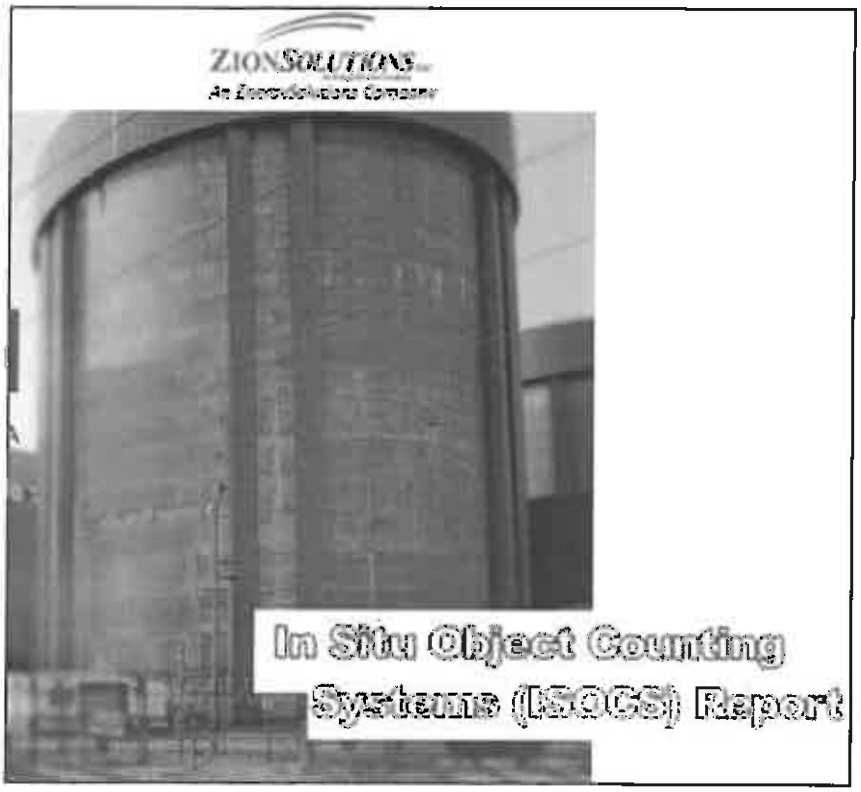
Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	4.913E+003	4.91E+003	3.951E+004	2.132E+003
Cr-51	320.08	9.91	1.075E+013	1.08E+013	1.015E+012	4.742E+012
Mn-54	834.85	99.98	1.939E+003	1.94E+003	-1.718E+001	7.833E+002
Co-58	810.76	99.45	1.702E+006	1.70E+006	7.377E+004	7.060E+005
Co-60	1173.23	99.85	3.775E+002	3.59E+002	-1.178E+001	1.462E+002
	1332.49	99.98	3.586E+002		4.719E+001	1.342E+002
Nb-94	702.65	99.81	3.364E+002	2.79E+002	6.479E+001	1.440E+002
	871.09	99.89	2.791E+002		-1.270E+002	1.128E+002
Sn-113	255.13	2.11	3.242E+006	8.15E+004	7.758E+005	1.480E+006
	391.70	64.97	8.154E+004		-1.594E+004	3.511E+004
+ Cs-134	475.36	1.48	3.372E+004	8.31E+002	-1.123E+004	1.382E+004
	563.25	8.34	8.963E+003		2.595E+003	3.896E+003
	569.33	15.37	3.325E+003		-4.126E+002	1.344E+003
	604.72*	97.62	8.306E+002		2.722E+003	3.634E+002
	795.86	85.46	9.707E+002		6.046E+002	4.180E+002
	801.95	8.69	7.387E+003		7.379E+002	3.028E+003
	1038.61	0.99	6.908E+004		2.082E+004	2.791E+004
	1167.97	1.79	4.300E+004		1.043E+004	1.763E+004
	1365.19	3.02	2.201E+004		4.923E+003	8.524E+003
Cs-137	661.66	85.10	2.823E+002	2.82E+002	-9.258E+001	1.120E+002
Eu-152	121.78	28.67	1.560E+003	1.17E+003	3.734E+002	7.351E+002
	244.70	7.61	4.667E+003		-3.219E+002	2.119E+003
	295.94	0.45	1.001E+005		1.997E+004	4.606E+004
	344.28	26.60	1.170E+003		-4.449E+002	5.127E+002
	367.79	0.86	2.970E+004		-9.547E+003	1.254E+004
	411.12	2.24	1.440E+004		-3.056E+003	6.259E+003
	443.96	2.83	1.216E+004		5.079E+002	5.306E+003
	488.68	0.42	7.306E+004		-1.190E+003	3.108E+004
	563.99	0.49	7.882E+004		2.796E+004	3.441E+004
	586.26	0.46	6.040E+004		-1.709E+004	2.476E+004
	678.62	0.47	6.316E+004		6.008E+002	2.589E+004
	688.67	0.86	4.381E+004		1.522E+004	1.876E+004
	719.35	0.28	8.788E+004		-2.652E+004	3.404E+004
	778.90	12.96	2.968E+003		-1.562E+002	1.262E+003
	810.45	0.32	1.221E+005		6.029E+004	5.195E+004
	867.37	4.26	7.391E+003		-1.179E+003	2.987E+003
	919.33	0.43	6.458E+004		-1.445E+004	2.502E+004
	964.08	14.65	2.800E+003		-4.018E+001	1.182E+003
	1085.87	10.24	3.432E+003		7.908E+002	1.387E+003
	1089.74	1.73	1.733E+004		1.803E+003	6.713E+003
	1112.07	13.69	1.982E+003		-1.473E+003	7.417E+002
	1212.95	1.43	3.068E+004		4.091E+002	1.285E+004
Eu-152	1249.94	0.19	1.987E+005	1.17E+003	3.874E+004	8.028E+004
	1299.14	1.63	2.505E+004		-4.588E+003	1.027E+004
	1408.01	21.07	1.760E+003		-8.057E+001	6.985E+002
	1457.64	0.50	9.556E+004		-2.115E+004	4.002E+004

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	1528.10	0.28	1.132E+005		3.155E+004	4.237E+004
Eu-154	123.07	40.40	1.100E+003	1.10E+003	-9.690E+001	5.159E+002
	247.93	6.89	5.492E+003		8.869E+000	2.490E+003
	591.76	4.95	6.053E+003		-7.198E+002	2.481E+003
	692.42	1.78	2.196E+004		9.990E+003	9.343E+003
	723.30	20.06	1.825E+003		-5.781E+001	7.644E+002
	756.80	4.52	6.513E+003		2.235E+002	2.584E+003
	873.18	12.08	2.989E+003		-2.488E+002	1.225E+003
	996.29	10.48	3.456E+003		1.123E+003	1.396E+003
	1004.76	18.01	1.330E+003		-3.937E+002	4.710E+002
	1274.43	34.80	1.245E+003		1.835E+002	5.102E+002
	1596.48	1.80	2.184E+004		5.795E+003	8.458E+003
Eu-155	45.30	1.31	3.994E+004	1.93E+003	3.919E+003	1.851E+004
	60.01	1.22	4.998E+004		1.915E+003	2.343E+004
	86.55	30.70	1.928E+003		-9.533E+002	9.115E+002
	105.31	21.10	2.680E+003		4.899E+002	1.264E+003
+ Tl-208	583.19*	85.00	4.654E+002	4.65E+002	5.707E+002	2.068E+002
Bi-211	351.07	13.02	3.774E+003	3.77E+003	1.658E+003	1.755E+003
Pb-211	404.85	3.78	7.892E+003	7.75E+003	-1.713E+003	3.458E+003
	427.09	1.76	1.385E+004		-5.565E+002	5.848E+003
	832.01	3.52	7.749E+003		2.747E+002	3.131E+003
Bi-212	39.86	1.06	5.669E+004	5.30E+003	3.845E+004	2.707E+004
	727.33	6.67	5.297E+003		2.039E+003	2.281E+003
	785.37	1.10	2.408E+004		-6.402E+003	9.728E+003
	1620.50	1.47	1.714E+004		-2.307E+003	6.071E+003
Pb-212	115.18	0.60	6.045E+004	1.11E+003	1.222E+004	2.832E+004
	238.63	43.60	1.114E+003		8.088E+002	5.243E+002
	300.09	3.30	9.420E+003		-1.919E+003	4.228E+003
Pb212-XR	74.82	10.28	6.204E+003	2.81E+003	-1.023E+003	2.985E+003
	77.11	17.10	2.811E+003		-1.977E+002	1.336E+003
	87.35	3.97	1.114E+004		4.510E+003	5.288E+003
	89.78	1.46	2.923E+004		1.313E+004	1.384E+004
+ Bi-214	609.32*	45.49	7.934E+002	7.93E+002	2.600E+003	3.471E+002
	768.36	4.89	7.419E+003		1.714E+003	3.194E+003
	806.18	1.26	2.514E+004		5.909E+003	1.053E+004
	934.06	3.11	1.243E+004		3.906E+003	5.321E+003
	1120.29	14.92	4.227E+003		2.889E+003	1.910E+003
	1155.21	1.63	2.796E+004		1.417E+004	1.210E+004
	1238.12	5.83	7.830E+003		2.613E+003	3.371E+003
	1280.98	1.43	2.495E+004		-8.901E+002	1.023E+004
	1377.67	3.99	8.744E+003		2.816E+003	3.533E+003
	1385.31	0.79	4.696E+004		1.173E+004	1.925E+004
	1401.52	1.33	1.743E+004		-5.631E+003	6.175E+003
	1407.99	2.39	1.371E+004		-3.659E+002	5.438E+003
	1509.21	2.13	1.836E+004		4.192E+003	7.525E+003
	1661.27	1.05	1.937E+004		-1.184E+004	6.123E+003
	1729.59	2.88	1.285E+004		2.941E+003	5.100E+003
+ Bi-214	1764.49	15.30	5.017E+003	7.93E+002	3.905E+003	2.256E+003
	1847.43	2.03	2.165E+004		8.085E+003	8.875E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
Pb-214	241.99	7.25	5.403E+003	1.48E+003	4.068E+002	2.503E+003
	295.22	18.42	2.340E+003		2.019E+003	1.084E+003
	351.93	35.60	1.477E+003		1.228E+003	6.900E+002
	785.96	1.06	2.330E+004		-7.643E+003	9.246E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
Pb214-XR	74.82	5.80	1.101E+004	4.96E+003	-1.814E+003	5.296E+003
	77.11	9.70	4.960E+003		-3.490E+002	2.358E+003
	87.35	2.24	1.977E+004		8.002E+003	9.382E+003
	89.78	0.82	5.210E+004		2.341E+004	2.468E+004
Ra-226	186.21	3.64	9.660E+003	9.66E+003	4.350E+003	4.482E+003
Ac-228	129.07	2.42	1.314E+004	2.25E+003	-5.719E+003	6.097E+003
	209.25	3.89	8.360E+003		3.032E+003	3.836E+003
	270.24	3.46	1.002E+004		-7.251E+002	4.574E+003
	328.00	2.95	1.119E+004		6.118E+003	5.030E+003
	338.32	11.27	3.254E+003		1.711E+003	1.477E+003
	409.46	1.92	1.715E+004		3.747E+003	7.609E+003
	463.00	4.40	7.427E+003		3.419E+003	3.266E+003
	794.95	4.25	8.381E+003		1.484E+003	3.588E+003
	911.20	25.80	2.245E+003		1.785E+003	1.016E+003
	964.77	4.99	8.126E+003		3.128E+003	3.499E+003
	968.97	15.80	3.238E+003		2.541E+003	1.440E+003
	1588.20	3.22	1.091E+004		1.457E+003	4.331E+003
Pa-231	27.36	10.30	2.688E+003	2.69E+003	9.056E+002	1.213E+003
	283.69	1.70	1.810E+004		-1.515E+003	8.141E+003
	300.07	2.47	1.259E+004		-2.564E+003	5.648E+003
	302.65	2.20	1.369E+004		-6.710E+002	6.118E+003
	330.06	1.40	2.324E+004		4.296E+003	1.043E+004
Th-234	92.38	2.13	2.078E+015	2.08E+015	3.799E+014	9.840E+014
	92.80	2.10	2.163E+015		8.795E+014	1.026E+015
	112.81	0.21	1.861E+016		6.903E+015	8.744E+015
U-235	143.76	10.96	3.006E+003	6.33E+002	8.154E+001	1.397E+003
	163.33	5.08	5.804E+003		5.446E+002	2.663E+003
	185.71	57.20	6.333E+002		4.944E+002	2.945E+002
	202.11	1.08	3.057E+004		-7.561E+002	1.407E+004
	205.31	5.01	6.432E+003		1.843E+003	2.951E+003
Am-241	59.54	35.90	1.243E+003	1.24E+003	5.375E+002	5.835E+002

+ = 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

G A M M A S P E C T R U M A N A L Y S I S



Filename: C:\GENIE2K\CAMFILES\RWC009.CNF

Report Generated On : 7/9/2015 7:32:35 AM

Sample Title : RFC009
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 10:07:27 AM

Live Time : 600.0 seconds
Real Time : 600.4 seconds
Dead Time : 0.06 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:32:35 AM
Sample Title: RFC009
Peak Analysis Performed on: 7/9/2015 7:32:35 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	5834	5855	5845.78	1460.76	1.83	2.724E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RFC009
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:32:36 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.453864E+004	6.663913E+003

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.453864E+004	6.663913E+003

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:32:35 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

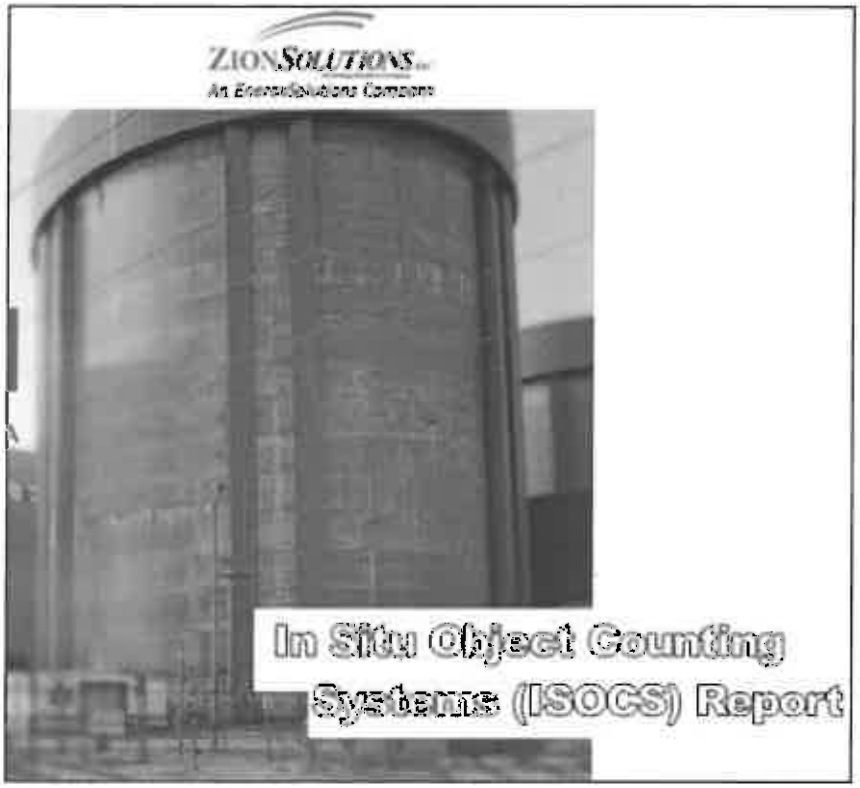
Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RFC009
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:32:36 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	3.164E+003	3.16E+003	3.454E+004	1.258E+003
Cr-51	320.08	9.91	1.021E+013	1.02E+013	-1.097E+011	4.473E+012
Mn-54	834.85	99.98	2.180E+003	2.18E+003	7.301E+002	9.042E+002
Co-58	810.76	99.45	9.952E+005	9.95E+005	-3.751E+005	3.526E+005
Co-60	1173.23	99.85	5.474E+002	5.00E+002	1.846E+002	2.312E+002
	1332.49	99.98	5.002E+002		1.975E+002	2.050E+002
Nb-94	702.65	99.81	3.364E+002	2.97E+002	1.381E+002	1.440E+002
	871.09	99.89	2.972E+002		8.412E+001	1.218E+002
Sn-113	255.13	2.11	2.402E+006	9.61E+004	-6.187E+005	1.060E+006
	391.70	64.97	9.614E+004		-2.587E+003	4.241E+004
Cs-134	475.36	1.48	4.375E+004	5.98E+002	1.740E+004	1.884E+004
	563.25	8.34	6.860E+003		-5.675E+002	2.845E+003
	569.33	15.37	2.832E+003		-1.474E+003	1.097E+003
	604.72	97.62	6.066E+002		-4.062E+001	2.516E+002
	795.86	85.46	5.985E+002		-3.425E+002	2.318E+002
	801.95	8.69	8.568E+003		9.469E+002	3.619E+003
	1038.61	0.99	7.771E+004		2.571E+004	3.223E+004
	1167.97	1.79	4.038E+004		1.432E+003	1.632E+004
	1365.19	3.02	1.701E+004		4.579E+002	6.027E+003
Cs-137	661.66	85.10	3.036E+002	3.04E+002	-1.050E+002	1.227E+002
Eu-152	121.78	28.67	1.233E+003	1.14E+003	-2.063E+002	5.715E+002
	244.70	7.61	3.890E+003		-5.334E+002	1.730E+003
	295.94	0.45	9.907E+004		3.991E+004	4.554E+004
	344.28	26.60	1.139E+003		-2.305E+002	4.974E+002
	367.79	0.86	3.533E+004		1.705E+002	1.536E+004
	411.12	2.24	1.353E+004		-1.229E+003	5.827E+003
	443.96	2.83	9.503E+003		-3.311E+003	3.980E+003
	488.68	0.42	5.681E+004		-7.049E+003	2.295E+004
	563.99	0.49	6.706E+004		2.840E+004	2.853E+004
	586.26	0.46	6.382E+004		-4.098E+004	2.647E+004
	678.62	0.47	7.009E+004		8.178E+003	2.935E+004
	688.67	0.86	3.282E+004		-7.176E+003	1.326E+004
	719.35	0.28	9.592E+004		1.646E+004	3.806E+004

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	778.90	12.96	2.457E+003		4.266E+002	1.007E+003
	810.45	0.32	7.248E+004		1.066E+004	2.713E+004
	867.37	4.26	7.391E+003		1.092E+003	2.987E+003
	919.33	0.43	8.073E+004		2.266E+004	3.309E+004
	964.08	14.65	2.800E+003		7.232E+002	1.182E+003
	1085.87	10.24	3.190E+003		-3.650E+001	1.266E+003
	1089.74	1.73	2.289E+004		4.779E+003	9.493E+003
	1112.07	13.69	2.211E+003		2.301E+002	8.565E+002
	1212.95	1.43	2.414E+004		6.443E+002	9.577E+003
Eu-152	1249.94	0.19	2.115E+005	1.14E+003	-2.012E+003	6.671E+004
	1299.14	1.63	1.549E+004		-2.085E+003	5.489E+003
	1408.01	21.07	1.894E+003		8.952E+001	7.652E+002
	1457.64	0.50	1.153E+005		-1.290E+004	4.991E+004
	1528.10	0.28	9.765E+004		5.258E+003	3.460E+004
Eu-154	123.07	40.40	1.024E+003	8.92E+002	-1.045E+002	4.776E+002
	247.93	6.89	4.825E+003		-1.937E+003	2.156E+003
	591.76	4.95	5.684E+003		6.718E+001	2.297E+003
	692.42	1.78	1.708E+004		-1.816E+003	6.900E+003
	723.30	20.06	1.908E+003		6.462E+002	8.058E+002
	756.80	4.52	5.347E+003		-2.153E+003	2.002E+003
	873.18	12.08	2.391E+003		2.364E+002	9.261E+002
	996.29	10.48	2.638E+003		-1.286E+003	9.874E+002
	1004.76	18.01	1.541E+003		-5.488E+002	5.769E+002
	1274.43	34.80	8.922E+002		-1.312E+002	3.340E+002
	1596.48	1.80	1.688E+004		-2.272E+003	5.981E+003
Eu-155	45.30	1.31	3.005E+004	1.80E+003	3.033E+003	1.356E+004
	60.01	1.22	3.669E+004		-9.463E+003	1.678E+004
	86.55	30.70	1.798E+003		-5.837E+002	8.466E+002
	105.31	21.10	2.024E+003		-8.047E+002	9.359E+002
Tl-208	583.19	85.00	4.800E+002	4.80E+002	-7.925E+000	2.141E+002
Bi-211	351.07	13.02	3.685E+003	3.69E+003	2.267E+003	1.711E+003
Pb-211	404.85	3.78	8.663E+003	4.04E+003	3.983E+003	3.844E+003
	427.09	1.76	1.695E+004		1.342E+003	7.398E+003
	832.01	3.52	4.043E+003		-2.885E+003	1.278E+003
Bi-212	39.86	1.06	2.571E+004	4.99E+003	3.091E+003	1.158E+004
	727.33	6.67	5.951E+003		3.542E+003	2.608E+003
	785.37	1.10	2.408E+004		2.988E+003	9.728E+003
	1620.50	1.47	4.994E+003		0.000E+000	0.000E+000
Pb-212	115.18	0.60	4.620E+004	8.76E+002	-2.813E+004	2.120E+004
	238.63	43.60	8.761E+002		3.549E+002	4.054E+002
	300.09	3.30	8.000E+003		-2.025E+003	3.518E+003
Pb212-XR	74.82	10.28	5.081E+003	2.22E+003	2.966E+003	2.423E+003
	77.11	17.10	2.222E+003		-1.605E+003	1.042E+003
	87.35	3.97	9.530E+003		-3.603E+003	4.481E+003
	89.78	1.46	2.309E+004		-1.828E+004	1.077E+004
Bi-214	609.32	45.49	1.615E+003	1.62E+003	2.223E+003	7.579E+002
	768.36	4.89	7.893E+003		3.294E+003	3.431E+003
	806.18	1.26	1.812E+004		-3.678E+003	7.020E+003
	934.06	3.11	1.368E+004		8.088E+003	5.949E+003
	1120.29	14.92	3.526E+003		2.174E+003	1.560E+003
	1155.21	1.63	2.421E+004		5.386E+003	1.023E+004
	1238.12	5.83	7.830E+003		3.262E+003	3.371E+003
	1280.98	1.43	1.789E+004		-4.154E+002	6.695E+003
	1377.67	3.99	9.310E+003		3.233E+003	3.816E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	1385.31	0.79	4.100E+004		-9.539E+003	1.627E+004
	1401.52	1.33	3.533E+004		1.642E+004	1.513E+004
	1407.99	2.39	1.570E+004		3.062E+003	6.435E+003
	1509.21	2.13	1.836E+004		6.506E+003	7.525E+003
	1661.27	1.05	3.161E+004		1.974E+003	1.225E+004
	1729.59	2.88	1.055E+004		8.988E+002	3.951E+003
Bi-214	1764.49	15.30	4.388E+003	1.62E+003	2.725E+003	1.942E+003
	1847.43	2.03	1.732E+004		-1.442E+003	6.709E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
Pb-214	241.99	7.25	4.596E+003	1.35E+003	1.370E+003	2.100E+003
	295.22	18.42	2.299E+003		1.520E+003	1.064E+003
	351.93	35.60	1.351E+003		6.812E+002	6.271E+002
	785.96	1.06	2.330E+004		-2.666E+002	9.246E+003
Pb214-XR	74.82	5.80	9.015E+003	3.92E+003	5.263E+003	4.300E+003
	77.11	9.70	3.922E+003		-2.833E+003	1.838E+003
	87.35	2.24	1.691E+004		-6.392E+003	7.950E+003
	89.78	0.82	4.115E+004		-3.258E+004	1.920E+004
Ra-226	186.21	3.64	9.167E+003	9.17E+003	2.847E+003	4.235E+003
Ac-228	129.07	2.42	1.378E+004	1.96E+003	2.714E+003	6.415E+003
	209.25	3.89	7.063E+003		-1.013E+003	3.187E+003
	270.24	3.46	8.544E+003		-1.125E+003	3.835E+003
	328.00	2.95	1.119E+004		6.511E+003	5.030E+003
	338.32	11.27	2.871E+003		-2.112E+002	1.286E+003
	409.46	1.92	1.562E+004		2.855E+003	6.846E+003
	463.00	4.40	6.001E+003		-4.888E+002	2.553E+003
	794.95	4.25	7.420E+003		2.783E+003	3.107E+003
	911.20	25.80	1.963E+003		9.545E+002	8.756E+002
	964.77	4.99	6.951E+003		4.635E+002	2.911E+003
	968.97	15.80	3.104E+003		1.578E+003	1.373E+003
	1588.20	3.22	1.321E+004		6.660E+003	5.478E+003
Pa-231	27.36	10.30	1.947E+003	1.95E+003	-1.694E+002	8.427E+002
	283.69	1.70	1.927E+004		-3.530E+002	8.723E+003
	300.07	2.47	1.069E+004		-2.705E+003	4.700E+003
	302.65	2.20	1.419E+004		1.621E+003	6.368E+003
	330.06	1.40	1.769E+004		-6.109E+003	7.655E+003
Th-234	92.38	2.13	1.819E+015	1.82E+015	-4.452E+012	8.546E+014
	92.80	2.10	1.897E+015		4.692E+014	8.929E+014
	112.81	0.21	1.552E+016		-1.130E+015	7.202E+015
U-235	143.76	10.96	2.933E+003	5.82E+002	-4.077E+002	1.360E+003
	163.33	5.08	5.477E+003		9.237E+002	2.499E+003
	185.71	57.20	5.820E+002		1.525E+002	2.689E+002
	202.11	1.08	2.463E+004		-1.628E+004	1.109E+004
	205.31	5.01	5.349E+003		-1.468E+002	2.410E+003
Am-241	59.54	35.90	9.644E+002	9.64E+002	1.230E+002	4.445E+002

\+ = 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



Filename: C:\GENIE2K\CAMFILES\RWC010.CNF

Report Generated On : 7/9/2015 7:33:14 AM

Sample Title : RWC010
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 2:16:34 PM

Live Time : 600.0 seconds
Real Time : 600.6 seconds
Dead Time : 0.10 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:33:14 AM
Sample Title: RWC010
Peak Analysis Performed on: 7/9/2015 7:33:13 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	1177	1187	1181.08	295.13	0.47	2.750E+001
2	1403	1416	1407.97	351.87	1.25	3.100E+001
3	2430	2444	2436.74	609.09	1.40	1.521E+001
4	4477	4489	4483.48	1120.55	0.40	1.125E+001
5	5833	5855	5846.26	1460.88	1.51	5.310E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC010
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:33:14 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.775138E+004	7.168778E+003
Bi-214	1.000	609.32*	45.49	2.227808E+003	8.001288E+002
		768.36	4.89		
		806.18	1.26		
		934.06	3.11		
		1120.29*	14.92	2.961505E+003	2.119045E+003
		1155.21	1.63		
		1238.12	5.83		
		1280.98	1.43		
		1377.67	3.99		
		1385.31	0.79		
		1401.52	1.33		
		1407.99	2.39		
		1509.21	2.13		
		1661.27	1.05		
		1729.59	2.88		
		1764.49	15.30		
		1847.43	2.03		
		2118.51	1.16		
Pb-214	1.000	241.99	7.25		
		295.22*	18.42	1.490145E+003	1.228468E+003
		351.93*	35.60	1.956499E+003	8.890628E+002

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty

* = Energy Line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.775183E+004	7.168768E+003
X Ba-133	0.519		
X Cs-134	0.392		
X Bi-211	0.999		
Bi-214	1.000	2.319350E+003	7.485435E+002
Pb-214	1.000	1.730565E+003	7.202308E+002

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:33:13 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

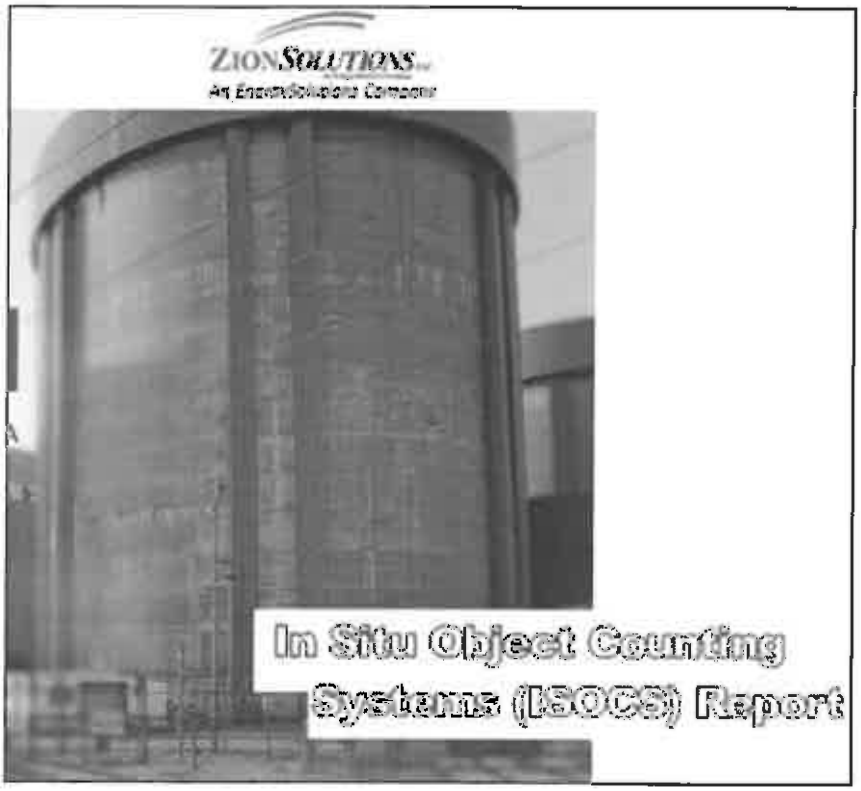
Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC010
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:33:15 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	4.135E+003	4.13E+003	3.775E+004	1.743E+003
Cr-51	320.08	9.91	1.172E+013	1.17E+013	-3.981E+012	5.225E+012
Mn-54	834.85	99.98	1.802E+003	1.80E+003	-4.124E+002	7.151E+002
Co-58	810.76	99.45	1.703E+006	1.70E+006	2.684E+005	7.064E+005
Co-60	1173.23	99.85	4.432E+002	4.37E+002	1.336E+002	1.791E+002
	1332.49	99.98	4.367E+002		-3.331E+001	1.733E+002
Nb-94	702.65	99.81	3.595E+002	3.59E+002	2.808E+001	1.556E+002
	871.09	99.89	3.726E+002		9.897E+001	1.595E+002
Sn-113	255.13	2.11	2.765E+006	8.16E+004	-9.384E+005	1.241E+006
	391.70	64.97	8.157E+004		-1.659E+004	3.512E+004
Cs-134	475.36	1.48	3.912E+004	9.38E+002	5.952E+003	1.652E+004
	563.25	8.34	4.016E+003		-4.379E+003	1.423E+003
	569.33	15.37	3.930E+003		-1.369E+003	1.646E+003
	604.72*	97.62	9.510E+002		2.333E+003	4.236E+002
	795.86	85.46	9.380E+002		-1.381E+002	4.016E+002
	801.95	8.69	5.909E+003		-2.091E+003	2.289E+003
	1038.61	0.99	6.908E+004		-8.164E+003	2.791E+004
	1167.97	1.79	3.083E+004		-4.773E+002	1.154E+004
	1365.19	3.02	1.348E+004		1.832E+003	4.262E+003
Cs-137	661.66	85.10	3.416E+002	3.42E+002	-9.083E+001	1.417E+002
Eu-152	121.78	28.67	1.568E+003	1.36E+003	8.456E+002	7.391E+002
	244.70	7.61	4.731E+003		-1.346E+003	2.151E+003
	295.94	0.45	9.803E+004		5.051E+004	4.502E+004
	344.28	26.60	1.363E+003		2.561E+002	6.092E+002
	367.79	0.86	3.732E+004		-1.705E+003	1.635E+004
	411.12	2.24	1.397E+004		-2.853E+003	6.047E+003
	443.96	2.83	9.933E+003		-4.077E+003	4.195E+003
	488.68	0.42	5.281E+004		-1.813E+004	2.095E+004
	563.99	0.49	5.552E+004		1.122E+004	2.276E+004
	586.26	0.46	7.295E+004		-3.227E+004	3.103E+004
	678.62	0.47	7.628E+004		-2.906E+004	3.245E+004
	688.67	0.86	3.495E+004		7.481E+002	1.432E+004
	719.35	0.28	9.592E+004		-7.573E+004	3.806E+004
	778.90	12.96	2.596E+003		-2.659E+002	1.077E+003
	810.45	0.32	9.495E+004		-2.693E+004	3.837E+004
	867.37	4.26	6.871E+003		-1.022E+003	2.726E+003
	919.33	0.43	8.960E+004		1.314E+004	3.752E+004
	964.08	14.65	3.518E+003		9.643E+002	1.542E+003
	1085.87	10.24	2.619E+003		7.300E+002	9.805E+002
	1089.74	1.73	2.166E+004		4.431E+003	8.880E+003
	1112.07	13.69	1.709E+003		-1.150E+003	6.056E+002
	1212.95	1.43	2.765E+004		8.548E+003	1.133E+004
Eu-152	1249.94	0.19	1.692E+005	1.36E+003	3.610E+004	6.555E+004
	1299.14	1.63	2.505E+004		6.257E+003	1.027E+004
	1408.01	21.07	2.016E+003		6.522E+002	8.265E+002
	1457.64	0.50	1.117E+005		0.000E+000	4.810E+004
	1528.10	0.28	7.739E+004		1.052E+004	2.446E+004
Eu-154	123.07	40.40	1.087E+003	1.09E+003	-2.070E+002	5.092E+002
	247.93	6.89	5.414E+003		-3.342E+002	2.451E+003
	591.76	4.95	6.395E+003		1.020E+003	2.652E+003
	692.42	1.78	1.708E+004		-2.321E+003	6.900E+003
	723.30	20.06	1.545E+003		-5.477E+002	6.242E+002
	756.80	4.52	8.278E+003		1.214E+003	3.467E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	873.18	12.08	2.989E+003		-9.811E+002	1.225E+003
	996.29	10.48	2.943E+003		-2.144E+002	1.140E+003
	1004.76	18.01	2.150E+003		4.295E+002	8.812E+002
	1274.43	34.80	1.245E+003		4.470E+002	5.102E+002
	1596.48	1.80	4.919E+003		0.000E+000	0.000E+000
Eu-155	45.30	1.31	3.634E+004	2.00E+003	1.492E+004	1.671E+004
	60.01	1.22	6.558E+004		1.269E+004	3.123E+004
	86.55	30.70	1.998E+003		-9.717E+002	9.466E+002
	105.31	21.10	2.707E+003		1.088E+003	1.277E+003
Tl-208	583.19	85.00	5.327E+002	5.33E+002	1.376E+002	2.404E+002
Bi-211	351.07*	13.02	3.234E+003	3.23E+003	5.071E+003	1.485E+003
Pb-211	404.85	3.78	6.008E+003	6.01E+003	4.306E+002	2.516E+003
	427.09	1.76	1.695E+004		1.019E+003	7.398E+003
	832.01	3.52	7.203E+003		-2.472E+002	2.858E+003
Bi-212	39.86	1.06	2.529E+004	5.64E+003	2.483E+003	1.137E+004
	727.33	6.67	5.635E+003		3.399E+002	2.450E+003
	785.37	1.10	2.845E+004		3.841E+003	1.191E+004
	1620.50	1.47	1.714E+004		3.691E+003	6.071E+003
Pb-212	115.18	0.60	6.120E+004	1.15E+003	-1.789E+004	2.870E+004
	238.63	43.60	1.150E+003		1.251E+003	5.421E+002
	300.09	3.30	8.193E+003		-7.504E+002	3.614E+003
Pb212-XR	74.82	10.28	6.404E+003	2.63E+003	9.492E+003	3.085E+003
	77.11	17.10	2.634E+003		-1.122E+003	1.247E+003
	87.35	3.97	1.146E+004		5.432E+003	5.444E+003
	89.78	1.46	2.670E+004		-9.144E+003	1.258E+004
+ Bi-214	609.32*	45.49	9.083E+002	9.08E+002	2.228E+003	4.045E+002
	768.36	4.89	6.907E+003		0.000E+000	2.938E+003
	806.18	1.26	2.394E+004		-3.772E+002	9.928E+003
	934.06	3.11	1.100E+004		5.942E+003	4.608E+003
	1120.29*	14.92	3.088E+003		2.962E+003	1.341E+003
	1155.21	1.63	2.881E+004		1.320E+004	1.252E+004
	1238.12	5.83	8.568E+003		3.655E+003	3.740E+003
	1280.98	1.43	1.543E+004		-5.400E+003	5.466E+003
	1377.67	3.99	1.080E+004		5.394E+003	4.561E+003
	1385.31	0.79	3.367E+004		-1.095E+004	1.260E+004
	1401.52	1.33	1.743E+004		-7.273E+003	6.175E+003
	1407.99	2.39	1.570E+004		5.339E+003	6.435E+003
	1509.21	2.13	1.603E+004		3.484E+003	6.360E+003
	1661.27	1.05	3.712E+004		1.579E+004	1.500E+004
	1729.59	2.88	1.556E+004		4.657E+003	6.452E+003
+ Bi-214	1764.49	15.30	3.754E+003	9.08E+002	2.376E+003	1.624E+003
	1847.43	2.03	1.552E+004		2.163E+003	5.810E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
+ Pb-214	241.99	7.25	5.674E+003	1.18E+003	2.788E+003	2.639E+003
	295.22*	18.42	1.877E+003		1.490E+003	8.525E+002
	351.93*	35.60	1.184E+003		1.856E+003	5.437E+002
	785.96	1.06	3.346E+004		1.155E+004	1.432E+004
Pb214-XR	74.82	5.80	1.136E+004	4.65E+003	1.684E+004	5.474E+003
	77.11	9.70	4.648E+003		-1.979E+003	2.201E+003
	87.35	2.24	2.033E+004		9.637E+003	9.659E+003
	89.78	0.82	4.759E+004		-1.630E+004	2.242E+004
Ra-226	186.21	3.64	9.167E+003	9.17E+003	2.327E+003	4.235E+003
Ac-228	129.07	2.42	1.506E+004	2.43E+003	4.056E+003	7.056E+003
	209.25	3.89	8.889E+003		4.027E+003	4.100E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	270.24	3.46	8.544E+003		-2.368E+003	3.835E+003
	328.00	2.95	8.624E+003		1.144E+003	3.749E+003
	338.32	11.27	3.021E+003		1.603E+003	1.361E+003
	409.46	1.92	1.715E+004		5.277E+003	7.609E+003
	463.00	4.40	7.053E+003		8.685E+002	3.079E+003
	794.95	4.25	9.491E+003		4.675E+003	4.143E+003
	911.20	25.80	2.433E+003		2.139E+003	1.111E+003
	964.77	4.99	8.892E+003		3.324E+003	3.882E+003
	968.97	15.80	3.303E+003		1.075E+003	1.473E+003
	1588.20	3.22	1.000E+004		6.244E+002	3.874E+003
Pa-231	27.36	10.30	2.514E+003	2.51E+003	3.873E+000	1.126E+003
	283.69	1.70	1.898E+004		4.894E+003	8.581E+003
	300.07	2.47	1.095E+004		-1.002E+003	4.829E+003
	302.65	2.20	1.175E+004		-4.847E+003	5.149E+003
	330.06	1.40	2.022E+004		4.675E+003	8.918E+003
Th-234	92.38	2.13	1.969E+015	1.97E+015	1.189E+014	9.293E+014
	92.80	2.10	2.130E+015		1.407E+015	1.009E+015
	112.81	0.21	1.672E+016		-3.721E+015	7.798E+015
U-235	143.76	10.96	2.982E+003	6.18E+002	1.393E+002	1.384E+003
	163.33	5.08	6.052E+003		1.334E+003	2.787E+003
	185.71	57.20	6.184E+002		3.567E+002	2.871E+002
	202.11	1.08	2.725E+004		-3.155E+003	1.240E+004
	205.31	5.01	4.898E+003		-4.766E+002	2.184E+003
Am-241	59.54	35.90	1.508E+003	1.51E+003	-3.574E+002	7.162E+002

\+ = 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



Filename: C:\GENIE2K\CAMFILES\RWC011.CNF

Report Generated On : 7/9/2015 7:34:13 AM

Sample Title : RWC011
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 1:07:07 PM

Live Time : 600.0 seconds
Real Time : 600.8 seconds
Dead Time : 0.13 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:34:14 AM
Sample Title: RWC011
Peak Analysis Performed on: 7/9/2015 7:34:13 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	948	961	955.86	238.80	1.08	4.719E+001
2	1402	1417	1408.83	352.08	1.03	2.358E+001
3	2432	2444	2438.65	609.57	0.94	1.953E+001
4	5836	5857	5846.48	1460.93	1.92	0.000E+000
5	7058	7069	7063.29	1764.66	1.15	2.750E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC011
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:34:14 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.710865E+004	6.775465E+003
Pb-212	1.000	115.18	0.60		
		238.63*	43.60	1.204075E+003	6.765158E+002
		300.09	3.30		
Bi-214	1.000	609.32*	45.49	1.630295E+003	7.466795E+002
		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	4.712372E+003	2.181955E+003
		1847.43	2.03		
		2118.51	1.16		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
		295.22	18.42		
		351.93*	35.60	2.01509E+00	8.67467E+00
		785.96	1.06		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.710862E+004	6.776458E+003
X Ba-133	0.533		
X Cs-134	0.389		
X Bi-211	0.998		
Pb-212	1.000	8.692995E+002	6.911422E+002
Bi-214	1.000	1.961482E+003	7.054214E+002
Pb-214	0.515	2.015090E+003	8.674308E+002
X Th-227	0.724		

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:34:13 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC011

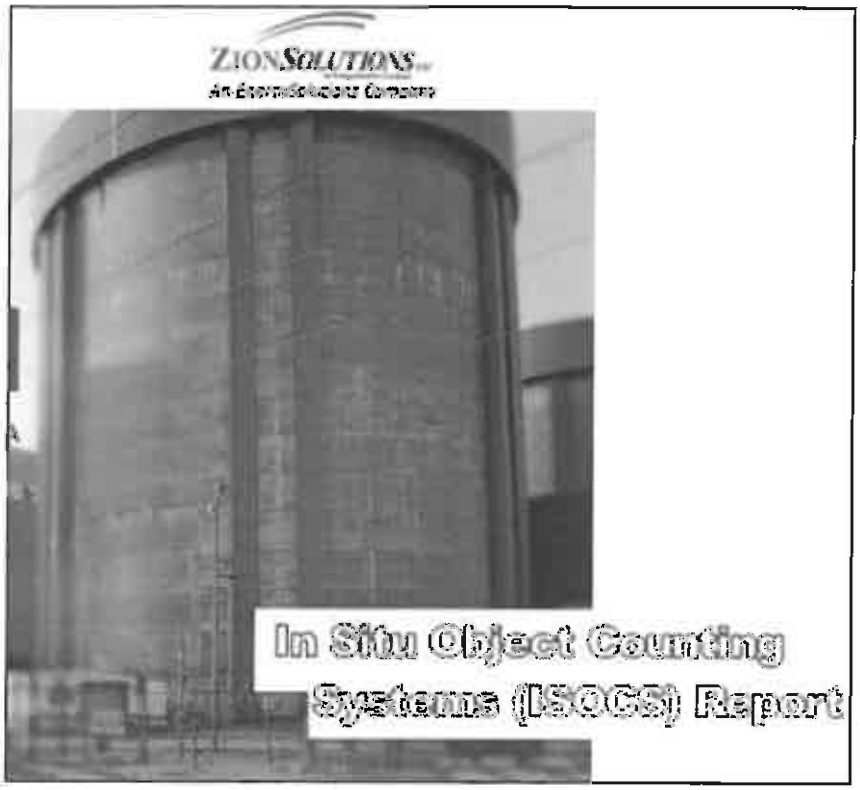
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:34:14 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	6.479E+002	6.48E+002	3.711E+004	0.000E+000
Cr-51	320.08	9.91	9.695E+012	9.70E+012	7.017E+011	4.215E+012
Mn-54	834.85	99.98	2.849E+003	2.85E+003	1.145E+003	1.239E+003
Co-58	810.76	99.45	1.946E+006	1.95E+006	7.389E+005	8.279E+005
Co-60	1173.23	99.85	3.383E+002	3.38E+002	1.571E+001	1.266E+002
	1332.49	99.98	4.001E+002		7.287E+001	1.550E+002
Nb-94	702.65	99.81	3.242E+002	2.59E+002	3.737E+001	1.379E+002
	871.09	99.89	2.595E+002		-6.829E+001	1.030E+002
Sn-113	255.13	2.11	2.764E+006	7.88E+004	-3.037E+005	1.240E+006
	391.70	64.97	7.879E+004		6.976E+002	3.373E+004
Cs-134	475.36	1.48	3.563E+004	7.03E+002	-4.141E+003	1.478E+004
	563.25	8.34	5.669E+003		-9.514E+002	2.250E+003
	569.33	15.37	3.325E+003		-1.768E+002	1.344E+003
	604.72*	97.62	1.015E+003		1.707E+003	4.557E+002
	795.86	85.46	7.027E+002		4.983E+001	2.839E+002
	801.95	8.69	5.909E+003		-1.968E+003	2.289E+003
	1038.61	0.99	6.908E+004		-2.327E+004	2.791E+004
	1167.97	1.79	3.440E+004		1.146E+004	1.332E+004
	1365.19	3.02	1.348E+004		-1.237E+004	4.262E+003
Cs-137	661.66	85.10	3.905E+002	3.91E+002	6.949E+001	1.661E+002
Eu-152	121.78	28.67	1.233E+003	1.08E+003	-3.621E+002	5.715E+002
	244.70	7.61	4.118E+003		-2.111E+003	1.844E+003
	295.94	0.45	9.907E+004		4.613E+004	4.554E+004
	344.28	26.60	1.075E+003		-7.827E+001	4.653E+002
	367.79	0.86	3.092E+004		2.480E+003	1.315E+004
	411.12	2.24	1.397E+004		1.030E+003	6.047E+003
	443.96	2.83	9.503E+003		4.910E+002	3.980E+003
	488.68	0.42	7.017E+004		-5.035E+003	2.963E+004
	563.99	0.49	4.847E+004		1.849E+003	1.923E+004
	586.26	0.46	6.382E+004		1.068E+004	2.647E+004
	678.62	0.47	7.009E+004		9.697E+003	2.935E+004
	688.67	0.86	3.282E+004		3.976E+003	1.326E+004
	719.35	0.28	1.099E+005		-5.383E+004	4.503E+004
	778.90	12.96	1.965E+003		-2.250E+002	7.613E+002
	810.45	0.32	1.173E+005		2.171E+004	4.953E+004
	867.37	4.26	5.642E+003		-7.993E+003	2.112E+003
	919.33	0.43	7.049E+004		1.936E+004	2.797E+004
	964.08	14.65	2.800E+003		9.724E+002	1.182E+003
	1085.87	10.24	2.619E+003		-6.083E+002	9.805E+002
	1089.74	1.73	2.035E+004		4.569E+003	8.221E+003
	1112.07	13.69	2.413E+003		2.025E+002	9.576E+002
	1212.95	1.43	2.596E+004		5.063E+003	1.049E+004
Eu-152	1249.94	0.19	2.115E+005	1.08E+003	-6.088E+004	8.671E+004
	1299.14	1.63	2.004E+004		1.251E+003	7.763E+003
	1408.01	21.07	2.016E+003		7.002E+002	8.265E+002
	1457.64	0.50	5.325E+004		-4.301E+003	1.887E+004
	1528.10	0.28	7.739E+004		7.887E+003	2.446E+004
Eu-154	123.07	40.40	1.016E+003	7.70E+002	3.693E+002	4.740E+002

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	247.93	6.89	4.734E+003		-1.448E+003	2.111E+003
	591.76	4.95	6.395E+003		-1.751E+003	2.652E+003
	692.42	1.78	2.018E+004		1.345E+003	8.451E+003
	723.30	20.06	1.545E+003		-6.435E+002	6.242E+002
	756.80	4.52	7.882E+003		1.304E+003	3.269E+003
	873.18	12.08	2.391E+003		-1.642E+003	9.261E+002
	996.29	10.48	4.084E+003		1.532E+003	1.710E+003
	1004.76	18.01	2.150E+003		1.534E+001	8.812E+002
	1274.43	34.80	7.697E+002		-3.730E+002	2.727E+002
	1596.48	1.80	1.338E+004		-2.272E+003	4.229E+003
Eu-155	45.30	1.31	3.187E+004	1.82E+003	1.033E+003	1.447E+004
	60.01	1.22	4.476E+004		-9.578E+003	2.082E+004
	86.55	30.70	1.817E+003		-8.196E+002	8.562E+002
	105.31	21.10	2.266E+003		2.702E+002	1.057E+003
Tl-208	583.19	85.00	4.983E+002	4.98E+002	3.502E+002	2.232E+002
Bi-211	351.07*	13.02	2.962E+003	2.96E+003	5.504E+003	1.349E+003
Pb-211	404.85	3.78	7.024E+003	7.02E+003	-8.320E+001	3.024E+003
	427.09	1.76	1.442E+004		-6.324E+002	6.134E+003
	832.01	3.52	7.203E+003		2.472E+002	2.858E+003
Bi-212	39.86	1.06	3.588E+004	5.47E+003	7.692E+003	1.667E+004
	727.33	6.67	5.469E+003		2.772E+003	2.367E+003
	785.37	1.10	2.564E+004		3.171E+003	1.051E+004
	1620.50	1.47	1.987E+004		2.614E+003	7.436E+003
+ Pb-212	115.18	0.60	5.275E+004	9.71E+002	-1.364E+004	2.448E+004
	238.63*	43.60	9.715E+002		1.204E+003	4.530E+002
	300.09	3.30	7.802E+003		1.562E+003	3.419E+003
Pb212-XR	74.82	10.28	5.694E+003	2.82E+003	4.652E+003	2.730E+003
	77.11	17.10	2.821E+003		-2.996E+001	1.341E+003
	87.35	3.97	1.005E+004		3.143E+003	4.740E+003
	89.78	1.46	2.656E+004		4.185E+003	1.251E+004
+ Bi-214	609.32*	45.49	9.697E+002	9.70E+002	1.630E+003	4.353E+002
	768.36	4.89	5.718E+003		9.520E+001	2.344E+003
	806.18	1.26	2.394E+004		6.271E+003	9.928E+003
	934.06	3.11	1.150E+004		-6.602E+002	4.857E+003
	1120.29	14.92	3.823E+003		2.564E+003	1.709E+003
	1155.21	1.63	1.669E+004		-7.036E+003	6.467E+003
	1238.12	5.83	8.798E+003		4.155E+003	3.855E+003
	1280.98	1.43	3.237E+004		1.860E+004	1.394E+004
	1377.67	3.99	1.125E+004		4.932E+003	4.784E+003
	1385.31	0.79	3.367E+004		-7.037E+003	1.260E+004
	1401.52	1.33	1.743E+004		3.754E+003	6.175E+003
	1407.99	2.39	1.570E+004		5.190E+003	6.435E+003
	1509.21	2.13	1.469E+004		-2.904E+003	5.689E+003
	1661.27	1.05	2.444E+004		5.264E+003	8.659E+003
	1729.59	2.88	9.105E+003		1.961E+003	3.226E+003
+ Bi-214	1764.49*	15.30	2.126E+003	9.70E+002	4.712E+003	8.103E+002
	1847.43	2.03	1.890E+004		4.614E+003	7.500E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
+ Pb-214	241.99*	7.25	5.848E+003	1.08E+003	7.248E+003	2.727E+003
	295.22	18.42	2.084E+003		1.171E+003	9.562E+002
	351.93*	35.60	1.084E+003		2.015E+003	4.939E+002
	785.96	1.06	2.962E+004		1.382E+004	1.240E+004
Pb214-XR	74.82	5.80	1.010E+004	4.98E+003	8.254E+003	4.843E+003
	77.11	9.70	4.979E+003		-5.287E+001	2.367E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	87.35	2.24	1.783E+004		5.577E+003	8.410E+003
	89.78	0.82	4.734E+004		7.460E+003	2.230E+004
Ra-226	186.21	3.64	8.821E+003	8.82E+003	4.018E+003	4.062E+003
Ac-228	129.07	2.42	1.357E+004	2.07E+003	5.173E+003	6.311E+003
	209.25	3.89	7.791E+003		1.145E+003	3.551E+003
	270.24	3.46	6.891E+003		-2.359E+003	3.008E+003
	328.00	2.95	1.081E+004		4.448E+003	4.840E+003
	338.32	11.27	2.541E+003		1.343E+003	1.121E+003
	409.46	1.92	1.344E+004		-7.971E+003	5.752E+003
	463.00	4.40	6.446E+003		8.717E+002	2.775E+003
	794.95	4.25	6.686E+003		-1.431E+003	2.741E+003
	911.20	25.80	2.074E+003		8.406E+002	9.309E+002
	964.77	4.99	7.565E+003		3.441E+003	3.218E+003
	968.97	15.80	2.485E+003		1.210E+002	1.064E+003
	1588.20	3.22	1.091E+004		4.163E+003	4.331E+003
Pa-231	27.36	10.30	2.326E+003	2.33E+003	-6.939E+002	1.032E+003
	283.69	1.70	1.584E+004		6.448E+003	7.006E+003
	300.07	2.47	1.042E+004		2.087E+003	4.567E+003
	302.65	2.20	1.234E+004		1.695E+003	5.444E+003
	330.06	1.40	1.925E+004		-7.760E+001	8.436E+003
Th-234	92.38	2.13	1.772E+015	1.77E+015	5.552E+013	8.311E+014
	92.80	2.10	1.830E+015		4.407E+014	8.593E+014
	112.81	0.21	1.694E+016		3.114E+015	7.906E+015
U-235	143.76	10.96	2.832E+003	5.66E+002	1.843E+002	1.310E+003
	163.33	5.08	5.477E+003		6.755E+002	2.499E+003
	185.71	57.20	5.656E+002		1.408E+002	2.607E+002
	202.11	1.08	2.579E+004		3.562E+003	1.167E+004
	205.31	5.01	5.601E+003		5.383E+002	2.535E+003
Am-241	59.54	35.90	1.028E+003	1.03E+003	-4.959E+002	4.765E+002

\+ = 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



Filename: C:\GENIE2K\CAMFILES\RWC012.CNF

Report Generated On : 7/9/2015 7:35:37 AM

Sample Title : RFC012
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 1:47:52 PM

Live Time : 600.0 seconds
Real Time : 600.6 seconds
Dead Time : 0.10 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:35:38 AM
Sample Title: RFC012
Peak Analysis Performed on: 7/9/2015 7:35:37 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	1402	1416	1407.43	351.73	0.98	2.280E+001
2	2430	2446	2438.40	609.51	1.45	8.463E+000
3	5837	5857	5846.73	1460.99	1.10	8.116E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RFC012
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:35:38 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.420888E+004	6.95625E+003
Ba-133	0.986	79.61	2.65		
		81.00	32.90		
		276.40	7.16		
		302.85	18.34		
		356.01*	62.05	1.27559E+003	5.63130E+002
		383.85	8.94		
Cs-134	0.389	475.36	1.48		
		563.25	8.34		
		569.33	15.37		
		604.72*	97.62	2.82255E+003	8.39613E+002
		795.86	85.46		
		801.95	8.69		
		1038.61	0.99		
		1167.97	1.79		
		1365.19	3.02		
Bi-211	0.999	351.07*	13.02	5.38725E+003	2.29199E+003
Bi-214	1.000	609.32*	45.49	2.69593E+003	8.02120E+002
		768.36	4.89		
		806.18	1.26		
		934.06	3.11		
		1120.29	14.92		
		1155.21	1.63		
		1238.12	5.83		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
		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	1.000	241.99	7.25		
		295.22	18.42		
		351.93*	35.60	1.89912E+00	8.38432E+00
		785.96	1.06		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.420879E+004	6.966253E+003
? Ba-133	**0.986**	**1.275588E+003**	**5.631297E+002**
? Cs-134	**0.389**	**2.822550E+003**	**8.396131E+002**
? Bi-211	**0.999**	**5.187251E+003**	**2.291994E+003**
? Bi-214	**1.000**	**2.695832E+003**	**8.021196E+002**
? Pb-214	**1.000**	**1.899121E+003**	**8.384322E+002**

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:35:37 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

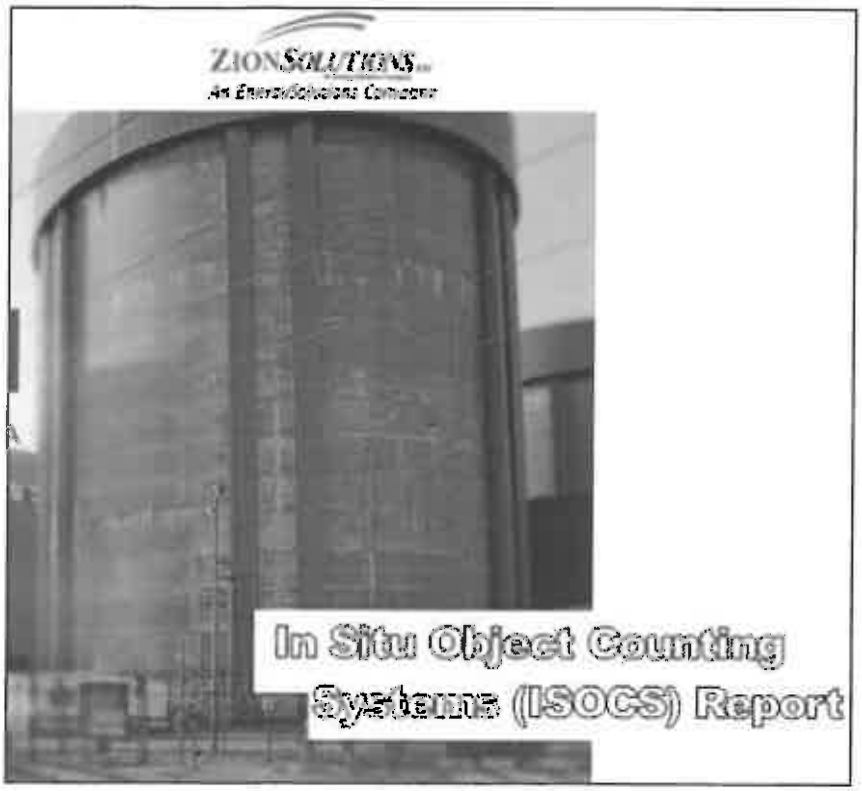
Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RFC012
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:35:38 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	4.983E+003	4.98E+003	3.421E+004	2.167E+003
Cr-51	320.08	9.91	1.101E+013	1.10E+013	6.056E+012	4.870E+012
Mn-54	834.85	99.98	2.181E+003	2.18E+003	3.437E+002	9.045E+002
Co-58	810.76	99.45	1.703E+006	1.70E+006	8.050E+004	7.063E+005
Co-60	1173.23	99.85	4.432E+002	3.09E+002	7.594E+001	1.791E+002
	1332.49	99.98	3.093E+002		4.164E+001	1.096E+002
Nb-94	702.65	99.81	3.113E+002	2.38E+002	-2.860E+001	1.315E+002
	871.09	99.89	2.377E+002		1.237E+001	9.209E+001
Sn-113	255.13	2.11	2.038E+006	6.98E+004	-1.229E+006	8.773E+005
	391.70	64.97	6.976E+004		-3.965E+004	2.922E+004
+ Cs-134	475.36	1.48	3.372E+004	7.55E+002	1.524E+003	1.382E+004
	563.25	8.34	7.207E+003		1.514E+003	3.018E+003
	569.33	15.37	2.832E+003		-3.979E+003	1.097E+003
	604.72*	97.62	7.553E+002		2.823E+003	3.257E+002
	795.86	85.46	8.304E+002		-5.398E+001	3.478E+002
	801.95	8.69	5.909E+003		-2.091E+003	2.289E+003
	1038.61	0.99	7.355E+004		-7.697E+003	3.015E+004
	1167.97	1.79	3.083E+004		7.160E+002	1.154E+004
	1365.19	3.02	1.701E+004		6.870E+002	6.027E+003
Cs-137	661.66	85.10	3.905E+002	3.91E+002	3.425E+001	1.661E+002
Eu-152	121.78	28.67	1.283E+003	1.11E+003	-1.725E+001	5.969E+002
	244.70	7.61	4.667E+003		-1.802E+002	2.119E+003
	295.94	0.45	9.907E+004		6.436E+004	4.554E+004
	344.28	26.60	1.108E+003		1.247E+001	4.816E+002
	367.79	0.86	3.919E+004		1.996E+003	1.729E+004
	411.12	2.24	1.397E+004		-6.339E+003	6.047E+003
	443.96	2.83	1.111E+004		3.290E+001	4.783E+003
	488.68	0.42	5.281E+004		2.014E+003	2.095E+004
	563.99	0.49	5.552E+004		-1.109E+004	2.276E+004
	586.26	0.46	6.703E+004		-5.363E+003	2.807E+004
	678.62	0.47	5.052E+004		-3.365E+004	1.957E+004
	688.67	0.86	4.054E+004		1.047E+004	1.712E+004
	719.35	0.28	9.592E+004		1.097E+004	3.806E+004
	778.90	12.96	2.457E+003		-2.513E+002	1.007E+003
	810.45	0.32	9.495E+004		-3.366E+004	3.837E+004
	867.37	4.26	6.871E+003		2.358E+002	2.726E+003
	919.33	0.43	9.366E+004		4.785E+004	3.955E+004
	964.08	14.65	2.678E+003		-3.706E+002	1.122E+003
	1085.87	10.24	2.260E+003		-4.867E+002	8.006E+002
	1089.74	1.73	1.733E+004		3.246E+003	6.713E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	1112.07	13.69	2.211E+003		-3.221E+002	8.565E+002
	1212.95	1.43	3.068E+004		8.336E+003	1.285E+004
Eu-152	1249.94	0.19	1.847E+005	1.11E+003	5.142E+004	7.328E+004
	1299.14	1.63	2.004E+004		5.005E+003	7.763E+003
	1408.01	21.07	1.613E+003		-1.846E+002	6.248E+002
	1457.64	0.50	9.556E+004		-5.543E+004	4.002E+004
	1528.10	0.28	1.263E+005		4.206E+004	4.893E+004
Eu-154	123.07	40.40	9.943E+002	5.39E+002	-5.299E+000	4.629E+002
	247.93	6.89	4.641E+003		-1.823E+003	2.065E+003
	591.76	4.95	4.842E+003		6.046E+002	1.875E+003
	692.42	1.78	1.124E+004		-7.266E+003	3.984E+003
	723.30	20.06	1.645E+003		6.533E+002	6.742E+002
	756.80	4.52	8.653E+003		2.235E+003	3.655E+003
	873.18	12.08	5.386E+002		0.000E+000	0.000E+000
	996.29	10.48	3.680E+003		-6.389E+002	1.508E+003
	1004.76	18.01	2.019E+003		4.653E+002	8.159E+002
	1274.43	34.80	8.923E+002		-7.253E+002	3.340E+002
	1596.48	1.80	1.688E+004		3.636E+003	5.981E+003
Eu-155	45.30	1.31	2.958E+004	1.86E+003	9.473E+002	1.333E+004
	60.01	1.22	5.633E+004		6.065E+003	2.660E+004
	86.55	30.70	1.864E+003		-7.996E+002	8.797E+002
	105.31	21.10	2.468E+003		2.264E+002	1.158E+003
Tl-208	583.19	85.00	5.409E+002	5.41E+002	3.597E+002	2.445E+002
+ Bi-211	351.07*	13.02	2.882E+003	2.88E+003	5.187E+003	1.309E+003
Pb-211	404.85	3.78	8.093E+003	7.20E+003	1.662E+003	3.559E+003
	427.09	1.76	1.442E+004		5.962E+002	6.134E+003
	832.01	3.52	7.203E+003		-1.786E+003	2.858E+003
Bi-212	39.86	1.06	2.163E+004	4.31E+003	-2.352E+002	9.540E+003
	727.33	6.67	4.314E+003		1.071E+003	1.789E+003
	785.37	1.10	2.564E+004		-2.744E+003	1.051E+004
	1620.50	1.47	2.603E+004		1.107E+004	1.052E+004
Pb-212	115.18	0.60	5.572E+004	1.08E+003	-3.116E+004	2.596E+004
	238.63	43.60	1.083E+003		1.296E+003	5.091E+002
	300.09	3.30	9.256E+003		2.270E+003	4.146E+003
Pb212-XR	74.82	10.28	5.898E+003	2.82E+003	8.103E+003	2.832E+003
	77.11	17.10	2.821E+003		2.119E+002	1.341E+003
	87.35	3.97	1.010E+004		3.538E+003	4.765E+003
	89.78	1.46	2.541E+004		-1.611E+003	1.193E+004
+ Bi-214	609.32*	45.49	7.214E+002	7.21E+002	2.696E+003	3.111E+002
	768.36	4.89	6.346E+003		1.936E+003	2.658E+003
	806.18	1.26	1.978E+004		2.565E+003	7.848E+003
	934.06	3.11	1.243E+004		4.126E+003	5.321E+003
	1120.29	14.92	3.823E+003		1.974E+003	1.709E+003
	1155.21	1.63	2.087E+004		1.142E+003	8.555E+003
	1238.12	5.83	7.566E+003		3.517E+003	3.239E+003
	1280.98	1.43	1.789E+004		-4.154E+002	6.695E+003
	1377.67	3.99	9.837E+003		4.960E+003	4.080E+003
	1385.31	0.79	4.100E+004		5.473E+003	1.627E+004
	1401.52	1.33	1.743E+004		-2.346E+003	6.175E+003
	1407.99	2.39	1.256E+004		-1.960E+003	4.864E+003
	1509.21	2.13	1.469E+004		4.890E+003	5.689E+003
	1661.27	1.05	2.833E+004		1.974E+003	1.061E+004
	1729.59	2.88	1.285E+004		4.902E+003	5.100E+003
+ Bi-214	1764.49	15.30	4.290E+003	7.21E+002	2.939E+003	1.892E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	1847.43	2.03	1.552E+004		-3.605E+002	5.810E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
+ Pb-214	241.99	7.25	4.705E+003	1.05E+003	8.200E+002	2.155E+003
	295.22	18.42	2.173E+003		1.571E+003	1.001E+003
	351.93*	35.60	1.055E+003		1.899E+003	4.792E+002
	785.96	1.06	2.962E+004		2.518E+003	1.240E+004
Pb214-XR	74.82	5.80	1.046E+004	4.98E+003	1.438E+004	5.024E+003
	77.11	9.70	4.979E+003		3.739E+002	2.367E+003
	87.35	2.24	1.792E+004		6.278E+003	8.454E+003
	89.78	0.82	4.529E+004		-2.872E+003	2.127E+004
Ra-226	186.21	3.64	9.081E+003	9.08E+003	5.207E+003	4.192E+003
Ac-228	129.07	2.42	1.497E+004	1.80E+003	3.138E+003	7.009E+003
	209.25	3.89	7.063E+003		-3.948E+001	3.187E+003
	270.24	3.46	8.690E+003		0.000E+000	3.908E+003
	328.00	2.95	8.370E+003		-1.650E+003	3.622E+003
	338.32	11.27	3.163E+003		7.124E+002	1.432E+003
	409.46	1.92	1.295E+004		1.217E+003	5.507E+003
	463.00	4.40	7.053E+003		6.101E+002	3.079E+003
	794.95	4.25	7.756E+003		2.582E+003	3.276E+003
	911.20	25.80	1.804E+003		9.469E+002	7.958E+002
	964.77	4.99	6.951E+003		1.159E+002	2.911E+003
	968.97	15.80	3.104E+003		1.782E+003	1.373E+003
	1588.20	3.22	1.000E+004		1.041E+003	3.874E+003
Pa-231	27.36	10.30	2.646E+003	2.65E+003	9.232E+002	1.192E+003
	283.69	1.70	1.618E+004		-9.861E+002	7.179E+003
	300.07	2.47	1.237E+004		3.033E+003	5.539E+003
	302.65	2.20	1.419E+004		4.940E+003	6.368E+003
	330.06	1.40	1.713E+004		-5.209E+003	7.377E+003
Th-234	92.38	2.13	1.997E+015	2.00E+015	4.283E+014	9.431E+014
	92.80	2.10	2.045E+015		5.385E+014	9.663E+014
	112.81	0.21	1.776E+016		-5.222E+014	8.316E+015
U-235	143.76	10.96	2.673E+003	6.18E+002	-5.767E+002	1.230E+003
	163.33	5.08	5.740E+003		1.817E+003	2.631E+003
	185.71	57.20	6.184E+002		4.794E+002	2.871E+002
	202.11	1.08	2.211E+004		-1.313E+004	9.835E+003
	205.31	5.01	5.434E+003		-1.174E+003	2.452E+003
Am-241	59.54	35.90	1.264E+003	1.26E+003	-4.081E+002	5.943E+002

+ = 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



Filename: C:\GENIE2K\CAMFILES\RWC013.CNF

Report Generated On : 7/9/2015 7:36:35 AM

Sample Title : RWC013
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/29/2015 12:31:20 PM

Live Time : 600.0 seconds
Real Time : 600.7 seconds
Dead Time : 0.12 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:36:35 AM
Sample Title: RWC013
Peak Analysis Performed on: 7/9/2015 7:36:34 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	80	87	83.49	20.56	0.83	2.809E+001
2	296	307	300.31	74.81	0.62	2.304E+002
3	2431	2445	2439.80	609.86	0.61	1.313E+001
4	5838	5857	5847.44	1461.17	0.98	1.266E+001

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: RWC013
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:36:35 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	3.38421E+004	7.16497E+003
Cs-134	0.387	475.36	1.48		
		563.25	8.34		
		569.33	15.37		
		604.72*	97.62	2.33710E+003	8.12632E+002
		795.86	85.46		
		801.95	8.69		
		1038.61	0.99		
		1167.97	1.79		
		1365.19	3.02		
Bi-214	1.000	609.32*	45.49	2.23225E+003	7.75329E+002
		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		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
		1729.59	2.88		
		1764.49	15.30		
		1847.43	2.03		
		2118.51	1.16		
Th-231	0.933	25.64*	14.10	4.23683E+00	1.88190E+00
		84.21*	6.60	6.41433E+00	6.95024E+00
		89.95	1.00		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	3.384212E+004	7.164973E+003
? Cs-134	**0.387**	**2.337098E+003**	**8.126320E+002**
? Bi-214	**1.000**	**2.232283E+003**	**7.763291E+002**
X Pa-231	0.959		
Th-231	0.933	4.385568E+003	1.816486E+003

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:36:34 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

Detector Name: 5456
Sample Geometry: Cribhouse 3m
Sample Title: RWC013

Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:36:36 AM

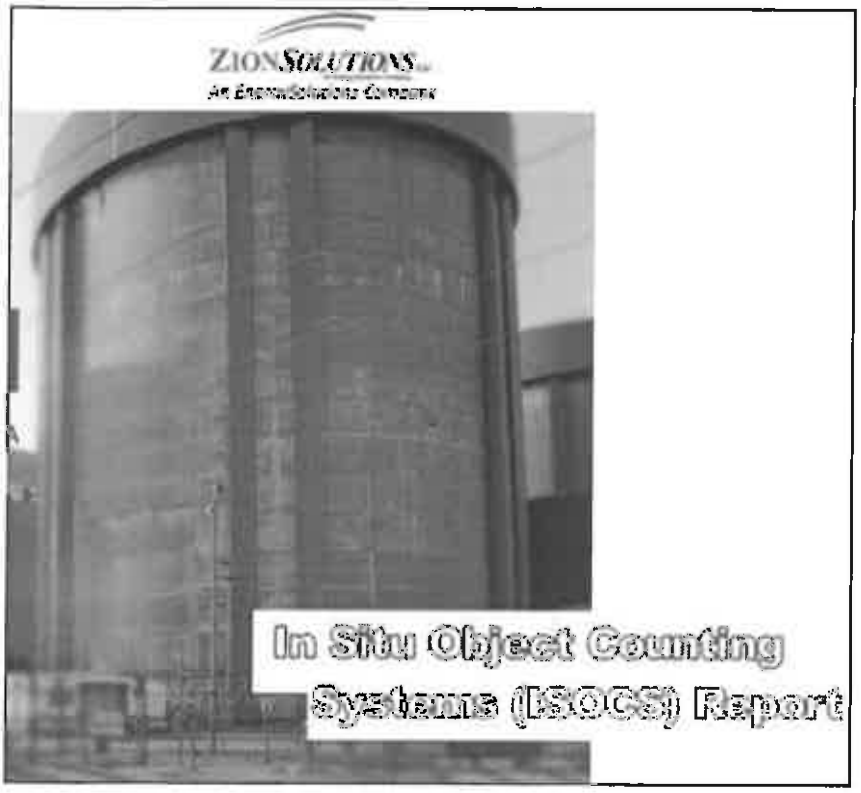
Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	5.925E+003	5.92E+003	3.384E+004	2.638E+003
Cr-51	320.08	9.91	9.404E+012	9.40E+012	-1.444E+012	4.069E+012
Mn-54	834.85	99.98	1.938E+003	1.94E+003	-1.031E+002	7.833E+002
Co-58	810.76	99.45	1.513E+006	1.51E+006	-4.425E+005	6.113E+005
Co-60	1173.23	99.85	3.774E+002	3.09E+002	3.928E+001	1.462E+002
	1332.49	99.98	3.093E+002		-8.744E+001	1.096E+002
Nb-94	702.65	99.81	1.315E+002	1.32E+002	-1.340E+002	4.158E+001
	871.09	99.89	2.377E+002		2.474E+001	9.209E+001
Sn-113	255.13	2.11	2.666E+006	9.84E+004	-3.921E+004	1.192E+006
	391.70	64.97	9.841E+004		3.662E+004	4.354E+004
+ Cs-134	475.36	1.48	3.742E+004	7.48E+002	-1.460E+004	1.567E+004
	563.25	8.34	7.843E+003		4.324E+002	3.337E+003
	569.33	15.37	4.107E+003		-5.718E+002	1.735E+003
	604.72*	97.62	8.803E+002		2.337E+003	3.882E+002
	795.86	85.46	7.482E+002		-1.424E+002	3.067E+002
	801.95	8.69	6.449E+003		-2.460E+002	2.559E+003
	1038.61	0.99	4.548E+004		-2.939E+004	1.611E+004
	1167.97	1.79	3.754E+004		-1.561E+004	1.490E+004
	1365.19	3.02	2.200E+004		1.374E+003	8.524E+003
Cs-137	661.66	85.10	3.233E+002	3.23E+002	-7.843E+001	1.325E+002
Eu-152	121.78	28.67	1.360E+003	1.23E+003	1.296E+002	6.354E+002
	244.70	7.61	4.731E+003		-8.406E+002	2.151E+003
	295.94	0.45	9.483E+004		3.215E+004	4.342E+004
	344.28	26.60	1.229E+003		3.235E+001	5.420E+002
	367.79	0.86	2.970E+004		-7.032E+003	1.254E+004
	411.12	2.24	1.353E+004		3.179E+003	5.827E+003
	443.96	2.83	1.182E+004		2.138E+003	5.138E+003
	488.68	0.42	7.017E+004		-1.007E+002	2.963E+004
	563.99	0.49	7.437E+004		2.086E+004	3.218E+004
	586.26	0.46	6.382E+004		-2.225E+004	2.647E+004
	678.62	0.47	6.673E+004		-1.945E+004	2.767E+004
	688.67	0.86	3.878E+004		3.879E+002	1.624E+004
	719.35	0.28	1.327E+005		-2.012E+004	5.645E+004
	778.90	12.96	2.145E+003		-3.191E+002	8.512E+002
	810.45	0.32	1.068E+005		4.671E+004	4.430E+004
	867.37	4.26	9.129E+003		1.874E+003	3.856E+003
	919.33	0.43	7.049E+004		6.183E+003	2.797E+004
	964.08	14.65	2.267E+003		-1.808E+002	9.159E+002
	1085.87	10.24	2.923E+003		-2.433E+002	1.132E+003
	1089.74	1.73	1.733E+004		-2.164E+003	6.713E+003
	1112.07	13.69	2.413E+003		-6.443E+001	9.576E+002
	1212.95	1.43	2.414E+004		-8.285E+002	9.577E+003
Eu-152	1249.94	0.19	1.987E+005	1.23E+003	2.113E+004	8.028E+004
	1299.14	1.63	1.796E+004		-2.781E+002	6.723E+003
	1408.01	21.07	2.016E+003		6.954E+002	8.265E+002
	1457.64	0.50	7.518E+004		-3.907E+004	2.983E+004
	1528.10	0.28	9.765E+004		1.446E+004	3.460E+004
Eu-154	123.07	40.40	1.009E+003	6.10E+002	1.932E+002	4.703E+002

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	247.93	6.89	5.170E+003		-1.007E+003	2.329E+003
	591.76	4.95	6.053E+003		-1.583E+003	2.481E+003
	692.42	1.78	1.708E+004		2.472E+003	6.900E+003
	723.30	20.06	1.545E+003		-3.012E+002	6.242E+002
	756.80	4.52	7.459E+003		-1.881E+003	3.058E+003
	873.18	12.08	2.143E+003		-7.464E+002	8.021E+002
	996.29	10.46	2.638E+003		4.288E+002	9.874E+002
	1004.76	18.01	2.150E+003		5.420E+002	8.812E+002
	1274.43	34.80	6.099E+002		-1.243E+002	1.928E+002
	1596.48	1.80	1.957E+004		5.454E+003	7.325E+003
Eu-155	45.30	1.31	3.230E+004	1.91E+003	-9.552E+003	1.469E+004
	60.01	1.22	4.406E+004		-9.530E+003	2.047E+004
	86.55	30.70	1.910E+003		-4.574E+002	9.025E+002
	105.31	21.10	2.233E+003		-1.142E+003	1.040E+003
Tl-208	583.19	85.00	5.875E+002	5.88E+002	5.741E+002	2.678E+002
Bi-211	351.07	13.02	3.166E+003	3.17E+003	1.360E+003	1.451E+003
Pb-211	404.85	3.78	7.686E+003	7.69E+003	-1.296E+003	3.355E+003
	427.09	1.76	1.496E+004		-6.525E+003	6.407E+003
	832.01	3.52	9.156E+003		1.709E+003	3.835E+003
Bi-212	39.86	1.06	2.260E+004	4.31E+003	-1.073E+004	1.003E+004
	727.33	6.67	4.314E+003		3.568E+002	1.789E+003
	785.37	1.10	2.238E+004		-6.829E+002	8.881E+003
	1620.50	1.47	1.987E+004		2.922E+003	7.436E+003
Pb-212	115.18	0.60	5.814E+004	1.05E+003	4.722E+003	2.717E+004
	238.63	43.60	1.046E+003		7.052E+002	4.901E+002
	300.09	3.30	9.420E+003		3.184E+003	4.228E+003
Pb212-XR	74.82	10.28	5.782E+003	2.53E+003	4.664E+003	2.774E+003
	77.11	17.10	2.529E+003		-4.031E+002	1.195E+003
	87.35	3.97	1.049E+004		-1.764E+003	4.962E+003
	89.78	1.46	2.859E+004		6.139E+003	1.352E+004
+ Bi-214	609.32*	45.49	8.409E+002	8.41E+002	2.232E+003	3.708E+002
	768.36	4.89	7.893E+003		3.687E+003	3.431E+003
	806.18	1.26	1.812E+004		-1.886E+003	7.020E+003
	934.06	3.11	1.150E+004		3.103E+003	4.857E+003
	1120.29	14.92	3.526E+003		1.799E+003	1.560E+003
	1155.21	1.63	1.960E+004		6.081E+003	7.920E+003
	1238.12	5.83	6.698E+003		-1.574E+003	2.805E+003
	1280.98	1.43	2.343E+004		4.569E+003	9.468E+003
	1377.67	3.99	9.310E+003		3.100E+002	3.816E+003
	1385.31	0.79	3.757E+004		6.842E+003	1.455E+004
	1401.52	1.33	2.254E+004		7.508E+003	8.733E+003
	1407.99	2.39	1.570E+004		3.920E+003	6.435E+003
	1509.21	2.13	1.316E+004		-3.057E+002	4.926E+003
	1661.27	1.05	7.122E+003		0.000E+000	0.000E+000
	1729.59	2.88	1.178E+004		3.922E+003	4.562E+003
+ Bi-214	1764.49	15.30	4.846E+003	8.41E+002	3.736E+003	2.171E+003
	1847.43	2.03	1.061E+004		-5.407E+003	3.354E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
Pb-214	241.99	7.25	4.916E+003	1.35E+003	4.027E+002	2.260E+003
	295.22	18.42	2.320E+003		2.043E+003	1.074E+003
	351.93	35.60	1.351E+003		1.592E+003	6.271E+002
	785.96	1.06	2.330E+004		-5.332E+003	9.246E+003
Pb214-XR	74.82	5.80	1.026E+004	4.46E+003	8.276E+003	4.922E+003
	77.11	9.70	4.463E+003		-7.113E+002	2.109E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	87.35	2.24	1.861E+004		-3.130E+003	8.803E+003
	89.78	0.82	5.095E+004		1.094E+004	2.410E+004
Ra-226	186.21	3.64	1.028E+004	1.03E+004	7.933E+003	4.791E+003
Ac-228	129.07	2.42	1.224E+004	2.00E+003	-2.043E+003	5.645E+003
	209.25	3.89	8.974E+003		5.514E+003	4.143E+003
	270.24	3.46	9.773E+003		1.547E+003	4.449E+003
	328.00	2.95	1.021E+004		1.291E+003	4.540E+003
	338.32	11.27	2.656E+003		8.291E+002	1.179E+003
	409.46	1.92	1.479E+004		2.736E+003	6.431E+003
	463.00	4.40	7.243E+003		2.345E+003	3.174E+003
	794.95	4.25	7.756E+003		1.670E+003	3.276E+003
	911.20	25.80	2.001E+003		7.750E+002	8.944E+002
	964.77	4.99	6.951E+003		1.993E+003	2.911E+003
	968.97	15.80	3.035E+003		2.321E+003	1.339E+003
	1588.20	3.22	1.000E+004		2.185E+003	3.874E+003
Pa-231	27.36*	10.30	2.861E+003	2.86E+003	5.800E+003	1.300E+003
	283.69	1.70	1.982E+004		4.240E+003	9.000E+003
	300.07	2.47	1.259E+004		4.253E+003	5.648E+003
	302.65	2.20	1.010E+004		-5.402E+003	4.326E+003
	330.06	1.40	2.022E+004		-1.504E+003	8.918E+003
Th-234	92.38	2.13	1.974E+015	1.97E+015	6.728E+014	9.321E+014
	92.80	2.10	2.013E+015		9.110E+014	9.504E+014
	112.81	0.21	1.762E+016		6.309E+015	8.247E+015
U-235	143.76	10.96	2.780E+003	6.48E+002	-3.076E+002	1.284E+003
	163.33	5.08	5.991E+003		2.014E+003	2.756E+003
	185.71	57.20	6.479E+002		3.203E+002	3.018E+002
	202.11	1.08	2.423E+004		1.427E+003	1.089E+004
	205.31	5.01	6.144E+003		2.434E+003	2.807E+003
Am-241	59.54	35.90	1.121E+003	1.12E+003	9.433E+001	5.227E+002

+ = 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

G A M M A S P E C T R U M A N A L Y S I S



Filename: C:\GENIE2K\CAMFILES\RWC014.CNF

Report Generated On : 7/9/2015 7:47:24 AM

Sample Title : B3-08101AF-RWC-014-GM
Spectrum Description :
Sample Identification :
Sample Type :
Sample Geometry : Cribhouse 3m

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 50 - 8192
Peak Area Range (in channels) : 50 - 8192
Identification Energy Tolerance : 10.000 keV
Sample Size : 2.827E+001 M^2

Sample Taken On : 1/28/2013 12:00:00 PM
Acquisition Started : 6/25/2015 12:48:39 PM

Live Time : 1000.0 seconds
Real Time : 1000.9 seconds
Dead Time : 0.09 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/8/2015
Efficiency ID : CRIB_HOUSE_3M

Report Date : 7/9/2015 7:47:24 AM
Sample Title: B3-08101AF-RWC-014-GM
Peak Analysis Performed on: 7/9/2015 7:47:23 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

P E A K A N A L Y S I S R E P O R T

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Continuum Counts
1	297	306	301.51	75.11	1.04	3.027E+002
2	948	960	955.45	238.69	0.77	1.068E+002
3	1176	1186	1180.79	295.05	0.69	4.967E+001
4	1402	1415	1408.02	351.88	0.88	3.757E+001
5	2430	2446	2438.18	609.45	1.29	2.351E+001
6	5836	5857	5846.60	1460.96	1.30	1.327E+001
7	7058	7069	7063.73	1764.77	0.47	4.558E+000

Dark Orange = First peak in a multiplet region
Lite Orange = Other peak in a multiplet region
Green = Fitted singlet
Errors quoted at 2.000 sigma

NUCLIDE IDENTIFICATION REPORT

Sample Title: B3-08101AF-RWC-014-GM
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated: 7/9/2015 7:47:24 AM

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	4.118899E+004	6.360308E+003
Ba-133	0.332	79.61*	2.65	1.691236E+004	1.360153E+004
		81.00	32.90		
		276.40	7.16		
		302.85*	18.34	1.266146E+003	1.102548E+003
		356.01*	62.05	1.142058E+003	4.296938E+002
		383.85	8.94		
Pb-212	0.997	115.18	0.60		
		238.63*	43.60	7.565548E+002	5.430958E+002
		300.09*	3.30	6.008708E+003	5.233648E+003
Bi-214	1.000	609.32*	45.49	2.144278E+003	5.311058E+002
		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		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
		1407.99	2.39		
		1509.21	2.13		
		1661.27	1.05		
		1729.59	2.88		
		1764.49*	15.30	2.40112E+00	1.30165E+00
		1847.43	2.03		
		2118.51	1.16		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
! = Nuclide was corrected for parent/daughter
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	1.000	4.118892E+004	6.363078E+003
Ba-133	0.332	1.152883E+003	4.004629E+002
X Cs-134	0.390		
X Bi-211	0.999		
Pb-212	0.997	7.542204E+002	5.402988E+002
Bi-214	1.000	2.193155E+003	5.678780E+002
X Pb-214	0.998		

? = 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 2.000 sigma

UNIDENTIFIED PEAKS

Peak Locate Performed on: 7/9/2015 7:47:23 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty

All peaks were identified.

NUCLIDE MDA REPORT

Detector Name: 5456

Sample Geometry: Cribhouse 3m
Sample Title: B3-08101AF-RWC-014-GM
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB
Report Generated on: 7/9/2015 7:47:24 AM

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+ K-40	1460.82*	10.66	3.691E+003	3.69E+003	4.119E+004	1.651E+003
Cr-51	320.08	9.91	7.872E+012	7.87E+012	1.489E+012	3.592E+012
Mn-54	834.85	99.98	1.694E+003	1.69E+003	5.749E+002	7.365E+002
Co-58	810.76	99.45	9.296E+005	9.30E+005	-3.228E+005	3.810E+005
Co-60	1173.23	99.85	2.987E+002	2.40E+002	-1.200E+002	1.239E+002
	1332.49	99.98	2.397E+002		9.979E+000	9.286E+001
Nb-94	702.65	99.81	2.465E+002	2.24E+002	2.681E+001	1.087E+002
	871.09	99.89	2.235E+002		2.895E+001	9.571E+001
Sn-113	255.13	2.11	2.279E+006	6.13E+004	-7.088E+005	1.057E+006
	391.70	64.97	6.133E+004		-8.314E+003	2.735E+004
Cs-134	475.36	1.48	2.862E+004	4.47E+002	-2.098E+001	1.249E+004
	563.25	8.34	5.511E+003		1.810E+003	2.406E+003
	569.33	15.37	2.653E+003		-1.175E+003	1.136E+003
	604.72*	97.62	7.114E+002		2.237E+003	3.247E+002
	795.86	85.46	4.473E+002		-2.649E+002	1.833E+002
	801.95	8.69	5.536E+003		-2.022E+003	2.370E+003
	1038.61	0.99	4.646E+004		-5.399E+003	1.927E+004
	1167.97	1.79	3.222E+004		1.252E+004	1.380E+004
	1365.19	3.02	1.644E+004		2.973E+003	6.741E+003
Cs-137	661.66	85.10	2.516E+002	2.52E+002	-6.830E+001	1.083E+002
Eu-152	121.78	28.67	1.001E+003	6.64E+002	1.187E+002	4.735E+002
	244.70	7.61	3.386E+003		-2.948E+001	1.564E+003
	295.94	0.45	7.562E+004		8.168E+003	3.542E+004
	344.28	26.60	6.643E+002		-1.603E+001	2.888E+002
	367.79	0.86	2.793E+004		5.184E+003	1.258E+004
	411.12	2.24	1.001E+004		-6.992E+002	4.441E+003
	443.96	2.83	7.676E+003		-1.439E+003	3.375E+003
	488.68	0.42	5.553E+004		4.354E+003	2.449E+004
	563.99	0.49	4.319E+004		1.705E+003	1.860E+004
	586.26	0.46	5.142E+004		0.000E+000	2.244E+004
	678.62	0.47	5.227E+004		4.119E+003	2.272E+004
	688.67	0.86	2.627E+004		3.315E+003	1.125E+004
	719.35	0.28	9.604E+004		2.833E+004	4.208E+004
	778.90	12.96	2.034E+003		1.733E+002	8.841E+002
	810.45	0.32	6.063E+004		-5.047E+003	2.485E+004
	867.37	4.26	4.719E+003		4.378E+002	1.934E+003
	919.33	0.43	5.373E+004		-1.531E+004	2.250E+004
	964.08	14.65	2.055E+003		3.644E+002	8.969E+002
	1085.87	10.24	2.647E+003		4.013E+002	1.126E+003
	1089.74	1.73	1.299E+004		8.343E+002	5.325E+003
	1112.07	13.69	1.839E+003		2.116E+002	7.704E+002
	1212.95	1.43	1.752E+004		-6.900E+002	7.264E+003
Eu-152	1249.94	0.19	1.472E+005	6.64E+002	2.703E+004	6.215E+004
	1299.14	1.63	1.667E+004		2.918E+003	6.983E+003
	1408.01	21.07	1.056E+003		7.650E+001	4.189E+002
	1457.64	0.50	7.127E+004		-1.754E+004	3.098E+004

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
	1528.10	0.28	6.788E+004		-1.577E+003	2.541E+004
Eu-154	123.07	40.40	7.936E+002	7.46E+002	1.462E+000	3.763E+002
	247.93	6.89	3.603E+003		-1.003E+003	1.648E+003
	591.76	4.95	4.707E+003		-3.392E+002	2.027E+003
	692.42	1.78	1.816E+004		5.815E+003	8.099E+003
	723.30	20.06	1.361E+003		6.161E+002	5.916E+002
	756.80	4.52	7.155E+003		5.062E+003	3.175E+003
	873.18	12.08	2.246E+003		-8.651E+002	9.616E+002
	996.29	10.46	2.331E+003		3.673E+002	9.666E+002
	1004.76	18.01	1.616E+003		5.579E+002	6.917E+002
	1274.43	34.80	7.461E+002		-2.200E+002	3.058E+002
	1596.48	1.80	1.012E+004		-6.811E+002	3.585E+003
Eu-155	45.30	1.31	2.393E+004	1.34E+003	-9.584E+003	1.109E+004
	60.01	1.22	3.471E+004		9.794E+003	1.642E+004
	86.55	30.70	1.338E+003		-1.375E+003	6.374E+002
	105.31	21.10	1.819E+003		1.968E+002	8.636E+002
Tl-208	583.19	85.00	4.174E+002	4.17E+002	3.148E+002	1.931E+002
Bi-211	351.07*	13.02	2.117E+003	2.12E+003	4.648E+003	9.791E+002
Pb-211	404.85	3.78	4.611E+003	4.61E+003	-9.329E+002	2.013E+003
	427.09	1.76	1.193E+004		1.151E+003	5.322E+003
	832.01	3.52	5.494E+003		9.615E+002	2.301E+003
Bi-212	39.86	1.06	1.972E+004	3.75E+003	1.476E+003	9.098E+003
	727.33	6.67	3.750E+003		1.030E+003	1.654E+003
	785.37	1.10	2.184E+004		5.122E+003	9.532E+003
	1620.50	1.47	1.330E+004		4.429E+003	5.152E+003
+ Pb-212	115.18	0.60	4.033E+004	8.39E+002	-2.129E+004	1.903E+004
	238.63*	43.60	8.386E+002		7.566E+002	3.997E+002
	300.09*	3.30	8.174E+003		6.009E+003	3.800E+003
Pb212-XR	74.82	10.28	4.358E+003	1.91E+003	4.797E+003	2.109E+003
	77.11	17.10	1.914E+003		-3.530E+002	9.153E+002
	87.35	3.97	8.168E+003		6.653E+003	3.914E+003
	89.78	1.46	1.995E+004		5.429E+002	9.514E+003
+ Bi-214	609.32*	45.49	6.820E+002	6.82E+002	2.144E+003	3.113E+002
	768.36	4.89	5.373E+003		-6.426E+002	2.377E+003
	806.18	1.26	1.930E+004		3.876E+003	8.424E+003
	934.06	3.11	1.029E+004		5.546E+003	4.608E+003
	1120.29	14.92	3.051E+003		3.306E+003	1.404E+003
	1155.21	1.63	1.872E+004		8.131E+003	8.231E+003
	1238.12	5.83	6.263E+003		4.461E+003	2.805E+003
	1280.98	1.43	2.066E+004		8.191E+003	8.982E+003
	1377.67	3.99	7.710E+003		8.246E+002	3.352E+003
	1385.31	0.79	2.254E+004		-1.525E+003	8.731E+003
	1401.52	1.33	2.265E+004		1.450E+004	9.803E+003
	1407.99	2.39	9.419E+003		3.674E+003	3.861E+003
	1509.21	2.13	1.035E+004		2.078E+003	4.180E+003
	1661.27	1.05	2.070E+004		4.264E+003	8.215E+003
	1729.59	2.88	5.463E+003		5.148E+002	1.935E+003
+ Bi-214	1764.49*	15.30	1.558E+003	6.82E+002	2.401E+003	6.274E+002
	1847.43	2.03	1.373E+004		1.162E+003	5.692E+003
>	2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
Pb-214	241.99*	7.25	5.048E+003	7.75E+002	4.554E+003	2.406E+003
	295.22*	18.42	1.466E+003		1.078E+003	6.815E+002
	351.93*	35.60	7.749E+002		1.702E+003	3.585E+002
	785.96	1.06	2.273E+004		9.664E+003	9.923E+003

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
Pb214-XR	74.82	5.80	7.732E+003	3.38E+003	8.511E+003	3.741E+003
	77.11	9.70	3.378E+003		-6.229E+002	1.615E+003
	87.35	2.24	1.449E+004		1.180E+004	6.943E+003
	89.78	0.82	3.557E+004		9.676E+002	1.696E+004
Ra-226	186.21	3.64	6.886E+003	6.89E+003	2.620E+003	3.234E+003
Ac-228	129.07	2.42	1.063E+004	1.60E+003	3.153E+003	5.033E+003
	209.25	3.89	6.139E+003		3.252E+003	2.863E+003
	270.24	3.46	6.373E+003		-5.461E+002	2.924E+003
	328.00	2.95	8.204E+003		1.332E+003	3.764E+003
	338.32	11.27	2.107E+003		9.019E+002	9.637E+002
	409.46	1.92	9.129E+003		-3.366E+003	3.985E+003
	463.00	4.40	5.062E+003		7.321E+002	2.263E+003
	794.95	4.25	5.374E+003		1.837E+003	2.325E+003
	911.20	25.80	1.597E+003		1.726E+003	7.348E+002
	964.77	4.99	5.753E+003		2.690E+003	2.538E+003
	968.97	15.80	2.199E+003		1.674E+003	9.923E+002
	1588.20	3.22	5.377E+003		1.499E+003	2.013E+003
Pa-231	27.36	10.30	2.106E+003	2.11E+003	3.569E+002	9.745E+002
	283.69	1.70	1.268E+004		2.961E+003	5.795E+003
	300.07	2.47	9.388E+003		2.512E+003	4.307E+003
	302.65	2.20	9.480E+003		4.831E+002	4.304E+003
	330.06	1.40	1.574E+004		9.700E+001	7.158E+003
Th-234	92.38	2.13	1.307E+015	1.31E+015	1.469E+014	6.242E+014
	92.80	2.10	1.343E+015		3.271E+014	6.415E+014
	112.81	0.21	1.128E+016		-2.275E+015	5.341E+015
U-235	143.76	10.96	2.317E+003	4.55E+002	1.301E+002	1.095E+003
	163.33	5.08	4.697E+003		8.478E+002	2.205E+003
	185.71	57.20	4.546E+002		2.333E+002	2.140E+002
	202.11	1.08	1.925E+004		-2.163E+002	8.896E+003
	205.31	5.01	4.890E+003		9.505E+002	2.286E+003
Am-241	59.54	35.90	8.233E+002	8.23E+002	2.848E+002	3.890E+002

\+ = 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

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**********  **********  **********
*****    G A M M A   S P E C T R U M   A N A L Y S I S    *****
**********  **********  **********

Filename: C:\GENIE2K\B308102\U1SE.CNF

Report Generated On                : 9/26/2017   2:46:14 PM

Sample Title                       : B308102ASFJSM001GD
Sample Description                 : U1SE R1
Sample Identification              :
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :    50 -  8192
Peak Area Range (in channels)      :    50 -  8192
Identification Energy Tolerance    :   10.000 keV

Sample Size                        :  1.000E+000 M^2

Sample Taken On                    : 9/17/2015   2:09:13 PM
Acquisition Started                : 9/17/2015   2:09:13 PM

Live Time                          :      600.0 seconds
Real Time                          :      601.2 seconds

Dead Time                          :   0.20 %

            Energy Calibration Used Done On       : 1/27/2015
            Efficiency Calibration Used Done On   : 9/26/2017
            Efficiency ID                         : 3M_TURBINE
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 5456
Sample Title: B308102ASFJSM001GD
Peak Analysis Performed on: 9/26/2017 2:46:13 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	80-	86	83.23	20.50	0.73	5.58E+001	39.79	1.26E+002
2	951-	959	955.86	238.80	0.44	1.56E+001	13.30	1.34E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: B308102ASFJSM001GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
Pb-212	1.000	238.63*	43.60	3.05117E+005	2.64520E+005

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
Pb-212	1.000	3.051165E+005	2.645203E+005

? = 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 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/26/2017 2:46:13 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	20.50	9.3045E-002	71.27		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: 5456
Sample Geometry:
Sample Title: B308102ASFJSM001GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
K-40	1460.82	10.66	3.962E+006	3.96E+006	1.765E+006	1.714E+006
Co-60	1173.23	99.85	1.373E+005	1.37E+005	9.332E+003	4.342E+004
	1332.49	99.98	2.140E+005		-6.959E+004	8.012E+004
Nb-94	702.65	99.81	1.342E+005	1.18E+005	2.167E+004	4.754E+004
	871.09	99.89	1.178E+005		-8.002E+003	3.723E+004
Ag-108m	433.90	90.50	1.776E+005	1.62E+005	1.102E+004	7.175E+004
	614.30	89.80	1.620E+005		-2.007E+004	6.064E+004
	722.90	90.80	2.271E+005		7.849E+004	9.175E+004
Cs-134	604.72	97.62	1.011E+005	1.01E+005	3.433E+003	3.195E+004
	795.86	85.46	2.526E+005		1.075E+005	1.021E+005
Cs-137	661.66	85.10	2.159E+005	2.16E+005	1.482E+004	8.565E+004
Eu-152	121.78	28.67	6.314E+005	5.74E+005	1.835E+005	2.839E+005
	344.28	26.60	5.740E+005		4.232E+004	2.353E+005
	1408.01	21.07	7.174E+005		-1.462E+005	2.268E+005
Eu-154	123.07	40.40	4.014E+005	4.01E+005	9.526E+004	1.781E+005
	723.30	20.06	8.756E+005		-3.554E+005	3.392E+005
	1274.43	34.80	5.186E+005		1.117E+005	1.838E+005
Eu-155	86.55	30.70	5.397E+005	5.40E+005	-3.053E+005	2.417E+005
	105.31	21.10	8.088E+005		1.763E+005	3.623E+005
Tl-208	583.19	85.00	2.328E+005	2.33E+005	1.661E+004	9.541E+004
Bi-212	727.33	6.67	2.882E+006	2.88E+006	-6.375E+005	1.144E+006
+ Pb-212	238.63*	43.60	3.967E+005	3.97E+005	3.051E+005	1.719E+005
Bi-214	609.32	45.49	5.154E+005	5.15E+005	1.701E+005	2.177E+005
	1120.29	14.92	1.600E+006		-2.319E+005	6.349E+005
	1764.49	15.30	1.435E+006		2.511E+005	5.083E+005
Pb-214	295.22	18.42	8.541E+005	5.98E+005	-1.523E+005	3.577E+005
	351.93	35.60	5.983E+005		1.732E+005	2.601E+005
Ra-226	186.21	3.64	4.784E+006	4.78E+006	1.509E+006	2.110E+006
Ac-228	338.32	11.27	1.173E+006	6.84E+005	-1.253E+005	4.654E+005
	911.20	25.80	6.835E+005		-2.646E+005	2.558E+005
	968.97	15.80	1.510E+006		1.338E+005	6.101E+005
Am-241	59.54	35.90	7.006E+005	7.01E+005	-7.798E+004	3.258E+005

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or MDA has not been calculated
@ = Half-life too short to be able to perform the decay correction

```
**********  **********  **********
*****      G A M M A   S P E C T R U M   A N A L Y S I S      *****
**********  **********  **********

Filename: C:\GENIE2K\B308102\U1SW.CNF

Report Generated On              : 9/26/2017   2:50:04 PM

Sample Title                     : B308102ASFJSM002GD
Sample Description               : U1SW R1
Sample Identification            :
Sample Type                      :
Sample Geometry                  :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :    50 -  8192
Peak Area Range (in channels)    :    50 -  8192
Identification Energy Tolerance  :   10.000 keV

Sample Size                      :  1.000E+000 M^2

Sample Taken On                  : 9/17/2015   2:49:06 PM
Acquisition Started              : 9/17/2015   2:49:06 PM

Live Time                        :      600.0 seconds
Real Time                        :      601.1 seconds

Dead Time                        :   0.19 %

            Energy Calibration Used Done On       : 1/27/2015
            Efficiency Calibration Used Done On   : 9/26/2017
            Efficiency ID                         : 3M_TURBINE
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 5456
Sample Title: B308102ASFJSM002GD
Peak Analysis Performed on: 9/26/2017 2:50:03 PM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	80-	89	83.47	20.56	1.19	3.91E+002	72.59	3.43E+002
2	297-	305	301.32	75.06	0.61	2.25E+001	20.35	3.75E+001
3	951-	961	955.64	238.74	0.93	2.02E+001	10.82	3.84E+000
4	5846-	5859	5851.82	1462.27	0.96	3.15E+001	13.67	5.49E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: B308102ASFJSM002GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/M^2)	Activity Uncertainty
K-40	0.997	1460.82*	10.66	6.21026E+006	2.74727E+006
Pb-212	1.000	238.63*	43.60	3.93883E+005	2.20813E+005

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/M^2)	Wt mean Activity Uncertainty
K-40	0.997	6.210261E+006	2.747267E+006
Pb-212	1.000	3.938830E+005	2.208131E+005

? = 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 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/26/2017 2:50:03 PM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	20.56	6.5144E-001	18.57		
2	75.06	3.7583E-002	90.23		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: 5456
Sample Geometry:
Sample Title: B308102ASFJSM002GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/M^2)	Nuclide MDA (pCi/M^2)	Activity (pCi/M^2)	Dec. Level (pCi/M^2)
+	K-40	1460.82*	10.66	3.061E+006	3.06E+006	6.210E+006	1.264E+006
	Co-60	1173.23	99.85	5.051E+004	5.05E+004	0.000E+000	0.000E+000
		1332.49	99.98	5.381E+004		0.000E+000	0.000E+000
	Nb-94	702.65	99.81	1.342E+005	1.34E+005	2.890E+004	4.754E+004
		871.09	99.89	1.486E+005		3.201E+004	5.266E+004
	Ag-108m	433.90	90.50	1.651E+005	1.62E+005	4.470E+004	6.550E+004
		614.30	89.80	1.620E+005		-2.884E+004	6.064E+004
		722.90	90.80	1.733E+005		2.147E+004	6.488E+004
	Cs-134	604.72	97.62	1.276E+005	1.28E+005	2.748E+004	4.520E+004
		795.86	85.46	1.664E+005		3.583E+004	5.894E+004
	Cs-137	661.66	85.10	1.978E+005	1.98E+005	2.058E+004	7.661E+004
	Eu-152	121.78	28.67	4.260E+005	2.64E+005	-1.361E+005	1.812E+005
		344.28	26.60	5.012E+005		1.911E+004	1.989E+005
		1408.01	21.07	2.638E+005		0.000E+000	0.000E+000
	Eu-154	123.07	40.40	3.462E+005	1.51E+005	4.594E+004	1.505E+005
		723.30	20.06	6.769E+005		-1.731E+005	2.398E+005
		1274.43	34.80	1.511E+005		0.000E+000	0.000E+000
	Eu-155	86.55	30.70	4.308E+005	4.31E+005	-1.933E+005	1.873E+005
		105.31	21.10	6.068E+005		-3.354E+004	2.613E+005
	Tl-208	583.19	85.00	2.583E+005	2.58E+005	6.976E+004	1.082E+005
	Bi-212	727.33	6.67	2.366E+006	2.37E+006	-5.496E+005	8.858E+005
+	Pb-212	238.63*	43.60	2.469E+005	2.47E+005	3.939E+005	9.703E+004
	Bi-214	609.32	45.49	3.554E+005	3.55E+005	8.507E+004	1.377E+005
		1120.29	14.92	1.600E+006		4.638E+005	6.349E+005
		1764.49	15.30	2.179E+006		5.279E+005	8.804E+005
	Pb-214	295.22	18.42	9.985E+005	6.15E+005	6.308E+004	4.299E+005
		351.93	35.60	6.154E+005		2.346E+005	2.686E+005
	Ra-226	186.21	3.64	4.186E+006	4.19E+006	1.078E+005	1.811E+006
	Ac-228	338.32	11.27	1.343E+006	5.90E+005	2.237E+005	5.507E+005
		911.20	25.80	5.896E+005		1.270E+005	2.089E+005
		968.97	15.80	1.286E+006		2.944E+005	4.981E+005
	Am-241	59.54	35.90	3.637E+005	3.64E+005	1.453E+004	1.574E+005

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or MDA has not been calculated
@ = Half-life too short to be able to perform the decay correction

********** ********** **********
*** GAMMA SPECTRUM ANALYSIS *****
********** ********** **********

.lename: C:\GENIE2K\CAMFILES\U2NE.CNF

:port Generated On : 9/21/2015 10:30:01 AM

ımple Title : B308102BSFJSM001GD
ımple Description : U2NE
ımple Identification :
ımple Type :
ımple Geometry :

:ak Locate Threshold : 3.00
:ak Locate Range (in channels) : 50 - 8192
:ak Area Range (in channels) : 50 - 8192
lentification Energy Tolerance : 1.000 FWHM

ımple Size : 1.000E+000 METERS

ımple Taken On : 1/28/2013 12:00:00 PM
:quisition Started : 9/17/2015 10:36:00 AM

.ve Time : 600.0 seconds
:al Time : 600.4 seconds

:ad Time : 0.06 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 7/24/2014
Efficiency ID : 3M_TURBINE area

Data Validated
CG Fuller

****
*** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 5456
Sample Title: B308102BSFJSM001GD
Peak Analysis Performed on: 9/21/2015 10:30:01 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	297-	306	301.19	75.03	0.59	1.95E+001	22.58	4.65E+001

= First peak in a multiplet region
= Other peak in a multiplet region
= Fitted singlet

rors quoted at 2.000 sigma

```
**********************************************************************
***  N U C L I D E  I D E N T I F I C A T I O N  R E P O R T  *****
**********************************************************************

   Sample Title:          B308102BSFJSM001GD
   Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion_LiB.NLB

 ..................    IDENTIFIED NUCLIDES    ..................

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


    * = Energy line found in the spectrum.
    @ = Energy line not used for Weighted Mean Activity
    Energy Tolerance :    1.000 FWHM
    Nuclide confidence index threshold =   0.30
    Errors quoted at  2.000 sigma
```

****
*** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/METE)	Wt mean Activity Uncertainty

? = 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 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/21/2015 10:30:01 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	75.03	3.2431E-002	116.06	Tol.	PB-212 PB-214

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
*** N U C L I D E M D A R E P O R T *****
****

Detector Name: 5456
Sample Geometry:
Sample Title: B308102BSFJSM001GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion_LiB.NLB

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/METE)	Nuclide MDA (pCi/METE)	Activity (pCi/METE)	Dec. Level (pCi/METE)
K-40	1460.81	10.67	2.525E+005	2.53E+005	2.218E+005	1.145E+005
MN-54	834.83	99.97	8.400E+004	8.40E+004	-6.087E+003	3.333E+004
CO-60	1173.22	100.00	2.637E+004	2.64E+004	1.357E+004	1.156E+004
	1332.49	100.00	3.101E+004		2.084E+004	1.379E+004
NB-94	702.63	100.00	6.671E+003	2.08E+003	2.694E+002	2.363E+003
	871.10	100.00	2.084E+003		0.000E+000	0.000E+000
SN-113	255.12	1.93	1.497E+008	3.57E+006	-3.007E+007	6.321E+007
	391.69	64.90	3.571E+006		-5.202E+005	1.383E+006
CS-134	475.35	1.46	1.371E+006	4.60E+003	4.236E+005	5.441E+005
	563.23	8.38	1.793E+005		-3.380E+004	6.354E+004
	569.32	15.43	1.581E+005		4.737E+004	6.479E+004
	604.70	97.60	4.595E+003		0.000E+000	0.000E+000
	795.84	85.40	1.562E+004		2.122E+003	4.938E+003
	801.93	8.73	1.532E+005		2.081E+004	4.842E+004
	1038.57	1.00	1.837E+006		3.958E+005	6.510E+005
	1167.94	1.80	3.100E+005		0.000E+000	0.000E+000
	1365.15	3.04	8.645E+005		2.879E+005	3.349E+005
CS-137	661.65	85.12	1.240E+004	1.24E+004	2.564E+003	5.009E+003
EU-152	121.78	28.40	3.950E+004	1.95E+004	1.062E+004	1.731E+004
	244.69	7.49	1.484E+005		1.333E+004	6.388E+004
	295.94	0.45	2.160E+006		2.042E+005	8.956E+005
	344.27	26.50	3.418E+004		4.443E+003	1.381E+004
	367.79	0.86	8.223E+005		-6.493E+005	3.078E+005
	411.11	2.21	4.914E+005		1.142E+005	2.038E+005
	443.98	3.11	3.769E+005		1.018E+005	1.579E+005
	488.68	0.42	2.085E+006		4.992E+005	8.078E+005
	563.99	0.49	1.682E+006		1.172E+005	6.295E+005
	586.26	0.46	1.566E+006		-1.897E+005	5.548E+005
	678.62	0.47	1.269E+006		-6.036E+005	4.012E+005
	688.67	0.86	8.843E+005		-7.142E+004	3.133E+005
	719.35	0.28	3.205E+006		-2.978E+005	1.200E+006
	778.89	12.74	1.058E+005		3.500E+004	4.387E+004
	810.45	0.32	2.894E+006		-3.360E+005	1.083E+006
	867.32	4.16	1.556E+005		-4.757E+004	4.918E+004
	919.33	0.43	5.680E+005		0.000E+000	0.000E+000
	964.01	14.40	9.495E+004		2.710E+004	3.892E+004
	1085.78	10.00	8.804E+004		1.185E+003	3.119E+004
	1089.74	1.73	5.104E+005		-1.237E+005	1.808E+005
	1112.02	13.30	1.945E+004		0.000E+000	0.000E+000
	1212.95	1.42	5.105E+005		6.937E+004	1.614E+005
	1249.94	0.19	3.905E+006		5.306E+005	1.234E+006
	1299.14	1.62	7.493E+005		1.715E+005	2.902E+005

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/METE)	Nuclide MDA (pCi/METE)	Activity (pCi/METE)	Dec. Level (pCi/METE)
	EU-152	1407.95	20.70	3.717E+004	1.95E+004	-1.010E+004	1.175E+004
		1457.64	0.50	1.962E+006		-2.641E+005	6.952E+005
		1528.10	0.28	1.043E+006		0.000E+000	0.000E+000
	EU-154	123.10	40.46	2.383E+004	1.50E+004	-6.635E+003	1.006E+004
		247.93	6.95	1.553E+005		7.576E+003	6.557E+004
		591.76	4.99	1.562E+005		-4.206E+003	5.535E+004
		692.42	1.80	5.893E+005		-2.146E+004	2.283E+005
		723.30	20.22	4.118E+004		2.217E+003	1.459E+004
		756.76	4.57	1.849E+005		4.978E+003	6.550E+004
		873.19	12.27	9.330E+004		2.573E+004	3.614E+004
		996.26	10.64	1.124E+005		2.514E+004	4.353E+004
		1004.72	18.01	1.500E+004		0.000E+000	0.000E+000
		1274.44	35.19	3.709E+004		1.235E+004	1.437E+004
		1596.49	1.80	4.887E+005		6.642E+004	1.545E+005
	EU-155	45.30	1.33	2.346E+006	6.02E+004	-7.311E+005	9.823E+005
		60.01	1.13	1.352E+006		-4.315E+005	5.464E+005
		86.54	30.70	7.022E+004		3.058E+004	3.184E+004
		105.31	21.20	6.021E+004		-2.666E+003	2.578E+004
@	Tl-208	583.19	84.50	1.000E+026	1.00E+026	1.000E+026	1.000E+020
	BI-211	72.87	1.20	1.557E+006	9.61E+004	2.665E+005	7.128E+005
		351.10	12.20	9.607E+004		1.298E+004	4.176E+004
		404.80	4.10	2.733E+005		1.234E+005	1.170E+005
		426.90	1.90	4.185E+005		-3.193E+004	1.661E+005
		831.80	3.30	3.014E+005		-3.448E+003	1.196E+005
	PB-211	404.80	3.00	3.735E+005	3.55E+005	1.686E+005	1.599E+005
		427.10	1.40	5.205E+005		-1.110E+005	2.016E+005
		831.80	2.80	3.552E+005		-4.064E+003	1.409E+005
	BI-212	39.86	1.10	2.443E+006	5.72E+004	5.695E+005	1.001E+006
		727.17	11.80	5.716E+004		-1.847E+004	2.025E+004
		785.42	2.00	3.457E+005		-1.489E+005	1.225E+005
		1620.56	2.75	3.283E+005		6.188E+004	1.163E+005
	PB-212	74.81	9.60	2.234E+005	2.55E+004	1.489E+005	1.037E+005
		77.11	17.50	7.575E+004		1.419E+004	3.361E+004
		87.20	6.30	2.288E+005		1.684E+005	1.036E+005
		89.80	1.75	5.691E+005		1.223E+005	2.463E+005
		115.19	0.60	1.515E+006		6.350E+005	6.557E+005
		238.63	44.60	2.550E+004		5.912E+003	1.125E+004
		300.09	3.41	2.613E+005		8.579E+004	1.094E+005
	BI-214	609.31	46.30	2.688E+004	2.69E+004	1.223E+004	1.144E+004
		768.36	5.04	2.330E+005		3.305E+004	9.664E+004
		806.17	1.23	8.013E+005		3.362E+004	3.179E+005
		934.06	3.21	2.282E+005		-6.143E+004	8.084E+004
		1120.29	15.10	8.344E+004		1.330E+004	3.420E+004
		1155.19	1.69	3.694E+005		-8.784E+004	1.168E+005
		1238.11	5.94	1.577E+005		-3.662E+003	5.903E+004
		1280.96	1.47	1.623E+005		0.000E+000	0.000E+000
		1377.67	4.11	2.376E+005		2.575E+004	8.893E+004
		1385.31	0.78	8.577E+005		1.166E+005	2.712E+005
		1401.50	1.39	1.778E+005		0.000E+000	0.000E+000
		1407.98	2.48	2.716E+005		-7.381E+004	8.585E+004
		1509.19	2.19	3.167E+005		-1.076E+004	1.001E+005

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/METE)	Nuclide MDA (pCi/METE)	Activity (pCi/METE)	Dec. Level (pCi/METE)
	BI-214	1661.28	1.15	2.318E+005	2.69E+004	0.000E+000	0.000E+000
		1729.60	3.05	3.546E+005		9.881E+004	1.327E+005
		1764.49	15.80	9.057E+004		1.766E+004	3.660E+004
		1847.44	2.12	5.278E+005		1.471E+005	1.976E+005
>		2118.54	1.21	0.000E+000		0.000E+000	0.000E+000
	PB-214	74.81	6.33	3.392E+005	3.25E+004	2.262E+005	1.575E+005
		77.11	10.70	1.240E+005		2.323E+004	5.503E+004
		87.20	3.70	3.900E+005		2.870E+005	1.766E+005
		89.80	1.03	9.681E+005		2.080E+005	4.189E+005
		241.98	7.49	1.107E+005		-2.546E+004	4.636E+004
		295.21	19.20	4.828E+004		1.178E+004	2.039E+004
		351.92	37.20	3.247E+004		1.928E+003	1.417E+004
		785.91	1.10	7.297E+005		-3.389E+004	2.731E+005
	RA-226	186.21	3.28	3.390E+005	3.39E+005	1.077E+005	1.504E+005
	AC-228	89.95	2.10	4.738E+005	4.24E+004	1.169E+005	2.050E+005
		93.35	3.50	3.599E+005		1.179E+005	1.612E+005
		129.08	2.80	2.526E+005		-1.234E+005	1.048E+005
		209.28	4.40	2.428E+005		1.448E+005	1.068E+005
		270.23	3.60	2.150E+005		4.091E+003	8.813E+004
		327.64	3.20	2.071E+005		-5.818E+004	8.020E+004
		338.32	11.40	8.157E+004		-9.654E+003	3.416E+004
		409.51	2.13	3.021E+005		4.677E+004	1.131E+005
		463.00	4.40	1.527E+005		-3.310E+004	5.716E+004
		794.70	4.60	1.196E+005		1.625E+004	3.780E+004
		911.60	27.70	4.237E+004		-3.023E+003	1.737E+004
		964.60	5.20	2.160E+005		1.787E+004	8.726E+004
		969.11	16.60	6.299E+004		1.081E+004	2.499E+004
		1587.90	3.71	7.026E+004		0.000E+000	0.000E+000
	PA-234M	766.36	0.29	3.018E+006	7.09E+005	-3.141E+005	1.169E+006
		1001.03	0.84	7.088E+005		9.633E+004	2.241E+005
	TH-234	92.38	2.81	4.753E+017	4.75E+017	2.179E+017	2.133E+017
		92.80	2.77	4.810E+017		2.238E+017	2.159E+017
		112.81	0.28	2.550E+018		-1.486E+018	1.045E+018
	U-235	89.96	1.50	6.633E+005	2.22E+004	1.637E+005	2.870E+005
		93.35	2.50	5.039E+005		1.651E+005	2.257E+005
		105.00	1.00	9.587E+005		1.180E+005	4.168E+005
		109.14	1.50	6.135E+005		-7.734E+004	2.655E+005
		143.76	10.50	8.536E+004		-1.364E+003	3.694E+004
		163.35	4.70	1.931E+005		-1.046E+004	8.355E+004
		185.71	54.00	2.222E+004		1.240E+004	9.951E+003
		202.12	1.00	6.649E+005		-2.652E+005	2.687E+005
		205.31	4.70	1.827E+005		-4.350E+003	7.772E+004
	AM-241	59.54	36.30	3.104E+004	3.10E+004	-1.093E+004	1.272E+004

+ = 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

```
*************************  ************************  ***************
***       G A M M A   S P E C T R U M   A N A L Y S I S        *****
***********************************************************************

lename: C:\GENIE2K\CAMFILES\U2NW.CNF

port Generated On           : 9/21/2015  10:36:54 AM

mple Title                  : B308102BSFJSM002GD
mple Description            : U2NW
mple Identification         :
mple Type                   :
mple Geometry               :

ak Locate Threshold                : 3.00
ak Locate Range (in channels)      :   50 -  8192
ak Area Range (in channels)        :   50 -  8192
entification Energy Tolerance      :   1.000 FWHM

mple Size                          : 1.000E+000 METERS

mple Taken On                      : 1/28/2013  12:00:00 PM
quisition Started                  : 9/17/2015  11:30:59 AM

ve Time                            :      600.0 seconds
al Time                            :      600.4 seconds

ad Time                            :   0.07 %

            Energy Calibration Used Done On      : 1/27/2015
            Efficiency Calibration Used Done On  : 7/24/2014
            Efficiency ID                        : 3M_TURBINE area
```

Initial Collect CF

****
*** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 5456
Sample Title: B308102BSFJSM002GD
Peak Analysis Performed on: 9/21/2015 10:36:53 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	286-	306	292.38	72.83	0.74	3.53E+001	14.42	2.45E+001
2	286-	306	300.14	74.77	0.74	4.59E+001	16.73	3.35E+001
3	4685-	4703	4693.72	1173.06	1.18	1.08E+002	21.40	2.10E+000
4	5322-	5339	5330.62	1332.13	1.74	8.60E+001	18.55	0.00E+000
5	5837-	5848	5842.98	1460.06	0.52	1.70E+001	9.97	2.95E+000

= First peak in a multiplet region
= Other peak in a multiplet region
= Fitted singlet

rors quoted at 2.000 sigma

****
*** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: B308102BSFJSM002GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion_LiB.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/METE)	Activity Uncertainty
K-40	0.963	1460.81*	10.67	1.48314E+005	8.76051E+004
CO-60	0.994	1173.22*	100.00	1.29989E+005	2.78011E+004
		1332.49*	100.00	1.08707E+005	2.50054E+004

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 FWHM
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

****
*** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/METE)	Wt mean Activity Uncertainty
K-40	0.963	1.483140E+005	8.760513E+004
CO-60	0.994	1.182243E+005	1.859155E+004

? = 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 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/21/2015 10:36:53 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
M	1	72.83	5.8879E-002	40.82	Tol.	BI-211
m	2	74.77	7.6574E-002	36.42	Tol.	PB-212
						PB-214

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
*** NUCLIDE MDA REPORT *****
****

Detector Name: 5456
Sample Geometry:
Sample Title: B308102BSFJSM002GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion_LiB.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/METE)	Nuclide MDA (pCi/METE)	Activity (pCi/METE)	Dec. Level (pCi/METE)
+	K-40	1460.81*	10.67	1.035E+005	1.04E+005	1.483E+005	3.999E+004
	MN-54	834.83	99.97	6.898E+004	6.90E+004	-1.869E+004	2.582E+004
+	CO-60	1173.22*	100.00	1.345E+004	3.42E+003	1.300E+005	5.093E+003
		1332.49*	100.00	3.421E+003		1.087E+005	0.000E+000
	NB-94	702.63	100.00	1.079E+004	1.01E+004	2.027E+003	4.421E+003
		871.10	100.00	1.010E+004		3.851E+003	4.006E+003
	SN-113	255.12	1.93	1.781E+008	4.72E+006	-1.361E+007	7.743E+007
		391.69	64.90	4.717E+006		1.003E+006	1.956E+006
	CS-134	475.35	1.46	1.571E+006	2.23E+004	2.876E+005	6.438E+005
		563.23	8.38	2.724E+005		-2.495E+004	1.101E+005
		569.32	15.43	1.485E+005		-7.895E+003	5.999E+004
		604.70	97.60	2.226E+004		1.698E+003	8.834E+003
		795.84	85.40	3.368E+004		1.128E+004	1.397E+004
		801.93	8.73	2.729E+005		-4.371E+004	1.083E+005
		1038.57	1.00	2.377E+006		7.915E+005	9.207E+005
		1167.94	1.80	1.233E+006		-1.241E+005	4.616E+005
		1365.15	3.04	7.748E+005		7.798E+004	2.900E+005
	CS-137	661.65	85.12	1.655E+004	1.65E+004	7.436E+003	7.084E+003
	EU-152	121.78	28.40	3.847E+004	3.72E+004	-7.049E+003	1.679E+004
		244.69	7.49	1.074E+005		-5.236E+004	4.340E+004
		295.94	0.45	2.738E+006		1.249E+006	1.185E+006
		344.27	26.50	4.395E+004		7.986E+003	1.870E+004
		367.79	0.86	1.438E+006		8.434E+005	6.156E+005
		411.11	2.21	4.368E+005		-6.194E+004	1.765E+005
		443.98	3.11	3.769E+005		1.087E+005	1.579E+005
		488.68	0.42	1.869E+006		-8.536E+005	6.996E+005
		563.99	0.49	2.048E+006		-2.968E+005	8.127E+005
		586.26	0.46	2.211E+006		-2.951E+005	8.772E+005
		678.62	0.47	1.856E+006		-2.069E+006	6.948E+005
		688.67	0.86	1.343E+006		4.087E+005	5.426E+005
		719.35	0.28	2.765E+006		7.444E+004	9.796E+005
		778.89	12.74	1.058E+005		2.458E+004	4.387E+004
		810.45	0.32	1.978E+006		-1.210E+006	6.254E+005
		867.32	4.16	3.354E+005		1.467E+005	1.391E+005
		919.33	0.43	2.752E+006		1.994E+005	1.092E+006
		964.01	14.40	7.595E+004		7.904E+003	2.942E+004
		1085.78	10.00	1.243E+005		-4.740E+003	4.932E+004
		1089.74	1.73	5.104E+005		-3.161E+005	1.808E+005
		1112.02	13.30	9.424E+004		3.594E+004	3.739E+004
		1212.95	1.42	6.442E+005		-2.255E+005	2.282E+005
		1249.94	0.19	3.905E+006		-6.633E+005	1.234E+006
		1299.14	1.62	6.715E+005		7.278E+004	2.514E+005

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/METE)	Nuclide MDA (pCi/METE)	Activity (pCi/METE)	Dec. Level (pCi/METE)
	EU-152	1407.95	20.70	3.717E+004	3.72E+004	0.000E+000	1.175E+004
		1457.64	0.50	1.555E+006		0.000E+000	4.916E+005
		1528.10	0.28	1.043E+006		0.000E+000	0.000E+000
	EU-154	123.10	40.46	2.995E+004	8.36E+003	8.651E+002	1.312E+004
		247.93	6.95	1.900E+005		5.626E+004	8.294E+004
		591.76	4.99	2.669E+005		5.888E+004	1.107E+005
		692.42	1.80	5.893E+005		1.472E+005	2.283E+005
		723.30	20.22	6.254E+004		1.441E+004	2.527E+004
		756.76	4.57	2.392E+005		-2.115E+004	9.264E+004
		873.19	12.27	1.018E+005		3.107E+004	4.041E+004
		996.26	10.64	8.688E+004		-3.275E+004	3.078E+004
		1004.72	18.01	4.079E+004		-2.079E+004	1.290E+004
		1274.44	35.19	8.357E+003		0.000E+000	0.000E+000
		1596.49	1.80	4.888E+005		6.642E+004	1.545E+005
	EU-155	45.30	1.33	2.553E+006	5.56E+004	-2.140E+006	1.086E+006
		60.01	1.13	2.044E+006		-4.974E+005	8.923E+005
		86.54	30.70	5.561E+004		-1.738E+004	2.453E+004
		105.31	21.20	7.522E+004		7.197E+003	3.328E+004
@	Tl-208	583.19	84.50	1.000E+026	1.00E+026	1.000E+026	1.000E+020
	BI-211	72.87	1.20	1.818E+006	5.57E+004	2.751E+005	8.435E+005
		351.10	12.20	5.568E+004		-4.114E+004	2.157E+004
		404.80	4.10	1.744E+005		-5.716E+004	6.754E+004
		426.90	1.90	5.065E+005		8.181E+004	2.101E+005
		831.80	3.30	2.135E+005		-8.046E+004	7.563E+004
	PB-211	404.80	3.00	2.383E+005	2.38E+005	-7.812E+004	9.231E+004
		427.10	1.40	6.875E+005		5.417E+003	2.851E+005
		831.80	2.80	2.516E+005		-9.482E+004	8.913E+004
	BI-212	39.86	1.10	4.517E+006	7.39E+004	1.701E+006	2.038E+006
		727.17	11.80	7.393E+004		7.694E+003	2.864E+004
		785.42	2.00	4.008E+005		-2.885E+005	1.500E+005
		1620.56	2.75	2.602E+005		3.536E+004	8.226E+004
	PB-212	74.81	9.60	2.475E+005	2.93E+004	1.963E+005	1.158E+005
		77.11	17.50	8.332E+004		6.608E+003	3.740E+004
		87.20	6.30	1.880E+005		1.859E+004	8.320E+004
		89.80	1.75	6.504E+005		-6.217E+004	2.869E+005
		115.19	0.60	1.366E+006		-6.215E+005	5.813E+005
		238.63	44.60	2.932E+004		1.387E+004	1.316E+004
		300.09	3.41	2.487E+005		-3.870E+004	1.032E+005
	BI-214	609.31	46.30	3.072E+004	3.07E+004	2.055E+004	1.335E+004
		768.36	5.04	2.205E+005		6.819E+004	9.040E+004
		806.17	1.23	8.013E+005		-1.192E+005	3.179E+005
		934.06	3.21	2.952E+005		9.829E+004	1.143E+005
		1120.29	15.10	7.285E+004		1.334E+004	2.891E+004
		1155.19	1.69	1.358E+005		0.000E+000	0.000E+000
		1238.11	5.94	1.078E+005		0.000E+000	3.408E+004
		1280.96	1.47	6.455E+005		5.497E+004	2.416E+005
		1377.67	4.11	1.624E+005		-5.518E+003	5.134E+004
		1385.31	0.78	3.154E+005		0.000E+000	0.000E+000
		1401.50	1.39	1.778E+005		0.000E+000	0.000E+000
		1407.98	2.48	2.716E+005		0.000E+000	8.585E+004
		1509.19	2.19	1.165E+005		0.000E+000	0.000E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/METE)	Nuclide MDA (pCi/METE)	Activity (pCi/METE)	Dec. Level (pCi/METE)
	BI-214	1661.28	1.15	2.318E+005	3.07E+004	0.000E+000	0.000E+000
		1729.60	3.05	3.546E+005		9.881E+004	1.327E+005
		1764.49	15.80	9.057E+004		1.873E+004	3.660E+004
		1847.44	2.12	4.553E+005		9.806E+004	1.613E+005
>		2118.54	1.21	0.000E+000		0.000E+000	0.000E+000
	PB-214	74.81	6.33	3.758E+005	2.54E+004	2.980E+005	1.758E+005
		77.11	10.70	1.364E+005		1.082E+004	6.123E+004
		87.20	3.70	3.205E+005		3.169E+004	1.418E+005
		89.80	1.03	1.106E+006		-1.057E+005	4.880E+005
		241.98	7.49	1.377E+005		4.882E+004	5.985E+004
		295.21	19.20	5.399E+004		5.543E+003	2.325E+004
		351.92	37.20	2.538E+004		5.966E+003	1.063E+004
		785.91	1.10	7.297E+005		-4.067E+005	2.731E+005
	RA-226	186.21	3.28	3.390E+005	3.39E+005	8.247E+004	1.504E+005
	AC-228	89.95	2.10	5.415E+005	4.24E+004	-5.300E+004	2.389E+005
		93.35	3.50	3.534E+005		-5.630E+003	1.579E+005
		129.08	2.80	3.203E+005		-5.374E+004	1.386E+005
		209.28	4.40	2.176E+005		-6.490E+004	9.415E+004
		270.23	3.60	2.695E+005		-4.206E+004	1.154E+005
		327.64	3.20	3.127E+005		8.854E+004	1.330E+005
		338.32	11.40	8.878E+004		-5.006E+003	3.777E+004
		409.51	2.13	3.370E+005		5.261E+004	1.306E+005
		463.00	4.40	2.251E+005		2.305E+004	9.335E+004
		794.70	4.60	2.292E+005		2.844E+004	9.260E+004
		911.60	27.70	4.237E+004		1.209E+003	1.737E+004
		964.60	5.20	1.839E+005		-6.700E+003	7.125E+004
		969.11	16.60	4.462E+004		-7.207E+003	1.581E+004
		1587.90	3.71	1.911E+005		-6.491E+003	6.040E+004
	PA-234M	766.36	0.29	3.294E+006	1.16E+006	1.256E+006	1.307E+006
		1001.03	0.84	1.157E+006		6.020E+004	4.482E+005
	TH-234	92.38	2.81	5.225E+017	5.14E+017	2.925E+017	2.369E+017
		92.80	2.77	5.136E+017		1.719E+017	2.322E+017
		112.81	0.28	3.908E+018		6.912E+017	1.724E+018
	U-235	89.96	1.50	7.580E+005	2.06E+004	-7.420E+004	3.344E+005
		93.35	2.50	4.947E+005		-7.882E+003	2.211E+005
		105.00	1.00	1.111E+006		6.113E+004	4.931E+005
		109.14	1.50	5.741E+005		-2.122E+005	2.458E+005
		143.76	10.50	9.525E+004		1.957E+004	4.189E+004
		163.35	4.70	2.101E+005		7.397E+004	9.207E+004
		185.71	54.00	2.056E+004		3.055E+002	9.120E+003
		202.12	1.00	7.481E+005		-2.122E+005	3.102E+005
		205.31	4.70	2.147E+005		2.424E+004	9.374E+004
	AM-241	59.54	36.30	4.640E+004	4.64E+004	-6.316E+002	2.040E+004

+ = 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

```
**********  **********  **********
***        G A M M A   S P E C T R U M   A N A L Y S I S        *****
**********************************************************************

.lename: C:\GENIE2K\CAMFILES\U2NBKG.CNF

:port Generated On          : 9/21/2015  10:26:11 AM

ımple Title                 : U2 BKG
ımple Description           : U2NBKG
ımple Identification        :
ımple Type                  :
ımple Geometry              :

:ak Locate Threshold           :  3.00
:ak Locate Range (in channels) :    50 -  8192
:ak Area Range (in channels)   :    50 -  8192
lentification Energy Tolerance :    1.000 FWHM

ımple Size                     :  1.000E+000 Meter

ımple Taken On                 : 1/28/2013  12:00:00 PM
:quisition Started             : 9/17/2015   1:25:04 PM

.ve Time                       :      600.0 seconds
:al Time                       :      600.9 seconds

:ad Time                       :   0.15 %

          Energy Calibration Used Done On       : 1/27/2015
          Efficiency Calibration Used Done On   : 7/24/2014
          Efficiency ID                         : 3M_TURBINE area
```

Check BKRD % to ensure no effect from Radons (JF)

****
*** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 5456
Sample Title: U2 BKG
Peak Analysis Performed on: 9/21/2015 10:26:10 AM
Peak Analysis From Channel: 50
Peak Analysis To Channel: 8192

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	80-	89	83.48	20.56	1.00	1.86E+002	40.89	9.00E+001
2	297-	308	301.42	75.09	0.71	6.49E+001	39.55	1.27E+002
3	333-	344	340.51	84.87	0.57	4.86E+001	33.79	9.34E+001
4	949-	960	955.48	238.70	0.73	2.70E+001	23.24	4.30E+001
5	1404-	1414	1408.87	352.09	0.80	1.45E+001	15.40	1.85E+001
6	2328-	2338	2333.12	583.19	0.57	2.45E+001	13.47	8.47E+000
7	5835-	5856	5844.63	1460.47	2.13	1.46E+002	26.34	7.53E+000

= First peak in a multiplet region
= Other peak in a multiplet region
= Fitted singlet

rors quoted at 2.000 sigma

****
*** NUCLIDE IDENTIFICATION REPORT *****
****

Sample Title: U2 BKG
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion_LiB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/Mete)	Activity Uncertainty
K-40	0.992	1460.81*	10.67	1.27427E+006	2.52207E+005
BI-211	0.965	72.87	1.20		
		351.10*	12.20	6.71048E+004	7.22717E+004
		404.80	4.10		
		426.90	1.90		
		831.80	3.30		
PB-212	0.490	74.81*	9.60	3.82125E+005	2.44994E+005
		77.11	17.50		
		87.20	6.30		
		89.80	1.75		
		115.19	0.60		
		238.63*	44.60	2.99963E+004	2.62239E+004
		300.09	3.41		
TH-231	0.992	26.64	18.70		
		84.21*	8.00	3.11717E+005	2.25324E+005
		89.95	1.25		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 FWHM
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

****
*** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/Mete)	Wt mean Activity Uncertainty
K-40	0.992	1.274268E+006	2.522069E+005
BI-211	0.965	6.710481E+004	7.227171E+004
PB-212	0.490	3.398503E+004	2.607499E+004
TH-231	0.992	3.117174E+005	2.253237E+005

? = 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 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 9/21/2015 10:26:10 AM
Peak Locate From Channel: 50
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	20.56	3.1004E-001	21.98		
6	583.19	4.0884E-002	54.89	Tol.	Tl-208

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
*** N U C L I D E M D A R E P O R T *****
****

Detector Name: 5456
Sample Geometry:
Sample Title: U2 BKG
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion_LiB.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/Mete)	Nuclide MDA (pCi/Mete)	Activity (pCi/Mete)	Dec. Level (pCi/Mete)
+	K-40	1460.81*	10.67	1.723E+005	1.72E+005	1.274E+006	7.439E+004
	MN-54	834.83	99.97	6.899E+004	6.90E+004	1.923E+004	2.582E+004
	CO-60	1173.22	100.00	1.809E+004	1.17E+004	1.807E+003	7.416E+003
		1332.49	100.00	1.174E+004		-8.849E+003	4.159E+003
	NB-94	702.63	100.00	1.197E+004	1.01E+004	1.357E+003	5.013E+003
		871.10	100.00	1.010E+004		2.233E+003	4.006E+003
	SN-113	255.12	1.93	1.976E+008	4.96E+006	-2.444E+007	8.719E+007
		391.69	64.90	4.957E+006		-6.610E+004	2.076E+006
	CS-134	475.35	1.46	1.660E+006	2.55E+004	-4.445E+005	6.883E+005
		563.23	8.38	3.219E+005		6.116E+004	1.348E+005
		569.32	15.43	1.754E+005		-2.398E+004	7.348E+004
		604.70	97.60	2.550E+004		4.246E+002	1.045E+004
		795.84	85.40	2.550E+004		-9.817E+003	9.876E+003
		801.93	8.73	2.936E+005		-1.821E+004	1.186E+005
		1038.57	1.00	1.456E+006		-8.905E+005	4.604E+005
		1167.94	1.80	1.233E+006		-2.864E+004	4.616E+005
		1365.15	3.04	5.297E+005		-3.599E+005	1.675E+005
	CS-137	661.65	85.12	1.594E+004	1.59E+004	5.994E+003	6.783E+003
	EU-152	121.78	28.40	5.930E+004	5.02E+004	-3.094E+003	2.721E+004
		244.69	7.49	1.791E+005		-3.617E+003	7.923E+004
		295.94	0.45	3.837E+006		1.960E+006	1.734E+006
		344.27	26.50	5.023E+004		7.028E+003	2.183E+004
		367.79	0.86	1.583E+006		2.368E+005	6.882E+005
		411.11	2.21	5.395E+005		-8.517E+003	2.279E+005
		443.98	3.11	3.397E+005		1.293E+004	1.392E+005
		488.68	0.42	2.276E+006		-3.038E+005	9.032E+005
		563.99	0.49	2.834E+006		6.107E+005	1.205E+006
		586.26	0.46	2.810E+006		8.197E+005	1.177E+006
		678.62	0.47	2.874E+006		1.245E+006	1.204E+006
		688.67	0.86	1.587E+006		7.142E+004	6.646E+005
		719.35	0.28	5.401E+006		2.457E+006	2.297E+006
		778.89	12.74	8.740E+004		-2.667E+003	3.468E+004
		810.45	0.32	2.496E+006		-1.344E+005	8.845E+005
		867.32	4.16	2.771E+005		3.277E+004	1.100E+005
		919.33	0.43	2.260E+006		-5.773E+005	8.458E+005
		964.01	14.40	1.003E+005		3.991E+004	4.161E+004
		1085.78	10.00	1.021E+005		2.844E+004	3.820E+004
		1089.74	1.73	8.254E+005		2.159E+005	3.383E+005
		1112.02	13.30	1.014E+005		1.078E+004	4.096E+004
		1212.95	1.42	1.208E+006		1.422E+005	5.104E+005
		1249.94	0.19	6.374E+006		3.980E+005	2.469E+006
		1299.14	1.62	8.178E+005		1.060E+005	3.245E+005

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/Mete)	Nuclide MDA (pCi/Mete)	Activity (pCi/Mete)	Dec. Level (pCi/Mete)
	EU-152	1407.95	20.70	6.067E+004	5.02E+004	2.020E+004	2.350E+004
		1457.64	0.50	3.978E+006		-1.057E+005	1.703E+006
		1528.10	0.28	1.043E+006		0.000E+000	0.000E+000
	EU-154	123.10	40.46	4.446E+004	3.32E+004	2.636E+003	2.038E+004
		247.93	6.95	2.096E+005		5.125E+004	9.273E+004
		591.76	4.99	2.526E+005		-4.507E+004	1.036E+005
		692.42	1.80	8.899E+005		2.910E+005	3.786E+005
		723.30	20.22	6.254E+004		7.761E+003	2.527E+004
		756.76	4.57	2.808E+005		-1.543E+005	1.135E+005
		873.19	12.27	1.018E+005		1.165E+003	4.041E+004
		996.26	10.64	1.124E+005		-3.275E+004	4.353E+004
		1004.72	18.01	5.968E+004		-2.079E+004	2.234E+004
		1274.44	35.19	3.324E+004		-4.890E+003	1.244E+004
		1596.49	1.80	4.888E+005		-1.328E+005	1.545E+005
	EU-155	45.30	1.33	4.310E+006	9.94E+004	-8.484E+005	1.965E+006
		60.01	1.13	2.973E+006		-1.319E+006	1.357E+006
		86.54	30.70	9.938E+004		-5.803E+003	4.641E+004
		105.31	21.20	1.128E+005		2.453E+004	5.209E+004
@	Tl-208	583.19	84.50	1.000E+026	1.00E+026	1.000E+026	1.000E+020
+	BI-211	72.87	1.20	2.430E+006	1.15E+005	1.147E+006	1.149E+006
		351.10*	12.20	1.148E+005		6.710E+004	5.112E+004
		404.80	4.10	2.303E+005		-4.899E+004	9.552E+004
		426.90	1.90	6.220E+005		9.946E+004	2.678E+005
		831.80	3.30	3.452E+005		6.978E+004	1.415E+005
	PB-211	404.80	3.00	3.148E+005	3.15E+005	-6.696E+004	1.305E+005
		427.10	1.40	9.486E+005		5.041E+005	4.157E+005
		831.80	2.80	4.068E+005		8.224E+004	1.668E+005
	BI-212	39.86	1.10	5.228E+006	1.03E+005	7.119E+003	2.394E+006
		727.17	11.80	1.026E+005		3.847E+004	4.296E+004
		785.42	2.00	5.591E+005		1.090E+005	2.292E+005
		1620.56	2.75	3.283E+005		4.862E+004	1.163E+005
+	PB-212	74.81*	9.60	3.656E+005	4.09E+004	3.821E+005	1.748E+005
		77.11	17.50	1.212E+005		5.891E+003	5.633E+004
		87.20	6.30	3.503E+005		1.849E+005	1.643E+005
		89.80	1.75	1.053E+006		8.591E+004	4.881E+005
		115.19	0.60	2.155E+006		-1.349E+005	9.758E+005
		238.63*	44.60	4.093E+004		3.000E+004	1.896E+004
		300.09	3.41	3.432E+005		-2.329E+004	1.504E+005
	BI-214	609.31	46.30	5.562E+004	5.56E+004	6.503E+004	2.580E+004
		768.36	5.04	2.447E+005		-2.407E+004	1.025E+005
		806.17	1.23	8.013E+005		5.501E+004	3.179E+005
		934.06	3.21	4.095E+005		7.850E+004	1.715E+005
		1120.29	15.10	1.216E+005		7.028E+004	5.330E+004
		1155.19	1.69	3.694E+005		-2.259E+005	1.168E+005
		1238.11	5.94	2.200E+005		-9.418E+003	9.017E+004
		1280.96	1.47	6.455E+005		-1.499E+004	2.416E+005
		1377.67	4.11	3.113E+005		1.076E+005	1.258E+005
		1385.31	0.78	1.255E+006		1.748E+005	4.697E+005
		1401.50	1.39	7.075E+005		-1.369E+005	2.648E+005
		1407.98	2.48	4.433E+005		1.476E+005	1.717E+005
		1509.19	2.19	5.170E+005		1.722E+005	2.003E+005

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/Mete)	Nuclide MDA (pCi/Mete)	Activity (pCi/Mete)	Dec. Level (pCi/Mete)
	BI-214	1661.28	1.15	2.318E+005	5.56E+004	0.000E+000	0.000E+000
		1729.60	3.05	3.956E+005		1.318E+005	1.533E+005
		1764.49	15.80	1.019E+005		4.616E+004	4.226E+004
		1847.44	2.12	4.553E+005		9.806E+004	1.613E+005
>		2118.54	1.21	0.000E+000		0.000E+000	0.000E+000
	PB-214	74.81	6.33	5.266E+005	4.42E+004	5.366E+005	2.512E+005
		77.11	10.70	1.984E+005		9.646E+003	9.224E+004
		87.20	3.70	5.971E+005		3.151E+005	2.801E+005
		89.80	1.03	1.791E+006		1.461E+005	8.303E+005
		241.98	7.49	1.844E+005		3.699E+004	8.322E+004
		295.21	19.20	7.694E+004		8.195E+003	3.472E+004
		351.92	37.20	4.421E+004		2.286E+004	2.004E+004
		785.91	1.10	1.018E+006		1.235E+005	4.172E+005
	RA-226	186.21	3.28	4.736E+005	4.74E+005	3.126E+005	2.177E+005
	AC-228	89.95	2.10	8.839E+005	6.49E+004	1.743E+005	4.101E+005
		93.35	3.50	5.731E+005		2.343E+005	2.678E+005
		129.08	2.80	6.169E+005		2.425E+005	2.869E+005
		209.28	4.40	2.543E+005		-5.746E+004	1.125E+005
		270.23	3.60	3.367E+005		-3.580E+003	1.490E+005
		327.64	3.20	4.053E+005		-9.912E+003	1.793E+005
		338.32	11.40	1.380E+005		8.611E+004	6.237E+004
		409.51	2.13	4.888E+005		-5.612E+003	2.064E+005
		463.00	4.40	2.764E+005		7.803E+004	1.190E+005
		794.70	4.60	2.130E+005		5.037E+004	8.453E+004
		911.60	27.70	6.486E+004		2.506E+004	2.861E+004
		964.60	5.20	2.300E+005		8.587E+004	9.426E+004
		969.11	16.60	8.714E+004		3.964E+004	3.707E+004
		1587.90	3.71	2.411E+005		-3.245E+004	8.542E+004
	PA-234M	766.36	0.29	4.557E+006	1.61E+006	1.382E+006	1.939E+006
		1001.03	0.84	1.605E+006		6.020E+005	6.723E+005
	TH-234	92.38	2.81	7.152E+017	7.15E+017	1.396E+017	3.332E+017
		92.80	2.77	7.501E+017		3.443E+017	3.503E+017
		112.81	0.28	5.838E+018		1.202E+018	2.688E+018
	U-235	89.96	1.50	1.237E+006	2.78E+004	2.441E+005	5.741E+005
		93.35	2.50	8.024E+005		3.281E+005	3.749E+005
		105.00	1.00	1.632E+006		2.438E+005	7.533E+005
		109.14	1.50	1.096E+006		-5.980E+004	5.067E+005
		143.76	10.50	1.249E+005		-2.636E+003	5.671E+004
		163.35	4.70	2.665E+005		-5.528E+004	1.203E+005
		185.71	54.00	2.780E+004		1.412E+004	1.274E+004
		202.12	1.00	1.109E+006		1.821E+005	4.905E+005
		205.31	4.70	2.616E+005		4.009E+004	1.172E+005
	AM-241	59.54	36.30	6.167E+004	6.17E+004	-3.347E+004	2.804E+004

\+ = 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

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**************************  **************************  ****************
***       G A M M A   S P E C T R U M   A N A L Y S I S        *****
*********************************************************************

.lename: E:\4-27-17\U2NBKG.CNF

:port Generated On              : 5/1/2017   11:24:59 AM

ımple Title                     : U2 BKG
ımple Description               : U2NBKG R1
ımple Identification            :
ımple Type                      :
ımple Geometry                  :

:ak Locate Threshold            :  3.00
:ak Locate Range (in channels)  :    85 -  8192
:ak Area Range (in channels)    :    85 -  8192
lentification Energy Tolerance  :   10.000 keV

ımple Size                      :  7.800E+001 Sq Meter

ımple Taken On                  : 1/28/2013  12:00:00 PM
:quisition Started              : 9/17/2015   1:25:04 PM

.ve Time                        :      600.0 seconds
:al Time                        :      600.9 seconds

:ad Time                        :   0.15 %

          Energy Calibration Used Done On       : 1/27/2015
          Efficiency Calibration Used Done On   : 4/27/2017
          Efficiency ID                         : 3M_TURBINE
```

****
*** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 5456
Sample Title: U2 BKG
Peak Analysis Performed on: 5/1/2017 11:24:59 AM
Peak Analysis From Channel: 85
Peak Analysis To Channel: 8192

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	297-	308	301.42	75.09	0.71	6.49E+001	39.55	1.27E+002
2	333-	344	340.51	84.87	0.57	4.86E+001	33.79	9.34E+001
3	949-	960	955.48	238.70	0.73	2.70E+001	23.24	4.30E+001
4	1404-	1414	1408.87	352.09	0.80	1.45E+001	15.40	1.85E+001
5	2328-	2338	2333.12	583.19	0.57	2.45E+001	13.47	8.47E+000
6	5835-	5856	5844.63	1460.47	2.13	1.46E+002	26.34	7.53E+000

= First peak in a multiplet region
= Other peak in a multiplet region
= Fitted singlet

rors quoted at 2.000 sigma

****
*** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: U2 BKG
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/Sq M)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	6.35157E+004	1.26855E+004
Ba-133	0.584	79.61*	2.65	4.05835E+004	2.60645E+004
		81.00*	32.90	2.43516E+003	1.76081E+003
		276.40	7.16		
		302.85	18.34		
		356.01*	62.05	6.19441E+002	6.67136E+002
		383.85	8.94		
Eu-155	0.306	45.30	1.31		
		60.01	1.22		
		86.55*	30.70	3.22300E+003	2.32974E+003
		105.31	21.10		
Tl-208	1.000	583.19*	85.00	8.31247E+002	4.67125E+002
Pb-212	0.872	115.18	0.60		
		238.63*	43.60	1.14573E+003	1.00199E+003
		300.09	3.30		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

****
*** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/Sq M)	Wt mean Activity Uncertainty
	K-40	1.000	6.351569E+004	1.268548E+004
X	Cd-109	0.963		
	Ba-133	0.584	6.456958E+002	6.669169E+002
	Eu-155	0.306	2.368401E+003	2.491345E+003
	Tl-208	1.000	8.312470E+002	4.671251E+002
X	Bi-211	0.998		
	Pb-212	0.872	1.145726E+003	1.001985E+003
X	Pb-214	0.493		

? = 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 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 5/1/2017 11:24:59 AM
Peak Locate From Channel: 85
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide

All peaks were identified.

****
*** NUCLIDE MDA REPORT *****
****

Detector Name: 5456
Sample Geometry:
Sample Title: U2 BKG
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/Sq M)	Nuclide MDA (pCi/Sq M)	Activity (pCi/Sq M)	Dec. Level (pCi/Sq M)
+	K-40	1460.82*	10.66	8.590E+003	8.59E+003	6.352E+004	3.708E+003
	Cr-51	320.08	9.91	2.303E+014	2.30E+014	6.758E+013	1.069E+014
	Mn-54	834.85	99.98	6.988E+003	6.99E+003	3.127E+003	3.101E+003
	Co-58	810.76	99.45	9.100E+006	9.10E+006	4.726E+006	3.987E+006
	Co-60	1173.23	99.85	1.421E+003	1.08E+003	2.297E+002	6.321E+002
		1332.49	99.98	1.077E+003		6.185E+002	4.550E+002
	Nb-94	702.65	99.81	9.182E+002	7.48E+002	5.548E+002	4.163E+002
		871.09	99.89	7.475E+002		-5.172E+002	3.263E+002
	Sn-113	255.13	2.11	1.142E+007	3.46E+005	-4.862E+006	5.309E+006
		391.70	64.97	3.460E+005		-3.539E+004	1.569E+005
	Cs-134	475.36	1.48	1.254E+005	2.28E+003	-8.491E+004	5.693E+004
		563.25	8.34	2.281E+004		-1.254E+004	1.029E+004
		569.33	15.37	1.282E+004		-6.396E+003	5.804E+003
		604.72	97.62	2.729E+003		-1.929E+003	1.266E+003
		795.86	85.46	2.282E+003		5.427E+002	1.013E+003
		801.95	8.69	2.346E+004		1.196E+004	1.046E+004
		1038.61	0.99	2.057E+005		-1.064E+004	9.015E+004
		1167.97	1.79	1.177E+005		-1.753E+005	5.137E+004
		1365.19	3.02	5.934E+004		3.205E+004	2.485E+004
	Cs-137	661.66	85.10	1.046E+003	1.05E+003	9.368E+001	4.714E+002
	Eu-152	121.78	28.67	3.419E+003	3.19E+003	9.348E+002	1.631E+003
		244.70	7.61	1.194E+004		8.428E+002	5.590E+003
		295.94	0.45	2.269E+005		9.805E+004	1.064E+005
		344.28	26.60	3.193E+003		-1.568E+003	1.468E+003
		367.79	0.86	9.406E+004		-4.001E+004	4.293E+004
		411.12	2.24	3.880E+004		-9.337E+003	1.773E+004
		443.96	2.83	3.030E+004		-4.824E+003	1.378E+004
		488.68	0.42	2.114E+005		1.378E+005	9.597E+004
		563.99	0.49	1.889E+005		-5.872E+004	8.551E+004
		586.26	0.46	2.628E+005		2.479E+005	1.217E+005
		678.62	0.47	1.990E+005		1.744E+004	8.929E+004
		688.67	0.86	1.138E+005		5.862E+004	5.128E+004
		719.35	0.28	3.147E+005		-1.081E+005	1.396E+005
		778.90	12.96	8.135E+003		1.061E+003	3.671E+003
		810.45	0.32	2.640E+005		1.401E+005	1.157E+005
		867.37	4.26	2.055E+004		6.048E+003	9.007E+003
		919.33	0.43	1.879E+005		-1.428E+004	8.090E+004
		964.08	14.65	7.228E+003		2.518E+003	3.223E+003
		1085.87	10.24	9.108E+003		4.541E+003	3.959E+003
		1089.74	1.73	6.127E+004		5.212E+004	2.711E+004
		1112.07	13.69	7.649E+003		1.007E+003	3.374E+003
		1212.95	1.43	8.677E+004		6.228E+004	3.886E+004

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/Sq M)	Nuclide MDA (pCi/Sq M)	Activity (pCi/Sq M)	Dec. Level (pCi/Sq M)
	Eu-152	1249.94	0.19	5.308E+005	3.19E+003	7.170E+004	2.307E+005
		1299.14	1.63	6.114E+004		-6.111E+004	2.646E+004
		1408.01	21.07	4.454E+003		-3.561E+003	1.895E+003
		1457.64	0.50	6.409E+005		1.612E+006	3.062E+005
		1528.10	0.28	1.793E+005		-9.172E+004	6.353E+004
	Eu-154	123.07	40.40	2.627E+003	2.63E+003	7.095E+001	1.253E+003
		247.93	6.89	1.299E+004		1.680E+003	6.036E+003
		591.76	4.95	2.012E+004		-1.218E+004	9.079E+003
		692.42	1.78	6.241E+004		1.610E+004	2.826E+004
		723.30	20.06	5.305E+003		2.471E+003	2.386E+003
		756.80	4.52	2.366E+004		9.021E+003	1.062E+004
		873.18	12.08	7.651E+003		-4.784E+003	3.340E+003
		996.29	10.48	1.044E+004		-3.174E+003	4.618E+003
		1004.76	18.01	6.364E+003		1.507E+003	2.831E+003
		1274.43	34.80	3.323E+003		1.770E+003	1.456E+003
		1596.48	1.80	4.749E+004		-1.599E+004	1.919E+004
+	Eu-155	45.30	1.31	7.642E+004	3.53E+003	-1.356E+004	3.607E+004
		60.01	1.22	9.397E+004		-4.824E+004	4.469E+004
		86.55*	30.70	3.534E+003		3.223E+003	1.677E+003
		105.31	21.10	6.046E+003		5.407E+002	2.889E+003
+	Tl-208	583.19*	85.00	6.002E+002	6.00E+002	8.312E+002	2.542E+002
	Bi-211	351.07*	13.02	4.247E+003	4.25E+003	2.483E+003	1.891E+003
	Pb-211	404.85	3.78	1.815E+004	1.82E+004	-9.363E+003	8.217E+003
		427.09	1.76	4.446E+004		3.948E+002	2.033E+004
		832.01	3.52	2.130E+004		-7.299E+003	9.335E+003
	Bi-212	39.86	1.06	6.919E+004	1.20E+004	1.325E+004	3.279E+004
		727.33	6.67	1.204E+004		-7.324E+002	5.370E+003
		785.37	1.10	7.709E+004		3.722E+004	3.446E+004
		1620.50	1.47	5.332E+004		-2.311E+003	2.211E+004
+	Pb-212	115.18	0.60	1.357E+005	1.56E+003	-7.223E+003	6.456E+004
		238.63*	43.60	1.563E+003		1.146E+003	7.243E+002
		300.09	3.30	2.389E+004		3.332E+003	1.110E+004
	Pb212-XR	74.82	10.28	1.177E+004	6.50E+003	2.094E+004	5.702E+003
		77.11	17.10	6.498E+003		-8.384E+002	3.139E+003
		87.35	3.97	2.638E+004		3.293E+003	1.272E+004
		89.78	1.46	6.542E+004		-2.257E+004	3.143E+004
	Bi-214	609.32	45.49	2.855E+003	2.85E+003	3.025E+003	1.340E+003
		768.36	4.89	1.813E+004		4.496E+002	8.152E+003
		806.18	1.26	5.850E+004		2.130E+004	2.563E+004
		934.06	3.11	3.151E+004		3.164E+004	1.417E+004
		1120.29	14.92	6.962E+003		7.051E+002	3.118E+003
		1155.21	1.63	6.226E+004		-2.975E+004	2.776E+004
		1238.12	5.83	1.941E+004		1.879E+003	8.730E+003
		1280.98	1.43	6.875E+004		3.758E+004	3.033E+004
		1377.67	3.99	2.183E+004		-1.680E+003	9.397E+003
		1385.31	0.79	8.969E+004		-4.381E+004	3.720E+004
		1401.52	1.33	5.656E+004		-2.932E+004	2.369E+004
		1407.99	2.39	3.430E+004		-2.742E+004	1.459E+004
		1509.21	2.13	2.909E+004		1.109E+004	1.154E+004
		1661.27	1.05	3.532E+004		4.800E+003	1.117E+004

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/Sq M)	Nuclide MDA (pCi/Sq M)	Activity (pCi/Sq M)	Dec. Level (pCi/Sq M)
	Bi-214	1729.59	2.88	2.690E+004	2.85E+003	1.254E+004	1.103E+004
		1764.49	15.30	5.946E+003		9.728E+002	2.511E+003
		1847.43	2.03	3.174E+004		1.057E+004	1.229E+004
>		2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
	Pb-214	241.99*	7.25	9.411E+003	1.56E+003	6.897E+003	4.360E+003
		295.22	18.42	4.881E+003		2.977E+003	2.290E+003
		351.93*	35.60	1.555E+003		9.091E+002	6.925E+002
		785.96	1.06	7.721E+004		-3.806E+004	3.435E+004
	Pb214-XR	74.82	5.80	2.089E+004	1.15E+004	3.716E+004	1.012E+004
		77.11	9.70	1.147E+004		-1.480E+003	5.540E+003
		87.35	2.24	4.680E+004		5.843E+003	2.256E+004
		89.78	0.82	1.166E+005		-4.023E+004	5.602E+004
	Ra-226	186.21	3.64	2.200E+004	2.20E+004	-6.314E+003	1.039E+004
	Ac-228	129.07	2.42	3.735E+004	3.86E+003	1.488E+004	1.785E+004
		209.25	3.89	2.100E+004		-2.231E+003	9.897E+003
		270.24	3.46	2.299E+004		-3.317E+003	1.073E+004
		328.00	2.95	2.922E+004		-1.555E+004	1.362E+004
		338.32	11.27	7.478E+003		-1.399E+003	3.476E+003
		409.46	1.92	3.895E+004		-1.087E+004	1.778E+004
		463.00	4.40	1.957E+004		1.246E+004	8.997E+003
		794.95	4.25	1.854E+004		4.081E+003	8.204E+003
		911.20	25.80	3.863E+003		-2.903E+002	1.743E+003
		964.77	4.99	1.925E+004		1.019E+004	8.623E+003
		968.97	15.80	6.094E+003		1.833E+003	2.730E+003
		1588.20	3.22	2.524E+004		4.165E+003	1.057E+004
	Pa-231	27.36	10.30	1.067E+004	1.07E+004	2.563E+003	5.152E+003
		283.69	1.70	4.475E+004		2.293E+004	2.078E+004
		300.07	2.47	3.192E+004		4.451E+003	1.483E+004
		302.65	2.20	3.390E+004		-1.006E+004	1.567E+004
		330.06	1.40	6.354E+004		6.756E+003	2.968E+004
	Th-234	92.38	2.13	4.468E+016	4.44E+016	1.148E+016	2.142E+016
		92.80	2.10	4.439E+016		2.639E+015	2.126E+016
		112.81	0.21	4.119E+017		9.684E+016	1.963E+017
	U-235	143.76	10.96	7.291E+003	1.44E+003	-1.677E+003	3.459E+003
		163.33	5.08	1.625E+004		8.824E+003	7.707E+003
		185.71	57.20	1.443E+003		3.572E+002	6.828E+002
		202.11	1.08	6.750E+004		-5.234E+004	3.161E+004
		205.31	5.01	1.573E+004		9.525E+002	7.402E+003
	Am-241	59.54	35.90	2.194E+003	2.19E+003	3.024E+002	1.043E+003

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or MDA has not been calculated
@ = Half-life too short to be able to perform the decay correction

********** ********** **********
*** G A M M A S P E C T R U M A N A L Y S I S *****
****

.lename: E:\4-27-17\U2NE.CNF

:port Generated On : 4/27/2017 5:11:57 PM

ımple Title : B308102BSFJSM001GD
ımple Description : U2NE R1
ımple Identification :
ımple Type :
ımple Geometry :

:ak Locate Threshold : 3.00
:ak Locate Range (in channels) : 85 - 8192
:ak Area Range (in channels) : 85 - 8192
lentification Energy Tolerance : 10.000 keV

ımple Size : 7.800E+001 SQ MET

ımple Taken On : 1/28/2013 12:00:00 PM
:quisition Started : 9/17/2015 10:36:00 AM

.ve Time : 600.0 seconds
:al Time : 600.4 seconds

:ad Time : 0.06 %

Energy Calibration Used Done On : 1/27/2015
Efficiency Calibration Used Done On : 4/27/2017
Efficiency ID : 3M_TURBINE

****
*** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 5456
Sample Title: B308102BSFJSM001GD
Peak Analysis Performed on: 4/27/2017 5:11:57 PM
Peak Analysis From Channel: 85
Peak Analysis To Channel: 8192

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	297-	306	301.19	75.03	0.59	1.95E+001	22.58	4.65E+001

= First peak in a multiplet region
= Other peak in a multiplet region
= Fitted singlet

rors quoted at 2.000 sigma

****
*** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: B308102BSFJSM001GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

IDENTIFIED NUCLIDES

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

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

****
*** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/SQ M)	Wt mean Activity Uncertainty

? = 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 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 4/27/2017 5:11:57 PM
Peak Locate From Channel: 85
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	75.03	3.2431E-002	116.06	Tol.	Pb214-XR Ba-133 Pb212-XR Pb212-XR Pb214-XR

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 2.000 sigma

****
*** NUCLIDE MDA REPORT *****
****

Detector Name: 5456
Sample Geometry:
Sample Title: B308102BSFJSM001GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/SQ M)	Nuclide MDA (pCi/SQ M)	Activity (pCi/SQ M)	Dec. Level (pCi/SQ M)
K-40	1460.82	10.66	1.394E+004	1.39E+004	1.735E+004	6.381E+003
Cr-51	320.08	9.91	1.519E+014	1.52E+014	1.893E+013	6.772E+013
Mn-54	834.85	99.98	6.027E+003	6.03E+003	0.000E+000	2.620E+003
Co-58	810.76	99.45	7.816E+006	7.82E+006	-3.010E+006	3.346E+006
Co-60	1173.23	99.85	1.477E+003	1.48E+003	4.170E+002	6.602E+002
	1332.49	99.98	1.717E+003		1.350E+003	7.748E+002
Nb-94	702.65	99.81	7.272E+002	5.56E+002	1.494E+002	3.208E+002
	871.09	99.89	5.564E+002		6.465E+001	2.307E+002
Sn-113	255.13	2.11	8.494E+006	2.54E+005	-3.711E+006	3.845E+006
	391.70	64.97	2.539E+005		4.132E+004	1.109E+005
Cs-134	475.36	1.48	8.829E+004	1.09E+003	2.662E+004	3.838E+004
	563.25	8.34	1.601E+004		7.664E+003	6.892E+003
	569.33	15.37	9.287E+003		2.576E+003	4.037E+003
	604.72	97.62	1.092E+003		-1.966E+003	4.476E+002
	795.86	85.46	1.245E+003		3.371E+002	4.940E+002
	801.95	8.69	1.229E+004		-5.438E+003	4.877E+003
	1038.61	0.99	1.232E+005		9.397E+002	4.888E+004
	1167.97	1.79	1.144E+005		-1.012E+005	4.973E+004
	1365.19	3.02	4.668E+004		-5.181E+004	1.852E+004
Cs-137	661.66	85.10	7.460E+002	7.46E+002	-3.851E+002	3.212E+002
Eu-152	121.78	28.67	2.014E+003	2.01E+003	-9.279E+002	9.283E+002
	244.70	7.61	8.278E+003		-1.112E+003	3.759E+003
	295.94	0.45	1.233E+005		-8.299E+004	5.456E+004
	344.28	26.60	2.380E+003		-3.433E+002	1.061E+003
	367.79	0.86	8.679E+004		3.420E+004	3.929E+004
	411.12	2.24	2.408E+004		1.070E+003	1.037E+004
	443.96	2.83	2.388E+004		3.225E+003	1.057E+004
	488.68	0.42	1.612E+005		5.725E+004	7.088E+004
	563.99	0.49	1.243E+005		-1.095E+005	5.320E+004
	586.26	0.46	1.613E+005		4.490E+004	7.091E+004
	678.62	0.47	1.062E+005		4.516E+004	4.289E+004
	688.67	0.86	7.256E+004		6.873E+003	3.064E+004
	719.35	0.28	2.376E+005		8.067E+004	1.011E+005
	778.90	12.96	6.414E+003		-2.456E+002	2.811E+003
	810.45	0.32	2.349E+005		-7.259E+004	1.011E+005
	867.37	4.26	1.231E+004		-9.765E+003	4.884E+003
	919.33	0.43	1.940E+005		4.443E+004	8.395E+004
	964.08	14.65	6.484E+003		1.685E+002	2.851E+003
	1085.87	10.24	7.970E+003		-8.948E+003	3.391E+003
	1089.74	1.73	4.905E+004		5.646E+003	2.100E+004
	1112.07	13.69	4.692E+003		-5.268E+002	1.896E+003
	1212.95	1.43	4.712E+004		2.005E+004	1.904E+004

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/SQ M)	Nuclide MDA (pCi/SQ M)	Activity (pCi/SQ M)	Dec. Level (pCi/SQ M)
Eu-152	1249.94	0.19	2.757E+005	2.01E+003	-7.042E+004	1.032E+005
	1299.14	1.63	5.294E+004		3.039E+004	2.236E+004
	1408.01	21.07	2.644E+003		7.368E+002	9.896E+002
	1457.64	0.50	3.414E+005		4.307E+005	1.565E+005
	1528.10	0.28	5.225E+004		0.000E+000	0.000E+000
Eu-154	123.07	40.40	1.607E+003	1.61E+003	-5.324E+002	7.431E+002
	247.93	6.89	9.805E+003		2.507E+002	4.445E+003
	591.76	4.95	1.314E+004		3.657E+003	5.592E+003
	692.42	1.78	4.521E+004		6.871E+003	1.965E+004
	723.30	20.06	3.289E+003		-1.480E+002	1.377E+003
	756.80	4.52	1.263E+004		-1.425E+004	5.101E+003
	873.18	12.08	5.695E+003		-3.690E+003	2.362E+003
	996.29	10.48	7.397E+003		3.995E+003	3.098E+003
	1004.76	18.01	2.793E+003		7.783E+002	1.045E+003
	1274.43	34.80	2.141E+003		9.108E+002	8.651E+002
	1596.48	1.80	3.624E+004		-2.020E+004	1.357E+004
Eu-155	45.30	1.31	4.593E+004	2.72E+003	9.049E+003	2.082E+004
	60.01	1.22	4.248E+004		-5.149E+003	1.894E+004
	86.55	30.70	2.719E+003		1.290E+003	1.270E+003
	105.31	21.10	3.035E+003		-1.561E+003	1.383E+003
Tl-208	583.19	85.00	7.789E+002	7.79E+002	-6.688E+000	3.436E+002
Bi-211	351.07	13.02	5.695E+003	5.69E+003	6.687E+003	2.615E+003
Pb-211	404.85	3.78	1.492E+004	1.49E+004	8.073E+003	6.600E+003
	427.09	1.76	3.217E+004		7.643E+003	1.419E+004
	832.01	3.52	2.075E+004		9.915E+003	9.056E+003
Bi-212	39.86	1.06	2.761E+004	8.02E+003	-3.685E+004	1.200E+004
	727.33	6.67	8.021E+003		-1.604E+003	3.359E+003
	785.37	1.10	5.483E+004		2.267E+003	2.333E+004
	1620.50	1.47	4.037E+004		-8.402E+003	1.564E+004
Pb-212	115.18	0.60	7.791E+004	1.41E+003	-1.812E+004	3.567E+004
	238.63	43.60	1.407E+003		6.008E+002	6.464E+002
	300.09	3.30	1.536E+004		-1.049E+004	6.835E+003
Pb212-XR	74.82	10.28	7.639E+003	3.85E+003	1.335E+004	3.636E+003
	77.11	17.10	3.851E+003		-9.547E+002	1.816E+003
	87.35	3.97	1.402E+004		5.291E+003	6.537E+003
	89.78	1.46	3.596E+004		-2.470E+004	1.669E+004
Bi-214	609.32	45.49	1.381E+003	1.38E+003	-3.351E+002	6.029E+002
	768.36	4.89	1.514E+004		-1.611E+003	6.656E+003
	806.18	1.26	5.206E+004		2.282E+004	2.242E+004
	934.06	3.11	2.126E+004		-4.661E+003	9.043E+003
	1120.29	14.92	5.393E+003		7.373E+002	2.334E+003
	1155.21	1.63	2.989E+004		-1.400E+003	1.158E+004
	1238.12	5.83	1.018E+004		5.416E+002	4.115E+003
	1280.98	1.43	3.593E+004		1.196E+004	1.392E+004
	1377.67	3.99	1.580E+004		6.722E+003	6.384E+003
	1385.31	0.79	4.160E+004		-1.385E+005	1.315E+004
	1401.52	1.33	3.654E+004		1.018E+004	1.368E+004
	1407.99	2.39	2.036E+004		5.673E+003	7.619E+003
	1509.21	2.13	2.060E+004		4.438E+003	7.300E+003
	1661.27	1.05	4.457E+004		9.599E+003	1.579E+004

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/SQ M)	Nuclide MDA (pCi/SQ M)	Activity (pCi/SQ M)	Dec. Level (pCi/SQ M)
	Bi-214	1729.59	2.88	2.152E+004	1.38E+003	7.166E+003	8.336E+003
		1764.49	15.30	6.191E+003		3.755E+003	2.634E+003
		1847.43	2.03	2.844E+004		7.927E+003	1.065E+004
>		2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
	Pb-214	241.99	7.25	8.531E+003	1.95E+003	2.546E+003	3.918E+003
		295.22	18.42	2.562E+003		-2.315E+003	1.130E+003
		351.93	35.60	1.949E+003		4.510E+002	8.894E+002
		785.96	1.06	5.246E+004		-6.313E+004	2.197E+004
	Pb214-XR	74.82	5.80	1.356E+004	6.80E+003	2.369E+004	6.452E+003
		77.11	9.70	6.797E+003		-1.685E+003	3.204E+003
		87.35	2.24	2.487E+004		9.387E+003	1.160E+004
		89.78	0.82	6.410E+004		-4.403E+004	2.976E+004
	Ra-226	186.21	3.64	1.606E+004	1.61E+004	4.013E+003	7.422E+003
	Ac-228	129.07	2.42	2.213E+004	3.41E+003	8.237E+003	1.024E+004
		209.25	3.89	1.497E+004		-1.595E+004	6.882E+003
		270.24	3.46	1.242E+004		-1.312E+004	5.443E+003
		328.00	2.95	1.721E+004		-1.672E+004	7.615E+003
		338.32	11.27	5.565E+003		1.762E+003	2.519E+003
		409.46	1.92	2.750E+004		-4.415E+003	1.205E+004
		463.00	4.40	1.371E+004		-4.066E+003	6.066E+003
		794.95	4.25	1.034E+004		4.731E+002	4.102E+003
		911.20	25.80	3.413E+003		1.635E+003	1.518E+003
		964.77	4.99	1.664E+004		3.295E+002	7.317E+003
		968.97	15.80	5.003E+003		-9.167E+002	2.184E+003
		1588.20	3.22	1.819E+004		6.059E+003	7.047E+003
	Pa-231	27.36	10.30	5.057E+003	5.06E+003	7.298E+002	2.343E+003
		283.69	1.70	2.901E+004		3.938E+003	1.291E+004
		300.07	2.47	2.053E+004		-1.402E+004	9.131E+003
		302.65	2.20	2.699E+004		1.131E+004	1.222E+004
		330.06	1.40	3.945E+004		-6.252E+003	1.763E+004
	Th-234	92.38	2.13	2.649E+016	2.63E+016	2.781E+016	1.233E+016
		92.80	2.10	2.626E+016		2.026E+016	1.220E+016
		112.81	0.21	2.361E+017		1.288E+017	1.084E+017
	U-235	143.76	10.96	4.730E+003	1.02E+003	-9.678E+002	2.178E+003
		163.33	5.08	1.004E+004		3.182E+003	4.602E+003
		185.71	57.20	1.020E+003		3.597E+002	4.712E+002
		202.11	1.08	5.413E+004		9.281E+003	2.493E+004
		205.31	5.01	1.115E+004		-8.090E+003	5.111E+003
	Am-241	59.54	35.90	9.489E+002	9.49E+002	1.114E+002	4.210E+002

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or
the region is outside the spectrum, or MDA has not been calculated
@ = Half-life too short to be able to perform the decay correction

```
************************  ************************  ****************
***        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*********************************************************************

.lename: E:\4-27-17\U2NW.CNF

port Generated On                : 4/27/2017   5:21:07 PM

mple Title                       : B308102BSFJSM002GD
mple Description                 : U2NW R1
mple Identification              :
mple Type                        :
mple Geometry                    :

ak Locate Threshold              :  3.00
ak Locate Range (in channels)    :    85 -  8192
ak Area Range (in channels)      :    85 -  8192
lentification Energy Tolerance   :   10.000 keV

mple Size                        :  1.000E+000 SQM

mple Taken On                    : 1/28/2013  12:00:00 PM
quisition Started                : 9/17/2015  11:45:37 AM

.ve Time                         :      600.0 seconds
al Time                          :      600.5 seconds

ad Time                          :   0.08 %

            Energy Calibration Used Done On       : 1/27/2015
            Efficiency Calibration Used Done On   : 4/27/2017
            Efficiency ID                         : 3M_TURBINE
```

****
*** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: 5456
Sample Title: B308102BSFJSM002GD
Peak Analysis Performed on: 4/27/2017 5:21:07 PM
Peak Analysis From Channel: 85
Peak Analysis To Channel: 8192

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	4685-	4702	4693.76	1173.07	1.14	9.90E+001	19.90	0.00E+000
2	5322-	5340	5330.69	1332.14	1.83	8.30E+001	18.22	0.00E+000
3	5839-	5850	5844.24	1460.37	0.38	2.39E+001	11.38	3.15E+000

= First peak in a multiplet region
= Other peak in a multiplet region
= Fitted singlet

rors quoted at 2.000 sigma

****
*** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: B308102BSFJSM002GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/SQM)	Activity Uncertainty
K-40	1.000	1460.82*	10.66	8.06759E+005	3.91265E+005
Co-60	0.999	1173.23*	99.85	4.47300E+005	9.67703E+004
		1332.49*	99.98	4.00353E+005	9.35430E+004

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 10.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000 sigma

****
*** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/SQM)	Wt mean Activity Uncertainty
K-40	1.000	8.067592E+005	3.912650E+005
Co-60	0.999	4.230307E+005	6.725688E+004

? = 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 2.000 sigma

********** U N I D E N T I F I E D P E A K S **********

Peak Locate Performed on: 4/27/2017 5:21:07 PM
Peak Locate From Channel: 85
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide

All peaks were identified.

****
*** N U C L I D E M D A R E P O R T *****
****

Detector Name: 5456
Sample Geometry:
Sample Title: B308102BSFJSM002GD
Nuclide Library Used: C:\GENIE2K\CAMFILES\Zion Lib-BNL.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/SQM)	Nuclide MDA (pCi/SQM)	Activity (pCi/SQM)	Dec. Level (pCi/SQM)
+	K-40	1460.82*	10.66	4.165E+005	4.17E+005	8.068E+005	1.625E+005
	Cr-51	320.08	9.91	1.186E+016	1.19E+016	-7.945E+015	5.289E+015
	Mn-54	834.85	99.98	4.114E+005	4.11E+005	-1.882E+005	1.750E+005
	Co-58	810.76	99.45	7.093E+008	7.09E+008	-1.187E+008	3.108E+008
+	Co-60	1173.23*	99.85	1.223E+004	1.22E+004	4.473E+005	0.000E+000
		1332.49*	99.98	1.305E+004		4.004E+005	0.000E+000
	Nb-94	702.65	99.81	4.963E+004	4.96E+004	-1.745E+004	2.148E+004
		871.09	99.89	6.139E+004		2.120E+004	2.700E+004
	Sn-113	255.13	2.11	7.528E+008	2.58E+007	-4.059E+008	3.450E+008
		391.70	64.97	2.580E+007		8.670E+006	1.164E+007
	Cs-134	475.36	1.48	7.638E+006	1.42E+005	-4.154E+006	3.369E+006
		563.25	8.34	1.473E+006		9.614E+004	6.499E+005
		569.33	15.37	7.030E+005		-5.767E+005	3.042E+005
		604.72	97.62	1.419E+005		-5.167E+004	6.328E+004
		795.86	85.46	1.535E+005		2.543E+004	6.674E+004
		801.95	8.69	1.425E+006		-7.468E+005	6.135E+005
		1038.61	0.99	1.724E+007		-3.353E+006	7.626E+006
		1167.97	1.79	2.110E+007		-1.307E+006	9.965E+006
		1365.19	3.02	4.628E+006		2.500E+006	1.938E+006
	Cs-137	661.66	85.10	7.177E+004	7.18E+004	3.179E+004	3.184E+004
	Eu-152	121.78	28.67	1.852E+005	1.85E+005	9.238E+004	8.646E+004
		244.70	7.61	7.516E+005		1.948E+005	3.461E+005
		295.94	0.45	1.329E+007		-2.561E+006	6.093E+006
		344.28	26.60	1.961E+005		-1.521E+005	8.801E+004
		367.79	0.86	6.770E+006		-3.673E+006	3.065E+006
		411.12	2.24	2.549E+006		1.324E+006	1.144E+006
		443.96	2.83	1.689E+006		-1.406E+006	7.372E+005
		488.68	0.42	1.317E+007		-5.041E+005	5.828E+006
		563.99	0.49	1.156E+007		-1.960E+006	5.082E+006
		586.26	0.46	1.161E+007		-2.242E+005	5.049E+006
		678.62	0.47	1.350E+007		7.872E+006	5.954E+006
		688.67	0.86	6.926E+006		3.569E+006	3.023E+006
		719.35	0.28	2.402E+007		5.108E+005	1.063E+007
		778.90	12.96	5.254E+005		3.242E+005	2.318E+005
		810.45	0.32	2.111E+007		1.199E+007	9.284E+006
		867.37	4.26	1.722E+006		-3.992E+005	7.620E+005
		919.33	0.43	1.769E+007		7.203E+006	7.826E+006
		964.08	14.65	5.179E+005		-8.301E+004	2.285E+005
		1085.87	10.24	6.217E+005		4.362E+004	2.645E+005
		1089.74	1.73	4.213E+006		2.104E+006	1.831E+006
		1112.07	13.69	5.532E+005		-2.733E+005	2.415E+005
		1212.95	1.43	5.704E+006		3.234E+006	2.500E+006

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/SQM)	Nuclide MDA (pCi/SQM)	Activity (pCi/SQM)	Dec. Level (pCi/SQM)
Eu-152	1249.94	0.19	2.999E+007	1.85E+005	1.398E+007	1.229E+007
	1299.14	1.63	4.769E+006		1.439E+006	2.064E+006
	1408.01	21.07	2.876E+005		2.394E+004	1.179E+005
	1457.64	0.50	2.310E+007		1.709E+007	1.044E+007
	1528.10	0.28	1.975E+007		7.531E+006	7.835E+006
Eu-154	123.07	40.40	1.393E+005	1.39E+005	2.272E+004	6.493E+004
	247.93	6.89	9.468E+005		5.797E+005	4.378E+005
	591.76	4.95	1.205E+006		1.590E+005	5.260E+005
	692.42	1.78	3.086E+006		-3.171E+005	1.313E+006
	723.30	20.06	3.851E+005		-2.091E+004	1.717E+005
	756.80	4.52	1.314E+006		-5.935E+005	5.627E+005
	873.18	12.08	6.128E+005		1.589E+005	2.685E+005
	996.29	10.48	7.381E+005		1.645E+005	3.222E+005
	1004.76	18.01	4.758E+005		3.048E+005	2.105E+005
	1274.43	34.80	1.670E+005		7.105E+004	6.748E+004
	1596.48	1.80	2.827E+006		7.879E+005	1.058E+006
Eu-155	45.30	1.31	5.566E+006	2.39E+005	1.420E+006	2.616E+006
	60.01	1.22	5.587E+006		-3.720E+006	2.614E+006
	86.55	30.70	2.393E+005		4.457E+004	1.127E+005
	105.31	21.10	2.877E+005		2.713E+004	1.334E+005
Tl-208	583.19	85.00	5.478E+004	5.48E+004	2.850E+004	2.381E+004
Bi-211	351.07	13.02	4.489E+005	4.49E+005	1.286E+005	2.064E+005
Pb-211	404.85	3.78	1.285E+006	1.29E+006	-2.187E+005	5.756E+005
	427.09	1.76	2.835E+006		-1.390E+006	1.270E+006
	832.01	3.52	1.527E+006		-3.036E+005	6.608E+005
Bi-212	39.86	1.06	4.087E+006	9.57E+005	-3.263E+005	1.903E+006
	727.33	6.67	9.573E+005		-5.905E+004	4.279E+005
	785.37	1.10	5.421E+006		4.480E+006	2.391E+006
	1620.50	1.47	2.434E+006		5.243E+005	8.624E+005
Pb-212	115.18	0.60	6.918E+006	1.27E+005	-3.279E+006	3.203E+006
	238.63	43.60	1.271E+005		8.501E+004	5.906E+004
	300.09	3.30	1.552E+006		-1.013E+006	7.098E+005
Pb212-XR	74.82	10.28	6.189E+005	3.47E+005	9.273E+005	2.951E+005
	77.11	17.10	3.473E+005		2.454E+005	1.651E+005
	87.35	3.97	1.240E+006		2.252E+005	5.830E+005
	89.78	1.46	3.127E+006		-6.940E+005	1.463E+006
Bi-214	609.32	45.49	1.312E+005	1.31E+005	-4.007E+004	5.878E+004
	768.36	4.89	1.264E+006		2.818E+005	5.608E+005
	806.18	1.26	4.061E+006		-2.493E+006	1.748E+006
	934.06	3.11	1.895E+006		-1.440E+006	8.236E+005
	1120.29	14.92	5.025E+005		4.391E+005	2.229E+005
	1155.21	1.63	3.234E+006		5.553E+005	1.355E+006
	1238.12	5.83	1.097E+006		7.041E+004	4.725E+005
	1280.98	1.43	2.166E+006		-2.275E+006	7.675E+005
	1377.67	3.99	1.232E+006		5.243E+005	4.979E+005
	1385.31	0.79	5.780E+006		2.205E+006	2.294E+006
	1401.52	1.33	3.180E+006		-1.026E+006	1.232E+006
	1407.99	2.39	2.215E+006		1.844E+005	9.078E+005
	1509.21	2.13	1.607E+006		3.461E+005	5.694E+005
	1661.27	1.05	4.497E+006		1.497E+006	1.742E+006

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/SQM)	Nuclide MDA (pCi/SQM)	Activity (pCi/SQM)	Dec. Level (pCi/SQM)
	Bi-214	1729.59	2.88	1.298E+006	1.31E+005	2.795E+005	4.598E+005
		1764.49	15.30	3.198E+005		1.065E+005	1.239E+005
		1847.43	2.03	2.219E+006		6.183E+005	8.304E+005
>		2118.51	1.16	0.000E+000		0.000E+000	0.000E+000
	Pb-214	241.99	7.25	7.579E+005	1.70E+005	3.257E+005	3.518E+005
		295.22	18.42	2.918E+005		1.948E+005	1.341E+005
		351.93	35.60	1.696E+005		1.891E+004	7.819E+004
		785.96	1.06	5.234E+006		-2.839E+005	2.285E+006
	Pb214-XR	74.82	5.80	1.098E+006	6.13E+005	1.645E+006	5.237E+005
		77.11	9.70	6.130E+005		4.330E+005	2.913E+005
		87.35	2.24	2.200E+006		3.996E+005	1.035E+006
		89.78	0.82	5.575E+006		-1.237E+006	2.609E+006
	Ra-226	186.21	3.64	1.265E+006	1.26E+006	-9.488E+003	5.847E+005
	Ac-228	129.07	2.42	1.942E+006	2.38E+005	9.653E+005	9.065E+005
		209.25	3.89	1.261E+006		-5.443E+005	5.835E+005
		270.24	3.46	1.229E+006		-3.621E+005	5.546E+005
		328.00	2.95	1.703E+006		1.016E+006	7.744E+005
		338.32	11.27	4.341E+005		1.208E+005	1.965E+005
		409.46	1.92	2.544E+006		-1.157E+006	1.140E+006
		463.00	4.40	1.243E+006		-1.851E+005	5.598E+005
		794.95	4.25	1.275E+006		-1.143E+006	5.542E+005
		911.20	25.80	2.376E+005		-9.305E+004	1.041E+005
		964.77	4.99	1.360E+006		-4.200E+005	6.016E+005
		968.97	15.80	4.208E+005		2.408E+005	1.856E+005
		1588.20	3.22	1.874E+006		9.451E+005	7.774E+005
	Pa-231	27.36	10.30	4.300E+005	4.30E+005	-3.747E+005	2.005E+005
		283.69	1.70	3.097E+006		1.561E+006	1.424E+006
		300.07	2.47	2.073E+006		-1.353E+006	9.483E+005
		302.65	2.20	2.254E+006		-1.748E+005	1.027E+006
		330.06	1.40	3.134E+006		1.303E+005	1.404E+006
	Th-234	92.38	2.13	2.221E+018	2.18E+018	1.462E+018	1.039E+018
		92.80	2.10	2.178E+018		1.239E+017	1.016E+018
		112.81	0.21	2.233E+019		8.309E+018	1.041E+019
	U-235	143.76	10.96	3.614E+005	8.03E+004	-1.319E+005	1.662E+005
		163.33	5.08	7.743E+005		-2.373E+005	3.545E+005
		185.71	57.20	8.028E+004		4.479E+003	3.712E+004
		202.11	1.08	4.347E+006		7.865E+005	2.007E+006
		205.31	5.01	9.789E+005		-4.784E+004	4.533E+005
	Am-241	59.54	35.90	1.333E+005	1.33E+005	-6.839E+003	6.247E+004

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or MDA has not been calculated
@ = Half-life too short to be able to perform the decay correction

ATTACHMENT 8
EBERLINE ANALYTICAL REPORTS

EBERLINE ANALYTICAL

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

EBS-OR-47182

May 8, 2020

Gerald Wood
Zion Solutions, LLC
2701 Deborah Avenue
Zion, IL 60099

CASE NARRATIVE
Work Order # 20-04072-OR

SAMPLE RECEIPT

This work order contains nine solid samples received 04/25/2020. Samples were analyzed for Isotopic Plutonium, Plutonium-241, Neptunium-237, Americium-241/243, Curium-243/244, Total Strontium, Technetium-99, Tritium, Carbon-14, Promethium-147, Nickel-59/63, Iron-55 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
B1-06202A-FSWC-040-CV	20-04072-04	B2-08201-CJWC-A018-CV 0 5-1 0	20-04072-09
B1-06214A-FSFC-001-CV	20-04072-05	L2-10214C-RJGS-001-SM-A	20-04072-10
B2-08101A-BJFC-007-CV 0 0-0 5	20-04072-06	L1-12109L-CJGS-001-SB-A	20-04072-11
B2-08101A-BJFC-007-CV 0 5-1 0	20-04072-07	L1-12106L-CJGS-001-SB-A	20-04072-12
B2-08201-CJWC-A018-CV 0 0-0 5	20-04072-08		

ANALYTICAL METHODS

Isotopic Plutonium and Plutonium-241 were analyzed using Method EML Pu-02 Modified. Neptunium-237 was analyzed using EIChroM Method ACW08 Modified. Americium and Curium were analyzed using Method EML Am-01 Modified. Total Strontium was analyzed using EIChroM Method SRW01 Modified. Technetium-99 was analyzed using EIChroM Method TCS01 Modified. Tritium was performed using Method LANL ER-210 Modified. Carbon-14 was performed using EPA Method 520.0 Modified. Promethium-147 was performed using Method EML Pm-01 Modified. Nickel-59/63 was performed using Method ASTM 3500-Ni Modified. Iron-55 was performed using EML Method Fe-01-01 Modified. Gamma Spectroscopy was performed using EPA Method 901.1 Modified.

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

ANALYTICAL RESULTS CONTINUED

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

ISOTOPIC PLUTONIUM

Samples were prepared by removing representative aliquots followed by mixed acid digestions as appropriate. Plutonium was selectively extracted by ion exchange. Plutonium was eluted, micro-precipitated and mounted on micro-porous filter media. Sample activities were determined by alpha spectroscopy using energy specific regions of interest for Plutonium-238 and Plutonium-239. Chemical recovery was determined using a Plutonium-242 tracer. Activity of the Plutonium-242 tracer was determined by alpha spectroscopy using an energy specific region of interest.

Samples demonstrated acceptable results for all Plutonium analyses Chemical recovery was acceptable for all samples. The Plutonium-238 and Plutonium-239/240 method blank demonstrated acceptable results. Results for the Plutonium-238 and Plutonium-239/240 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Plutonium-238 and Plutonium-239 laboratory control sample demonstrated an acceptable percent recovery.

PLUTONIUM-241

Following sample analysis for Isotopic Plutonium, filter media used was dissolved. Dissolved samples were placed into scintillation vials, scintillation cocktail was added and Plutonium-241 was determined by liquid scintillation counting. Analytical tracer recovery was determined by yields from the Isotopic Plutonium tracer.

Samples demonstrated acceptable results for all Plutonium-241 analyses. All sample results demonstrated slightly high method detection limits. Chemical recovery was acceptable for all samples. The Plutonium-241 method blank demonstrated an acceptable result. Results for the Plutonium-241 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Plutonium-241 laboratory control sample demonstrated an acceptable percent recovery.

NEPTUNIUM-237

Samples were prepared by removing representative aliquots followed by mixed acid digestions as appropriate. Sample residues were dissolved in dilute acid and Neptunium was selectively separated using EIChroM stabilized selective resins. Neptunium was eluted, micro-precipitated and mounted on micro-porous filter media. Sample activities were determined by alpha spectroscopy using an energy specific region of interest for Neptunium-237 activity. A Neptunium-239 tracer was used for chemical yields, which was determined by beta proportional counting.

Samples demonstrated acceptable results for all Neptunium-237 analyses. Chemical recovery was acceptable for all samples. The Neptunium-237 method blank demonstrated an acceptable result. Results for the Neptunium-237 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Neptunium-237 laboratory control sample demonstrated an acceptable percent recovery.

ANALYTICAL RESULTS CONTINUED

AMERICIUM-241

Samples were prepared by removing representative aliquots followed by mixed acid digestions as appropriate. Samples were co-precipitated with Calcium Phosphate. Precipitates were nitrate converted using Nitric acid and Aluminum Nitrate. The Americium fractions were separated from other elements using the EIChroM, TRU and UTEVA resins. The separated Americium fractions were mounted on a membrane filter by micro-precipitation and counted on the alpha spectroscopy system. Analytical tracer recovery was determined using an Americium-243 standard and subsequent activity determination by alpha spectroscopy.

Samples demonstrated acceptable results for all Americium-241 analyses. Chemical recovery was acceptable for all samples. The Americium-241 method blank demonstrated an acceptable result. Results for the Americium-241 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Americium-241 laboratory control sample demonstrated an acceptable percent recovery.

AMERICIUM-243

Samples were prepared by removing representative aliquots followed by mixed acid digestions as appropriate. Samples were co-precipitated with Calcium Phosphate. Precipitates were nitrate converted using Nitric acid and Aluminum Nitrate. The Americium fractions were separated from other elements using the EIChroM, TRU and UTEVA resins. The separated Americium fractions were mounted on a membrane filter by micro-precipitation and counted on the alpha spectroscopy system. Analytical tracer recovery was determined using a Curium-244 standard and subsequent activity determination by alpha spectroscopy.

Samples demonstrated acceptable results for all Americium-243 analyses. Chemical recovery was low for laboratory fraction -06 (Client ID: B2-08101A-BJFC-007-CV 0 0-0 5). Chemical recovery was acceptable for all other samples. The Americium-243 method blank demonstrated an acceptable result. Results for the Americium-243 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Americium-243 laboratory control sample demonstrated an acceptable percent recovery.

CURIUM-243/244

Samples were prepared by removing representative aliquots followed by mixed acid digestions as appropriate. Samples were co-precipitated with Calcium Phosphate. Precipitates were nitrate converted using Nitric acid and Aluminum Nitrate. The Curium fractions were separated from other elements using the EIChroM, TRU and UTEVA resins. The separated Curium fractions were mounted on a membrane filter by micro-precipitation and counted on the alpha spectroscopy system. Analytical tracer recovery was determined using an Americium-243 standard and subsequent activity determination by alpha spectroscopy.

Samples demonstrated acceptable results for all Curium-243/244 analyses. Chemical recovery was acceptable for all samples. The Curium-243/244 method blank demonstrated an acceptable result. Results for the Curium-243/244 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Curium-244 laboratory control sample demonstrated an acceptable percent recovery.

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM

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

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

TECHNETIUM-99

A representative aliquot was removed from each sample followed by leaching in acids. Samples were prepared by oxidative reactions with Nitric acid and Hydrogen Peroxide. After complete oxidization, Technetium was selectively extracted using EIChroM stabilized resins. Special cleanup chemistry was conducted for complete removal of interferences associated with Uranium. Processed resins were transferred to liquid scintillation vials, scintillation cocktail was added, and samples were counted by beta liquid scintillation.

Samples demonstrated acceptable results for all Technetium-99 analyses. The Technetium-99 method blank demonstrated an acceptable result. Results for the Technetium-99 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Technetium-99 laboratory control sample demonstrated an acceptable percent recovery.

TRITIUM

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

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

CARBON-14

A representative aliquot of each sample was placed into a 1-liter reaction vessel. A carbonate solution was added. Samples were oxidized using Potassium Permanganate. Carbon Dioxide was evolved and Carbon-14 was captured into Harvey brand, Carb-Sorb cocktail. Carbon-14 beta emissions were then determined by beta liquid scintillation using an energy selective region.

ANALYTICAL RESULTS CONTINUED

CARBON-14 CONTINUED

Samples demonstrated acceptable results for all Carbon-14 analyses. The Carbon-14 method blank demonstrated an acceptable result. Results for the Carbon-14 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Carbon-14 laboratory control sample demonstrated an acceptable percent recovery.

PROMETHIUM-147

Samples were prepared by leaching in HNO_3. Aliquots were taken to near dryness. Sample residues were dissolved in deionized water. The pH of each sample was adjusted with HNO_3. Samples were extracted with scintillation extractant. Organic phase of each sample was transferred to scintillation vials. Promethium-147 was determined by liquid scintillation counting.

Samples demonstrated acceptable results for all Promethium-147 analyses. The Promethium-147 method blank demonstrated an acceptable result. Results for the Promethium-147 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Promethium-147 laboratory control sample demonstrated an acceptable percent recovery.

NICKEL-63

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

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

NICKEL-59

Representative aliquots were removed from samples and placed into Petri geometry containers. Samples were counted by low-energy photon spectroscopy.

Samples demonstrated acceptable results for all Nickel-59 analyses. The Nickel-59 method blank demonstrated an acceptable result. Results for the Nickel-59 replicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Iron-55 laboratory control sample demonstrated a statistically acceptable percent recovery.

ANALYTICAL RESULTS CONTINUED

IRON-55

Representative aliquots were removed from samples and placed into Petri geometry containers. Samples were counted by low-energy photon spectroscopy.

Samples demonstrated acceptable results for all Iron-55 analyses. The Iron-55 method blank demonstrated an acceptable result. Results for the Iron-55 replicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Iron-55 laboratory control sample demonstrated an acceptable percent recovery.

GAMMA SPECTROSCOPY

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

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. Cobalt-60 results for laboratory fraction -08 (Client ID: B2-08201-CJWC-A018-CV 0 0-0 5) demonstrated a slightly high method detection limit. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Bismuth-214 and Potassium-40 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Thorium-234 replicate demonstrated a high relative percent; however, normalized difference is within acceptable limits for the analytical technique. Results for the Cobalt-60 and Cesium-137 laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 11/13/2019

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Gerald Wood		SDG:	20-04072
Zion Solutions		Purchase Order:	677116
2701 Deborah Ave		Analysis Category:	ENVIRONMENTAL
Zion, IL 60099		Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	5.55E+00	1.66E-01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	5.47E+00	1.01E+00	1.10E+00	1.40E-01		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	6.96E-02	7.57E-02	7.59E-02	9.09E-02	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	7.52E-02	8.00E-02	8.02E-02	1.11E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	6.44E-02	8.10E-02	8.12E-02	1.29E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	-4.34E-04	4.60E-02	4.60E-02	1.37E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	4.23E-02	5.13E-02	5.14E-02	6.24E-02	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	2.06E-02	5.15E-02	5.16E-02	1.07E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	-1.29E-02	4.50E-02	4.50E-02	1.27E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	1.73E-02	5.61E-02	5.61E-02	1.16E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	3.36E-02	5.17E-02	5.18E-02	8.85E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	6.61E-02	6.77E-02	6.79E-02	9.05E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/30/2020	20-04072	Americium-241	EML Am-01 Modified	4.47E-02	6.86E-02	6.87E-02	1.02E-01	U	pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	6.05E+00	1.82E-01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	5.41E+00	7.46E-01	1.10E+00	9.62E-02		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	5.60E-02	6.78E-02	6.83E-02	8.26E-02	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	7.10E-02	7.33E-02	7.40E-02	7.74E-02	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	2.85E-02	6.17E-02	6.18E-02	1.22E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	4.43E-02	5.81E-02	5.84E-02	8.86E-02	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	2.02E-01	3.46E-01	3.47E-01	6.07E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	5.82E-02	7.03E-02	7.09E-02	8.58E-02	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	1.14E-01	1.16E-01	1.17E-01	1.56E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	6.77E-02	7.96E-02	8.03E-02	1.17E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	1.41E-02	3.38E-02	3.39E-02	7.10E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	-1.41E-02	3.49E-02	3.50E-02	9.95E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/30/2020	20-04072	Americium-243	EML Am-01 Modified	-2.63E-02	4.75E-02	4.77E-02	1.46E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG: **20-04072**
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	5.99E+00	1.08E-01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	5.83E+00	1.07E+00	1.28E+00	1.07E-01		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	1.14E-01	9.99E-02	1.01E-01	1.14E-01		pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	2.29E-02	4.96E-02	4.96E-02	9.78E-02	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	2.12E-02	4.60E-02	4.60E-02	9.08E-02	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	3.47E-02	6.62E-02	6.63E-02	1.22E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	1.24E-02	2.98E-02	2.98E-02	6.24E-02	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	8.35E-02	7.99E-02	8.06E-02	8.57E-02	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	4.05E-02	6.63E-02	6.64E-02	1.16E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	6.71E-02	7.25E-02	7.30E-02	1.05E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	1.53E-02	4.19E-02	4.19E-02	8.65E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	2.31E-02	4.97E-02	4.98E-02	9.66E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/30/2020	20-04072	Curium-243/244	EML Am-01 Modified	4.59E-02	7.04E-02	7.06E-02	1.05E-01	U	pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Carbon-14	EPA 520.0 Modified	1.32E+03	3.70E+01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Carbon-14	EPA 520.0 Modified	1.30E+03	9.67E+00	1.81E+02	4.08E+00		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Carbon-14	EPA 520.0 Modified	-3.73E-01	4.65E-01	4.68E-01	7.99E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Carbon-14	EPA 520.0 Modified	-5.57E-01	3.64E-01	3.72E-01	6.32E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Carbon-14	EPA 520.0 Modified	-4.31E-01	3.70E-01	3.75E-01	6.39E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/28/2020	20-04072	Carbon-14	EPA 520.0 Modified	-6.32E-01	3.49E-01	3.60E-01	6.09E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/28/2020	20-04072	Carbon-14	EPA 520.0 Modified	-4.56E-01	3.63E-01	3.69E-01	6.28E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/28/2020	20-04072	Carbon-14	EPA 520.0 Modified	-2.87E-01	4.03E-01	4.04E-01	6.91E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/28/2020	20-04072	Carbon-14	EPA 520.0 Modified	-6.71E-01	3.91E-01	4.02E-01	6.81E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/28/2020	20-04072	Carbon-14	EPA 520.0 Modified	-5.32E-01	3.69E-01	3.77E-01	6.41E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/28/2020	20-04072	Carbon-14	EPA 520.0 Modified	-4.72E-01	3.76E-01	3.81E-01	6.50E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/28/2020	20-04072	Carbon-14	EPA 520.0 Modified	-4.92E-01	3.91E-01	3.97E-01	6.77E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/28/2020	20-04072	Carbon-14	EPA 520.0 Modified	-3.28E-01	3.68E-01	3.71E-01	6.33E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 20-04072
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/28/2020	20-04072	Iron-55	EML Fe-01-01 Modified	4.08E+03	3.50E+02				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/28/2020	20-04072	Iron-55	EML Fe-01-01 Modified	3.41E+03	2.32E+02	6.33E+02	2.51E+02		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/28/2020	20-04072	Iron-55	EML Fe-01-01 Modified	5.18E+00	1.92E+01	1.92E+01	3.01E+01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/28/2020	20-04072	Iron-55	EML Fe-01-01 Modified	3.19E-02	1.31E-01	1.31E-01	2.15E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/28/2020	20-04072	Iron-55	EML Fe-01-01 Modified	-3.00E-02	1.41E-01	1.41E-01	2.23E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/28/2020	20-04072	Iron-55	EML Fe-01-01 Modified	6.56E-02	1.89E-01	1.89E-01	3.14E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/28/2020	20-04072	Iron-55	EML Fe-01-01 Modified	7.56E-01	2.76E+00	2.76E+00	4.46E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/29/2020	20-04072	Iron-55	EML Fe-01-01 Modified	-1.76E+00	2.08E+00	2.10E+00	3.04E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/29/2020	20-04072	Iron-55	EML Fe-01-01 Modified	-1.79E-01	3.22E+00	3.22E+00	5.12E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/29/2020	20-04072	Iron-55	EML Fe-01-01 Modified	1.34E+00	2.55E+00	2.56E+00	4.30E+00	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/29/2020	20-04072	Iron-55	EML Fe-01-01 Modified	5.91E-02	6.71E-02	6.79E-02	1.15E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/29/2020	20-04072	Iron-55	EML Fe-01-01 Modified	-1.82E-02	3.86E-01	3.86E-01	6.15E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/29/2020	20-04072	Iron-55	EML Fe-01-01 Modified	1.85E-01	2.37E-01	2.39E-01	4.04E-01	U	pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Tritium	LANL ER-210 Modified	3.61E+02	1.30E+01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Tritium	LANL ER-210 Modified	3.69E+02	6.96E+00	2.18E+01	3.62E+00		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Tritium	LANL ER-210 Modified	2.05E+00	2.16E+00	2.16E+00	3.62E+00	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Tritium	LANL ER-210 Modified	1.85E+00	2.36E+00	2.37E+00	3.98E+00	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Tritium	LANL ER-210 Modified	3.70E+00	2.42E+00	2.42E+00	3.98E+00	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	5/1/2020	20-04072	Tritium	LANL ER-210 Modified	3.86E+00	2.40E+00	2.41E+00	3.94E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	5/1/2020	20-04072	Tritium	LANL ER-210 Modified	4.97E+00	3.43E+00	3.44E+00	5.67E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	5/1/2020	20-04072	Tritium	LANL ER-210 Modified	6.35E+00	5.68E+00	5.69E+00	9.48E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	5/1/2020	20-04072	Tritium	LANL ER-210 Modified	4.02E+00	3.34E+00	3.35E+00	5.56E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	5/1/2020	20-04072	Tritium	LANL ER-210 Modified	6.41E+00	3.46E+00	3.47E+00	5.64E+00		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	5/1/2020	20-04072	Tritium	LANL ER-210 Modified	2.74E+00	2.28E+00	2.28E+00	3.79E+00	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	5/1/2020	20-04072	Tritium	LANL ER-210 Modified	8.51E+00	2.36E+00	2.41E+00	3.67E+00		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	5/1/2020	20-04072	Tritium	LANL ER-210 Modified	1.50E+00	2.16E+00	2.16E+00	3.64E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Gerald Wood		SDG:	20-04072
Zion Solutions		Purchase Order:	677116
2701 Deborah Ave		Analysis Category:	ENVIRONMENTAL
Zion, IL 60099		Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/28/2020	20-04072	Iron-55	ASTM 3500-Ni Modified	4.08E+03	3.50E+02				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/28/2020	20-04072	Iron-55	ASTM 3500-Ni Modified	3.05E+03	2.42E+02	3.20E+02	2.94E+02		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/28/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	-2.65E+00	1.49E+01	1.49E+01	2.28E+01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/28/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	-2.89E-02	7.41E-02	7.41E-02	1.11E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/28/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	1.46E-02	7.26E-02	7.27E-02	1.15E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/28/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	-4.18E-03	9.97E-02	9.97E-02	1.53E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/28/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	1.10E-02	2.98E-01	2.98E-01	4.67E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/29/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	7.38E-02	1.97E-01	1.97E-01	3.17E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/29/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	1.08E-01	3.31E-01	3.31E-01	5.28E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/29/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	3.79E-02	2.76E-01	2.76E-01	4.38E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/29/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	-6.28E-03	4.68E-02	4.68E-02	7.12E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/29/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	1.80E-01	2.62E-01	2.63E-01	4.32E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/29/2020	20-04072	Nickel-59	ASTM 3500-Ni Modified	-1.36E-01	1.78E-01	1.78E-01	2.52E-01	U	pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	1.46E+03	4.39E+01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	1.48E+03	9.06E+00	8.76E+01	2.19E+00		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	-8.58E-01	1.28E+00	1.28E+00	2.22E+00	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	9.36E-01	1.30E+00	1.31E+00	2.20E+00	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	1.45E+00	1.32E+00	1.32E+00	2.20E+00	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	2.70E-01	1.37E+00	1.37E+00	2.33E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	4.56E-01	1.39E+00	1.39E+00	2.36E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	7.46E-01	1.42E+00	1.42E+00	2.41E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	-6.62E-01	1.41E+00	1.41E+00	2.44E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	5.54E-01	1.41E+00	1.41E+00	2.38E+00	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	-1.73E-01	1.30E+00	1.30E+00	2.24E+00	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	7.13E-01	1.36E+00	1.36E+00	2.30E+00	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/30/2020	20-04072	Nickel-63	ASTM 3500-Ni Modified	-1.09E+00	1.24E+00	1.24E+00	2.16E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Gerald Wood		SDG:	20-04072
Zion Solutions		Purchase Order:	677116
2701 Deborah Ave		Analysis Category:	ENVIRONMENTAL
Zion, IL 60099		Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	1.02E+01	3.67E-01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	1.17E+01	9.71E-01	1.67E+00	1.19E-01		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	5.84E-02	8.35E-02	8.37E-02	1.37E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	-2.75E-03	3.22E-02	3.22E-02	6.75E-02	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	4.76E-02	5.74E-02	5.76E-02	7.02E-02	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	2.94E-02	4.98E-02	4.99E-02	8.80E-02	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	7.53E-02	7.65E-02	7.70E-02	1.03E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	4.84E-02	6.93E-02	6.95E-02	1.14E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	4.18E-02	5.04E-02	5.07E-02	6.17E-02	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	4.72E-02	7.22E-02	7.24E-02	1.23E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	7.03E-02	6.64E-02	6.69E-02	8.17E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	4.14E-02	4.99E-02	5.01E-02	6.10E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/29/2020	20-04072	Neptunium-237	EIChroM ACW08 Mod	1.52E-02	5.68E-02	5.68E-02	1.23E-01	U	pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Promethium-147	EML Pm-01 Modified	5.99E+01	1.62E+00				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Promethium-147	EML Pm-01 Modified	5.89E+01	1.77E+00	9.02E+00	1.51E+00		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Promethium-147	EML Pm-01 Modified	5.01E-01	8.91E-01	8.94E-01	1.51E+00	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/29/2020	20-04072	Promethium-147	EML Pm-01 Modified	1.47E+00	1.41E+00	1.43E+00	2.36E+00	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/29/2020	20-04072	Promethium-147	EML Pm-01 Modified	1.63E+00	1.46E+00	1.48E+00	2.44E+00	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/30/2020	20-04072	Promethium-147	EML Pm-01 Modified	1.38E+00	1.52E+00	1.53E+00	2.55E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Promethium-147	EML Pm-01 Modified	1.34E+01	7.54E+00	7.80E+00	1.24E+01		pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Promethium-147	EML Pm-01 Modified	1.17E+01	7.08E+00	7.30E+00	1.17E+01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Promethium-147	EML Pm-01 Modified	7.99E+00	7.19E+00	7.29E+00	1.20E+01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Promethium-147	EML Pm-01 Modified	1.10E+01	7.27E+00	7.46E+00	1.20E+01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/30/2020	20-04072	Promethium-147	EML Pm-01 Modified	9.09E-01	1.18E+00	1.19E+00	1.99E+00	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/30/2020	20-04072	Promethium-147	EML Pm-01 Modified	1.66E+00	1.14E+00	1.17E+00	1.90E+00	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/30/2020	20-04072	Promethium-147	EML Pm-01 Modified	7.42E-02	1.04E+00	1.04E+00	1.78E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG: **20-04072**
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	7.13E+00	1.50E-01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	5.64E+00	7.02E-01	8.87E-01	1.36E-01		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	-1.22E-02	5.21E-02	5.21E-02	1.45E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	7.21E-02	9.43E-02	9.45E-02	1.52E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	5.50E-02	7.41E-02	7.42E-02	1.16E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	-2.76E-03	3.23E-02	3.23E-02	6.77E-02	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	-8.11E-03	4.81E-02	4.81E-02	1.14E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	-1.77E-02	4.37E-02	4.37E-02	1.25E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	-2.84E-02	5.91E-02	5.92E-02	1.75E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	-2.21E-02	6.72E-02	6.72E-02	1.83E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	3.03E-02	8.41E-02	8.42E-02	1.82E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	1.84E-02	6.63E-02	6.63E-02	1.50E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/30/2020	20-04072	Plutonium-238	EML Pu-02 Modified	-2.11E-02	3.38E-02	3.38E-02	1.06E-01	U	pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	5.63E+00	1.80E-01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	5.93E+00	7.24E-01	9.21E-01	8.31E-02		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	-1.47E-02	3.81E-02	3.82E-02	1.28E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	-3.56E-03	4.03E-02	4.03E-02	1.23E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	3.60E-02	6.36E-02	6.37E-02	1.15E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	0.00E+00	4.43E-02	4.43E-02	9.58E-02	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	0.00E+00	6.21E-02	6.21E-02	1.34E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	-3.32E-03	3.89E-02	3.89E-02	8.16E-02	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	1.72E-02	5.27E-02	5.27E-02	1.25E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	4.02E-02	8.70E-02	8.71E-02	1.72E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	-5.12E-03	5.98E-02	5.98E-02	1.26E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	1.88E-02	4.51E-02	4.51E-02	9.45E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/30/2020	20-04072	Plutonium-239/240	EML Pu-02 Modified	1.02E-02	3.11E-02	3.11E-02	7.38E-02	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 20-04072
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	2.83E+02	1.30E+01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	3.08E+02	8.37E+00	2.64E+01	7.08E+00		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	-1.57E+00	4.81E+00	4.81E+00	8.28E+00	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	-1.14E+00	5.83E+00	5.84E+00	1.00E+01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	1.51E+00	5.85E+00	5.85E+00	9.95E+00	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	9.59E-01	3.72E+00	3.72E+00	6.33E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	-1.47E+00	7.51E+00	7.52E+00	1.29E+01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	2.44E+00	7.59E+00	7.59E+00	1.29E+01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	7.81E+00	9.44E+00	9.46E+00	1.59E+01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	-8.68E+00	1.01E+01	1.01E+01	1.76E+01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	-1.04E+00	8.03E+00	8.03E+00	1.38E+01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	-7.34E-01	5.65E+00	5.65E+00	9.68E+00	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	5/1/2020	20-04072	Plutonium-241	EML Pu-02 Modified	-4.80E+00	4.25E+00	4.27E+00	7.44E+00	U	pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.01E+03	2.22E+01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.04E+03	5.96E+00	1.04E+02	1.42E+00		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	2.58E-01	8.27E-01	8.28E-01	1.41E+00	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.00E+00	6.85E-01	6.92E-01	1.14E+00	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.79E+00	7.12E-01	7.34E-01	1.16E+00		pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.49E+00	6.88E-01	7.04E-01	1.13E+00		pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	2.07E+00	6.99E-01	7.28E-01	1.13E+00		pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.29E+00	7.36E-01	7.47E-01	1.21E+00		pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	9.57E-01	5.63E-01	5.71E-01	9.30E-01		pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.71E+00	6.65E-01	6.87E-01	1.08E+00		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.46E+00	6.40E-01	6.56E-01	1.04E+00		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.73E+00	7.60E-01	7.80E-01	1.24E+00		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	5/1/2020	20-04072	Technetium-99	ElChroM TCS01 Modified	1.17E+00	5.13E-01	5.26E-01	8.38E-01		pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 20-04072
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	5.02E+01	2.81E-01				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	5.18E+01	1.42E+00	1.81E+01	6.90E-01		pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	1.96E-02	2.87E-02	2.95E-02	5.93E-02	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	-5.27E-03	3.58E-02	3.58E-02	7.73E-02	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	9.38E-03	3.70E-02	3.72E-02	7.85E-02	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	4.13E-02	2.90E-02	3.23E-02	5.70E-02	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	2.48E-02	3.32E-02	3.43E-02	6.82E-02	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	-8.90E-04	3.25E-02	3.25E-02	6.96E-02	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	-2.77E-02	2.69E-02	2.86E-02	6.12E-02	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	3.48E-03	2.83E-02	2.83E-02	6.04E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	-9.40E-03	3.41E-02	3.42E-02	7.39E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	-2.56E-02	3.76E-02	3.86E-02	8.28E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/29/2020	20-04072	Strontium-90	ElChroM SRW01 Modified	2.42E-02	3.09E-02	3.20E-02	6.34E-02	U	pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	2.62E+02	1.02E+01				pCi/g
20-04072-01	LCS	KNOWN	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	1.94E+02	7.96E+00				pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	2.37E+02	1.45E+01	1.89E+01	2.39E+00		pCi/g
20-04072-01	LCS	SPIKE	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	1.56E+02	1.37E+01	1.59E+01	1.57E+00		pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 20-04072
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	-1.34E-02	7.02E-02	7.02E-02	1.12E-01	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	-1.07E-02	3.23E-02	3.23E-02	3.11E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	-1.49E-02	3.36E-02	3.36E-02	3.93E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	-1.14E-02	6.22E-02	6.22E-02	9.39E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	5.05E-03	2.55E-02	2.55E-02	4.40E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	2.32E-03	2.89E-02	2.89E-02	3.62E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	1.42E-02	2.86E-02	2.87E-02	5.01E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	7.98E-02	7.05E-02	7.06E-02	9.37E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	1.97E-02	6.70E-02	6.70E-02	4.51E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	9.34E-03	4.73E-02	4.73E-02	6.30E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	3.65E-02	4.29E-02	4.29E-02	3.72E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	-2.51E-03	5.23E-02	5.23E-02	7.37E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	3.19E-01	2.51E-01	2.52E-01	5.75E-01	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	7.72E-03	2.13E-02	2.13E-02	3.63E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	-6.89E-03	2.12E-02	2.12E-02	3.08E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	1.50E-02	2.37E-02	2.37E-02	3.65E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	3.17E-01	4.58E-01	4.58E-01	6.69E-01	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	2.73E-02	4.45E-02	4.45E-02	6.52E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	2.00E-02	5.02E-02	5.02E-02	7.53E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	3.32E-02	6.87E-02	6.87E-02	9.40E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	-1.14E-02	6.22E-02	6.22E-02	9.39E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	1.99E-02	4.96E-02	4.96E-02	9.23E-02	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	7.38E-01	4.14E-01	4.15E-01	6.72E-01	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	8.23E-02	6.42E-02	6.44E-02	1.28E-01	U	pCi/g
20-04072-02	MBL	BLANK	04/25/20 00:00	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	8.75E-02	1.50E-01	1.50E-01	2.15E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 20-04072
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	3.56E-01	2.24E-01	2.24E-01	5.24E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	1.25E-02	4.64E-02	4.64E-02	7.07E-02	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	1.50E-03	2.56E-02	2.57E-02	1.41E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	3.97E-01	1.88E-01	1.89E-01	2.74E-01		pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	3.90E-02	8.20E-02	8.21E-02	1.20E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	-2.78E-01	1.81E-01	1.82E-01	1.76E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	-3.81E-03	5.23E-02	5.23E-02	8.14E-02	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	-2.06E-01	2.83E-01	2.83E-01	2.37E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	1.01E-01	1.56E-01	1.56E-01	1.24E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	1.92E-01	9.66E-02	9.71E-02	2.57E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	7.09E-02	4.66E-02	4.67E-02	9.07E-02	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	-9.48E-02	1.40E-01	1.40E-01	2.12E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	5.33E+00	1.33E+00	1.36E+00	1.17E+00		pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	-1.27E-01	2.81E-01	2.81E-01	4.02E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	4.05E-03	4.95E-02	4.95E-02	8.09E-02	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	3.53E-02	3.29E-02	3.30E-02	7.25E-02	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	7.39E-01	1.03E+00	1.03E+00	1.73E+00	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	3.69E-01	1.43E-01	1.44E-01	2.13E-01		pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	4.16E-01	1.57E-01	1.59E-01	2.60E-01		pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	2.20E-02	1.30E-01	1.30E-01	2.16E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	3.97E-01	1.88E-01	1.89E-01	2.74E-01		pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	1.79E-02	7.68E-02	7.68E-02	3.30E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	2.06E+00	9.35E-01	9.41E-01	1.65E+00	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	2.57E-01	1.41E-01	1.42E-01	2.77E-01	U	pCi/g
20-04072-03	DUP	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	9.50E-02	2.66E-01	2.66E-01	4.10E-01	U	pCi/g

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Final Report of Analysis

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2701 Deborah Ave
Zion, IL 60099

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SDG: 20-04072
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	4.58E-01	1.84E-01	1.86E-01	5.56E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	9.84E-03	3.48E-02	3.48E-02	6.21E-02	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	-1.08E-01	1.24E-01	1.25E-01	1.25E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	3.95E-01	1.24E-01	1.26E-01	2.81E-01		pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	1.48E-02	5.69E-02	5.69E-02	1.08E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	4.12E-02	6.30E-02	6.31E-02	1.57E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	1.37E-01	8.16E-02	8.19E-02	1.23E-01		pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	-4.18E-01	2.79E-01	2.80E-01	2.32E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	-3.08E-02	1.08E-01	1.08E-01	1.23E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	1.47E-01	1.48E-01	1.48E-01	2.41E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	2.05E-02	9.15E-02	9.15E-02	8.70E-02	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	-1.46E-02	1.39E-01	1.39E-01	2.25E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	5.71E+00	1.33E+00	1.36E+00	1.03E+00		pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	-3.94E-02	2.94E-01	2.94E-01	3.94E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	1.65E-02	5.15E-02	5.15E-02	8.71E-02	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	-6.70E-03	5.79E-02	5.79E-02	7.05E-02	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	1.52E+00	1.36E+00	1.36E+00	2.25E+00	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	3.09E-01	1.09E-01	1.10E-01	2.26E-01		pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	4.22E-01	1.26E-01	1.28E-01	3.22E-01		pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	5.31E-02	1.32E-01	1.33E-01	2.22E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	3.95E-01	1.24E-01	1.26E-01	2.81E-01		pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	1.54E-01	1.81E-01	1.81E-01	3.19E-01	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	1.20E+00	1.43E+00	1.43E+00	2.40E+00	U	pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	3.67E-01	1.71E-01	1.72E-01	2.42E-01		pCi/g
20-04072-04	DO	B1-06202A-FSWC-040-CV	06/18/18 10:30	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	8.27E-02	2.71E-01	2.71E-01	4.15E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	20-04072
Purchase Order:	677116
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	-1.27E-01	1.49E-01	1.49E-01	8.49E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	3.17E-02	1.22E-01	1.22E-01	1.39E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	1.07E-02	6.60E-02	6.60E-02	2.75E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	7.03E-01	2.65E-01	2.67E-01	2.56E-01		pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	-5.41E-02	1.85E-01	1.85E-01	2.88E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	-4.09E-02	9.97E-02	9.97E-02	3.59E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	2.89E-03	1.48E-01	1.48E-01	2.07E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	-3.69E-01	5.24E-01	5.25E-01	3.08E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	-3.41E-01	4.60E-01	4.60E-01	1.72E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	2.44E-01	2.07E-01	2.08E-01	3.25E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	-3.48E-02	1.83E-01	1.83E-01	1.39E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	2.86E-02	2.40E-01	2.40E-01	3.60E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	6.45E+00	1.84E+00	1.87E+00	8.62E-01		pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	4.62E-01	4.28E-01	4.28E-01	8.84E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	3.42E-02	1.02E-01	1.02E-01	1.37E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	2.32E-02	1.21E-01	1.21E-01	1.79E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	1.38E+00	1.56E+00	1.56E+00	2.45E+00	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	7.02E-01	2.39E-01	2.42E-01	3.38E-01		pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	5.56E-01	2.39E-01	2.41E-01	4.17E-01		pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	-2.11E-01	2.32E-01	2.32E-01	3.16E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	7.03E-01	2.65E-01	2.67E-01	2.56E-01		pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	4.16E-01	4.52E-01	4.52E-01	7.29E-01	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	2.43E+00	1.33E+00	1.33E+00	2.19E+00	U	pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	4.50E-01	2.41E-01	2.42E-01	4.10E-01		pCi/g
20-04072-05	TRG	B1-06214A-FSFC-001-CV	05/05/18 15:15	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	5.84E-01	4.01E-01	4.02E-01	6.81E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Gerald Wood	SDG:	20-04072
Zion Solutions	Purchase Order:	677116
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	7.82E-01	8.24E-01	8.25E-01	1.38E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	-7.38E-02	2.77E-01	2.77E-01	2.37E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	2.93E-01	5.75E-01	5.76E-01	7.52E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	1.34E+00	4.57E-01	4.62E-01	3.37E-01		pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	-5.83E-01	5.59E-01	5.60E-01	7.34E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	4.82E-01	1.88E+00	1.88E+00	3.99E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	1.15E-01	2.37E-01	2.37E-01	3.78E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	2.89E-01	8.81E-01	8.81E-01	9.93E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	4.41E-01	9.70E-01	9.70E-01	6.53E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	6.54E-02	1.28E+00	1.28E+00	1.85E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	3.81E-01	2.78E-01	2.79E-01	3.12E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	2.64E-01	6.11E-01	6.11E-01	9.18E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	8.56E+00	3.05E+00	3.08E+00	3.60E+00		pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	-1.66E+01	1.31E+02	1.31E+02	1.78E+02	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	6.50E-02	3.10E-01	3.10E-01	4.58E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	1.74E-02	1.98E-01	1.98E-01	2.70E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	4.33E+00	4.51E+00	4.51E+00	7.13E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	1.07E+00	4.84E-01	4.88E-01	7.40E-01		pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	1.33E+00	4.24E-01	4.30E-01	1.24E+00		pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	3.88E-01	6.81E-01	6.81E-01	1.06E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	1.34E+00	4.57E-01	4.62E-01	3.37E-01		pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	-1.51E+00	3.40E+00	3.40E+00	4.75E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	7.69E+00	3.52E+00	3.54E+00	5.86E+00	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	3.80E-01	6.33E-01	6.33E-01	9.84E-01	U	pCi/g
20-04072-06	TRG	B2-08101A-BJFC-007-CV 0 0-0 5	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	2.58E-01	1.08E+00	1.08E+00	1.65E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	20-04072
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Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	1.48E+00	6.73E-01	6.77E-01	1.21E+00		pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	-1.03E-01	1.41E-01	1.41E-01	2.06E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	8.29E-02	1.69E-01	1.69E-01	4.70E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	1.22E+00	6.96E-01	6.98E-01	1.08E+00		pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	1.19E-01	4.80E-01	4.80E-01	7.55E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	0.00E+00	1.27E+00	1.27E+00	3.23E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	-1.22E-01	2.28E-01	2.28E-01	3.10E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	-2.32E-01	8.27E-01	8.27E-01	9.63E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	-1.58E-01	8.76E-01	8.76E-01	6.04E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	1.69E+00	1.08E+00	1.08E+00	1.65E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	8.14E-02	3.02E-01	3.02E-01	2.88E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	3.45E-01	3.43E-01	3.43E-01	5.53E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	1.15E+01	3.01E+00	3.07E+00	1.92E+00		pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	-1.12E+02	1.23E+02	1.23E+02	1.52E+02	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	3.27E-02	2.06E-01	2.06E-01	3.48E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	1.51E-01	1.20E-01	1.21E-01	2.46E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	3.88E+00	4.40E+00	4.40E+00	7.34E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	7.44E-01	2.85E-01	2.88E-01	7.47E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	9.94E-01	4.58E-01	4.61E-01	7.75E-01		pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	2.32E-01	5.73E-01	5.73E-01	7.98E-01	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	1.22E+00	6.96E-01	6.98E-01	1.08E+00		pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	1.05E+00	2.55E+00	2.55E+00	4.60E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	3.08E+00	3.34E+00	3.35E+00	4.83E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	3.96E-01	6.22E-01	6.22E-01	1.04E+00	U	pCi/g
20-04072-07	TRG	B2-08101A-BJFC-007-CV 0 5-1 0	05/09/12 14:22	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	1.48E-01	9.48E-01	9.48E-01	1.30E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-04072**
Purchase Order:	677116
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	1.89E+00	1.33E+00	1.34E+00	2.70E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	-1.60E-01	3.91E-01	3.91E-01	4.55E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	1.34E-01	2.59E-01	2.59E-01	9.98E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	1.31E+00	6.33E-01	6.36E-01	9.56E-01		pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	-8.17E-01	1.52E+00	1.52E+00	1.60E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	-5.14E+00	6.77E+00	6.77E+00	7.60E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	8.97E-02	4.50E-01	4.50E-01	6.93E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	-1.78E+00	2.31E+00	2.31E+00	1.19E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	-2.01E-01	1.86E+00	1.86E+00	8.00E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	4.58E-01	1.26E+00	1.26E+00	1.94E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	3.42E-01	5.13E-01	5.13E-01	3.33E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	-1.99E-02	7.20E-01	7.20E-01	1.08E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	6.63E+00	4.17E+00	4.18E+00	5.44E+00		pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	-2.99E+01	2.03E+02	2.03E+02	3.28E+02	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	-2.37E-01	5.55E-01	5.55E-01	7.95E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	2.62E-01	3.39E-01	3.39E-01	5.03E-01	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	6.20E+00	4.99E+00	5.00E+00	8.26E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	8.14E-01	3.71E-01	3.73E-01	1.02E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	1.25E+00	7.13E-01	7.16E-01	1.26E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	-2.10E-01	7.80E-01	7.80E-01	1.14E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	1.31E+00	6.33E-01	6.36E-01	9.56E-01		pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	-2.89E-01	6.44E+00	6.44E+00	9.17E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	7.28E+00	4.18E+00	4.20E+00	6.66E+00		pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	5.36E-01	9.57E-01	9.58E-01	1.57E+00	U	pCi/g
20-04072-08	TRG	B2-08201-CJWC-A018-CV 0 0-0 5	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	7.87E-01	1.10E+00	1.10E+00	1.81E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG: **20-04072**
Purchase Order: 677116
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	-2.94E-01	8.38E-01	8.38E-01	1.11E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	1.31E-01	1.19E-01	1.19E-01	2.29E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	-5.55E-02	1.21E-01	1.21E-01	6.16E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	9.88E-01	4.95E-01	4.98E-01	8.46E-01		pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	6.65E-02	1.81E-01	1.81E-01	8.74E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	0.00E+00	1.33E+00	1.33E+00	4.46E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	2.52E-01	2.28E-01	2.28E-01	4.02E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	8.30E-02	6.27E-01	6.27E-01	1.02E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	4.39E-01	8.07E-01	8.07E-01	6.61E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	-8.71E-02	1.16E+00	1.16E+00	1.69E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	2.90E-02	3.43E-01	3.43E-01	2.93E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	-3.76E-01	5.87E-01	5.87E-01	8.14E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	8.11E+00	3.11E+00	3.14E+00	3.93E+00		pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	-5.06E+01	1.56E+02	1.56E+02	1.90E+02	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	-8.88E-02	3.31E-01	3.31E-01	4.46E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	-7.09E-02	2.12E-01	2.12E-01	2.82E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	4.42E+00	3.86E+00	3.87E+00	6.32E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	3.96E-01	3.85E-01	3.86E-01	6.35E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	9.67E-01	4.55E-01	4.57E-01	9.06E-01		pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	9.01E-02	6.14E-01	6.14E-01	9.28E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	9.88E-01	4.95E-01	4.98E-01	8.46E-01		pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	-1.17E+00	3.21E+00	3.21E+00	4.56E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	5.06E+00	3.29E+00	3.30E+00	5.36E+00	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	7.44E-01	5.68E-01	5.69E-01	9.58E-01	U	pCi/g
20-04072-09	TRG	B2-08201-CJWC-A018-CV 0 5-1 0	05/10/12 12:56	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	1.69E-01	9.78E-01	9.78E-01	1.49E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	
Gerald Wood	
Zion Solutions	
2701 Deborah Ave	
Zion, IL 60099	

Work Order Details:	
SDG:	20-04072
Purchase Order:	677116
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	2.05E-01	8.86E-02	8.92E-02	1.84E-01		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	2.26E-02	1.67E-02	1.67E-02	3.00E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	4.61E-03	3.41E-02	3.41E-02	4.72E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	1.82E-01	4.48E-02	4.58E-02	1.49E-01		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	2.65E-01	3.39E-02	3.65E-02	4.51E-02		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	-1.57E-01	4.61E-02	4.68E-02	3.57E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	2.18E+00	2.50E-01	2.74E-01	5.19E-02		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	1.33E-02	6.46E-02	6.46E-02	7.87E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	4.61E-02	5.72E-02	5.72E-02	4.12E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	-8.47E-03	4.60E-02	4.60E-02	6.57E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	5.79E-03	2.77E-02	2.77E-02	2.78E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	9.89E-03	2.49E-02	2.49E-02	7.80E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	5.09E+00	6.51E-01	7.02E-01	4.74E-01		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	7.01E-03	3.94E-02	3.94E-02	5.91E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	-1.32E-02	1.69E-02	1.69E-02	2.01E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	2.40E-02	1.67E-02	1.68E-02	2.53E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	4.98E-01	4.11E-01	4.12E-01	6.82E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	2.12E-01	5.56E-02	5.66E-02	7.94E-02		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	2.10E-01	5.98E-02	6.07E-02	1.09E-01		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	-4.66E-02	4.65E-02	4.66E-02	7.14E-02	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	1.82E-01	4.48E-02	4.58E-02	1.49E-01		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	3.80E-02	7.98E-02	7.99E-02	1.18E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	8.17E-01	2.93E-01	2.96E-01	4.86E-01	U	pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	1.80E-01	5.83E-02	5.91E-02	9.63E-02		pCi/g
20-04072-10	TRG	L2-10214C-RJGS-001-SM-A	05/07/19 07:45	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	1.17E-01	1.05E-01	1.05E-01	1.57E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Gerald Wood	SDG:	20-04072
Zion Solutions	Purchase Order:	677116
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	1.11E+00	2.50E-01	2.57E-01	4.54E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	2.57E-03	4.71E-02	4.71E-02	7.80E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	8.15E-03	2.98E-02	2.98E-02	1.50E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	1.24E+00	1.90E-01	2.00E-01	2.55E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	9.43E-02	7.75E-02	7.76E-02	1.18E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	4.83E-02	5.80E-02	5.81E-02	1.47E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	1.47E-01	8.15E-02	8.18E-02	1.31E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	-2.05E-03	1.31E-01	1.31E-01	2.52E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	-1.19E-01	2.01E-01	2.01E-01	1.31E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	1.01E+00	1.84E-01	1.91E-01	2.67E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	2.38E-01	8.51E-02	8.60E-02	1.38E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	-1.11E-01	2.16E-01	2.17E-01	3.07E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	2.59E+01	2.65E+00	2.96E+00	1.93E+00		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	1.33E-01	1.23E-01	1.23E-01	1.76E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	1.49E-02	6.62E-02	6.62E-02	9.11E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	2.92E-02	6.45E-02	6.45E-02	9.12E-02	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	2.40E+00	1.43E+00	1.43E+00	2.34E+00		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	1.15E+00	1.89E-01	1.98E-01	2.88E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	1.35E+00	2.32E-01	2.42E-01	3.27E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	4.47E-02	1.81E-01	1.81E-01	2.63E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	1.24E+00	1.90E-01	2.00E-01	2.55E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	-1.85E-01	1.95E-01	1.96E-01	2.67E-01	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	6.92E+00	1.33E+00	1.37E+00	1.97E+00	U	pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	9.01E-01	1.88E-01	1.93E-01	3.50E-01		pCi/g
20-04072-11	TRG	L1-12109L-CJGS-001-SB-A	08/21/19 10:25	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	5.96E-01	3.59E-01	3.60E-01	5.40E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Gerald Wood		SDG:	20-04072
Zion Solutions		Purchase Order:	677116
2701 Deborah Ave		Analysis Category:	ENVIRONMENTAL
Zion, IL 60099		Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Actinium-228	EPA 901.1 Modified	5.36E-01	1.52E-01	1.54E-01	3.38E-01		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Silver-108m	EPA 901.1 Modified	4.17E-03	2.76E-02	2.76E-02	4.45E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Barium-133	EPA 901.1 Modified	-3.19E-01	1.03E-01	1.05E-01	6.63E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Bismuth-214	EPA 901.1 Modified	6.70E-01	1.24E-01	1.29E-01	1.96E-01		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Cobalt-60	EPA 901.1 Modified	2.89E-02	5.38E-02	5.38E-02	7.28E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Cesium-134	EPA 901.1 Modified	1.56E-02	3.25E-02	3.25E-02	7.48E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Cesium-137	EPA 901.1 Modified	1.92E-01	6.43E-02	6.50E-02	9.63E-02		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Europium-152	EPA 901.1 Modified	1.34E-01	1.31E-01	1.31E-01	1.51E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Europium-154	EPA 901.1 Modified	1.57E-02	1.25E-01	1.25E-01	7.86E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Europium-155	EPA 901.1 Modified	6.02E-02	6.89E-02	6.90E-02	1.15E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Holmium-166m	EPA 901.1 Modified	6.21E-02	6.76E-02	6.77E-02	9.36E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Iodine-129	EPA 901.1 Modified	9.17E-02	8.74E-02	8.76E-02	1.23E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Potassium-40	EPA 901.1 Modified	1.95E+01	2.02E+00	2.25E+00	1.14E+00		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Manganese-54	EPA 901.1 Modified	3.61E-02	7.05E-02	7.05E-02	1.09E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Molybdenum-93	EPA 901.1 Modified	1.21E-02	2.17E-02	2.17E-02	5.50E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Niobium-94	EPA 901.1 Modified	-3.10E-03	4.05E-02	4.05E-02	5.95E-02	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Lead-210	EPA 901.1 Modified	1.41E+00	1.05E+00	1.06E+00	1.75E+00	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Lead-212	EPA 901.1 Modified	4.37E-01	9.77E-02	1.00E-01	1.33E-01		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Lead-214	EPA 901.1 Modified	6.06E-01	1.21E-01	1.25E-01	2.08E-01		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Promethium-145	EPA 901.1 Modified	-2.10E-01	1.25E-01	1.25E-01	1.45E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Radium-226	EPA 901.1 Modified	6.70E-01	1.24E-01	1.29E-01	1.96E-01		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Antimony-125	EPA 901.1 Modified	3.25E-02	1.02E-01	1.03E-01	1.69E-01	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Thorium-234	EPA 901.1 Modified	1.10E+00	7.84E-01	7.86E-01	1.30E+00	U	pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Thallium-208	EPA 901.1 Modified	5.15E-01	1.24E-01	1.26E-01	2.10E-01		pCi/g
20-04072-12	TRG	L1-12106L-CJGS-001-SB-A	08/14/19 13:30	4/25/2020	4/27/2020	20-04072	Uranium-235	EPA 901.1 Modified	-1.06E-01	2.46E-01	2.46E-01	3.09E-01	U	pCi/g

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

ZION SOLUTIONS LLC
An EnergySolutions Company

ZS-WM-131
Revision 0
Information Use

20-04072

REC'D APR 25 2020

Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
B2-06207C-JFCCV-002- 0.0-0.5	NA	NA	Concrete	120.18	gm	Plastic bag	1	11-19-2012	1045	FULL SUITE and 5 ROC	NA	NA
B2-06207C-JFCCV-002- 0.5-1.0	NA	NA	Concrete	129.04	gm	Plastic bag	1	11-19-2012	1045	FULL SUITE and 5 ROC	NA	NA
B2-06104C-JFCCV-003- 0.5-1.0	NA	NA	Concrete	115.89	gm	Plastic bag	1	11-12-2012	1008	FULL SUITE and 5 ROC	NA	NA
B2-06104C-JFCCV-003- 1.0-1.5	NA	NA	Concrete	118.77	gm	Plastic bag	1	11-12-2012	1008	FULL SUITE and 5 ROC	NA	NA
B1-06201A-FSFC-009-CV	NA	NA	Concrete	298.87	gm	Plastic bag	1	06-07-2018	1130	FULL SUITE and 5 ROC	NA	NA
B1-06201A-FSWC-041-CV	NA	NA	Concrete	231.42	gm	Plastic bag	1	06-18-2018	0900	FULL SUITE and 5 ROC	NA	NA
B1-06201A-FSWC-050-CV	NA	NA	Concrete	259.58	gm	Plastic bag	1	06-07-2018	1300	FULL SUITE and 5 ROC	NA	NA
B1-06202A-FSFC-028-CV	NA	NA	Concrete	244.20	gm	Plastic bag	1	06-18-2018	1450	FULL SUITE and 5 ROC	NA	NA
B1-06202A-FSWC-033CV	NA	NA	Concrete	274.50	gm	Plastic bag	1	06-18-2018	1344	FULL SUITE and 5 ROC	NA	NA
B1-06202A-FSWC-040-CV	NA	NA	Concrete	389.08	gm	Plastic bag	1	06-18-2018	1030	FULL SUITE and 5 ROC	NA	NA
B1-06214A-FSFC-001-CV	NA	NA	Concrete	298.3	gm	Plastic bag	1	05-05-2018	1515	FULL SUITE and 5 ROC	NA	NA

4
5

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
1.1. **Eberline Labs**	NA	**NA**	**NA**	Fed Ex Priority Overnight 8132 0229 0060

	Relinquished by:	Date:	Time:	Received by:	Date:	Time:
1	Vicky M. Baldwin	04/24/2020	1145	Richard F. Rickert	04/24/2020	1145
2	Richard F. Rickert	04/24/2020	1600	Fed Ex Priority Overnight	04/24/2020	1600
3	Fed Ex	4/25/20	9:10 am	E. Towery	4/25/20	910am

Comments

FULL SUITE and 5 ROC EXPEDITE

ZION SOLUTIONS LLC
An EnergySolutions Company

20-04072
REC'D APR 25 2020

Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
6 B2-08101A-BJFC-007-CV 0.0-0.5	NA	NA	Concrete	120.18	gms	Plastic	1	05-09-2012	1422	FULL SUITE and 5 ROC	NA	NA
7 B2-08101A-BJFC-007-CV 0.5-1.0	NA	NA	Concrete	175.02	gms	Plastic	1	05-09-2012	1422	FULL SUITE and 5 ROC	NA	NA
8 B2-08201-CJWC-A018-CV 0.0-0.5	NA	NA	Concrete	123.37	gms	Plastic	1	05-10-2012	1256	FULL SUITE and 5 ROC	NA	NA
9 B2-08201-CJWC-A018-CV 0.5-1.0	NA	NA	Concrete	132.37	gms	Plastic	1	05-10-2012	1256	FULL SUITE and 5 ROC	NA	NA
10 L2-10214C-RJGS-001-SM-A	NA	NA	Sediment	561.53	gms	Marinelli	1	05-07-2019	0745	FULL SUITE and 5 ROC	NA	NA
11 L1-12109L-CJGS-001-SB-A	NA	NA	Soil	145.65	gms	Marinelli	1	08-21-2019	1025	FULL SUITE and 5 ROC	NA	NA
12 L1-12106L-CJGS-001-SB-A	NA	NA	Soil	174.32	gms	Marinelli	1	08-14-2019	1330	FULL SUITE and 5 ROC	NA	NA

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
1.1. **Eberline Labs**	NA	**NA**	**NA**	Fed Ex Priority Overnight 8132 0229 0060

Relinquished by: Vicky Baldwin	Date: 04/24/2020	Time: 1145	Received by: Richard F. Rickert	Date: 04/24/2020	Time: 1145
Relinquished by: Richard F. Rickert	Date: 04/24/2020	Time: 1600	Received by: Fed Ex Priority Overnight	Date: 04/24/2020	Time: 1600
Relinquished by: Fed Ex	Date: 4/25/20	Time: 9:10am	Received by: E Towery	Date: 4/25/20	Time: 9:10am

Comments

FULL SUITE and 5 ROC **EXPEDITE**