






**LA CROSSE BOILING WATER REACTOR
FINAL STATUS SURVEY RELEASE RECORD**

**WASTE TREATMENT BUILDING EXCAVATION
SURVEY UNIT L1-010-101C**



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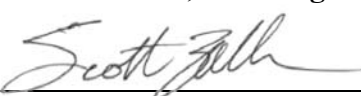
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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
CR	Condition Report
DQA	Data Quality Assessment
DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
DCGL _s	Soil Derived Concentration Guideline Level
FSS	Final Status Survey
GPS	Global Positioning System
HPSW	High Pressure Service Water
HSA	Historical Site Assessment
IC	Insignificant Contributors
LACBWR	La Crosse Boiling Water Reactor
LBGR	Lower Bound of the Gray Region
LPSW	Low Pressure Service Water
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
NaI	Sodium Iodide
OpDCGL _s	Soil Operational Derived Concentration Guideline Level
QAPP	Quality Assurance Project Plan
QC	Quality Control
RASS	Remedial Action Support Survey
ROC	Radionuclides of Concern
SOF	Sum-of-Fraction
TEDE	Total Effective Dose Equivalent
UBGR	Upper Bound of the Gray Region
UCL	Upper Confidence Limit

WTB Waste Treatment Building

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for survey unit L1-010-101C, the Waste Treatment Building (WTB) excavation, has been generated in accordance with LaCrosseSolutions procedure LC-FS-PR-009, *Final Status Survey Data Reporting* (Reference 1) and satisfies the requirements of Section 5.11 of the *La Crosse Boiling Water Reactor License Termination Plan* (LTP) (Reference 2).

An FSS sample plan for this survey unit was developed in accordance with LaCrosseSolutions procedure LC-FS-PR-002, *Final Status Survey Package Development* (Reference 3), the LACBWR LTP, and with guidance from NUREG-1575, Revision 1, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (Reference 4).

This survey unit has a MARSSIM classification of 1. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. As a systematic sample population, fifteen (15) soil samples were acquired from the survey unit. In addition, soil scanning was performed on 100% of the total surface area in the survey unit. The analytical results for all soil samples taken in survey unit L1-010-101C indicate that the maximum Sum-of-Fraction (SOF), considering the concentration of all applicable Radionuclides of Concern (ROC) either by direct measurement or by inference, is equal to 0.1033 when applying the respective Operational Derived Concentration Guideline Levels (OpDCGLs) for soil. Therefore, the null hypothesis is rejected and survey unit L1-010-101C is acceptable for unrestricted release. The mean SOF when applying the respective Base Case DCGLs (DCGLs) for soil is 0.0144. This SOF equates to a dose for the survey unit of 0.3597 mrem/yr.

2. SURVEY UNIT DESCRIPTION

L1-010-101C is an impacted Class 1 excavation survey unit within open land survey unit L1-010-101. The survey unit consists of the underlying soil post-removal of the WTB. The surface area of the survey unit is 87.8 m².

The boundary of the survey unit and the location of the soil samples were defined using a Global Positioning System (GPS). Refer to Attachment 1 of this report for figures and maps depicting survey unit L1-010-101C.

3. CLASSIFICATION BASIS

Based on the Historical Site Assessment (HSA) (Reference 5), survey unit L1-010-101 was identified as a Class 1 area. As survey unit L1-010-101C consists of the underlying soils

from L1-010-101, it is also designated as Class 1. The following summarizes the results of the characterization surveys for survey unit L1-010-101.

The initial site characterization surveys performed by EnergySolutions were conducted between October 9, 2014, and August 6, 2015. In total, twelve (12) surface soil samples and eighteen (18) subsurface soil samples were collected in the survey unit. All samples were analyzed by the on-site gamma spectroscopy system. For surface soil samples, Cs-137 was detected at concentrations above Minimum Detectable Concentration (MDC) in all twelve (12) samples, at a maximum concentration of 1.07E+00 pCi/g, and Co-60 was detected at concentrations above MDC in two (2) samples, at a maximum concentration of 2.87E-01 pCi/g. For subsurface soil samples, Cs-137 was detected at concentrations above MDC in eight (8) of the samples, at a maximum concentration of 1.61E-01 pCi/g. Co-60 was not detected at concentrations above MDC for subsurface soil samples. A summary of the analyses for the surface soil and subsurface soil samples taken during site characterization are presented in Table 3-1.

Table 3-1 - Statistical Quantities for Cs-137 and Co-60 from the Characterization Survey

Surface Soil	Co-60	Cs-137
# of Samples	12	
# >MDC	2	12
Mean (pCi/g)	8.00E-02	2.15E-01
Median (pCi/g)	5.80E-02	1.00E-01
Max (pCi/g)	2.87E-01	1.07E+00
Min (pCi/g)	4.80E-02	3.20E-02
Standard Deviation (pCi/g)	6.60E-02	2.96E-01
Subsurface Soil	Co-60	Cs-137
# of Samples	18	
# >MDC	0	8
Mean (pCi/g)	7.80E-02	6.60E-02
Median (pCi/g)	5.20E-02	5.40E-02
Max (pCi/g)	5.16E-01	1.61E-01
Min (pCi/g)	4.70E-02	3.30E-02
Standard Deviation (pCi/g)	1.09E-01	3.50E-02

Five (5) surface soil samples and two (2) subsurface soil samples from characterization were sent to Test America Laboratories for off-site analysis. A summary of the off-site analyses is presented in Table 3-2.

Table 3-2 – Summary of Off-site Analysis for Characterization Samples (pCi/g)

Radionuclide	L1010101- CJ-GS- 002-SS	L1010101- CJ-GS- 009-SS	L1010101- CJ-GS- 010-SS	L1010101- QJ-GS- 001-SB	L1010101- QJ-GS- 001-SS	L1010101- QJ-GS- 002-SB	L1010101- QJ-GS- 002-SS
H-3				3.64E-01	4.41E-01	3.77E-01	1.38E+00
C-14				8.96E-01	6.76E-01	6.79E-01	6.77E-01
Fe-55				2.43E+00	2.19E+00	2.15E+00	4.19E+00
Ni-59				1.85E+00	1.90E+00	1.75E+00	2.01E+00
Co-60	2.40E-02	4.00E-02	2.86E-01	2.40E-02	1.80E-02	1.70E-02	1.50E-02
Ni-63				3.04E+00	3.04E+00	2.93E+00	3.32E+00
Sr-90				3.35E-01	4.40E-01	3.38E-01	3.57E-01
Nb-94	2.00E-02	2.00E-02	2.50E-02	1.50E-02	1.20E-02	1.10E-02	1.00E-02
Tc-99				5.79E-01	5.87E-01	6.20E-01	5.21E-01
Cs-137	2.33E-01	1.85E-01	4.13E-01	2.00E-02	1.47E-01	1.49E-01	5.90E-02
Pm-147				8.00E-01	3.17E+00	7.72E-01	9.78E-01
Eu-152	5.60E-02	5.60E-02	6.20E-02	5.00E-02	3.40E-02	4.00E-02	3.30E-02
Eu-154	1.61E-01	1.81E-01	2.47E-01	1.43E-01	1.12E-01	1.09E-01	9.60E-02
Eu-155	6.60E-02	5.00E-02	5.70E-02	4.40E-02	4.40E-02	4.00E-02	3.60E-02
Np-237				1.90E-02	6.00E-03	1.90E-02	1.60E-02
Pu-238				4.60E-02	3.90E-02	4.10E-02	4.00E-02
Pu-239/240				2.30E-02	2.30E-02	2.20E-02	1.60E-02
Pu-241				1.97E+00	1.83E+00	1.95E+00	2.09E+00
Am-241	5.80E-02	4.20E-02	5.10E-02	1.50E-02	1.60E-02	1.70E-02	2.00E-02
Am-243				2.30E-02	2.10E-02	2.90E-02	1.70E-02
Cm-243/244				2.10E-02	1.90E-02	1.40E-02	2.20E-02

Note: Bold values indicate concentration greater than MDC. Unbolded values indicate the MDC value. Blank cells indicate that a particular radionuclide was not included in the analysis.

Section 5.1 of the LTP states that the actual Insignificant Contributor (IC) dose will be calculated for each individual sample result using the DCGLs from TSD RS-TD-313196-004, *LACBWR Soil DCGL*, *Basement Concrete DCGL*, and *Buried Pipe DCGL*, Table 4 (Reference 6) for soil. If the IC dose calculated is less than the IC dose assigned for DCGL adjustment, then no further action will be taken. If the actual IC dose calculated from the sample result is greater than the IC dose assigned for DCGL adjustment, then a minimum of five (5) additional investigation samples will be taken around the original sample location. Each investigation sample will be analyzed by the on-site gamma spectroscopy system and sent for HTD analysis (full suite of radionuclides from LTP Table 5-1). As with the original sample, the actual IC dose will be calculated for each investigation sample. In this case, the actual calculated maximum IC dose from an individual sample observed in the survey unit will be used to readjust the DCGLs in that survey unit. If the maximum IC dose exceeds 10%, then the additional radionuclides that were the cause of the IC dose exceeding 10% will be added as additional ROC for that survey unit. The survey unit-specific DCGLs used for compliance, the ROC for that survey unit, and the survey data serving as the basis for the IC dose adjustment will be documented in the release record for the survey unit.

An assessment of the results of continuing characterization confirmed that the IC dose is unchanged (dose fraction less than 10%).

Based upon review of the historical information, the results of the characterization survey data, and completion of a final Survey Unit Classification Worksheet, the correct final classification of survey unit L1-010-101C was determined to be Class 1.

4. DATA QUALITY OBJECTIVES

Final Status Survey planning and design relies on a properly executed Data Quality Objective (DQO) process to ensure, through compliance with explicitly defined inputs and boundaries, that the primary objective of the survey is satisfied. The DQO process is described in the LACBWR LTP in accordance with MARSSIM. 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 L1-010-101C does not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

LaCrosseSolutions TSD RS-TD-313196-001, *Radionuclides of Concern during LACBWR Decommissioning* (Reference 7) established the basis for an initial suite of potential ROC for decommissioning. LTP Chapter 2 provides detailed characterization data that describes the results of surveys taken of soil. Surface and subsurface soil samples were taken in each impacted open land survey units and analyzed for the presence of plant-derived radionuclides. The results of surface and subsurface soil characterization in the impacted area surrounding LACBWR indicate that there is minimal residual radioactivity in soil.

Insignificant dose contributors were determined consistent with the guidance contained in Section 3.3 of NUREG-1757, Volume 2, Revision 1, *Consolidated Decommissioning Guidance – Characterization, Survey, and Determination of Radiological Criteria, Final Report* (Reference 8). In all soil and concrete scenarios, Cs-137, Co-60, Sr-90, Eu-152 and Eu-154 contribute nearly 100% of the total dose. The remaining radionuclides were designated as insignificant dose contributors and are eliminated from further detailed evaluation. Therefore, the final ROCs for LACBWR soil, basement concrete and buried piping are Cs-137, Co-60, Sr-90, Eu-152 and Eu-154.

LTP Chapter 6, Section 6.14.1 discusses the process used to derive the ROC for the decommissioning of LACBWR, including the elimination of IC from the initial suite. Table 4-1 presents the ROC for the decommissioning of soil at LACBWR and the normalized mixture fractions based on the radionuclide mixture.

Table 4-1 - Dose Significant Radionuclides and Mixture for Soil

Radionuclide	Fraction of Total Activity (normalized)⁽¹⁾
Co-60	0.064
Sr-90	0.098
Cs-137	0.829
Eu-152	0.005
Eu-154	0.003

(1) Based on maximum percent of total activity from Table 22 of RS-TD-313196-001, normalized to one for the dose significant radionuclides.

LTP, Section 5.2 states that each radionuclide-specific Base Case DCGL is equivalent to the level of residual radioactivity (above background levels) that could, when considered independently, result in a Total Effective Dose Equivalent (TEDE) of 25 mrem/yr to an Average Member of the Critical Group. To ensure that the summation of dose from each source term is 25 mrem/yr or less after all FSS is completed, the Base Case DCGLs are reduced based on an expected, or *a priori*, fraction of the 25 mrem/yr dose limit from each source term. The reduced DCGLs, or “Operational” DCGLs can be related to the Base Case DCGLs as an expected fraction of dose based on an *a priori* assessment of what the expected dose should be based on the results of site characterization, process knowledge, and the extent of planned remediation. The Operational DCGL is then used as the DCGL for the FSS design of the survey unit (calculation of surrogate DCGLs, investigations levels, etc.). Details of the Operational DCGLs derived for each dose component and the basis for the applied *a priori* dose fractions are provided in LC-FS-TSD-002, *Operational Derived Concentration Guideline Levels for Final Status Survey* (Reference 9).

The dose contribution from each ROC is accounted for using the SOF to ensure that the total dose from all ROC does not exceed the dose criterion. A Base Case DCGL that is established for the average residual radioactivity in a survey unit is equivalent to a DCGL_w. The DCGL_w can be multiplied by Area Factors to obtain a Base Case DCGL that represents the same dose to an individual for residual radioactivity over a smaller area within a survey unit.

At LACBWR, compliance is demonstrated through the summation of dose from five (5) distinct source terms for the end-state (basements, soils, buried pipe, above-ground structures, and groundwater). When applied to soil, the DCGLs are expressed in units of activity per unit of mass (pCi/g).

For LACBWR, soil is defined as a layer of soil beginning at the surface but extending to a depth of 1 m to allow for flexibility in compliance demonstration if contamination deeper than 0.15 m is encountered. Based on characterization data and historical information, there are no expectations of encountering a source term geometry that is comprised of a clean surface layer of soil over a contaminated subsurface soil layer. EnergySolutions TSD RS-TD-313196-004 and LTP Chapter 6, Sections 6.4 and 6.8 provide the exposure scenarios and modeling parameters that were used to calculate the site-specific soil DCGLs. The adjusted soil DCGLs for the unrestricted release of open land survey units as provided in Chapter 6, Section 6.16.1 are reproduced in Table 4-2. The insignificant dose contributor percentages for the most limiting basement scenario was used to adjust the DCGLs for soil to account for the dose from the eliminated insignificant contributor radionuclides.

Table 4-2 - Base Case DCGLs for Soil

Radionuclide	DCGLs (pCi/g)
Co-60	10.6
Sr-90	5470
Cs-137	48.3
Eu-152	23.6
Eu-154	21.9

The Operational DCGLs are then used as the DCGL for the FSS design of the survey unit (calculation of surrogate DCGLs, investigation levels, etc.). The OpDCGLs for the unrestricted release of soil are provided in Table 4-3.

Table 4-3 - Operational DCGLs for Soil

Radionuclide	OpDCGLs (pCi/g)
Co-60	3.83
Sr-90	1970.45
Cs-137	17.39
Eu-152	8.51
Eu-154	7.89

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest relative to the Operational DCGL. Survey instrument response checks were required prior to issuance and after the instrument had been used. Control and accountability of survey instruments was required to assure the quality and prevent the loss of data.

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

In accordance with the LTP, for laboratory analysis, MDCs less than 10% of the Operational DCGL were preferable while MDCs up to 50% of the Operational DCGL were acceptable.

The minimum acceptable MDC for measurements obtained using field instruments was 50% of the applicable Operational DCGL.

5. SURVEY DESIGN

The level of effort associated with planning a survey is based on the complexity of the survey and nature of the hazards. Guidance for preparing FSS plans is provided in procedure LC-FS-PR-002, *Final Status Survey Package Development*.

The DQO process validated that Co-60, Sr-90, Cs-137, Eu-152, and Eu-154 would be the ROC in survey unit L1-010-101C as presented in LTP Section 5.1. During the data analysis of the FSS results, concentrations for the HTD ROC Sr-90 are inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90. During characterization, both Sr-90 and Cs-137 was positively detected in all thirty (30) concrete core samples assessed in the Reactor Building, Tunnel, and WTB. The 95% Upper Confidence Limit (UCL) of the Cs-137 fractions was chosen to represent the overall nuclide mix for soils/buried pipe, the Reactor Building, and the Waste Gas Tank Vault. The surrogate ratio for soil is given in Table 5-1.

Table 5-1 – Soil Surrogate Ratio

Radionuclides	Ratio
Sr-90/Cs-137	0.502

The equation for calculating a surrogate DCGL is as follows:

Equation 1

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

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

$DCGL_{2,3,...n}$ = 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 4-3 and the ratio from Table 5-1, the following surrogate calculation was performed:

Equation 2

$$Surrogate_{DCGL(Cs-137)} = \frac{1}{\left[\left(\frac{1}{17.39_{(Cs-137)}}\right) + \left(\frac{0.502}{1970.45_{(Sr-90)}}\right)\right]} = 17.31 \text{ pCi/g}$$

The surrogate Operational DCGL that was used for Cs-137 in this survey unit for direct comparison of sample results to demonstrate compliance was 17.31 pCi/g.

The action levels for survey unit L1-010-101C are based on the Operational DCGL and are presented in Table 5-2.

Table 5-2 – Action Levels for Survey Unit L1-010-101C

ROC	Action Level (pCi/g)
Co-60	3.83 ⁽¹⁾
Cs-137	17.31 ⁽²⁾
Eu-152	8.51 ⁽¹⁾
Eu-154	7.89 ⁽¹⁾

- (1) Based on the Operational DCGL.
 (2) Based on the surrogate adjusted DCGL of 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 number of soil samples for FSS was determined in accordance with procedure LC-FS-PR-002. The relative shift (Δ/σ) for the survey unit data set is defined as shift (Δ), which is the Upper Boundary of the Gray Region (UBGR), or the DCGL (SOF of 1), minus the Lower Bound of the Gray Region (LBGR) (SOF of 0.5), divided by sigma (σ), which is the standard deviation of the data set used for survey design. The optimal value for Δ/σ should range between one (1) and three (3). The largest value the Δ/σ can have is three (3). If the Δ/σ exceeds three (3), then the value of three (3) will be used for Δ/σ . The Δ/σ for survey unit L1-010-101C, based on Cs-137 and Co-60 data for subsurface soil samples collected during characterization of L1-010-101, was calculated as follows:

Equation 3

$$\Delta/\sigma = 0.5/0.03 = 16.67$$

As the calculated relative shift (16.67) was greater than three (3), then a value of three (3) was used as the adjusted Δ/σ . Both the Type I error, or α value, and the Type II error, or β value, was set at 0.05. The sample size from Table 5.5 of MARSSIM that equates to the Type I and Type II error of 0.05 for use with the Sign Test is an N value of fourteen (14). One (1) additional systematic sample location was added during survey design, for a total sample size of fifteen (15) for use with the Sign Test.

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

As the survey unit was classified as Class 1, sample locations were selected based on a systematic triangular grid with a random starting point. The systematic locations of the soil samples were selected using Visual Sample Plan (VSP), in accordance with LC-FS-PR-002. Input parameters included use of aerial photographs and the GPS route of the boundary of the excavation. The systematic coordinates generated with VSP were integrated with a GPS to identify sample locations in the field. Table 5-3 lists the systematic samples collected for FSS and the corresponding GPS coordinates, based on the Wisconsin State Plan North American Datum 1983 coordinate system.

Table 5-3 – Systematic Sample Locations

Sample ID	Northing	Easting
L1-010-101-FSGS-C01-SB	570977.5477	1642217.5327
L1-010-101-FSGS-C02-SB	570981.5917	1642200.5415
L1-010-101-FSGS-C03-SB	570981.5917	1642209.0709
L1-010-101-FSGS-C04-SB	570981.5917	1642217.6004
L1-010-101-FSGS-C05-SB	570988.9784	1642196.2768
L1-010-101-FSGS-C06-SB	570988.9784	1642204.8062
L1-010-101-FSGS-C07-SB	570988.9784	1642213.3356
L1-010-101-FSGS-C08-SB	570988.9784	1642221.8651
L1-010-101-FSGS-C09-SB	570996.3651	1642200.5415
L1-010-101-FSGS-C10-SB	570996.3651	1642209.0709
L1-010-101-FSGS-C11-SB	570996.3651	1642217.6004
L1-010-101-FSGS-C12-SB	570996.3651	1642226.1298
L1-010-101-FSGS-C13-SB	571003.7518	1642204.8062
L1-010-101-FSGS-C14-SB	571003.7518	1642213.3356

Sample ID	Northing	Easting
L1-010-101-FSGS-C15-SB	571003.7518	1642221.8651

The LACBWR LTP Chapter 5, Section 5.1 states that soil samples will be collected during FSS to confirm the HTD to surrogate radionuclide ratio. Ten percent (10%) of the FSS samples collected from open land survey units (including excavations where major sub-grade structures previously resided) will be analyzed for HTD ROC. Only the HTD radionuclide included as ROC (Sr-90) will be analyzed in the FSS confirmatory samples. In addition, if any sample has a SOF of 10% of the Operational DCGL or more, it must be sent for HTD ROC analysis. For samples with positive results for both the HTD ROC and the corresponding surrogate radionuclide (Cs-137), the HTD surrogate ratio will be derived and compared against the 95% UCL ratio (see Table 5-1). If the derived ratio from the confirmatory samples exceeds the 95% UCL ratio, then the area-specific ratio as determined by actual survey data will be used.

The selection of one (1) soil sample (L1-010-101-FSGS-C06-SB) met the requirement that a minimum of 10% of the samples collected for the FSS of survey unit L1-010-101C be analyzed for HTD ROC. In addition, sample L1-010-101-FSGS-C14-SB was selected for off-site HTD ROC analysis, on the basis of a SOF greater than 10%. The selected samples were sent off-site (GEL Laboratories) for analysis of the HTD ROC as specified in LTP Chapter 5, Section 5.1.

The implementation of quality control measures as referenced by LTP Chapter 5, Section 5.9 and LaCrosseSolutions LC-QA-PN-001, *Final Status Survey Quality Assurance Project Plan* (QAPP) (Reference 10) includes the collection of a soil sample for “split sample” analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. One (1) soil sample, L1-010-101-QRGS-C03-SB, was designated for split sample QC analysis for the FSS of this survey unit.

LTP Chapter 5, Section 5.6.4.4 and Table 5-15 specifies that for Class 1 survey units, surface scans will be performed on 100% of the surface area in the survey unit. For survey unit L1-010-101C, 100% scan coverage equates to 87.8 m². To encapsulate the entire area of the survey unit, fifty (50) half-meter wide scan lanes were established in the survey unit. A map of survey unit is provided in Attachment 1.

For this Class 1 excavation survey unit, the “Investigation Levels” for area scanning and soil sample measurement results are those levels specified in LTP Chapter 5, Table 5-16, and are reproduced below in Table 5-4.

Table 5-4 – Investigation Levels

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

Table 5-5 provides a synopsis of the survey design for survey unit L1-010-101C.

Table 5-5 – Synopsis of Survey Design

Feature	Design Criteria	Basis
Survey Unit Surface Area	87.8 m ²	GPS
Number of Systematic Samples (N)	15	<ul style="list-style-type: none"> • $\sigma = 0.03$ • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I & II error = 0.05 • $\Delta/\sigma = 3$ (adjusted) • MARSSIM Table 5.5 • 1 additional measurement added in survey design
DCGLs and Action Levels	<ul style="list-style-type: none"> • Co-60: 3.83 pCi/g • Sr-90: 1970.45 pCi/g • Cs-137: 17.39 pCi/g (Surrogate Cs-137 DCGL: 17.31 pCi/g) • Eu-152: 8.51 pCi/g • Eu-154: 7.89 pCi/g 	Operational DCGLs for soil, LTP Chapter 5, Table 5-6, Release Record Table 5-2
Scan and Direct Investigation Levels	>Operational DCGL	LTP Chapter 5, Table 5-16
Scan Areal Coverage	87.8 m ² or 100% areal coverage	LTP Chapter 5, Table 5-15
HTD ROC Analysis	1 sample 2 (1 with SOF greater than 0.1)	LTP Chapter 5, Section 5.1 Actual Number Obtained
QC	1 split sample selected at random	LTP Chapter 5, Section 5.9

6. SURVEY IMPLEMENTATION

For survey unit L1-010-101C, compliance with the unrestricted release criteria was demonstrated through a combination of soil scanning with a Ludlum Model 44-10 gamma detector and the sampling of soil for isotopic analysis.

An FSS Supervisor performed a visual inspection and walk-down of the survey unit on September 11, 2017, 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. At the time of survey, the walls of the excavation were widely sloped as to allow safe access into the survey unit. The soil in the survey unit was dry and only some concrete piers from the WTB foundation were left in the survey unit. Nothing was noted as a considerable constraint for the safe collection of samples and scan measurements.

FSS field activities were conducted under the FSS Sample Plan, which included DQOs, survey design, detailed FSS instructions, job safety analysis, and related procedures for reference. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. A "Field Log" was used to document field activities and other information pertaining to the performance of the FSS. FSS field activities commenced on September 12, 2017.

During implementation of the FSS on September 13, 2017, elevated scan readings were identified near concrete foundation caps and residual concrete chunks that remained post-demolition of the WTB foundation. These elevated scan readings were verified by a Region III NRC Inspector who was performing confirmatory scan surveys. Count rates of up to 70,000 counts per minute (cpm) were identified in these areas. FSS Supervision determined that the elevated areas needed to be remediated and the remaining concrete in the survey unit taken out. The work crew was instructed to continue taking out soil and concrete until count rates were consistently below 10,000 cpm. Gamma scans of the material in excavator buckets during removal of the material indicated count rates of up to 1,400,000 cpm. Approximately seventy (70) cubic yards of soil and concrete debris were removed from the excavation.

After completion of the remediation, three (3) soil samples were collected at the edges of the remediated area and analyzed using the on-site gamma spectroscopy system. Cs-137 was detected at concentrations greater than MDC in three (3) of the samples, with a maximum concentration of 2.30E-01 pCi/g. Co-60 was detected at concentrations above MDC in two (2) of the samples, with a maximum concentration of 2.71E-02 pCi/g. The results of these samples are far below the Operational DCGLs.

A 100% gamma scan of the excavation (summarized in Section 7 of this release record) was performed after remediation was completed, on September 14, 2017. A total of fifty (50) half-meter wide grids (labeled E, EX, and N) were scanned using a Ludlum 2350-1 paired with a Ludlum Model 44-10 (2"x 2") sodium iodide (NaI) detector. The background for the scan grids was established as the average of five (5) 1-minute static measurements collected in the environmental lab. The background values collected in the environmental lab (ranging from 5,004 cpm up to 5,095 cpm) were used as the final backgrounds for the scan survey.

All designated scan areas were scanned using a Ludlum 2350-1 paired with a Model 44-10 2"x 2" NaI detector operated in the rate-meter mode and using audio response. The probe was positioned no more than 3" from the ground and was moved at a scan speed of approximately 0.5 meters per second. In accordance with RS-TD-313196-006, *Ludlum Model 44-10 Detector Sensitivity* (Reference 11), the scan MDC was sufficient to detect residual radioactivity at the action level (adjusted surrogate DCGL of 17.31 pCi/g, which was based on the surrogate adjusted DCGL of Cs-137 while inferring Sr-90). Complete scan results are provided in Attachment 2.

After scanning was completed with no alarms, the area was backfilled. Upon further review of the FSS data and implementation, it was determined that the remediation and additional excavation in the survey unit invalidated eleven (11) of the original fifteen (15) soil samples, as those samples no longer represented the end state condition of the survey unit. In addition, the survey unit size expanded during additional excavation. A Condition Report (CR), ES-LCR-CR-2017-0073 (Reference 12), was issued on October 9, 2017, which documented the need for resurvey of L1-010-101C, in addition to reviews and revisions of several key FSS procedures to clarify what controls were needed to eliminate the potential for leaving building components or systems in below grade survey units.

The FSS sample plan was revised for the acquisition of fifteen (15) new soil samples. Because the survey unit was backfilled, soil samples had to be collected using a GeoProbe® direct push machine, which could reach and obtain soil from the end state elevation of the excavation. The scan measurements collected post-remediation of the survey unit were still valid for FSS because they represented the end state condition of the excavation. Although not required, additional scanning was performed during the collection of the new soil samples; a 1 m² area at each sample location and, in some cases, scans of the actual samples in a low-background area, were scanned using the Ludlum 2350-1 paired with a Model 44-10 2"x 2" NaI detector. Background measurements for the sample location scans were collected in a field near a non-impacted survey unit that had little influence or "shine" from the Reactor building and ranged from 6,129 cpm up to 7,385 cpm. Field work for the revised FSS sample plan concluded on October 18, 2017.

The fifteen (15) systematic soil sample locations were marked with flags based on GPS coordinates provided. Each soil sample consisted of approximately one (1) liter of soil. The sample media was sifted to remove stones and other media larger than one (1) centimeter in diameter. All soil samples were collected, controlled, transported, stored and transferred to the on-site laboratory using the Chain-of-Custody process from LC-FS-PR-012, *Chain of Custody Protocol* (Reference 13), and in accordance with LC-FS-PR-004, *Sample Media Collection for Site Characterization and Final Status Survey* (Reference 14), LC-FS-PR-005, *Sample Media Preparation for Site Characterization and Final Status Survey* (Reference 15), and LC-FS-PR-001, *Sample Storage* (Reference 16).

The survey design specified that a minimum of one (1) sample was required for HTD ROC analysis. In total, two (2) samples (L1-010-101-FSGS-C06-SB and L1-010-101-FSGS-C14-SB) were selected for HTD radionuclide analysis. L1-010-101-FSGS-C06-SB was selected, and L1-010-101-FSGS-C14-SB was selected because of a sample SOF of 0.1033, which is greater than the 10% threshold described in the LTP.

The survey design specified one (1) sample to be collected for QC split analysis. The implementation of survey specific QC measures included the collection of one (1) sample (L1-010-101-QRGS-C03-SB) for split sample analysis.

7. SURVEY RESULTS

All areas identified in the FSS Sample Plan were scanned for elevated radiation levels. No elevated measurement locations were identified by surface scan. Table 7-1 provides an overview of the scan results for all fifty (50) scan grids (identified with E, EX, and N), the 1 m² scan areas around each sample location (identified with SP), and QC locations (identified with Q). Complete scan results are provided in Attachment 2.

Table 7-1 – Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level ⁽¹⁾ (cpm)	# of Scan Alarms	Investigation Samples
E01	9,886	27,235	0	0
E02	9,858	27,235	0	0
E03	9,806	27,235	0	0
E04	9,889	27,235	0	0
E05	9,731	27,235	0	0
E06	9,794	27,235	0	0
E07	9,755	27,235	0	0

Scan Area	Highest Logged Reading (cpm)	Action Level ⁽¹⁾ (cpm)	# of Scan Alarms	Investigation Samples
E08	10,691	27,235	0	0
E09	9,093	27,235	0	0
E10	9,349	27,235	0	0
E11	8,862	27,235	0	0
E12	9,349	27,235	0	0
E13	8,463	27,235	0	0
E14	8,692	27,235	0	0
E15	8,835	27,235	0	0
E16	8,933	27,235	0	0
E17	8,869	27,235	0	0
E18	8,449	27,235	0	0
E19	8,878	27,235	0	0
E20	9,505	27,235	0	0
E21	8,597	27,235	0	0
E22	8,500	27,235	0	0
E23	9,615	27,235	0	0
E24	8,837	27,235	0	0
EX01	9,588	27,144	0	0
EX02	9,971	27,144	0	0
EX03	9,851	27,144	0	0
EX04	9,970	27,144	0	0
EX05 & EX06	10,126	27,144	0	0
EX07	9,929	27,144	0	0
EX08	9,749	27,144	0	0
EX09	9,754	27,144	0	0
EX10	9,598	27,144	0	0
EX11	9,624	27,144	0	0
EX12	9,459	27,144	0	0
EX13	9,825	27,144	0	0
EX14	9,384	27,144	0	0
EX15	9,282	27,144	0	0
EX16	10,196	27,144	0	0
N01	9,947	27,235	0	0

Scan Area	Highest Logged Reading (cpm)	Action Level ⁽¹⁾ (cpm)	# of Scan Alarms	Investigation Samples
N02	10,036	27,235	0	0
N03	10,145	27,235	0	0
N04	10,276	27,235	0	0
N05	10,757	27,235	0	0
N06	9,671	27,235	0	0
N07	10,200	27,235	0	0
N08	9,812	27,235	0	0
N09	9,966	27,235	0	0
N10	9,212	27,235	0	0
QSP03	11,910	20,000	0	0
SP01	10,610	20,000	0	0
SP02	13,845	20,000	0	0
SP03	11,145	20,000	0	0
SP04	10,113	20,000	0	0
SP05	14,316	20,000	0	0
SP06	8,355	20,000	0	0
SP07	12,102	20,000	0	0
SP08	9,904	20,000	0	0
SP09	16,110	20,000	0	0
SP10	11,996	20,000	0	0
SP11	10,972	20,000	0	0
SP12	9,947	20,000	0	0
SP13	14,605	20,000	0	0
SP14	11,675	20,000	0	0
SP15	11,279	20,000	0	0

(1) Action Level based on average background plus 22,140 cpm (from RS-TD-313196-006). The Action Levels for the measurements labeled "SP" were reduced and simplified from the original 22,140 cpm for quick field reference.

The Action Level for scanning was established as the average background plus 22,140 cpm. The 22,140 cpm value is equal to the scanning instrumentation response to a Cs-137 concentration of 12 pCi/g. This value is equivalent to 22% of the IC adjusted DCGL for soil that was in use before the Operational DCGLs were established. Typically, the 25% IC adjusted DCGL value (13 pCi/g) would be used for the Action Level calculation, but a more conservative value was selected for this survey unit.

Evaluating the logged scan data to the correct and current Action Levels based on the Operational DCGL shows that nearly all the scan measurements from the E, EX, and N grids, and would have produced alarms, and in turn would have triggered the collection of investigational soil samples. It was discovered that background values for the scan grids (E, EX, and N) for this survey unit were erroneously collected in the environmental lab and were not representative of actual background levels. The lab backgrounds ranged from 5,004 cpm to 5,095 cpm. The background values for the scan measurements at the sample locations (measurements labeled with SP) were collected in a field near a non-impacted survey unit that had little influence or “shine” from the Reactor building and ranged from 6,129 cpm up to 7,385 cpm. Both sets of backgrounds are lower than the activity of scan measurements collected for FSS, which ranged from 8,449 cpm to 16,110 cpm (as shown in Table 7-1 above), though the backgrounds collected for the sample locations are a closer representation of true background in the survey unit. If the average background for the sample locations (6,824 cpm) was applied to the scan grids, and the scan data was evaluated against the current Action Levels based on the Operational DCGL, only two (2) locations would have produced alarms. Because 100% of the soil in the survey unit was scanned and no soil samples collected for FSS resulted in ROC concentrations above the Operational DCGLs, the probability of discovering an elevated soil sample is very low, even had investigational samples been collected.

The higher measurements in the data set can be attributed to “shine” from the Reactor building. The higher scan area measurements were collected in the northern portion of the survey unit, which had the least amount of natural shielding (soil) from the Reactor Building (which is south-west of the survey unit). The lower range of logged measurements were collected near the bottom of the excavation. Because of the close proximity to the Reactor Building, the background count rate varied with distance and depth below the ground surface surrounding the excavation. The field logs that detail the collection of scan measurements at the sample locations note that measurements were likely higher due to the survey unit’s proximity to a ramp being used to access the Reactor building.

The on-site laboratory analyzed the fifteen (15) soil samples taken for non-parametric statistical testing using the on-site gamma spectroscopy system. A summary of the fifteen (15) samples collected for non-parametric statistical testing results is provided in Table 7-2. Gamma spectroscopy results revealed twelve (12) samples above MDC for Cs-137 and one (1) sample above MDC for Co-60. No other ROC were positively identified. The concentration for Sr-90 was inferred based on the ratio specified in Table 5-1. The complete gamma spectroscopy reports are presented in Attachment 7. The basic statistics for the systematic sample population is summarized in Table 7-3.

Table 7-2 - Summary of Gamma Spectroscopy Results for Soil Samples Comprising the Statistical Sample Population

Sample ID	Co-60 (pCi/g)	Cs-137 (pCi/g)	Eu-152 (pCi/g)	Eu-154 (pCi/g)	Sr-90 (pCi/g)
L1-010-101-FSGS-C01-SB	5.70E-02	7.11E-02	0.00E+00	6.47E-03	3.57E-02
L1-010-101-FSGS-C02-SB	4.72E-02	8.02E-02	6.30E-02	2.36E-02	4.03E-02
L1-010-101-FSGS-C03-SB	6.30E-02	9.30E-02	9.58E-02	9.86E-03	4.67E-02
L1-010-101-FSGS-C04-SB	2.95E-02	1.03E-01	1.37E-01	5.69E-02	5.17E-02
L1-010-101-FSGS-C05-SB	4.08E-02	7.66E-02	2.22E-02	4.65E-02	3.85E-02
L1-010-101-FSGS-C06-SB	7.08E-02	4.43E-01	3.71E-02	0.00E+00	2.22E-01
L1-010-101-FSGS-C07-SB	6.47E-02	9.30E-02	9.39E-03	1.08E-01	4.67E-02
L1-010-101-FSGS-C08-SB	4.74E-02	6.37E-02	3.68E-02	5.80E-02	3.20E-02
L1-010-101-FSGS-C09-SB	3.34E-02	3.13E-01	7.88E-02	0.00E+00	1.57E-01
L1-010-101-FSGS-C10-SB	7.18E-02	2.21E-01	4.97E-02	3.50E-02	1.11E-01
L1-010-101-FSGS-C11-SB	3.46E-02	2.78E-01	0.00E+00	4.58E-02	1.40E-01
L1-010-101-FSGS-C12-SB	6.76E-02	1.56E-01	1.75E-01	1.18E-03	7.83E-02
L1-010-101-FSGS-C13-SB	6.38E-02	3.56E-01	2.77E-03	1.10E-02	1.79E-01
L1-010-101-FSGS-C14-SB	4.10E-02	1.41E+00	2.25E-02	6.73E-02	7.08E-01
L1-010-101-FSGS-C15-SB	9.39E-02	2.43E-01	0.00E+00	4.98E-02	1.22E-01

Note: Bold values indicate concentrations greater than MDC.

Table 7-3 - Basic Statistical Properties of Systematic Sample Population

ROC	Mean (pCi/g)	Median (pCi/g)	Max (pCi/g)	Min (pCi/g)	Std. Dev. (pCi/g)	BcDCGL (pCi/g)	Avg. SOF per ROC	Avg. Dose Per ROC
Co-60	5.51E-02	5.70E-02	9.39E-02	2.95E-02	0.01791	1.06E+01	0.0052	0.1300
Sr-90	1.34E-01	7.83E-02	7.08E-01	3.20E-02	0.16975	5.47E+03	0.0000	0.0006
Cs-137	2.67E-01	1.56E-01	1.41E+00	6.37E-02	0.33816	4.83E+01	0.0055	0.1380
Eu-152	4.87E-02	3.68E-02	1.75E-01	0.00E+00	0.05313	2.36E+01	0.0021	0.0516
Eu-154	3.46E-02	3.50E-02	1.08E-01	0.00E+00	0.03116	2.19E+01	0.0016	0.0395

The off-site laboratory, GEL Laboratories, processed the two (2) samples selected for HTD ROC analysis. Samples L1-010-101-FSGS-C06-SB and L1-010-101-FSGS-C14-SB were selected. Only the analysis of the HTD ROC Sr-90 was required, but both samples were inadvertently analyzed for the full initial suite of radionuclides. All analyses met the required MDC.

Sr-90 was not detected in the off-site analysis of samples L1-010-101-FSGS-C06-SB and L1-010-101-FSGS-C14-SB. The results are provided in Table 7-4. The full GEL Laboratories analysis report is provided in Attachment 8.

Table 7-4 - Off-Site Analysis Results

Sample ID	ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
L1-010-101-FSGS-C06-SB	Sr-90	1.49E-01	1.82E-01	4.00E-01	No
L1-010-101-FSGS-C14-SB	Sr-90	-9.77E-02	1.67E-01	3.37E-01	No

The implementation of survey specific QC measures included the collection of one (1) sample (L1-010-101-QRGS-C03-SB) for split sample analysis. The on-site laboratory analyzed the designated QC sample using the on-site gamma spectroscopy system. A summary of the analytical results for the QC sample is provided in Table 7-5. Gamma spectroscopy results revealed that the sample was above MDC for Cs-137. The concentration for Sr-90 was inferred based on the ratio specified in Table 5-1.

Table 7-5 - Summary of Gamma Spectroscopy Results for the QC Soil Sample

Sample ID	Co-60 (pCi/g)	Cs-137 (pCi/g)	Eu-152 (pCi/g)	Eu-154 (pCi/g)	Sr-90 (pCi/g)
L1-010-101-QRGS-C03-SB	7.09E-02	4.61E-02	8.40E-03	8.21E-04	2.31E-02

Note: Bold values indicate concentrations greater than MDC.

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

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

Where: C_n = concentration of radionuclide n

$DCGL_n$ = DCGL of radionuclide n .

The results of the unity rule calculation for the ROC in the systematic sample population for survey unit L1-010-101C are provided in Table 7-6.

Table 7-6 - Sum-of-Fractions for Individual Soil Samples (Systematic and QC)

Sample ID	Fraction of Operational DCGL					SOF
	Co-60	Cs-137	Eu-152	Eu-154	Sr-90	
L1-010-101-FSGS-C01-SB	0.0149	0.0041	0.0000	0.0008	0.0000	0.0198
L1-010-101-FSGS-C02-SB	0.0123	0.0046	0.0074	0.0030	0.0000	0.0274
L1-010-101-FSGS-C03-SB	0.0164	0.0053	0.0113	0.0012	0.0000	0.0343
L1-010-101-FSGS-C04-SB	0.0077	0.0059	0.0161	0.0072	0.0000	0.0370
L1-010-101-FSGS-C05-SB	0.0107	0.0044	0.0026	0.0059	0.0000	0.0236
L1-010-101-FSGS-C06-SB	0.0185	0.0255	0.0044	0.0000	0.0001	0.0484
L1-010-101-FSGS-C07-SB	0.0169	0.0053	0.0011	0.0137	0.0000	0.0371
L1-010-101-FSGS-C08-SB	0.0124	0.0037	0.0043	0.0074	0.0000	0.0277
L1-010-101-FSGS-C09-SB	0.0087	0.0180	0.0093	0.0000	0.0001	0.0361
L1-010-101-FSGS-C10-SB	0.0187	0.0127	0.0058	0.0044	0.0001	0.0418
L1-010-101-FSGS-C11-SB	0.0090	0.0160	0.0000	0.0058	0.0001	0.0309
L1-010-101-FSGS-C12-SB	0.0177	0.0090	0.0206	0.0001	0.0000	0.0474
L1-010-101-FSGS-C13-SB	0.0167	0.0205	0.0003	0.0014	0.0001	0.0389
L1-010-101-FSGS-C14-SB	0.0107	0.0811	0.0026	0.0085	0.0004	0.1033
L1-010-101-FSGS-C15-SB	0.0245	0.0140	0.0000	0.0063	0.0001	0.0449
L1-010-101-QRGS-C03-SB	0.0185	0.0027	0.0010	0.0001	0.0000	0.0223

Systematic Measurements

Number of Systematic Measurements =	15
# of Systematic Measurements with SOF ≥ 1 =	0
# of Systematic Measurements with SOF > 0.1 (HTD Assessment) =	1
Max Individual Systematic Measurement SOF =	0.1033
Mean Systematic Measurement SOF =	0.0399

8. QUALITY CONTROL

The on-site laboratory processed one (1) split samples (L1-010-101-QRGS-C03-SB) using gamma spectroscopy analysis. The data was evaluated using USNRC acceptance criteria specified in Inspection Procedure No. 84750, *Radioactive Waste Treatment, and Effluent and Environmental Monitoring* (Reference 17). There was acceptable agreement between field split results. Refer to Attachment 4 for data and quality control analysis results.

9. INVESTIGATIONS AND RESULTS

No investigations were performed during the performance of the survey or analyses of the survey results.

10. REMEDIATION AND RESULTS

The original purpose of the excavation was not to support removal of contaminated subsurface soil, but rather to support the demolition and removal of the WTB. Additional excavation was necessary to remove elevated soil and concrete after scan measurements indicated areas of activity in excess of the Operational DCGL for soil. See Section 6 of this release record for a description and results of the Remedial Action Support Survey (RASS) conducted in survey unit L1-010-101C.

11. CHANGES FROM THE FINAL STATUS SURVEY PLAN

The original FSS sample plan was revised to include the collection of fifteen (15) new soil samples after remediation invalidated previous sample results. In addition, background measurements for the performance of the scan survey were not collected in the field as prescribed by the sample plan, but rather were erroneously collected in the environmental lab. See sections 6 and 7 of this release record, which provide details on the scan survey in this survey unit.

12. DATA QUALITY ASSESSMENT (DQA)

The DQO sample design and data were reviewed in accordance with LC-FS-PR-008, *Final Status Survey Data Assessment* (Reference 18) for completeness and consistency. Documentation was complete and legible. Surveys and the collection of samples were consistent with the DQOs and were sufficient to ensure that the survey unit was properly designated as Class 1. The survey design had adequate power as indicated by the Retrospective Power Curve (see Attachment 6).

The analytical results indicated that all samples were less than a SOF of one (1) when compared to the OpDCGLs.

Although MARSSIM states that the Sign Test need not be performed in the instance that no measurements surpass the DCGL, the test was conducted to demonstrate coherence to the statistical principles of the DQO process. The Sign Test was performed on the data and compared to the original assumptions of the DQOs. The evaluation of the Sign Test results clearly demonstrates that the survey unit passes the unrestricted release criteria, thus, the null hypothesis is rejected. The Sign Test results are provided in Attachment 3.

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 that exceeded two standard deviations. The mean and median values for each ROC were well below the respective Operational DCGLs. Also, the retrospective power curve shows that a sufficient number of samples were collected to achieve the desired power. Therefore, the survey unit meets the unrestricted release criteria with adequate power as required by the DQOs.

The mean of all identified isotopes are less than the Consultation Triggers for Residential Soil Concentration depicted in Table H.1 of NUREG 1757, Vol.1, Rev. 2 (MOU Table 1). The full table is included in Attachment 5 of this release record.

The data for Cs-137 is presented graphically through a frequency plot and quantile plot. All graphical presentations are provided in Attachment 6.

13. ANOMALIES

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

14. CONCLUSION

Survey unit L1-010-101C has met the DQOs of the FSS plan. The ALARA criteria as specified in Chapter 4 of the LTP were achieved. The Elevated Measurement Comparison for soils was not applicable, and remediation was not required.

All identified ROC were used for statistical testing to determine the adequacy of the survey unit for FSS. Evaluation of the data shows that none of the systematic ROC concentration values exceeds the OpDCGLs; therefore, in accordance with LTP Section 5.11, the survey unit meets the release criteria.

The sample data passed the Sign Test. The null hypothesis was rejected. The Retrospective Power Curve showed that adequate power was achieved. The survey unit is properly classified as Class 1.

The dose contribution from soil in survey unit L1-010-101C is 0.3597 mrem/yr TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

Survey unit L1-010-101C is acceptable for unrestricted release.

15. REFERENCES

1. LC-FS-PR-009, Final Status Survey Data Reporting
2. *La Crosse Boiling Water Reactor License Termination Plan (LTP)*

3. LC-FS-PR-002, *Final Status Survey Package Development*
4. NUREG-1575, Revision 1, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*
5. *La Crosse Boiling Water Reactor Historical Site Assessment (HSA)*
6. RS-TD-313196-004, *LACBWR Soil DCGL, Basement Concrete DCGL, and Buried Pipe DCGL*
7. RS-TD-313196-001, *Radionuclides of Concern during LACBWR Decommissioning*
8. NUREG-1757, Volume 2, Revision 1, *Consolidated Decommissioning Guidance – Characterization, Survey, and Determination of Radiological Criteria, Final Report*
9. LC-FS-TSD-002, *Operational Derived Concentration Guideline Levels for Final Status Survey*
10. LC-QA-PN-001, *Final Status Survey Quality Assurance Project Plan (QAPP)*
11. RS-TD-313196-006, *Ludlum Model 44-10 Detector Sensitivity*
12. LaCrosseSolutions Condition Report ES-LCR-CR-2017-0073
13. LC-FS-PR-012, *Chain of Custody Protocol*
14. LC-FS-PR-004, *Sample Media Collection for Site Characterization and Final Status Survey*
15. LC-FS-PR-005, *Sample Media Preparation for Site Characterization and Final Status Survey*
16. LC-FS-PR-001, *Sample Storage*
17. USNRC Inspection Procedure No. 84750, *Radioactive Waste Treatment, and Effluent and Environmental Monitoring*
18. LC-FS-PR-008, *Final Status Survey Data Assessment*

16. ATTACHMENTS

Attachment 1 – Figures and Maps

Attachment 2 – Scan Data

Attachment 3 – Sign Test

Attachment 4 – Quality Control Assessment

Attachment 5 – Consultation Triggers for Residential Soil Concentrations

Attachment 6 – Graphical Presentations

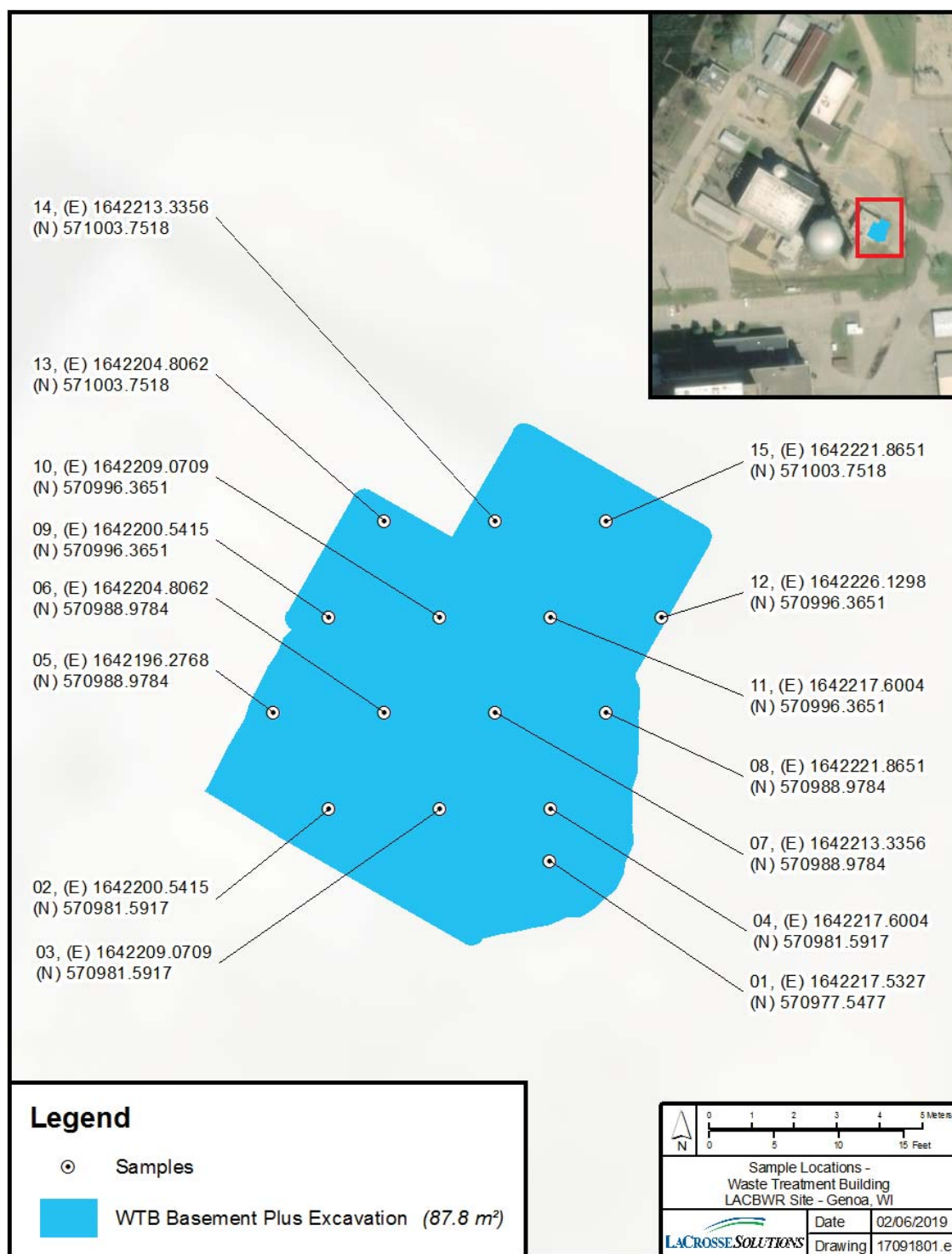
Attachment 7 – Sample Analytical Reports

Attachment 8 – GEL Laboratories Analytical Reports

ATTACHMENT 1

FIGURES AND MAPS

Figure 16-1 – L1-010-101C Systematic Sample Locations Map



ATTACHMENT 2

SCAN DATA

Table 16-1 – L1-010-101C Complete Scan Data

Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	318218	120636	E01	9,886	5,095	27,235	0
44-10	318218	120636	E02	9,858	5,095	27,235	0
44-10	318218	120636	E03	9,806	5,095	27,235	0
44-10	318218	120636	E04	9,889	5,095	27,235	0
44-10	318218	120636	E05	9,731	5,095	27,235	0
44-10	318218	120636	E06	9,794	5,095	27,235	0
44-10	318218	120636	E07	9,755	5,095	27,235	0
44-10	318218	120636	E08	10,691	5,095	27,235	0
44-10	318218	120636	E09	9,093	5,095	27,235	0
44-10	318218	120636	E10	9,349	5,095	27,235	0
44-10	318218	120636	E11	8,862	5,095	27,235	0
44-10	318218	120636	E12	9,349	5,095	27,235	0
44-10	318218	120636	E13	8,463	5,095	27,235	0
44-10	318218	120636	E14	8,692	5,095	27,235	0
44-10	318218	120636	E15	8,835	5,095	27,235	0
44-10	318218	120636	E16	8,933	5,095	27,235	0
44-10	318218	120636	E17	8,869	5,095	27,235	0
44-10	318218	120636	E18	8,449	5,095	27,235	0
44-10	318218	120636	E19	8,878	5,095	27,235	0
44-10	318218	120636	E20	9,505	5,095	27,235	0
44-10	318218	120636	E21	8,597	5,095	27,235	0
44-10	318218	120636	E22	8,500	5,095	27,235	0
44-10	318218	120636	E23	9,615	5,095	27,235	0
44-10	318218	120636	E24	8,837	5,095	27,235	0
44-10	357783	325261	EX01	9,588	5,004	27,144	0
44-10	357783	325261	EX02	9,971	5,004	27,144	0
44-10	357783	325261	EX03	9,851	5,004	27,144	0
44-10	357783	325261	EX04	9,970	5,004	27,144	0
44-10	357783	325261	EX05 & EX06	10,126	5,004	27,144	0
44-10	357783	325261	EX07	9,929	5,004	27,144	0
44-10	357783	325261	EX08	9,749	5,004	27,144	0
44-10	357783	325261	EX09	9,754	5,004	27,144	0

FSS RELEASE RECORD
 WTB EXCAVATION
 SURVEY UNIT L1-010-101C



Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	357783	325261	EX10	9,598	5,004	27,144	0
44-10	357783	325261	EX11	9,624	5,004	27,144	0
44-10	357783	325261	EX12	9,459	5,004	27,144	0
44-10	357783	325261	EX13	9,825	5,004	27,144	0
44-10	357783	325261	EX14	9,384	5,004	27,144	0
44-10	357783	325261	EX15	9,282	5,004	27,144	0
44-10	357783	325261	EX16	10,196	5,004	27,144	0
44-10	318218	120636	N01	9,947	5,095	27,235	0
44-10	318218	120636	N02	10,036	5,095	27,235	0
44-10	318218	120636	N03	10,145	5,095	27,235	0
44-10	318218	120636	N04	10,276	5,095	27,235	0
44-10	318218	120636	N05	10,757	5,095	27,235	0
44-10	318218	120636	N06	9,671	5,095	27,235	0
44-10	318218	120636	N07	10,200	5,095	27,235	0
44-10	318218	120636	N08	9,812	5,095	27,235	0
44-10	318218	120636	N09	9,966	5,095	27,235	0
44-10	318218	120636	N10	9,212	5,095	27,235	0
44-10	357783	325261	QSP03	11,910	7,057	20,000	0
44-10	318218	120636	SP01	10,610	6,668	20,000	0
44-10	357783	325261	SP02	13,845	7,385	20,000	0
44-10	357783	325261	SP02	7,676	7,385	20,000	0
44-10	318218	120636	SP03	11,145	6,668	20,000	0
44-10	318218	120636	SP04	10,113	6,668	20,000	0
44-10	357783	325261	SP05	14,316	7,385	20,000	0
44-10	357783	325261	SP05	6,485	7,385	20,000	0
44-10	357783	325261	SP05	7,284	7,385	20,000	0
44-10	318218	120636	SP06	8,355	6,668	20,000	0
44-10	357783	325261	SP07	12,102	7,385	20,000	0
44-10	357783	325261	SP07	8,232	7,385	20,000	0
44-10	357783	325261	SP07	8,108	7,385	20,000	0
44-10	318218	120636	SP08	9,904	6,668	20,000	0
44-10	318218	120636	SP08	8,363	6,668	20,000	0
44-10	357783	325261	SP09	16,110	6,129	20,000	0

FSS RELEASE RECORD
WTB EXCAVATION
SURVEY UNIT L1-010-101C



Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	357783	325261	SP09	7,268	6,129	20,000	0
44-10	318218	120636	SP10	11,996	6,668	20,000	0
44-10	318218	120636	SP11	10,972	6,668	20,000	0
44-10	318218	120636	SP12	9,947	6,668	20,000	0
44-10	357783	325261	SP13	14,605	6,129	20,000	0
44-10	357783	325261	SP13	5,513	6,129	20,000	0
44-10	318218	120636	SP14	11,675	6,668	20,000	0
44-10	318218	120636	SP15	11,279	6,668	20,000	0

ATTACHMENT 3

SIGN TEST

Table 16-2 – L1-010-101C Sign Test

#	SOF (W _s)	1-W _s	Sign
1	0.0198	0.98	+1
2	0.0274	0.97	+1
3	0.0343	0.97	+1
4	0.0370	0.96	+1
5	0.0236	0.98	+1
6	0.0484	0.95	+1
7	0.0371	0.96	+1
8	0.0277	0.97	+1
9	0.0361	0.96	+1
10	0.0418	0.96	+1
11	0.0309	0.97	+1
12	0.0474	0.95	+1
13	0.0389	0.96	+1
14	0.1033	0.90	+1
15	0.0449	0.96	+1

Number of positive differences
(S+) 15

Critical Value 11

Survey Unit Meets the Acceptance
Criteria

ATTACHMENT 4

QUALITY CONTROL ASSESSMENT

Table 16-3 – L1-010-101C QC Assessment

STANDARD						COMPARISON				
Sample ID	Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range (Low to High)	Sample ID	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
L1-010-101-FSGS-C03-SB	Cs-137	9.30E-02	1.72E-02	5.41	0.5 2	L1-010-101-QRGS-C03-SB	4.61E-02	1.58E-02	0.50	Y
Comments/Corrective Actions: None.						Table is provided to show acceptance criteria used to assess split samples.				
						Resolution	Acceptable Ratio			
						<4	0.4-2.5			
						4-7	0.5-2.0			
						8-15	0.6-1.66			
						16-50	0.75-1.33			
						51-200	0.80-1.25			
						>200	0.85-1.18			

ATTACHMENT 5

CONSULTATION TRIGGERS FOR RESIDENTIAL SOIL CONCENTRATION

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

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

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

ATTACHMENT 6

GRAPHICAL PRESENTATIONS

Figure 16-2 – Quantile Plot for Cs-137 Concentration

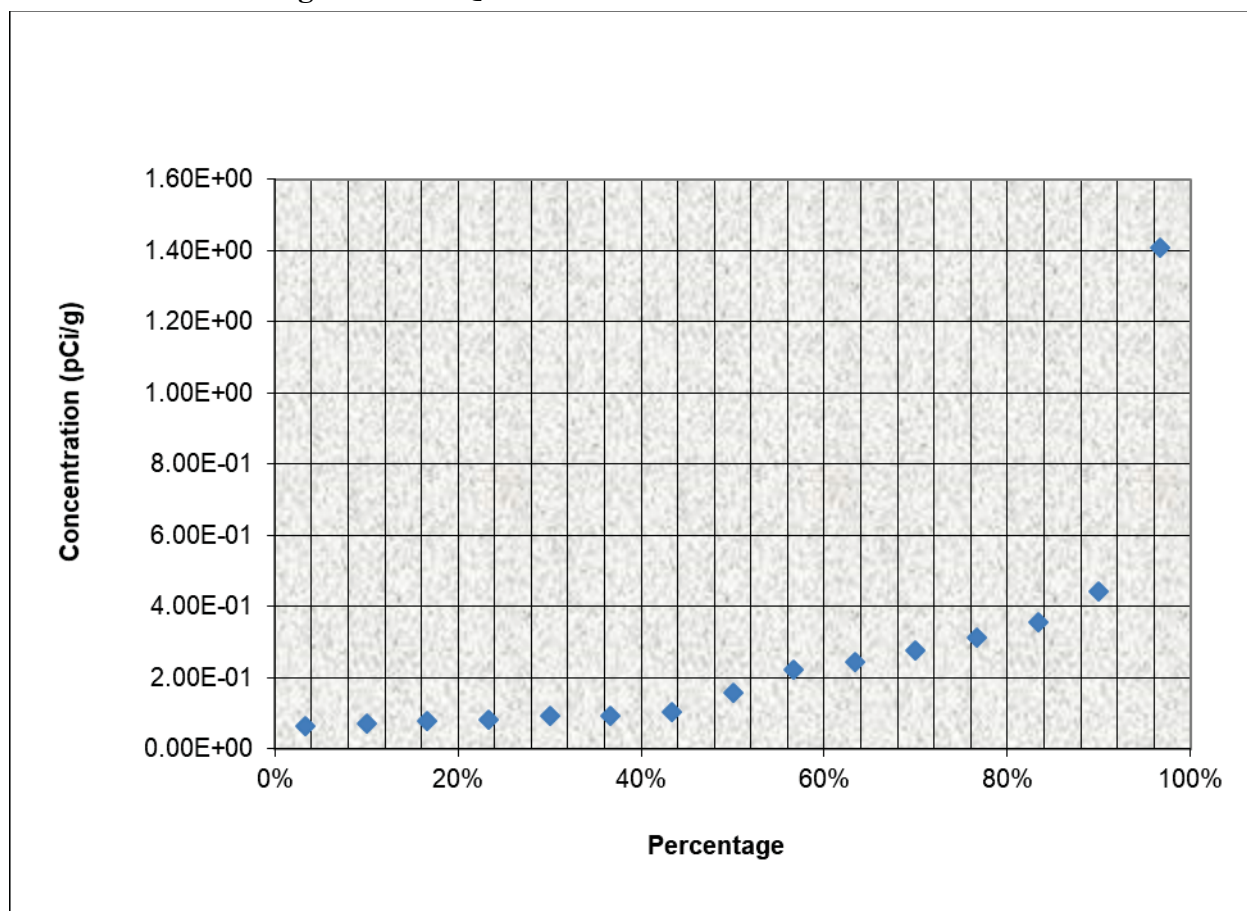


Figure 16-3 - Histogram for Cs-137 Concentration

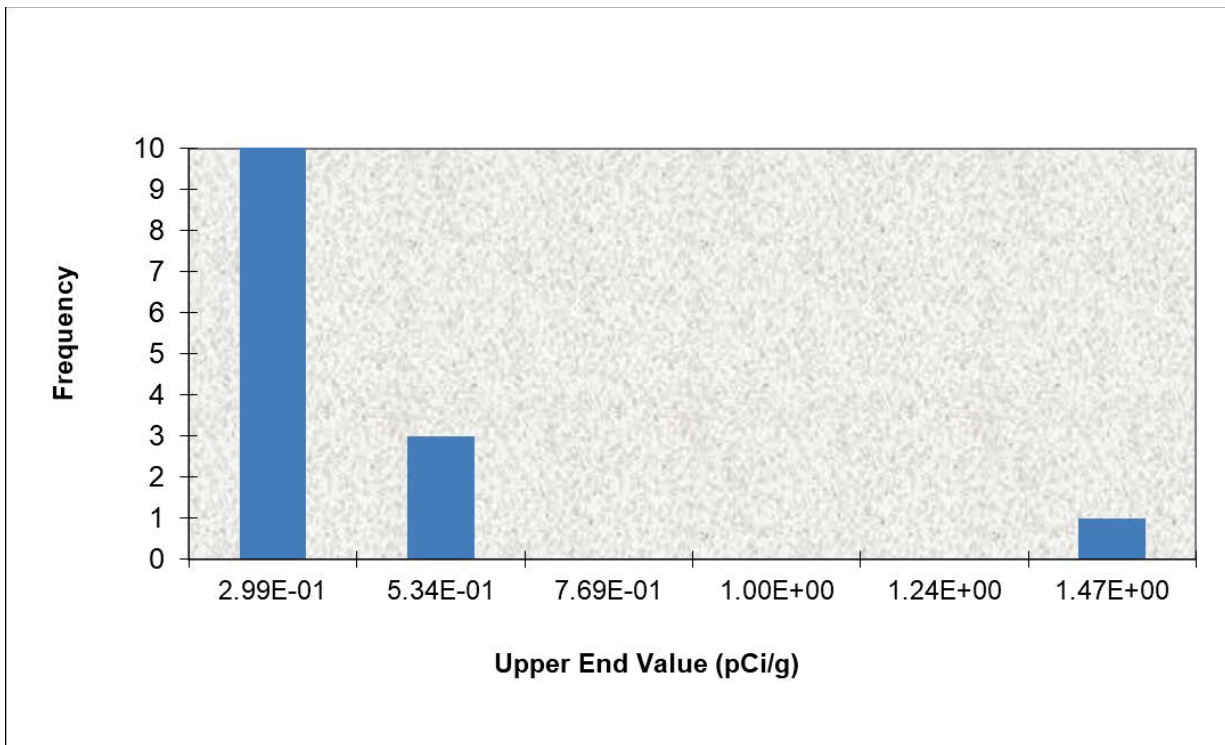
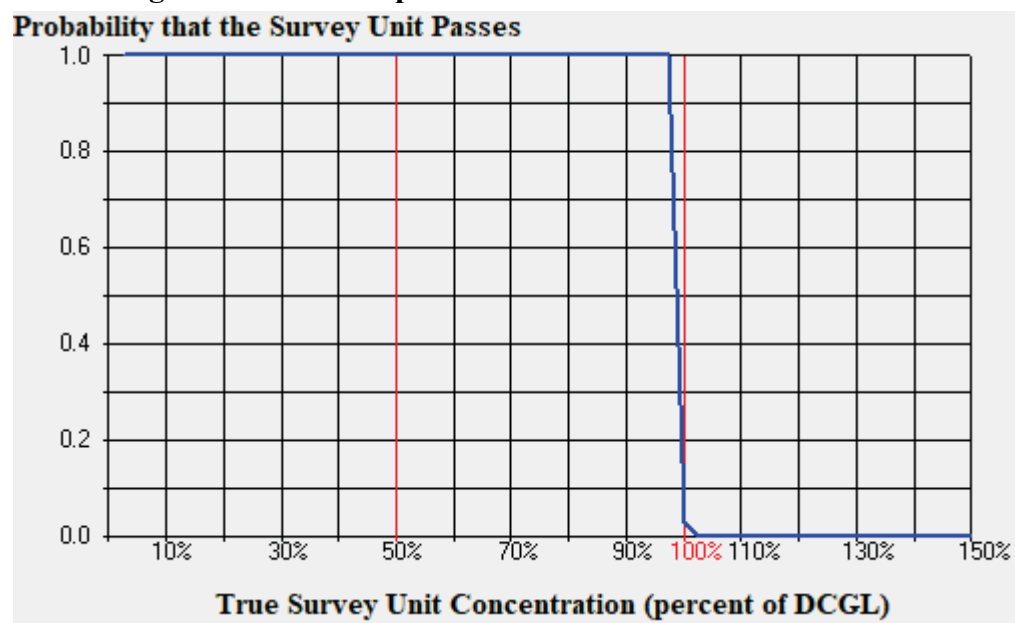


Figure 16-4 - Retrospective Power Curve for L1-010-101C



ATTACHMENT 7

SAMPLE ANALYTICAL REPORTS

14, (E) 1642213.3356
(N) 571003.7518

11, (E) 1642217.6004
(N) 570996.3651

13, (E) 1642204.8062
(N) 571003.7518

10, (E) 1642209.0709
(N) 570996.3651

09, (E) 1642200.5415
(N) 570996.3651

06, (E) 1642204.8062
(N) 570988.9784

05, (E) 1642196.2768
(N) 570988.9784

02, (E) 1642200.5415
(N) 570981.5917

03, (E) 1642209.0709
(N) 570981.5917

15, (E) 1642221.8651
(N) 571003.7518

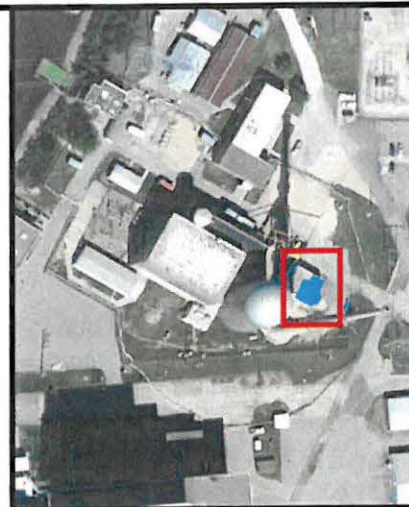
12, (E) 1642226.1298
(N) 570996.3651

08, (E) 1642221.8651
(N) 570988.9784

07, (E) 1642213.3356
(N) 570988.9784

04, (E) 1642217.6004
(N) 570981.5917

01, (E) 1642213.3356
(N) 570974.205

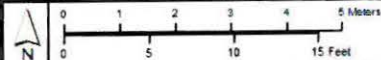


Legend

⊙ Samples



WTB Basement Plus Excavation



Sample Locations -
Waste Treatment Building
LACBWR Site - Genoa, WI

Date 10/16/2017
Drawing 17091801.c

LACROSSE SOLUTIONS

Analysis Report for L1-010-101-FS-GS-C01-SB

WTB L1-010-101-FS-GS-C01-SB 10/20/17

GAMMA SPECTRUM ANALYSIS

Sample Identification	: L1-010-101-FS-GS-C01-SB / 10/18/17
Sample Description	: WTB L1-010-101-FS-GS-C01-SB 10/20/17 REM 10/20/17
Sample Type	: 500 ml Marinelli ✓
Unit	:
Sample Point	:
Sample Size	: 7.850E+02 grams ✓
Facility	: Dairyland_NPP
Sample Taken On	: 10/18/2017 1:30:00PM
Acquisition Started	: 10/20/2017 8:13:12AM ✓
Procedure	: 500ml Marinelli
Operator	: Administrator
Detector Name	: HOTLAB
Geometry	: 500ml Marinelli ✓
Live Time	: 3600.0 seconds
Real Time	: 3612.0 seconds
Dead Time	: 0.33 % ✓
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 4096
Peak Area Range (in channels)	: 100 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 7/8/2014
Efficiency Calibration Used Done On	: 7/8/2014
Efficiency Calibration Description	:
Sample Number	: 3539

Reviewed
Jm Ogle
10/20/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 9:13:26AM

Peak Analysis From Channel : 100

Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C01-SB

WTB L1-010-101-FS-GS-C01-SB 10/20/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	77.01	147 -	160	154.58	1.15E+02	15.41	6.83E+02	0.62
F	2	92.75	180 -	193	186.04	1.05E+02	21.38	5.17E+02	1.82
F	3	238.50	472 -	485	477.47	3.21E+02	21.77	2.30E+02	1.42
F	4	295.17	585 -	596	590.78	5.34E+01	12.58	1.62E+02	1.45
F	5	338.04	669 -	681	676.51	4.32E+01	11.25	1.34E+02	1.45
F	6	351.88	698 -	711	704.19	1.50E+02	15.65	1.46E+02	1.64
F	7	463.03	923 -	931	926.45	1.85E+01	6.59	4.97E+01	0.75
F	8	583.08	1160 -	1172	1166.50	1.04E+02	12.23	5.85E+01	1.77
F	9	609.10	1214 -	1227	1218.53	1.20E+02	13.08	7.05E+01	1.84
F	10	727.22	1449 -	1458	1454.74	2.09E+01	6.30	3.24E+01	1.06
F	11	910.76	1816 -	1829	1821.77	5.19E+01	8.78	3.74E+01	1.67
M	12	964.69	1925 -	1944	1929.60	2.14E+01	5.48	1.36E+01	1.12
m	13	968.55	1925 -	1944	1937.32	3.16E+01	6.64	1.88E+01	1.12
F	14	1332.37	2659 -	2669	2664.88	1.81E+01	4.86	1.25E+01	0.81
F	15	1460.47	2912 -	2931	2921.06	4.97E+02	22.68	6.72E+00	2.25

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 9:13:26AM

Env. Background File : C:\Canberra\Apex\Root\Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	77.01	1.15E+02	15.41			1.15E+02	1.54E+01
F	2	92.75	1.05E+02	21.38			1.05E+02	2.14E+01
F	3	238.50	3.21E+02	21.77			3.21E+02	2.18E+01
F	4	295.17	5.34E+01	12.58			5.34E+01	1.26E+01
F	5	338.04	4.32E+01	11.25			4.32E+01	1.12E+01
F	6	351.88	1.50E+02	15.65	8.36E+01	1.86E+01	6.68E+01	2.43E+01
F	7	463.03	1.85E+01	6.59			1.85E+01	6.59E+00
F	8	583.08	1.04E+02	12.23			1.04E+02	1.22E+01
F	9	609.10	1.20E+02	13.08	4.12E+01	1.21E+01	7.89E+01	1.78E+01
F	10	727.22	2.09E+01	6.30			2.09E+01	6.30E+00
F	11	910.76	5.19E+01	8.78			5.19E+01	8.78E+00
M	12	964.69	2.14E+01	5.48			2.14E+01	5.48E+00
m	13	968.55	3.16E+01	6.64			3.16E+01	6.64E+00
F	14	1332.37	1.81E+01	4.86			1.81E+01	4.86E+00

Analysis Report for L1-010-101-FS-GS-C01-SB

WTB L1-010-101-FS-GS-C01-SB 10/20/17

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F 15	1460.47	4.97E+02	22.68	5.63E+01	8.57E+00	4.41E+02	2.42E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Daityland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	6.12E-06	3.77E-07
BI-212	0.60	727.17 *	11.80	1.41E-07	4.28E-08
		785.42	2.00		
		1620.56	2.75		
PB-212	0.99	77.11 *	17.50	2.06E-07	2.85E-08
		238.63 *	44.60	2.11E-07	1.53E-08
BI-214	0.34	609.31 *	46.30	1.16E-07	2.63E-08
		1120.29	15.10		
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	1.00	77.11 *	10.70	3.37E-07	4.66E-08
		295.21 *	19.20	9.73E-08	2.30E-08
		351.92 *	37.20	7.35E-08	2.68E-08
AC-228	0.67	209.28	4.40		
		338.32 *	11.40	1.49E-07	3.91E-08
		794.70	4.60		
		911.60 *	27.70	1.83E-07	3.12E-08
		964.60 *	5.20	4.24E-07	1.09E-07
		969.11 *	16.60	1.96E-07	4.16E-08

Analysis Report for L1-010-101-FS-GS-C01-SB

WTB L1-010-101-FS-GS-C01-SB 10/20/17

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.988	6.12E-06	3.77E-07	
BI-212	0.605	1.41E-07	4.28E-08	
PB-212	0.998	1.99E-07	1.37E-08	
BI-214	0.346	1.16E-07	2.63E-08	
PB-214	1.000	7.78E-08	1.66E-08	
AC-228	0.677	1.86E-07	2.07E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C01-SB

WTB L1-010-101-FS-GS-C01-SB 10/20/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 9:13:26AM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 2	92.75	2.92210E-02	20.33	Tol.	PA-228 ✓
F 7	463.03	5.14948E-03	35.55	Tol.	PA-228 ✓
F 8	583.08	2.88801E-02	11.76		
F 14	1332.37	5.02764E-03	26.83	Tol.	

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

Handwritten notes:
 Tl-208
 CO-60 not ID
 ~ 100% 300KZ
 1173 KeV 208
 1332 KeV 208
 1332 KeV 208
 10/20/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	6.12E-06	6.00E-07
+	AR-41	1293.64	99.16	-3.98E-02	7.16E-01	7.16E-01
+	✓ CO-60	1173.22	100.00	5.70E-08	5.62E-08	6.81E-08
		1332.49	100.00	1.29E-08		5.62E-08
+	KR-85	513.99	0.43	1.66E-05	1.03E-05	1.03E-05
+	Y-88	898.04	93.70	2.32E-08	3.18E-08	5.28E-08
		1836.06	99.20	-4.40E-08		3.18E-08
+	NB-94	702.63	100.00	2.78E-08	4.35E-08	4.35E-08
		871.10	100.00	-1.97E-08		4.67E-08
+	I-131	284.30	6.06	1.64E-07	4.72E-08	6.29E-07
		364.48	81.20	5.54E-09		4.72E-08

Analysis Report for L1-010-101-FS-GS-C01-SB

WTB L1-010-101-FS-GS-C01-SB 10/20/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
	I-131	636.97	7.27	2.44E-07	4.72E-08	6.47E-07
+	CS-134	604.70	97.60	-5.05E-08	5.37E-08	5.39E-08
		795.84	85.40	-2.66E-08		5.37E-08
+	✓ CS-137	661.65	85.12	7.11E-08	5.87E-08	5.87E-08
+	CE-144	80.12	1.36	-1.65E-06	2.81E-07	3.52E-06
		133.51	11.09	1.15E-07		2.81E-07
+	✓ EU-152	121.78	28.40	-8.37E-08	1.09E-07	1.09E-07
		244.69	7.49	-4.60E-07		5.00E-07
		964.00	14.44	3.14E-07		4.25E-07
		1408.00	20.74	-7.65E-10		2.30E-07
+	✓ EU-154	123.07	40.40	-1.39E-08	7.70E-08	7.70E-08
		247.94	6.60	-5.20E-07		4.89E-07
		723.30	19.70	6.15E-08		2.28E-07
		873.20	11.50	2.29E-07		4.24E-07
		1004.76	17.90	-6.19E-08		2.92E-07
		1274.51	35.50	6.47E-09		1.53E-07
+	EU-155	86.54	32.80	-1.75E-08	1.23E-07	1.23E-07
		105.31	21.80	2.56E-08		1.54E-07
+	BI-214	609.31	* 46.30	1.16E-07	9.88E-08	9.88E-08
		1120.29	15.10	4.19E-07		3.99E-07
		1238.11	5.94	-2.16E-08		1.14E-06
		1377.67	4.11	6.37E-07		1.15E-06
		1407.98	2.48	-6.39E-09		1.92E-06
		1509.19	2.19	1.58E-06		2.18E-06
		1764.49	15.80	1.26E-07		3.19E-07
+	PB-214	77.11	* 10.70	3.37E-07	1.07E-07	4.28E-07
		295.21	* 19.20	9.73E-08		1.26E-07
		351.92	* 37.20	7.35E-08		1.07E-07
+	PA-228	89.95	22.00	1.69E-07	4.10E-07	7.04E-07
		93.35	35.00	-2.26E-07		4.10E-07
		105.00	16.30	4.86E-07		8.03E-07
		129.22	2.97	1.77E-07		4.07E-06
		338.32	5.30	1.59E-06		2.62E-06
		463.00	13.80	-5.08E-07		1.01E-06
		911.23	16.70	5.09E-07		1.34E-06
+	✓ AM-241	59.54	36.30	-2.41E-07	2.16E-07	2.16E-07
+	CM-243	103.76	23.00	-1.85E-09	1.45E-07	1.45E-07
		228.18	10.60	1.06E-07		2.95E-07
		277.60	14.00	4.38E-08		2.42E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C01-SB

WTB L1-010-101-FS-GS-C01-SB 10/20/17

Analysis Report for L1-010-101-FS-GS-C02-SB
WTB L1-010-101 10/17/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C02-SB
Sample Description : WTB L1-010-101 10/17/17
Sample Type : 500 ml Marinelli ✓
Unit :
Sample Point :

Sample Size : 1.081E+03 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/17/2017 2:30:00PM
Acquisition Started : 10/17/2017 3:54:00PM

Procedure : 500ml Marinelli
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli
Live Time : 3600.0 seconds ✓
Real Time : 3611.5 seconds

Dead Time : 0.32 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3530

reviewed
Jo O'Quinn
10/18/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/17/2017 4:54:14PM
Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C02-SB

WTB L1-010-101 10/17/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.77	144 -	158	150.09	1.12E+02	19.38	4.56E+02	1.15
m	2	76.95	144 -	158	154.45	1.68E+02	21.91	4.58E+02	1.16
F	3	129.12	255 -	263	258.75	5.57E+01	16.53	4.19E+02	0.90
	4	185.73	367 -	375	371.96	4.40E+01	26.96	3.21E+02	1.84
F	5	238.55	469 -	485	477.58	4.10E+02	25.09	3.93E+02	1.46
F	6	295.19	587 -	596	590.82	9.92E+01	14.46	1.72E+02	1.19
F	7	351.76	697 -	712	703.94	2.05E+02	17.44	1.76E+02	1.61
F	8	462.76	920 -	931	925.91	4.49E+01	11.01	8.72E+01	1.94
F	9	583.02	1161 -	1172	1166.39	1.16E+02	12.64	5.96E+01	1.53
F	10	609.12	1212 -	1224	1218.57	1.66E+02	15.01	7.82E+01	1.66
F	11	661.41	1316 -	1328	1323.13	1.95E+02	15.79	7.48E+01	1.61
F	12	911.25	1818 -	1827	1822.74	7.47E+01	10.60	4.13E+01	1.58
F	13	968.93	1933 -	1944	1938.09	2.51E+01	7.60	5.29E+01	1.34
F	14	1332.29	2660 -	2669	2664.72	2.21E+01	6.10	3.12E+01	0.92
F	15	1460.44	2911 -	2929	2920.99	6.79E+02	26.70	1.92E+01	2.43

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/17/2017 4:54:14PM

Env. Background File : C:\Canberra\Apex\Root\Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	74.77	1.12E+02	19.38			1.12E+02	1.94E+01
m	2	76.95	1.68E+02	21.91			1.68E+02	2.19E+01
F	3	129.12	5.57E+01	16.53			5.57E+01	1.65E+01
	4	185.73	4.40E+01	26.96			4.40E+01	2.70E+01
F	5	238.55	4.10E+02	25.09			4.10E+02	2.51E+01
F	6	295.19	9.92E+01	14.46			9.92E+01	1.45E+01
F	7	351.76	2.05E+02	17.44	8.36E+01	1.86E+01	1.21E+02	2.55E+01
F	8	462.76	4.49E+01	11.01			4.49E+01	1.10E+01
F	9	583.02	1.16E+02	12.64			1.16E+02	1.26E+01
F	10	609.12	1.66E+02	15.01	4.12E+01	1.21E+01	1.25E+02	1.93E+01
F	11	661.41	1.95E+02	15.79	6.61E+01	1.27E+01	1.28E+02	2.03E+01
F	12	911.25	7.47E+01	10.60			7.47E+01	1.06E+01
F	13	968.93	2.51E+01	7.60			2.51E+01	7.60E+00
F	14	1332.29	2.21E+01	6.10			2.21E+01	6.10E+00

Analysis Report for L1-010-101-FS-GS-C02-SB

WTB L1-010-101 10/17/17

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F 15	1460.44	6.79E+02	26.70	5.63E+01	8.57E+00	6.22E+02	2.80E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\ Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.98	1460.75	*	10.67	6.27E-06	3.32E-07
CS-137	0.99	661.65	*	85.12	8.02E-08	1.28E-08
PB-212	0.99	77.11	*	17.50	2.20E-07	2.95E-08
		238.63	*	44.60	1.95E-07	1.30E-08
BI-214	0.34	609.31	*	46.30	1.33E-07	2.09E-08
		1120.29		15.10		
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
PB-214	0.99	77.11	*	10.70	3.59E-07	4.83E-08
		295.21	*	19.20	1.31E-07	1.94E-08
		351.92	*	37.20	9.68E-08	2.05E-08
RA-226	0.96	186.21	*	3.28	2.40E-07	1.47E-07

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C02-SB

WTB L1-010-101 10/17/17

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
✓ K-40	0.985	6.27E-06	3.32E-07	
CS-137	0.991	8.02E-08	1.28E-08	
PB-212	0.998	1.88E-07	1.20E-08	
BI-214	0.347	1.33E-07	2.09E-08	
PB-214	0.997	1.10E-07	1.36E-08	
RA-226	0.964	2.40E-07	1.47E-07	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C02-SB

WTB L1-010-101 10/17/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/17/2017 4:54:14PM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
M 1	74.77	3.10287E-02	17.35		PB214
F 3	129.12	1.54653E-02	29.69	Tol.	PA-228 ✓
F 8	462.76	1.24670E-02	24.53	Tol.	SB-125 ✓ PA-228 ✓
F 9	583.02	3.23041E-02	10.87		Tl-208 ✓
F 12	911.25	2.07509E-02	14.19	Tol.	AC-228 ✓ PA-228 ✓
F 13	968.93	6.98611E-03	30.24	Tol.	AC-228 ✓
F 14	1332.29	6.13774E-03	27.62		Bi-208 ✓

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

Ja OGD
 10/18/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	6.27E-06	4.90E-07
+	AR-41	1293.64	99.16	-2.84E-08	8.90E-08	8.90E-08
+	✓ CO-60	1173.22	100.00	2.18E-08	5.14E-08	5.37E-08
		1332.49	100.00	4.72E-08		5.14E-08

Analysis Report for L1-010-101-FS-GS-C02-SB

WTB L1-010-101 10/17/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	KR-85	513.99	0.43	7.82E-06	8.23E-06	8.23E-06
+	Y-88	898.04	93.70	-1.09E-09	2.64E-08	4.10E-08
		1836.06	99.20	4.92E-09		2.64E-08
+	NB-94	702.63	100.00	1.84E-08	3.37E-08	3.37E-08
		871.10	100.00	-1.72E-09		3.60E-08
+	I-131	284.30	6.06	9.63E-08	3.14E-08	4.42E-07
		364.48	81.20	-1.62E-08		3.14E-08
		636.97	7.27	-5.79E-08		4.60E-07
+	CS-134	604.70	97.60	3.50E-09	4.25E-08	4.44E-08
		795.84	85.40	-2.88E-08		4.25E-08
+	✓ CS-137	661.65	* 85.12	8.02E-08	4.40E-08	4.40E-08
+	CE-144	80.12	1.36	-3.46E-06	2.33E-07	2.92E-06
		133.51	11.09	-3.31E-08		2.33E-07
+	✓ EU-152	121.78	28.40	-3.68E-08	8.75E-08	8.75E-08
		244.69	7.49	-3.10E-07		4.26E-07
		964.00	14.44	1.31E-07		3.23E-07
		1408.00	20.74	1.20E-07		1.67E-07
+	✓ EU-154	123.07	40.40	-2.75E-08	6.19E-08	6.19E-08
		247.94	6.60	-5.53E-07		4.15E-07
		723.30	19.70	6.86E-08		1.78E-07
		873.20	11.50	-3.97E-09		3.06E-07
		1004.76	17.90	6.15E-10		2.24E-07
		1274.51	35.50	2.36E-08		1.24E-07
+	EU-155	86.54	32.80	-9.81E-09	1.01E-07	1.01E-07
		105.31	21.80	2.31E-08		1.23E-07
+	BI-214	609.31	* 46.30	1.33E-07	7.24E-08	7.24E-08
		1120.29	15.10	7.78E-08		3.57E-07
		1238.11	5.94	3.38E-07		9.43E-07
		1377.67	4.11	5.46E-07		9.49E-07
		1407.98	2.48	1.00E-06		1.40E-06
		1509.19	2.19	3.51E-07		1.42E-06
		1764.49	15.80	2.53E-07		2.76E-07
+	PB-214	77.11	* 10.70	3.59E-07	8.35E-08	2.19E-07
		295.21	* 19.20	1.31E-07		8.99E-08
		351.92	* 37.20	9.68E-08		8.35E-08
+	PA-228	89.95	22.00	1.24E-07	9.13E-08	1.55E-07
		93.35	35.00	-3.05E-08		9.13E-08
		105.00	16.30	-2.60E-08		1.75E-07
		129.22	2.97	6.73E-07		9.23E-07
		338.32	5.30	4.35E-07		5.91E-07
		463.00	13.80	7.45E-08		2.38E-07
		911.23	16.70	2.93E-07		3.14E-07
+	✓ AM-241	59.54	36.30	1.78E-07	1.86E-07	1.86E-07
+	CM-243	103.76	23.00	-4.95E-08	1.18E-07	1.18E-07
		228.18	10.60	3.35E-08		2.41E-07
		277.60	14.00	-1.30E-07		1.91E-07

Analysis Report for L1-010-101-FS-GS-C02-SB

WTB L1-010-101 10/17/17

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

Analysis Report for L1-010-101-FS-GS-C03-SB

WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification	: L1-010-101-FS-GS-C03-SB
Sample Description	: WTB L1-010-101 10/18/17
Sample Type	: 500 ml Marinelli
Unit	:
Sample Point	:
Sample Size	: 7.799E+02 grams
Facility	: Dairyland_NPP
Sample Taken On	: 10/18/2017 1:55:00PM
Acquisition Started	: 10/20/2017 12:27:07PM
Procedure	: 500ml Marinelli
Operator	: Administrator
Detector Name	: HOTLAB
Geometry	: 500ml Marinelli
Live Time	: 3600.0 seconds
Real Time	: 3611.2 seconds
Dead Time	: 0.31 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 4096
Peak Area Range (in channels)	: 100 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 7/8/2014
Efficiency Calibration Used Done On	: 7/8/2014
Efficiency Calibration Description	:
Sample Number	: 3543

REVIEWED
Jim O. Johnson
10/20/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 1:27:21PM

Peak Analysis From Channel	: 100
Peak Analysis To Channel	: 4096

Analysis Report for L1-010-101-FS-GS-C03-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.59	148 -	160	153.73	1.46E+02	25.68	5.74E+02	2.22
F	2	92.70	179 -	193	185.93	7.73E+01	19.06	6.37E+02	1.29
F	3	238.60	473 -	485	477.68	2.69E+02	20.51	2.32E+02	1.23
F	4	295.34	588 -	595	591.14	7.21E+01	12.57	1.04E+02	1.25
F	5	337.92	672 -	681	676.27	3.79E+01	3.27	1.10E+02	0.53
F	6	583.09	1161 -	1171	1166.53	8.80E+01	11.31	5.32E+01	1.48
F	7	661.44	1318 -	1329	1323.20	1.74E+02	15.03	5.81E+01	1.75
F	8	910.71	1816 -	1831	1821.65	5.14E+01	8.75	4.24E+01	1.73
F	9	968.87	1933 -	1944	1937.97	4.07E+01	8.03	3.00E+01	1.67
F	10	1331.97	2659 -	2670	2664.08	3.85E+01	6.97	8.61E+00	2.32
F	11	1460.38	2911 -	2929	2920.87	4.79E+02	22.13	9.35E+00	2.45

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 1:27:21PM

Env. Background File : C:\Canberra\Apex\Root\Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	76.59	1.46E+02	25.68			1.46E+02	2.57E+01
F	2	92.70	7.73E+01	19.06			7.73E+01	1.91E+01
F	3	238.60	2.69E+02	20.51			2.69E+02	2.05E+01
F	4	295.34	7.21E+01	12.57			7.21E+01	1.26E+01
F	5	337.92	3.79E+01	3.27			3.79E+01	3.27E+00
F	6	583.09	8.80E+01	11.31			8.80E+01	1.13E+01
F	7	661.44	1.74E+02	15.03	6.61E+01	1.27E+01	1.07E+02	1.97E+01
F	8	910.71	5.14E+01	8.75			5.14E+01	8.75E+00
F	9	968.87	4.07E+01	8.03			4.07E+01	8.03E+00
F	10	1331.97	3.85E+01	6.97			3.85E+01	6.97E+00
F	11	1460.38	4.79E+02	22.13	5.63E+01	8.57E+00	4.23E+02	2.37E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C03-SB

WTB L1-010-101 10/18/17

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.97	1460.75 *	10.67	5.91E-06	3.70E-07
CS-137	0.99	661.65 *	85.12	9.30E-08	1.72E-08
PB-212	0.98	77.11 *	17.50	2.67E-07	4.77E-08
		238.63 *	44.60	1.78E-07	1.43E-08
AC-228	0.57	209.28	4.40		
		338.32 *	11.40	1.32E-07	1.18E-08
		794.70	4.60		
		911.60 *	27.70	1.83E-07	3.14E-08
		964.60	5.20		
		969.11 *	16.60	2.55E-07	5.07E-08

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
✓ K-40	0.978	5.91E-06	3.70E-07	
CS-137	0.993	9.30E-08	1.72E-08	
PB-212	0.988	1.85E-07	1.37E-08	
AC-228	0.578	1.44E-07	1.08E-08	

Analysis Report for L1-010-101-FS-GS-C03-SB

WTB L1-010-101 10/18/17

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C03-SB

WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 1:27:21PM

Peak Locate From Channel : 100

Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 2	92.70	2.14783E-02	24.65	Tol.	PA-228 ✓
F 4	295.34	2.00370E-02	17.43	Tol.	PB-214 ✓
F 6	583.09	2.44515E-02	12.84		Tl-208
F 10	1331.97	1.06882E-02	18.11		Bi-206

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

Jim Aguirre
 10/20/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	5.91E-06	6.21E-07
+	AR-41	1293.64		99.16	3.78E-01	3.00E+00
+	CO-60	1173.22	100.00	1.71E-08	6.46E-08	6.62E-08
		1332.49	100.00	6.30E-08		6.46E-08
+	KR-85	513.99	0.43	1.06E-05	1.01E-05	1.01E-05
+	Y-88	898.04	93.70	2.48E-08	3.59E-08	5.43E-08
		1836.06	99.20	-5.07E-08		3.59E-08
+	NB-94	702.63	100.00	1.77E-08	4.28E-08	4.28E-08
		871.10	100.00	-8.10E-09		4.63E-08
+	I-131	284.30	6.06	-1.11E-07	5.07E-08	6.37E-07
		364.48	81.20	-1.16E-09		5.07E-08
		636.97	7.27	-1.15E-07		6.27E-07
+	CS-134	604.70	97.60	4.81E-08	5.16E-08	5.16E-08

Analysis Report for L1-010-101-FS-GS-C03-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)		Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+ /	CS-134	795.84		85.40	-2.12E-08	5.16E-08	5.18E-08
+ *	CS-137	661.65		85.12	9.30E-08	5.76E-08	5.76E-08
+	CE-144	80.12		1.36	-1.29E-06	2.87E-07	3.50E-06
		133.51		11.09	7.21E-11		2.87E-07
+ ∫	EU-152	121.78		28.40	-2.69E-08	1.08E-07	1.08E-07
		244.69		7.49	-2.93E-07		5.19E-07
		964.00		14.44	3.80E-07		4.13E-07
+ /	EU-154	1408.00		20.74	9.58E-08		2.31E-07
		123.07		40.40	9.86E-09	7.66E-08	7.66E-08
		247.94		6.60	-5.86E-07		5.14E-07
		723.30		19.70	1.62E-08		2.31E-07
		873.20		11.50	-8.90E-10		3.96E-07
		1004.76		17.90	-7.21E-08		2.86E-07
		1274.51		35.50	-2.07E-08		1.64E-07
+	EU-155	86.54		32.80	-3.35E-08	1.25E-07	1.25E-07
		105.31		21.80	3.36E-09		1.53E-07
+	BI-214	609.31		46.30	1.52E-07	1.11E-07	1.11E-07
		1120.29		15.10	1.80E-07		4.17E-07
		1238.11		5.94	8.66E-07		1.21E-06
		1377.67		4.11	6.05E-07		1.08E-06
		1407.98		2.48	8.01E-07		1.93E-06
		1509.19		2.19	4.72E-07		1.53E-06
		1764.49		15.80	1.63E-07		3.12E-07
+	PB-214	77.11		10.70	3.69E-07	1.11E-07	4.73E-07
		295.21		19.20	1.62E-07		1.91E-07
		351.92		37.20	1.59E-07		1.11E-07
+	PA-228	89.95		22.00	-9.12E-09	4.76E-07	8.07E-07
		93.35		35.00	2.17E-07		4.76E-07
		105.00		16.30	1.93E-07		9.05E-07
		129.22		2.97	5.94E-07		4.61E-06
		338.32		5.30	3.33E-06		3.06E-06
		463.00		13.80	-1.58E-07		1.25E-06
+ /	AM-241	911.23		16.70	1.44E-06		1.55E-06
+		59.54		36.30	-1.39E-07	2.20E-07	2.20E-07
+	CM-243	103.76		23.00	3.41E-08	1.47E-07	1.47E-07
		228.18		10.60	9.23E-08		3.03E-07
		277.60		14.00	1.84E-07		2.37E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C03-SB

WTB L1-010-101 10/18/17

Analysis Report for L1-010-101-QR-GS-C03-SB
WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-QR-GS-C03-SB
Sample Description : WTB L1-010-101 10/18/17
Sample Type : 500 ml Marinelli
Unit :
Sample Point :

Sample Size : 7.674E+02 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/18/2017 2:20:00PM
Acquisition Started : 10/20/2017 11:23:55AM ✓

Procedure : 500ml Marinelli ✓
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli ✓
Live Time : 3600.0 seconds ✓
Real Time : 3611.1 seconds

Dead Time : 0.31 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3542

*reviewed
20/10/17
10/20/17*

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 12:24:08PM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-QR-GS-C03-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	75.86	147 -	159	152.27	2.26E+02	28.29	5.06E+02	3.72
F	2	186.04	368 -	376	372.57	7.05E+01	17.35	2.61E+02	1.51
F	3	238.64	474 -	485	477.76	2.85E+02	21.32	2.45E+02	1.34
F	4	295.21	585 -	595	590.87	8.97E+01	13.86	1.39E+02	1.49
F	5	338.14	671 -	683	676.71	6.55E+01	11.93	1.23E+02	1.49
F	6	583.02	1159 -	1172	1166.37	7.70E+01	10.42	5.24E+01	1.53
F	7	609.41	1214 -	1226	1219.15	1.06E+02	12.19	5.26E+01	1.80
F	8	661.34	1318 -	1327	1322.99	1.19E+02	12.68	4.89E+01	1.47
F	9	727.64	1451 -	1461	1455.57	1.90E+01	6.66	3.90E+01	1.32
F	10	911.08	1817 -	1829	1822.40	6.26E+01	10.10	4.18E+01	2.08
F	11	968.78	1933 -	1942	1937.78	2.17E+01	7.27	3.73E+01	1.52
F	12	1120.30	2236 -	2247	2240.78	2.13E+01	5.88	2.75E+01	1.05
F	13	1331.80	2659 -	2669	2663.74	2.55E+01	6.12	1.78E+01	1.29
F	14	1460.40	2912 -	2929	2920.92	4.27E+02	21.01	1.57E+01	2.33
F	15	1763.64	3523 -	3532	3527.35	1.53E+01	4.42	3.83E+00	1.69

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 12:24:08PM

Env. Background File : C:\Canberra\Apex\Root\ Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	75.86	2.26E+02	28.29			2.26E+02	2.83E+01
F	2	186.04	7.05E+01	17.35			7.05E+01	1.73E+01
F	3	238.64	2.85E+02	21.32			2.85E+02	2.13E+01
F	4	295.21	8.97E+01	13.86			8.97E+01	1.39E+01
F	5	338.14	6.55E+01	11.93			6.55E+01	1.19E+01
F	6	583.02	7.70E+01	10.42			7.70E+01	1.04E+01
F	7	609.41	1.06E+02	12.19	4.12E+01	1.21E+01	6.48E+01	1.72E+01
F	8	661.34	1.19E+02	12.68	6.61E+01	1.27E+01	5.24E+01	1.79E+01
F	9	727.64	1.90E+01	6.66			1.90E+01	6.66E+00
F	10	911.08	6.26E+01	10.10			6.26E+01	1.01E+01
F	11	968.78	2.17E+01	7.27			2.17E+01	7.27E+00
F	12	1120.30	2.13E+01	5.88			2.13E+01	5.88E+00
F	13	1331.80	2.55E+01	6.12			2.55E+01	6.12E+00
F	14	1460.40	4.27E+02	21.01	5.63E+01	8.57E+00	3.70E+02	2.27E+01

Analysis Report for L1-010-101-QR-GS-C03-SB

WTB L1-010-101 10/18/17

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F 15	1763.64	1.53E+01	4.42			1.53E+01	4.42E+00

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\ Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	5.26E-06	3.54E-07
CS-137	0.98	661.65 *	85.12	4.61E-08	1.58E-08
BI-212	0.58	727.17 *	11.80	1.31E-07	4.62E-08
		785.42	2.00		
		1620.56	2.75		
PB-212	0.56	77.11	17.50		
		238.63 *	44.60	1.91E-07	1.52E-08
BI-214	0.76	609.31 *	46.30	9.72E-08	2.59E-08
		1120.29 *	15.10	1.69E-07	4.70E-08
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49 *	15.80	1.72E-07	4.99E-08
RA-226	0.99	186.21 *	3.28	5.42E-07	1.34E-07
AC-228	0.61	209.28	4.40		
		338.32 *	11.40	2.32E-07	4.26E-08
		794.70	4.60		
		911.60 *	27.70	2.26E-07	3.68E-08
		964.60	5.20		
		969.11 *	16.60	1.38E-07	4.64E-08

Analysis Report for L1-010-101-QR-GS-C03-SB

WTB L1-010-101 10/18/17

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
✓ K-40	0.981	5.26E-06	3.54E-07	
✓ CS-137	0.985	4.61E-08	1.58E-08	
✓ BI-212	0.581	1.31E-07	4.62E-08	
✓ PB-212	0.560	1.91E-07	1.52E-08	
✓ BI-214	0.767	1.24E-07	2.07E-08	
✓ RA-226	0.995	5.42E-07	1.34E-07	
✓ AC-228	0.611	2.05E-07	2.39E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Ena
Joe J. Smith
10/20/17

Analysis Report for L1-010-101-QR-GS-C03-SB

WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 12:24:08PM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 1	75.86	6.27423E-02	12.52		
F 4	295.21	2.49098E-02	15.45	Tol.	
F 6	583.02	2.13876E-02	13.54		
F 13	1331.80	7.07805E-03	24.03		

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

g d g m
10/20/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Daityland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	5.26E-06	6.66E-07
+	AR-41	1293.64	99.16	-1.34E+00	1.61E+00	1.61E+00
+	/ CO-60	1173.22	100.00	3.08E-08	6.83E-08	6.94E-08
		1332.49	100.00	7.09E-08		6.83E-08
+	KR-85	513.99	0.43	1.69E-05	1.08E-05	1.08E-05
+	Y-88	898.04	93.70	-4.51E-08	3.76E-08	4.62E-08
		1836.06	99.20	-3.13E-08		3.76E-08
+	NB-94	702.63	100.00	1.24E-09	4.52E-08	4.52E-08
		871.10	100.00	-3.46E-08		4.76E-08
+	I-131	284.30	6.06	-2.99E-08	4.94E-08	6.31E-07
		364.48	81.20	-1.20E-08		4.94E-08
		636.97	7.27	2.01E-07		6.95E-07
+	CS-134	604.70	97.60	-4.13E-08	5.17E-08	5.32E-08
		795.84	85.40	-6.09E-08		5.17E-08

Analysis Report for L1-010-101-QR-GS-C03-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)		Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	✓ CS-137	661.65	*	85.12	4.61E-08	5.56E-08	5.56E-08
+	CE-144	80.12		1.36	-1.67E-06	2.82E-07	3.56E-06
		133.51		11.09	3.19E-08		2.82E-07
+	EU-152	121.78		28.40	8.40E-09	1.09E-07	1.09E-07
		244.69		7.49	-3.55E-07		5.32E-07
		964.00		14.44	4.00E-07		4.18E-07
		1408.00		20.74	1.24E-07		2.20E-07
+	EU-154	123.07		40.40	-1.79E-08	7.67E-08	7.67E-08
		247.94		6.60	-5.83E-07		5.33E-07
		723.30		19.70	9.10E-08		2.29E-07
		873.20		11.50	2.18E-07		4.18E-07
		1004.76		17.90	5.64E-08		2.77E-07
		1274.51		35.50	8.21E-10		1.62E-07
+	EU-155	86.54		32.80	7.43E-08	1.27E-07	1.27E-07
		105.31		21.80	5.29E-09		1.51E-07
+	BI-214	609.31	*	46.30	9.72E-08	9.34E-08	9.34E-08
		1120.29	*	15.10	1.69E-07		2.40E-07
		1238.11		5.94	8.73E-08		1.08E-06
		1377.67		4.11	1.08E-07		1.10E-06
		1407.98		2.48	1.04E-06		1.84E-06
		1509.19		2.19	8.21E-09		1.88E-06
		1764.49	*	15.80	1.72E-07		1.40E-07
+	PB-214	77.11		10.70	4.16E-07	1.13E-07	4.79E-07
		295.21		19.20	2.33E-07		1.91E-07
		351.92		37.20	2.17E-07		1.13E-07
+	PA-228	89.95		22.00	7.82E-07	4.47E-07	7.72E-07
		93.35		35.00	-1.60E-07		4.47E-07
		105.00		16.30	1.14E-07		8.54E-07
		129.22		2.97	9.05E-07		4.46E-06
		338.32		5.30	3.65E-07		2.94E-06
		463.00		13.80	1.73E-07		1.15E-06
		911.23		16.70	2.56E-06		1.56E-06
+	✓ AM-241	59.54		36.30	-8.87E-08	2.23E-07	2.23E-07
+	CM-243	103.76		23.00	-1.10E-08	1.44E-07	1.44E-07
		228.18		10.60	1.67E-07		3.11E-07
		277.60		14.00	-1.59E-08		2.39E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-QR-GS-C03-SB
WTB L1-010-101 10/18/17

Analysis Report for L1-010-101-FS-GS-C04-SB
WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C04-SB ✓
Sample Description : WTB L1-010-101 10/18/17
Sample Type : 500 ml Marinelli
Unit :
Sample Point :

Sample Size : 7.657E+02 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/18/2017 12:50:00PM
Acquisition Started : 10/20/2017 1:28:21PM

Procedure : 500ml Marinelli
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli ✓
Live Time : 3600.0 seconds
Real Time : 3611.5 seconds

Dead Time : 0.32 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3544

*Reviewed
Jim O. Jones
10/20/17*

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 2:28:36PM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C04-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	77.01	152 -	161	154.57	1.22E+02	18.91	4.14E+02	1.03
F	2	185.83	368 -	378	372.16	6.13E+01	13.57	2.99E+02	0.88
F	3	238.49	473 -	485	477.46	2.53E+02	20.50	2.74E+02	1.35
F	4	294.78	584 -	597	590.02	8.01E+01	13.72	2.06E+02	1.38
F	5	338.14	669 -	681	676.72	5.50E+01	10.05	1.11E+02	0.97
F	6	583.02	1163 -	1174	1166.37	8.01E+01	10.72	4.56E+01	1.68
F	7	609.30	1215 -	1224	1218.94	1.03E+02	12.15	4.59E+01	1.78
F	8	911.04	1816 -	1827	1822.31	4.56E+01	9.03	4.32E+01	1.60
F	9	968.96	1934 -	1944	1938.14	2.55E+01	6.82	4.00E+01	1.02
F	10	1460.28	2912 -	2930	2920.68	4.46E+02	21.22	6.92E+00	2.31

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 2:28:35PM

Env. Background File : C:\Canberra\Apex\Root\Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	77.01	1.22E+02	18.91			1.22E+02	1.89E+01
F	2	185.83	6.13E+01	13.57			6.13E+01	1.36E+01
F	3	238.49	2.53E+02	20.50			2.53E+02	2.05E+01
F	4	294.78	8.01E+01	13.72			8.01E+01	1.37E+01
F	5	338.14	5.50E+01	10.05			5.50E+01	1.00E+01
F	6	583.02	8.01E+01	10.72			8.01E+01	1.07E+01
F	7	609.30	1.03E+02	12.15	4.12E+01	1.21E+01	6.13E+01	1.72E+01
F	8	911.04	4.56E+01	9.03			4.56E+01	9.03E+00
F	9	968.96	2.55E+01	6.82			2.55E+01	6.82E+00
F	10	1460.28	4.46E+02	21.22	5.63E+01	8.57E+00	3.89E+02	2.29E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C04-SB

WTB L1-010-101 10/18/17

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\ Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.96	1460.75	*	10.67	5.54E-06	3.60E-07
PB-212	0.99	77.11	*	17.50	2.25E-07	3.56E-08
		238.63	*	44.60	1.70E-07	1.45E-08
BI-214	0.35	609.31	*	46.30	9.23E-08	2.59E-08
		1120.29		15.10		
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
RA-226	0.97	186.21	*	3.28	4.72E-07	1.05E-07
AC-228	0.61	209.28		4.40		
		338.32	*	11.40	1.95E-07	3.60E-08
		794.70		4.60		
		911.60	*	27.70	1.65E-07	3.29E-08
		964.60		5.20		
		969.11	*	16.60	1.63E-07	4.37E-08

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for L1-010-101-FS-GS-C04-SB

WTB L1-010-101 10/18/17

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.966	5.54E-06	3.60E-07	
PB-212	0.998	1.78E-07	1.34E-08	
BI-214	0.350	9.23E-08	2.59E-08	
RA-226	0.977	4.72E-07	1.05E-07	
AC-228	0.611	1.75E-07	2.12E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C04-SB
 WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 2:28:35PM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F	4	294.78	2.22475E-02	17.13	Tol.
F	6	583.02	2.22365E-02	13.39	PB-214 Tl-208

Joe J. Jones
 10/20/17

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

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Daivland_NPPLibrary\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	* 10.67	5.54E-06	6.17E-07	6.17E-07
+	AR-41	1293.64	99.16	-1.40E+00	6.59E+00	6.59E+00
+	✓ CO-60	1173.22	100.00	3.56E-09	6.22E-08	6.58E-08
		1332.49	100.00	2.95E-08		6.22E-08
+	KR-85	513.99	0.43	1.06E-05	1.05E-05	1.05E-05
+	Y-88	898.04	93.70	-1.38E-08	4.41E-08	4.86E-08
		1836.06	99.20	-2.02E-08		4.41E-08
+	NB-94	702.63	100.00	3.51E-08	4.19E-08	4.42E-08
		871.10	100.00	-3.60E-08		4.19E-08
+	I-131	284.30	6.06	-1.17E-07	5.19E-08	6.54E-07
		364.48	81.20	-3.00E-08		5.19E-08
		636.97	7.27	-2.08E-07		6.66E-07
+	CS-134	604.70	97.60	-6.73E-08	5.33E-08	5.33E-08
		795.84	85.40	-9.87E-09		5.34E-08
+	CS-137	661.65	85.12	1.03E-07	6.41E-08	6.41E-08
+	CE-144	80.12	1.36	1.41E-06	2.77E-07	3.50E-06

Analysis Report for L1-010-101-FS-GS-C04-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	CE-144	133.51	11.09	-2.55E-07	2.77E-07	2.77E-07
	✓ EU-152	121.78	28.40	-1.75E-08	1.11E-07	1.11E-07
		244.69	7.49	-5.15E-07		5.22E-07
		964.00	14.44	2.98E-07		4.18E-07
+	✓ EU-154	1408.00	20.74	1.37E-07		2.38E-07
		123.07	40.40	-5.46E-09	7.77E-08	7.77E-08
		247.94	6.60	-5.74E-07		5.36E-07
		723.30	19.70	1.53E-07		2.39E-07
		873.20	11.50	1.30E-07		3.74E-07
		1004.76	17.90	2.58E-07		2.88E-07
		1274.51	35.50	5.69E-08		1.62E-07
		86.54	32.80	1.68E-08	1.24E-07	1.24E-07
+	EU-155	105.31	21.80	1.72E-08		1.52E-07
	BI-214	609.31	* 46.30	9.23E-08	8.87E-08	8.87E-08
		1120.29	15.10	4.24E-07		4.08E-07
		1238.11	5.94	9.73E-08		1.12E-06
		1377.67	4.11	-8.10E-07		1.25E-06
		1407.98	2.48	1.15E-06		1.99E-06
		1509.19	2.19	3.63E-07		1.88E-06
		1764.49	15.80	7.73E-08		2.76E-07
+	PB-214	77.11	10.70	2.93E-07	1.06E-07	4.72E-07
		295.21	19.20	2.26E-07		1.94E-07
		351.92	37.20	8.59E-08		1.06E-07
+	PA-228	89.95	22.00	3.66E-07	4.98E-07	8.44E-07
		93.35	35.00	6.46E-08		4.98E-07
		105.00	16.30	-4.86E-07		9.50E-07
		129.22	2.97	2.37E-07		4.88E-06
		338.32	5.30	1.27E-06		3.13E-06
		463.00	13.80	7.80E-08		1.24E-06
		911.23	16.70	1.72E-06		1.71E-06
		59.54	36.30	9.52E-08	2.37E-07	2.37E-07
+	CM-243	103.76	23.00	-2.91E-08	1.45E-07	1.45E-07
		228.18	10.60	-2.21E-07		2.90E-07
		277.60	14.00	-1.42E-07		2.40E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C05-SB
WTB L1-010-101 10/17/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C05-SB
Sample Description : WTB L1-010-101 10/17/17
Sample Type : 500 ml Marinelli
Unit :
Sample Point :

Sample Size : 1.024E+03 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/17/2017 1:37:00PM
Acquisition Started : 10/17/2017 4:55:17PM

Procedure : 500ml Marinelli ✓
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli
Live Time : 3600.0 seconds
Real Time : 3612.1 seconds ✓

Dead Time : 0.34 %

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3531

*Reviewed
J. O. G. Jr.
10/18/17*

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/17/2017 5:55:32PM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C05-SB

WTB L1-010-101 10/17/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.68	142 -	161	149.90	9.31E+01	16.48	3.32E+02	1.00
m	2	76.99	142 -	161	154.54	1.41E+02	18.79	3.21E+02	1.00
M	3	238.50	471 -	490	477.47	3.94E+02	24.00	1.87E+02	1.44
m	4	241.83	471 -	490	484.14	9.39E+01	14.05	1.91E+02	1.44
F	5	294.98	583 -	597	590.40	1.01E+02	14.34	2.35E+02	1.24
F	6	351.64	696 -	709	703.71	1.47E+02	15.02	1.68E+02	1.15
F	7	510.20	1015 -	1029	1020.78	6.02E+01	12.04	9.61E+01	2.56
F	8	582.98	1159 -	1171	1166.30	1.15E+02	12.90	7.12E+01	1.59
F	9	609.16	1214 -	1227	1218.64	1.24E+02	12.78	7.13E+01	1.34
F	10	661.43	1314 -	1329	1323.17	1.82E+02	14.99	7.35E+01	1.55
F	11	726.76	1450 -	1457	1453.82	1.59E+01	3.41	3.31E+01	1.46
F	12	910.98	1818 -	1832	1822.20	5.82E+01	8.99	4.23E+01	1.47
F	13	968.53	1927 -	1943	1937.27	5.90E+01	10.36	5.76E+01	2.74
F	14	1120.24	2235 -	2245	2240.67	2.37E+01	6.67	2.90E+01	1.44
F	15	1332.15	2660 -	2669	2664.43	2.07E+01	6.18	2.11E+01	1.49
F	16	1460.41	2913 -	2929	2920.94	5.48E+02	24.04	1.67E+01	2.32

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/17/2017 5:55:32PM

Env. Background File : C:\Canberra\Apex\Root\Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	74.68	9.31E+01	16.48			9.31E+01	1.65E+01
m	2	76.99	1.41E+02	18.79			1.41E+02	1.88E+01
M	3	238.50	3.94E+02	24.00			3.94E+02	2.40E+01
m	4	241.83	9.39E+01	14.05			9.39E+01	1.40E+01
F	5	294.98	1.01E+02	14.34			1.01E+02	1.43E+01
F	6	351.64	1.47E+02	15.02	8.36E+01	1.86E+01	6.39E+01	2.39E+01
F	7	510.20	6.02E+01	12.04			6.02E+01	1.20E+01
F	8	582.98	1.15E+02	12.90			1.15E+02	1.29E+01
F	9	609.16	1.24E+02	12.78	4.12E+01	1.21E+01	8.27E+01	1.76E+01
F	10	661.43	1.82E+02	14.99	6.61E+01	1.27E+01	1.16E+02	1.96E+01
F	11	726.76	1.59E+01	3.41			1.59E+01	3.41E+00
F	12	910.98	5.82E+01	8.99			5.82E+01	8.99E+00
F	13	968.53	5.90E+01	10.36			5.90E+01	1.04E+01

Analysis Report for L1-010-101-FS-GS-C05-SB

WTB L1-010-101 10/17/17

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
✓ K-40	0.982	5.23E-06	3.08E-07	
CS-137	0.992	7.66E-08	1.31E-08	
BI-212	0.586	8.22E-08	1.78E-08	
PB-212	0.997	1.87E-07	1.19E-08	
BI-214	0.583	1.03E-07	1.79E-08	
PB-214	0.990	8.86E-08	1.37E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C05-SB

WTB L1-010-101 10/17/17

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	14	1120.24	2.37E+01	6.67			2.37E+01	6.67E+00
F	15	1332.15	2.07E+01	6.18			2.07E+01	6.18E+00
F	16	1460.41	5.48E+02	24.04	5.63E+01	8.57E+00	4.92E+02	2.55E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Daistryland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	5.23E-06	3.08E-07
CS-137	0.99	661.65 *	85.12	7.66E-08	1.31E-08
BI-212	0.58	727.17 *	11.80	8.22E-08	1.78E-08
		785.42	2.00		
		1620.56	2.75		
PB-212	0.99	77.11 *	17.50	1.94E-07	2.67E-08
		238.63 *	44.60	1.98E-07	1.31E-08
BI-214	0.58	609.31 *	46.30	9.30E-08	2.00E-08
		1120.29 *	15.10	1.42E-07	3.99E-08
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	0.99	77.11 *	10.70	3.17E-07	4.36E-08
		295.21 *	19.20	1.40E-07	2.03E-08
		351.92 *	37.20	5.39E-08	2.02E-08

Analysis Report for L1-010-101-FS-GS-C05-SB
WTB L1-010-101 10/17/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/17/2017 5:55:32PM
Peak Locate From Channel : 100
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
M 1	74.68	2.58676E-02	17.70		<i>Pd 214</i>
m 4	241.83	2.60741E-02	14.96		<i>Pd 214</i>
F 7	510.20	1.67106E-02	20.02		<i>Tl 208</i>
F 8	582.98	3.19860E-02	11.21		<i>Bi 206</i>
F 12	910.98	1.61629E-02	15.45	Tol.	AC-228 PA-228
F 13	968.53	1.64008E-02	17.55	Tol.	AC-228
F 15	1332.15	5.74191E-03	29.90	Tol.	CO-60 <i>AS 10 NO</i> <i>100% BUSTAR</i> <i>PEAK</i> <i>AT</i> <i>1173 KEV</i> <i>likely Bi 206</i>

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

John D. Jones
10/15/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Daityland_NPPLibrary\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	5.23E-06	5.00E-07
+	AR-41	1293.64	99.16	7.14E-08	1.90E-07	1.90E-07
+	CO-60	1173.22	100.00	3.71E-08	4.94E-08	5.93E-08
		1332.49	100.00	4.08E-08		4.94E-08

Analysis Report for L1-010-101-FS-GS-C05-SB

WTB L1-010-101 10/17/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	KR-85	513.99	0.43	8.32E-06	7.85E-06	7.85E-06
+	Y-88	898.04	93.70	3.26E-09	3.19E-08	3.98E-08
		1836.06	99.20	-3.08E-09		3.19E-08
+	NB-94	702.63	100.00	-1.87E-09	3.35E-08	3.35E-08
		871.10	100.00	-3.03E-08		3.63E-08
+	I-131	284.30	6.06	9.75E-08	3.30E-08	4.44E-07
		364.48	81.20	-1.50E-08		3.30E-08
		636.97	7.27	-2.26E-07		4.60E-07
+	CS-134	604.70	97.60	-2.39E-08	4.34E-08	4.34E-08
		795.84	85.40	-1.14E-08		4.57E-08
+	✓ CS-137	661.65	* 85.12	7.66E-08	4.77E-08	4.77E-08
+	CE-144	80.12	1.36	-1.05E-06	2.27E-07	2.87E-06
		133.51	11.09	2.97E-08		2.27E-07
+	✓ EU-152	121.78	28.40	-7.71E-08	8.82E-08	8.82E-08
		244.69	7.49	3.52E-08		4.34E-07
		964.00	14.44	2.60E-07		3.51E-07
		1408.00	20.74	2.17E-07		1.82E-07
+	✓ EU-154	123.07	40.40	-2.05E-08	6.25E-08	6.25E-08
		247.94	6.60	-1.27E-07		4.23E-07
		723.30	19.70	2.99E-08		1.80E-07
		873.20	11.50	-2.03E-07		3.13E-07
		1004.76	17.90	2.30E-08		2.21E-07
		1274.51	35.50	4.65E-08		1.37E-07
+	EU-155	86.54	32.80	-1.16E-07	1.00E-07	1.00E-07
		105.31	21.80	-6.22E-08		1.25E-07
+	BI-214	609.31	* 46.30	9.30E-08	7.64E-08	7.64E-08
		1120.29	* 15.10	1.42E-07		1.80E-07
		1238.11	5.94	-2.54E-07		9.57E-07
		1377.67	4.11	5.24E-07		1.04E-06
		1407.98	2.48	1.81E-06		1.52E-06
		1509.19	2.19	1.02E-06		1.36E-06
		1764.49	15.80	1.05E-07		2.48E-07
+	PB-214	77.11	* 10.70	3.17E-07	8.51E-08	1.94E-07
		295.21	* 19.20	1.40E-07		1.23E-07
		351.92	* 37.20	5.39E-08		8.51E-08
+	PA-228	89.95	22.00	1.29E-07	9.83E-08	1.65E-07
		93.35	35.00	6.86E-08		9.83E-08
		105.00	16.30	-1.55E-07		1.89E-07
		129.22	2.97	-3.23E-07		9.48E-07
		338.32	5.30	1.99E-07		6.12E-07
		463.00	13.80	-5.64E-08		2.52E-07
		911.23	16.70	2.58E-07		3.08E-07
+	✓ AM-241	59.54	36.30	9.51E-08	1.84E-07	1.84E-07
+	CM-243	103.76	23.00	-7.02E-08	1.19E-07	1.19E-07
		228.18	10.60	-8.04E-08		2.36E-07
		277.60	14.00	-1.06E-07		1.93E-07

Analysis Report for L1-010-101-FS-GS-C05-SB

WTB L1-010-101 10/17/17

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

Analysis Report for L1-010-101-FS-GS-C06-SB
WTB L1-010-101-FS-GS-C06-SB 10/20/17

GAMMA SPECTRUM ANALYSIS

Sample Identification	: L1-010-101-FS-GS-C06-SB ✓
Sample Description	: WTB L1-010-101-FS-GS-C06-SB 10/20/17 10/18/17 REM 10/20/17
Sample Type	: 500 ml Marinelli
Unit	:
Sample Point	:
Sample Size	: 8.799E+02 grams
Facility	: Dairyland_NPP
Sample Taken On	: 10/18/2017 8:30:00AM ✓
Acquisition Started	: 10/20/2017 9:14:37AM ✓
Procedure	: 500ml Marinelli ✓
Operator	: Administrator
Detector Name	: HOTLAB
Geometry	: 500ml Marinelli ✓
Live Time	: 3600.0 seconds
Real Time	: 3612.0 seconds
Dead Time	: 0.33 % ✓
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 4096
Peak Area Range (in channels)	: 100 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 7/8/2014
Efficiency Calibration Used Done On	: 7/8/2014
Efficiency Calibration Description	:
Sample Number	: 3540

*REVIEWED
J. O. J. ✓
10/20/17*

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 10:14:52AM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C06-SB

WTB L1-010-101-FS-GS-C06-SB 10/20/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	93.25	180 -	192	187.05	1.33E+02	23.17	5.19E+02	1.98
F	2	186.05	369 -	377	372.61	6.90E+01	14.54	2.90E+02	0.79
F	3	238.57	472 -	485	477.62	2.81E+02	22.11	3.41E+02	1.40
F	4	295.09	586 -	594	590.63	8.81E+01	13.66	1.29E+02	1.26
F	5	338.40	672 -	685	677.23	4.63E+01	11.93	1.84E+02	1.37
F	6	351.83	695 -	712	704.10	1.59E+02	15.86	2.13E+02	1.44
F	7	583.04	1160 -	1173	1166.42	1.01E+02	12.09	7.03E+01	1.61
F	8	609.05	1213 -	1224	1218.42	1.12E+02	12.44	5.81E+01	1.54
F	9	661.43	1315 -	1332	1323.18	6.43E+02	26.72	7.01E+01	1.62
F	10	726.77	1448 -	1462	1453.83	3.42E+01	7.20	3.42E+01	1.33
F	11	910.71	1817 -	1827	1821.66	3.92E+01	8.80	4.82E+01	1.53
F	12	968.78	1933 -	1942	1937.79	2.34E+01	7.52	3.47E+01	1.75
F	13	1332.33	2660 -	2670	2664.79	3.18E+01	6.83	2.00E+01	1.45
F	14	1460.44	2914 -	2929	2920.99	5.15E+02	23.05	1.09E+01	2.43

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 10:14:52AM

Env. Background File : C:\Canberra\Apex\Root\ Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	93.25	1.33E+02	23.17			1.33E+02	2.32E+01
F	2	186.05	6.90E+01	14.54			6.90E+01	1.45E+01
F	3	238.57	2.81E+02	22.11			2.81E+02	2.21E+01
F	4	295.09	8.81E+01	13.66			8.81E+01	1.37E+01
F	5	338.40	4.63E+01	11.93			4.63E+01	1.19E+01
F	6	351.83	1.59E+02	15.86	8.36E+01	1.86E+01	7.58E+01	2.44E+01
F	7	583.04	1.01E+02	12.09			1.01E+02	1.21E+01
F	8	609.05	1.12E+02	12.44	4.12E+01	1.21E+01	7.11E+01	1.74E+01
F	9	661.43	6.43E+02	26.72	6.61E+01	1.27E+01	5.77E+02	2.96E+01
F	10	726.77	3.42E+01	7.20			3.42E+01	7.20E+00
F	11	910.71	3.92E+01	8.80			3.92E+01	8.80E+00
F	12	968.78	2.34E+01	7.52			2.34E+01	7.52E+00
F	13	1332.33	3.18E+01	6.83			3.18E+01	6.83E+00
F	14	1460.44	5.15E+02	23.05	5.63E+01	8.57E+00	4.58E+02	2.46E+01

Analysis Report for L1-010-101-FS-GS-C06-SB

WTB L1-010-101-FS-GS-C06-SB 10/20/17

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

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.98	1460.75	*	10.67	5.68E-06	3.43E-07
CS-137	0.99	661.65	*	85.12	4.43E-07	2.57E-08
BI-212	0.58	727.17	*	11.80	2.07E-07	4.37E-08
		785.42		2.00		
		1620.56		2.75		
PB-212	0.56	77.11		17.50		
		238.63	*	44.60	1.65E-07	1.36E-08
BI-214	0.34	609.31	*	46.30	9.31E-08	2.29E-08
		1120.29		15.10		
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
PB-214	0.72	77.11		10.70		
		295.21	*	19.20	1.43E-07	2.25E-08
		351.92	*	37.20	7.44E-08	2.41E-08
RA-226	0.99	186.21	*	3.28	4.62E-07	9.83E-08
AC-228	0.58	209.28		4.40		
		338.32	*	11.40	1.43E-07	3.71E-08
		794.70		4.60		
		911.60	*	27.70	1.23E-07	2.78E-08
		964.60		5.20		
		969.11	*	16.60	1.30E-07	4.19E-08

Analysis Report for L1-010-101-FS-GS-C06-SB

WTB L1-010-101-FS-GS-C06-SB 10/20/17

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

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
J K-40	0.984	5.68E-06	3.43E-07	
CS-137	0.992	4.43E-07	2.57E-08	
BI-212	0.587	2.07E-07	4.37E-08	
PB-212	0.560	1.65E-07	1.36E-08	
BI-214	0.344	9.31E-08	2.29E-08	
PB-214	0.720	1.11E-07	1.64E-08	
RA-226	0.996	4.62E-07	9.83E-08	
AC-228	0.580	1.30E-07	1.97E-08	

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C06-SB

WTB L1-010-101-FS-GS-C06-SB 10/20/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 10:14:52AM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 1	93.25	3.69416E-02	17.42	Tol.	PA-228
F 7	583.04	2.79414E-02	12.02		
F 13	1332.33	8.83006E-03	21.50	Tol.	

7/20/17
 CO-60
 mis ID
 M100405123
 PLEA
 AT 1173 KEV
 11/20/17

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

Joe O. Jule
 10/20/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	5.68E-06	5.50E-07
+	AR-41	1293.64		99.16	6.37E-01	6.79E+00
+	✓ CO-60	1173.22	100.00	7.08E-08	5.66E-08	6.97E-08
		1332.49	100.00	4.27E-08		5.66E-08
+	KR-85	513.99	0.43	8.29E-06	9.66E-06	9.66E-06
+	Y-88	898.04	93.70	-1.48E-08	3.38E-08	4.82E-08
		1836.06	99.20	-3.63E-08		3.38E-08
+	NB-94	702.63	100.00	4.47E-08	3.97E-08	3.97E-08
		871.10	100.00	1.46E-08		4.24E-08
+	I-131	284.30	6.06	4.88E-07	4.79E-08	6.39E-07
		364.48	81.20	-2.69E-08		4.79E-08
		636.97	7.27	-2.59E-09		6.42E-07
+	CS-134	604.70	97.60	-8.71E-09	4.77E-08	4.77E-08

Analysis Report for L1-010-101-FS-GS-C06-SB

WTB L1-010-101-FS-GS-C06-SB 10/20/17

	Nuclide Name	Energy (keV)		Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
	CS-134	795.84		85.40	9.35E-09	4.77E-08	5.36E-08
+	✓ CS-137	661.65	*	85.12	4.43E-07	5.58E-08	5.58E-08
+	CE-144	80.12		1.36	2.29E-06	2.64E-07	3.40E-06
		133.51		11.09	-6.40E-08		2.64E-07
+	✓ EU-152	121.78		28.40	-5.58E-08	1.03E-07	1.03E-07
		244.69		7.49	-4.64E-07		4.94E-07
		964.00		14.44	1.31E-07		3.66E-07
		1408.00		20.74	3.71E-08		2.09E-07
+	✓ EU-154	123.07		40.40	-5.15E-08	7.27E-08	7.27E-08
		247.94		6.60	-8.34E-07		5.09E-07
		723.30		19.70	-2.84E-08		2.08E-07
		873.20		11.50	2.70E-07		3.72E-07
		1004.76		17.90	-1.50E-07		2.44E-07
		1274.51		35.50	-3.92E-08		1.48E-07
+	EU-155	86.54		32.80	-7.51E-08	1.14E-07	1.14E-07
		105.31		21.80	1.84E-07		1.47E-07
+	BI-214	609.31	*	46.30	9.31E-08	8.21E-08	8.21E-08
		1120.29		15.10	8.13E-08		3.64E-07
		1238.11		5.94	5.78E-08		1.04E-06
		1377.67		4.11	-1.65E-07		9.71E-07
		1407.98		2.48	3.10E-07		1.75E-06
		1509.19		2.19	2.17E-07		1.58E-06
		1764.49		15.80	1.33E-07		2.72E-07
+	PB-214	77.11		10.70	7.47E-07	9.31E-08	4.64E-07
		295.21	*	19.20	1.43E-07		9.31E-08
		351.92	*	37.20	7.44E-08		1.11E-07
+	PA-228	89.95		22.00	9.20E-08	4.62E-07	7.98E-07
		93.35		35.00	-1.42E-07		4.62E-07
		105.00		16.30	1.40E-06		9.31E-07
		129.22		2.97	-6.10E-07		4.64E-06
		338.32		5.30	1.45E-07		3.08E-06
		463.00		13.80	6.94E-07		1.36E-06
		911.23		16.70	1.01E-06		1.57E-06
+	✓ AM-241	59.54		36.30	-7.91E-09	2.09E-07	2.09E-07
+	CM-243	103.76		23.00	2.52E-07	1.41E-07	1.41E-07
		228.18		10.60	4.53E-08		2.85E-07
		277.60		14.00	-4.69E-08		2.34E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C06-SB

WTB L1-010-101-FS-GS-C06-SB 10/20/17

Analysis Report for L1-010-101-FS-GS-C07

WTB L1-010-101 10.18.17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C07
Sample Description : WTB L1-010-101 10.18.17
Sample Type : 500 ml Marinelli
Unit :
Sample Point :

Sample Size : 9.704E+02 grams
Facility : Dairyland_NPP

Sample Taken On : 10/17/2017 3:51:00PM
Acquisition Started : 10/18/2017 7:19:01AM

Procedure : 500ml Marinelli
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli
Live Time : 3600.0 seconds
Real Time : 3610.8 seconds

Dead Time : 0.30 %

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3533

25000
J. J. [signature]
10/18/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/18/2017 8:19:15AM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C07
WTB L1-010-101 10.18.17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.84	147 -	160	154.22	1.46E+02	22.96	6.86E+02	1.42
F	2	185.95	364 -	379	372.40	8.98E+01	16.95	4.46E+02	1.37
F	3	238.46	470 -	481	477.39	2.58E+02	21.74	3.15E+02	1.25
F	4	294.93	586 -	594	590.32	8.99E+01	13.94	1.40E+02	1.23
F	5	338.38	674 -	685	677.20	6.93E+01	11.95	1.16E+02	1.34
F	6	351.76	698 -	710	703.94	1.47E+02	16.32	1.71E+02	1.68
F	7	582.82	1160 -	1171	1165.98	8.47E+01	11.72	6.91E+01	1.67
F	8	609.09	1210 -	1226	1218.51	1.32E+02	13.13	6.80E+01	1.79
F	9	661.42	1316 -	1331	1323.15	2.21E+02	16.38	7.97E+01	1.59
F	10	726.72	1449 -	1459	1453.74	2.69E+01	8.19	4.40E+01	1.78
F	11	910.85	1817 -	1828	1821.93	5.09E+01	9.14	4.55E+01	1.53
F	12	968.72	1933 -	1944	1937.66	3.43E+01	7.73	3.11E+01	1.67
F	13	1119.74	2235 -	2244	2239.67	2.17E+01	6.96	3.85E+01	1.30
F	14	1331.64	2657 -	2670	2663.42	4.84E+01	8.19	1.78E+01	2.38
F	15	1460.35	2911 -	2930	2920.82	5.35E+02	23.87	1.70E+01	2.34

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/18/2017 8:19:15AM

Env. Background File : C:\Canberra\Apex\Root\Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	76.84	1.46E+02	22.96			1.46E+02	2.30E+01
F	2	185.95	8.98E+01	16.95			8.98E+01	1.69E+01
F	3	238.46	2.58E+02	21.74			2.58E+02	2.17E+01
F	4	294.93	8.99E+01	13.94			8.99E+01	1.39E+01
F	5	338.38	6.93E+01	11.95			6.93E+01	1.20E+01
F	6	351.76	1.47E+02	16.32	8.36E+01	1.86E+01	6.32E+01	2.47E+01
F	7	582.82	8.47E+01	11.72			8.47E+01	1.17E+01
F	8	609.09	1.32E+02	13.13	4.12E+01	1.21E+01	9.04E+01	1.79E+01
F	9	661.42	2.21E+02	16.38	6.61E+01	1.27E+01	1.54E+02	2.07E+01
F	10	726.72	2.69E+01	8.19			2.69E+01	8.19E+00
F	11	910.85	5.09E+01	9.14			5.09E+01	9.14E+00
F	12	968.72	3.43E+01	7.73			3.43E+01	7.73E+00
F	13	1119.74	2.17E+01	6.96			2.17E+01	6.96E+00
F	14	1331.64	4.84E+01	8.19			4.84E+01	8.19E+00

Analysis Report for L1-010-101-FS-GS-C07

WTB L1-010-101 10.18.17

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	15	1460.35	5.35E+02	23.87	5.63E+01	8.57E+00	4.78E+02	2.54E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.97	1460.75	*	10.67	5.37E-06	3.21E-07
CS-137	0.99	661.65	*	85.12	1.07E-07	1.47E-08
BI-212	0.58	727.17	*	11.80	1.47E-07	4.50E-08
		785.42		2.00		
		1620.56		2.75		
PB-212	0.99	77.11	*	17.50	2.13E-07	3.42E-08
		238.63	*	44.60	1.37E-07	1.21E-08
BI-214	0.57	609.31	*	46.30	1.07E-07	2.14E-08
		1120.29	*	15.10	1.37E-07	4.40E-08
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
PB-214	0.99	77.11	*	10.70	3.48E-07	5.60E-08
		295.21	*	19.20	1.32E-07	2.08E-08
		351.92	*	37.20	5.63E-08	2.21E-08
RA-226	0.98	186.21	*	3.28	5.46E-07	1.04E-07
AC-228	0.59	209.28		4.40		
		338.32	*	11.40	1.94E-07	3.38E-08
		794.70		4.60		
		911.60	*	27.70	1.45E-07	2.63E-08
		964.60		5.20		
		969.11	*	16.60	1.73E-07	3.91E-08

Analysis Report for L1-010-101-FS-GS-C07

WTB L1-010-101 10.18.17

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.975	5.37E-06	3.21E-07	
CS-137	0.991	1.07E-07	1.47E-08	
BI-212	0.583	1.47E-07	4.50E-08	
PB-212	0.994	1.39E-07	1.14E-08	
BI-214	0.573	1.13E-07	1.92E-08	
PB-214	0.992	9.83E-08	1.47E-08	
RA-226	0.989	5.46E-07	1.04E-07	
AC-228	0.592	1.66E-07	1.83E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C07
 WTB L1-010-101 10.18.17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/18/2017 8:19:15AM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 7	582.82	2.35360E-02	13.83		T/208
F 14	1331.64	1.34306E-02	16.95	Tol.	CO-60 NO 10/18/17 PEAK at 1331.64 very Bi-208 J Ogn 10/18/17

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

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	* 10.67	5.37E-06	5.38E-07	5.38E-07
+	AR-41	1293.64	99.16	2.14E-06	1.94E-05	1.94E-05
+	CO-60	1173.22	100.00	4.16E-08	5.55E-08	5.97E-08
		1332.49	100.00	5.60E-08		5.55E-08
+	KR-85	513.99	0.43	3.62E-06	8.52E-06	8.52E-06
+	Y-88	898.04	93.70	-2.79E-08	2.66E-08	4.14E-08
		1836.06	99.20	2.93E-09		2.66E-08
+	NB-94	702.63	100.00	7.59E-09	3.53E-08	3.53E-08
		871.10	100.00	-3.17E-10		3.98E-08
+	I-131	284.30	6.06	2.56E-07	3.52E-08	4.90E-07
		364.48	81.20	-2.54E-08		3.52E-08
		636.97	7.27	-2.73E-07		4.75E-07
+	CS-134	604.70	97.60	-8.73E-09	4.23E-08	4.23E-08
		795.84	85.40	-4.90E-08		4.56E-08
+	CS-137	661.65	* 85.12	1.07E-07	5.14E-08	5.14E-08
+	CE-144	80.12	1.36	-3.72E-07	2.34E-07	2.98E-06

Analysis Report for L1-010-101-FS-GS-C07

WTB L1-010-101 10.18.17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
	CE-144	133.51	11.09	2.76E-08	2.34E-07	2.34E-07
+	EU-152	121.78	28.40	-8.80E-08	9.13E-08	9.13E-08
		244.69	7.49	-7.43E-07		4.31E-07
		964.00	14.44	1.87E-07		3.23E-07
		1408.00	20.74	4.20E-09		1.65E-07
+	EU-154	123.07	40.40	-4.96E-08	6.41E-08	6.41E-08
		247.94	6.60	-1.67E-06		4.30E-07
		723.30	19.70	2.28E-07		2.06E-07
		873.20	11.50	-3.40E-07		3.18E-07
		1004.76	17.90	7.58E-08		2.27E-07
		1274.51	35.50	-9.56E-08		1.27E-07
+	EU-155	86.54	32.80	-1.04E-08	1.03E-07	1.03E-07
		105.31	21.80	2.93E-08		1.27E-07
+	BI-214	609.31	* 46.30	1.07E-07	8.13E-08	8.13E-08
		1120.29	* 15.10	1.37E-07		2.10E-07
		1238.11	5.94	-4.66E-08		9.50E-07
		1377.67	4.11	1.58E-07		9.11E-07
		1407.98	2.48	3.51E-08		1.38E-06
		1509.19	2.19	6.20E-07		1.49E-06
		1764.49	15.80	1.75E-07		2.85E-07
+	PB-214	77.11	* 10.70	3.48E-07	8.81E-08	3.48E-07
		295.21	* 19.20	1.32E-07		8.81E-08
		351.92	* 37.20	5.63E-08		8.93E-08
+	PA-228	89.95	22.00	2.93E-07	1.43E-07	2.46E-07
		93.35	35.00	-1.63E-08		1.43E-07
		105.00	16.30	-9.38E-08		2.78E-07
		129.22	2.97	-5.68E-07		1.42E-06
		338.32	5.30	-6.30E-07		9.25E-07
		463.00	13.80	-6.90E-08		3.90E-07
		911.23	16.70	4.41E-07		4.97E-07
+	AM-241	59.54	36.30	1.08E-07	1.91E-07	1.91E-07
+	CM-243	103.76	23.00	1.26E-08	1.20E-07	1.20E-07
		228.18	10.60	-1.75E-07		2.36E-07
		277.60	14.00	-2.40E-08		1.95E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C07-SB

WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C07-SB
Sample Description : WTB L1-010-101 10/18/17
Sample Type : 500 ml Marinelli
Unit :
Sample Point :

Dried Sample

Sample Size : 8.627E+02 grams
Facility : Dairyland_NPP

Sample Taken On : 10/17/2017 3:51:00PM
Acquisition Started : 10/19/2017 8:36:14AM

Procedure : 500ml Marinelli
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli
Live Time : 3600.0 seconds
Real Time : 3611.0 seconds

Dead Time : 0.30 %

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3535

10/19/17
OGW
10/19/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/19/2017 9:36:28AM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C07-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.81	147 -	159	154.16	1.29E+02	21.25	6.08E+02	1.27
F	2	238.56	472 -	485	477.60	3.05E+02	21.97	2.93E+02	1.37
F	3	295.02	582 -	596	590.50	1.16E+02	14.23	1.84E+02	1.30
F	4	338.09	672 -	684	676.61	3.91E+01	11.51	1.60E+02	1.43
F	5	351.83	700 -	708	704.09	1.41E+02	15.18	1.01E+02	1.44
F	6	582.99	1161 -	1173	1166.33	8.36E+01	11.18	6.61E+01	1.45
F	7	609.08	1212 -	1226	1218.49	1.14E+02	12.34	5.84E+01	1.67
F	8	661.25	1317 -	1331	1322.82	1.85E+02	14.85	5.25E+01	1.77
F	9	726.69	1450 -	1458	1453.68	3.08E+01	7.93	3.38E+01	1.59
F	10	911.17	1815 -	1831	1822.57	6.37E+01	10.09	3.21E+01	3.57
F	11	968.55	1933 -	1942	1937.32	2.64E+01	7.04	3.86E+01	1.11
F	12	1120.12	2235 -	2244	2240.43	1.61E+01	5.00	2.17E+01	0.71
F	13	1377.62	2751 -	2760	2755.38	1.15E+01	3.87	7.50E+00	1.58
F	14	1460.27	2911 -	2929	2920.66	5.50E+02	23.79	7.15E+00	2.35

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/19/2017 9:36:28AM

Env. Background File : C:\Canberra\Apex\Root\ Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	76.81	1.29E+02	21.25			1.29E+02	2.13E+01
F	2	238.56	3.05E+02	21.97			3.05E+02	2.20E+01
F	3	295.02	1.16E+02	14.23			1.16E+02	1.42E+01
F	4	338.09	3.91E+01	11.51			3.91E+01	1.15E+01
F	5	351.83	1.41E+02	15.18	8.36E+01	1.86E+01	5.73E+01	2.40E+01
F	6	582.99	8.36E+01	11.18			8.36E+01	1.12E+01
F	7	609.08	1.14E+02	12.34	4.12E+01	1.21E+01	7.28E+01	1.73E+01
F	8	661.25	1.85E+02	14.85	6.61E+01	1.27E+01	1.19E+02	1.95E+01
F	9	726.69	3.08E+01	7.93			3.08E+01	7.93E+00
F	10	911.17	6.37E+01	10.09			6.37E+01	1.01E+01
F	11	968.55	2.64E+01	7.04			2.64E+01	7.04E+00
F	12	1120.12	1.61E+01	5.00			1.61E+01	5.00E+00
F	13	1377.62	1.15E+01	3.87			1.15E+01	3.87E+00
F	14	1460.27	5.50E+02	23.79	5.63E+01	8.57E+00	4.93E+02	2.53E+01

Analysis Report for L1-010-101-FS-GS-C07-SB

WTB L1-010-101 10/18/17

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

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\ Dairyland_NPPLibrary\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.96	1460.75	*	10.67	6.23E-06	3.63E-07
CS-137	0.97	661.65	*	85.12	9.30E-08	1.55E-08
BI-212	0.58	727.17	*	11.80	1.90E-07	4.90E-08
		785.42		2.00		
		1620.56		2.75		
PB-212	0.99	77.11	*	17.50	2.13E-07	3.56E-08
		238.63	*	44.60	1.82E-07	1.39E-08
BI-214	0.63	609.31	*	46.30	9.72E-08	2.32E-08
		1120.29	*	15.10	1.14E-07	3.55E-08
		1238.11		5.94		
		1377.67	*	4.11	3.58E-07	1.21E-07
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
PB-214	0.99	77.11	*	10.70	3.48E-07	5.82E-08
		295.21	*	19.20	1.93E-07	2.40E-08
		351.92	*	37.20	5.74E-08	2.41E-08
AC-228	0.60	209.28		4.40		
		338.32	*	11.40	1.23E-07	3.64E-08
		794.70		4.60		
		911.60	*	27.70	2.05E-07	3.27E-08
		964.60		5.20		
		969.11	*	16.60	1.49E-07	4.00E-08

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C07-SB

WTB L1-010-101 10/18/17

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.964	6.23E-06	3.63E-07	
CS-137	0.975	9.30E-08	1.55E-08	
BI-212	0.580	1.90E-07	4.90E-08	
PB-212	0.995	1.76E-07	1.31E-08	
BI-214	0.638	1.09E-07	1.92E-08	
PB-214	0.995	1.20E-07	1.64E-08	
AC-228	0.608	1.63E-07	2.08E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C07-SB
 WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/19/2017 9:36:28AM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 6	582.99	2.32157E-02	13.38		11/20/17

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

for OGP
 10/19/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	6.23E-06	5.50E-07	5.50E-07
+	AR-41	1293.64		99.16	-8.53E-02	3.09E-01	3.09E-01
+	CO-60	1173.22		100.00	6.47E-08	5.32E-08	6.37E-08
		1332.49		100.00	2.55E-08		5.32E-08
+	KR-85	513.99		0.43	8.89E-06	9.61E-06	9.61E-06
+	Y-88	898.04		93.70	-1.88E-08	3.73E-08	4.82E-08
		1836.06		99.20	-4.15E-09		3.73E-08
+	NB-94	702.63		100.00	9.67E-09	3.85E-08	3.85E-08
		871.10		100.00	-4.05E-08		4.44E-08
+	I-131	284.30		6.06	1.16E-07	4.50E-08	5.86E-07
		364.48		81.20	-9.14E-09		4.50E-08
		636.97		7.27	1.09E-07		6.09E-07
+	CS-134	604.70		97.60	6.23E-09	4.86E-08	4.86E-08
		795.84		85.40	-2.29E-08		5.04E-08
+	CS-137	661.65	*	85.12	9.30E-08	5.26E-08	5.26E-08
+	CE-144	80.12		1.36	-2.48E-07	2.64E-07	3.37E-06
		133.51		11.09	1.11E-07		2.64E-07

Analysis Report for L1-010-101-FS-GS-C07-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	EU-152	121.78	28.40	-3.39E-08	1.04E-07	1.04E-07
		244.69	7.49	-3.80E-07		4.88E-07
		964.00	14.44	4.67E-07		4.04E-07
		1408.00	20.74	9.30E-09		1.85E-07
+	EU-154	123.07	40.40	-2.06E-08	7.28E-08	7.28E-08
		247.94	6.60	-4.62E-07		4.91E-07
		723.30	19.70	1.08E-07		2.16E-07
		873.20	11.50	9.21E-08		3.90E-07
		1004.76	17.90	-3.99E-08		2.48E-07
		1274.51	35.50	-4.00E-08		1.58E-07
+	EU-155	86.54	32.80	-2.66E-08	1.18E-07	1.18E-07
		105.31	21.80	-2.09E-08		1.39E-07
+	BI-214	609.31	* 46.30	9.72E-08	8.64E-08	8.64E-08
		1120.29	* 15.10	1.14E-07		1.83E-07
		1238.11	5.94	3.17E-07		1.08E-06
		1377.67	* 4.11	3.58E-07		5.07E-07
		1407.98	2.48	7.78E-08		1.55E-06
		1509.19	2.19	-3.93E-07		1.81E-06
		1764.49	15.80	2.47E-07		3.02E-07
+	PB-214	77.11	* 10.70	3.48E-07	8.64E-08	3.63E-07
		295.21	* 19.20	1.93E-07		1.30E-07
		351.92	* 37.20	5.74E-08		8.64E-08
+	PA-228	89.95	22.00	5.24E-07	3.66E-07	6.24E-07
		93.35	35.00	8.43E-08		3.66E-07
		105.00	16.30	-2.30E-07		6.82E-07
		129.22	2.97	1.83E-06		3.65E-06
		338.32	5.30	8.53E-07		2.35E-06
		463.00	13.80	-3.06E-07		9.69E-07
		911.23	16.70	4.65E-07		1.19E-06
+	AM-241	59.54	36.30	-7.26E-09	2.10E-07	2.10E-07
+	CM-243	103.76	23.00	2.11E-09	1.34E-07	1.34E-07
		228.18	10.60	4.45E-08		2.76E-07
		277.60	14.00	-1.41E-07		2.17E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C08-SB
WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C08-SB
Sample Description : WTB L1-010-101 10/18/17
Sample Type : 500 ml Marinelli
Unit :
Sample Point :

Sample Size : 7.780E+02 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/18/2017 12:30:00PM
Acquisition Started : 10/20/2017 10:23:15AM ✓

Procedure : 500ml Marinelli
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli ✓
Live Time : 3600.0 seconds ✓
Real Time : 3611.2 seconds

Dead Time : 0.31 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3541

Reviewed
Joe D. John
10/20/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 11:23:29AM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C08-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.90	147 -	160	154.34	1.15E+02	18.42	5.48E+02	1.10
F	2	92.89	183 -	193	186.32	6.86E+01	16.56	4.01E+02	1.03
F	3	186.12	369 -	380	372.74	7.06E+01	17.17	2.99E+02	1.85
F	4	238.59	471 -	485	477.65	2.77E+02	21.36	3.09E+02	1.40
F	5	294.97	586 -	595	590.39	5.72E+01	12.09	1.38E+02	1.21
F	6	338.19	670 -	681	676.82	5.97E+01	12.20	1.46E+02	1.39
F	7	351.74	697 -	710	703.90	1.35E+02	14.59	1.21E+02	1.59
F	8	582.93	1160 -	1170	1166.21	7.91E+01	11.06	4.68E+01	1.71
F	9	609.09	1214 -	1223	1218.51	8.82E+01	11.27	4.64E+01	1.47
F	10	910.87	1817 -	1827	1821.98	4.28E+01	8.77	3.64E+01	1.83
F	11	1460.42	2913 -	2929	2920.96	4.61E+02	21.89	1.67E+01	2.43

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 11:23:29AM

Env. Background File : C:\Canberra\Apex\Root\ Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	76.90	1.15E+02	18.42			1.15E+02	1.84E+01
F	2	92.89	6.86E+01	16.56			6.86E+01	1.66E+01
F	3	186.12	7.06E+01	17.17			7.06E+01	1.72E+01
F	4	238.59	2.77E+02	21.36			2.77E+02	2.14E+01
F	5	294.97	5.72E+01	12.09			5.72E+01	1.21E+01
F	6	338.19	5.97E+01	12.20			5.97E+01	1.22E+01
F	7	351.74	1.35E+02	14.59	8.36E+01	1.86E+01	5.11E+01	2.36E+01
F	8	582.93	7.91E+01	11.06			7.91E+01	1.11E+01
F	9	609.09	8.82E+01	11.27	4.12E+01	1.21E+01	4.70E+01	1.65E+01
F	10	910.87	4.28E+01	8.77			4.28E+01	8.77E+00
F	11	1460.42	4.61E+02	21.89	5.63E+01	8.57E+00	4.05E+02	2.35E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C08-SB

WTB L1-010-101 10/18/17

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\ Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	5.67E-06	3.65E-07
PB-212	0.99	77.11 *	17.50	2.08E-07	3.42E-08
		238.63 *	44.60	1.84E-07	1.49E-08
BI-214	0.34	609.31 *	46.30	6.95E-08	2.46E-08
		1120.29	15.10		
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	0.99	77.11 *	10.70	3.41E-07	5.59E-08
		295.21 *	19.20	1.05E-07	2.24E-08
		351.92 *	37.20	5.68E-08	2.63E-08
RA-226	0.99	186.21 *	3.28	5.36E-07	1.31E-07

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
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Analysis Report for L1-010-101-FS-GS-C08-SB

WTB L1-010-101 10/18/17

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.983	5.67E-06	3.65E-07	
PB-212	0.998	1.80E-07	1.38E-08	
BI-214	0.346	6.95E-08	2.46E-08	
PB-214	0.993	8.15E-08	1.64E-08	
RA-226	0.999	5.36E-07	1.31E-07	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C08-SB

WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 11:23:29AM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 2	92.89	1.90618E-02	24.13	Tol.	PA-228 ✓
F 6	338.19	1.65965E-02	20.41	Tol.	AC-228 ✓ PA-228
F 8	582.93	2.19808E-02	13.98		Tl 208
F 10	910.87	1.18854E-02	20.49	Tol.	AC-228 ✓ PA-228

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

Joe O. J...
 10/20/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	5.67E-06	6.59E-07
+	AR-41	1293.64		99.16	-5.11E-01	2.28E+00
+	CO-60	1173.22	100.00	3.43E-08	5.31E-08	6.40E-08
		1332.49	100.00	4.74E-08		5.31E-08
+	KR-85	513.99	0.43	1.22E-05	1.05E-05	1.05E-05
+	Y-88	898.04	93.70	-4.79E-08	3.82E-08	4.96E-08
		1836.06	99.20	-1.79E-08		3.82E-08
+	NB-94	702.63	100.00	8.42E-09	4.38E-08	4.38E-08
		871.10	100.00	6.27E-09		4.60E-08

Analysis Report for L1-010-101-FS-GS-C08-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	I-131	284.30	6.06	2.11E-07	4.86E-08	6.33E-07
		364.48	81.20	-1.85E-08		4.86E-08
		636.97	7.27	4.09E-07		6.65E-07
+	CS-134	604.70	97.60	5.87E-08	5.00E-08	5.00E-08
		795.84	85.40	-2.90E-08		5.48E-08
+	CS-137	661.65	85.12	6.37E-08	5.86E-08	5.86E-08
+	CE-144	80.12	1.36	-1.53E-06	2.74E-07	3.41E-06
		133.51	11.09	-1.08E-07		2.74E-07
+	EU-152	121.78	28.40	-2.83E-08	1.13E-07	1.13E-07
		244.69	7.49	-5.24E-07		5.24E-07
		964.00	14.44	4.63E-07		4.07E-07
		1408.00	20.74	3.68E-08		1.97E-07
+	EU-154	123.07	40.40	-8.59E-10	7.98E-08	7.98E-08
		247.94	6.60	-8.89E-07		5.22E-07
		723.30	19.70	-6.78E-08		2.34E-07
		873.20	11.50	-9.92E-08		3.93E-07
		1004.76	17.90	-5.22E-08		2.67E-07
		1274.51	35.50	5.80E-08		1.60E-07
+	EU-155	86.54	32.80	1.92E-08	1.20E-07	1.20E-07
		105.31	21.80	6.90E-08		1.53E-07
+	BI-214	609.31	* 46.30	6.95E-08	8.73E-08	8.73E-08
		1120.29	15.10	1.55E-07		4.17E-07
		1238.11	5.94	-1.95E-07		1.11E-06
		1377.67	4.11	-7.27E-07		1.02E-06
		1407.98	2.48	3.07E-07		1.65E-06
		1509.19	2.19	-9.19E-07		1.61E-06
		1764.49	15.80	9.36E-08		2.83E-07
+	PB-214	77.11	* 10.70	3.41E-07	1.04E-07	3.89E-07
		295.21	* 19.20	1.05E-07		1.12E-07
		351.92	* 37.20	5.68E-08		1.04E-07
+	PA-228	89.95	22.00	1.29E-08	4.48E-07	7.65E-07
		93.35	35.00	-3.61E-07		4.48E-07
		105.00	16.30	5.58E-07		8.86E-07
		129.22	2.97	1.78E-06		4.52E-06
		338.32	5.30	3.10E-06		3.09E-06
		463.00	13.80	6.08E-07		1.25E-06
		911.23	16.70	1.55E-06		1.47E-06
+	AM-241	59.54	36.30	-5.35E-08	2.17E-07	2.17E-07
+	CM-243	103.76	23.00	5.31E-08	1.46E-07	1.46E-07
		228.18	10.60	1.03E-08		2.95E-07
		277.60	14.00	7.03E-08		2.41E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C08-SB
WTB L1-010-101 10/18/17

Analysis Report for L1-010-101-FS-GS-C09-SB
WTB L1-010-101 10/16/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C09-SB ✓
Sample Description : WTB L1-010-101 10/16/17
Sample Type : 500 ml Marinelli /
Unit :
Sample Point :

Sample Size : 9.824E+02 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/16/2017 4:50:00PM
Acquisition Started : 10/17/2017 7:36:24AM ✓

Procedure : 500ml Marinelli ✓
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli ✓
Live Time : 3600.0 seconds ✓
Real Time : 3611.2 seconds

Dead Time : 0.31 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3527

RECEIVED
Joe P. Jones
10/17/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/17/2017 8:36:38AM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C09-SB

WTB L1-010-101 10/16/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.95	152 -	161	154.46	9.98E+01	19.66	5.38E+02	0.85
F	2	185.83	368 -	378	372.15	7.51E+01	18.27	3.60E+02	1.53
F	3	238.54	473 -	485	477.56	3.39E+02	24.15	3.24E+02	1.61
F	4	295.18	582 -	595	590.81	1.10E+02	14.72	2.00E+02	1.37
F	5	338.24	673 -	685	676.91	7.86E+01	13.32	1.64E+02	1.43
F	6	351.74	700 -	710	703.91	1.72E+02	16.72	1.35E+02	1.60
F	7	510.23	1016 -	1029	1020.83	6.21E+01	11.73	1.05E+02	1.84
F	8	583.30	1162 -	1172	1166.95	8.42E+01	11.18	7.47E+01	1.02
F	9	609.11	1213 -	1224	1218.56	1.25E+02	13.24	6.77E+01	1.54
F	10	661.28	1314 -	1329	1322.87	5.22E+02	24.72	8.84E+01	1.74
F	11	910.73	1816 -	1826	1821.71	4.48E+01	8.89	3.93E+01	1.63
F	12	968.78	1932 -	1942	1937.78	4.17E+01	8.83	4.42E+01	1.71
F	13	1119.95	2236 -	2245	2240.08	2.45E+01	7.05	2.86E+01	1.61
F	14	1460.35	2913 -	2929	2920.81	5.58E+02	24.07	9.68E+00	2.37

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/17/2017 8:36:38AM

Env. Background File : C:\Canberra\Apex\Root\Daityland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	76.95	9.98E+01	19.66			9.98E+01	1.97E+01
F	2	185.83	7.51E+01	18.27			7.51E+01	1.83E+01
F	3	238.54	3.39E+02	24.15			3.39E+02	2.42E+01
F	4	295.18	1.10E+02	14.72			1.10E+02	1.47E+01
F	5	338.24	7.86E+01	13.32			7.86E+01	1.33E+01
F	6	351.74	1.72E+02	16.72	8.36E+01	1.86E+01	8.81E+01	2.50E+01
F	7	510.23	6.21E+01	11.73			6.21E+01	1.17E+01
F	8	583.30	8.42E+01	11.18			8.42E+01	1.12E+01
F	9	609.11	1.25E+02	13.24	4.12E+01	1.21E+01	8.35E+01	1.79E+01
F	10	661.28	5.22E+02	24.72	6.61E+01	1.27E+01	4.56E+02	2.78E+01
F	11	910.73	4.48E+01	8.89			4.48E+01	8.89E+00
F	12	968.78	4.17E+01	8.83			4.17E+01	8.83E+00
F	13	1119.95	2.45E+01	7.05			2.45E+01	7.05E+00
F	14	1460.35	5.58E+02	24.07	5.63E+01	8.57E+00	5.02E+02	2.55E+01

Analysis Report for L1-010-101-FS-GS-C09-SB

WTB L1-010-101 10/16/17

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

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPPLibrary\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.97	1460.75	*	10.67	5.57E-06	3.23E-07
CS-137	0.97	661.65	*	85.12	3.13E-07	2.09E-08
PB-212	0.99	77.11	*	17.50	1.44E-07	2.87E-08
		238.63	*	44.60	1.78E-07	1.35E-08
BI-214	0.57	609.31	*	46.30	9.78E-08	2.12E-08
		1120.29	*	15.10	1.53E-07	4.40E-08
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
PB-214	0.99	77.11	*	10.70	2.35E-07	4.69E-08
		295.21	*	19.20	1.60E-07	2.18E-08
		351.92	*	37.20	7.75E-08	2.21E-08
RA-226	0.97	186.21	*	3.28	4.51E-07	1.10E-07
AC-228	0.58	209.28		4.40		
		338.32	*	11.40	2.18E-07	3.73E-08
		794.70		4.60		
		911.60	*	27.70	1.26E-07	2.52E-08
		964.60		5.20		
		969.11	*	16.60	2.08E-07	4.42E-08

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C09-SB

WTB L1-010-101 10/16/17

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
✓ K-40	0.975	5.57E-06	3.23E-07	
CS-137	0.978	3.13E-07	2.09E-08	
PB-212	0.998	1.60E-07	1.23E-08	
BI-214	0.579	1.08E-07	1.91E-08	
PB-214	0.996	1.05E-07	1.49E-08	
RA-226	0.977	4.51E-07	1.10E-07	
AC-228	0.582	1.65E-07	1.89E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C09-SB
 WTB L1-010-101 10/16/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/17/2017 8:36:38AM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 7	510.23	1.72486E-02	18.90		T1208 Ac228
F 8	583.30	2.33984E-02	13.27		

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

J. O. J.
 10/17/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	* 10.67	5.57E-06	4.89E-07	4.89E-07
+	AR-41	1293.64	99.16	-5.06E-06	1.61E-05	1.61E-05
+	✓ CO-60	1173.22	100.00	3.34E-08	4.64E-08	5.82E-08
		1332.49	100.00	2.10E-08		4.64E-08
+	KR-85	513.99	0.43	5.58E-06	8.50E-06	8.50E-06
+	Y-88	898.04	93.70	-9.86E-09	2.92E-08	3.83E-08
		1836.06	99.20	-3.78E-09		2.92E-08
+	NB-94	702.63	100.00	9.74E-09	3.47E-08	3.47E-08
		871.10	100.00	-1.88E-10		3.63E-08
+	I-131	284.30	6.06	-5.58E-08	3.93E-08	4.91E-07
		364.48	81.20	9.56E-09		3.93E-08
		636.97	7.27	-1.65E-07		4.79E-07
+	CS-134	604.70	97.60	-1.86E-08	4.51E-08	4.58E-08
		795.84	85.40	-3.62E-08		4.51E-08
+	✓ CS-137	661.65	* 85.12	3.13E-07	5.20E-08	5.20E-08
+	CE-144	80.12	1.36	-4.61E-07	2.45E-07	2.98E-06

Analysis Report for L1-010-101-FS-GS-C09-SB

WTB L1-010-101 10/16/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
	CE-144	133.51	11.09	1.04E-07	2.45E-07	2.45E-07
+	✓ EU-152	121.78	28.40	-9.37E-08	9.35E-08	9.35E-08
		244.69	7.49	-4.29E-07		4.47E-07
		964.00	14.44	2.77E-07		3.55E-07
		1408.00	20.74	7.88E-08		1.74E-07
+	✓ EU-154	123.07	40.40	-6.21E-08	6.52E-08	6.52E-08
		247.94	6.60	-5.03E-07		4.56E-07
		723.30	19.70	-2.66E-08		1.76E-07
		873.20	11.50	-3.29E-08		3.16E-07
		1004.76	17.90	1.65E-07		2.31E-07
		1274.51	35.50	-4.59E-08		1.33E-07
+	EU-155	86.54	32.80	2.26E-08	1.06E-07	1.06E-07
		105.31	21.80	-5.69E-08		1.29E-07
+	BI-214	609.31	* 46.30	9.78E-08	7.61E-08	7.61E-08
		1120.29	* 15.10	1.53E-07		1.81E-07
		1238.11	5.94	6.11E-07		1.06E-06
		1377.67	4.11	8.32E-08		9.48E-07
		1407.98	2.48	6.59E-07		1.45E-06
		1509.19	2.19	5.89E-07		1.57E-06
		1764.49	15.80	1.72E-07		2.55E-07
+	PB-214	77.11	* 10.70	2.35E-07	8.19E-08	2.79E-07
		295.21	* 19.20	1.60E-07		1.16E-07
		351.92	* 37.20	7.75E-08		8.19E-08
+	PA-228	89.95	22.00	3.20E-07	1.48E-07	2.50E-07
		93.35	35.00	2.12E-08		1.48E-07
		105.00	16.30	-2.46E-07		2.78E-07
		129.22	2.97	1.29E-06		1.48E-06
		338.32	5.30	1.27E-07		9.77E-07
		463.00	13.80	-2.09E-08		4.14E-07
		911.23	16.70	3.18E-07		4.42E-07
+	AM-241	59.54	36.30	9.04E-09	1.93E-07	1.93E-07
+	CM-243	103.76	23.00	-1.74E-09	1.25E-07	1.25E-07
		228.18	10.60	-1.29E-07		2.60E-07
		277.60	14.00	-8.08E-09		2.09E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C10-SB

WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C10-SB ✓
Sample Description : WTB L1-010-101 10/18/17
Sample Type : 500 ml Marinelli
Unit :
Sample Point :

Sample Size : 7.402E+02 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/18/2017 9:02:00AM ✓
Acquisition Started : 10/20/2017 2:30:11PM ✓

Procedure : 500ml Marinelli
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli ✓
Live Time : 3600.0 seconds
Real Time : 3611.1 seconds

Dead Time : 0.31 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3545

REVIEWED
Joe O. Jacobson
10/20/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 3:30:25PM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C10-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	77.07	147 -	158	154.69	1.01E+02	17.90	5.60E+02	0.89
F	2	238.45	470 -	485	477.38	2.49E+02	20.54	3.46E+02	1.35
F	3	582.92	1162 -	1173	1166.18	8.70E+01	10.76	5.22E+01	1.17
F	4	609.12	1215 -	1223	1218.57	8.38E+01	10.82	4.38E+01	1.24
F	5	661.48	1313 -	1329	1323.27	3.09E+02	18.75	6.67E+01	1.66
F	6	910.69	1815 -	1826	1821.63	4.01E+01	7.93	3.42E+01	1.32
F	7	969.14	1934 -	1943	1938.50	3.68E+01	7.74	2.70E+01	1.55
F	8	1119.76	2234 -	2244	2239.71	2.42E+01	6.08	2.58E+01	1.06
F	9	1332.10	2660 -	2669	2664.33	2.14E+01	6.07	1.53E+01	1.82
F	10	1460.33	2911 -	2929	2920.78	4.73E+02	21.94	9.37E+00	2.54

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 3:30:25PM

Env. Background File : C:\Canberra\Apex\Root\ Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	77.07	1.01E+02	17.90			1.01E+02	1.79E+01
F	2	238.45	2.49E+02	20.54			2.49E+02	2.05E+01
F	3	582.92	8.70E+01	10.76			8.70E+01	1.08E+01
F	4	609.12	8.38E+01	10.82	4.12E+01	1.21E+01	4.26E+01	1.62E+01
F	5	661.48	3.09E+02	18.75	6.61E+01	1.27E+01	2.43E+02	2.26E+01
F	6	910.69	4.01E+01	7.93			4.01E+01	7.93E+00
F	7	969.14	3.68E+01	7.74			3.68E+01	7.74E+00
F	8	1119.76	2.42E+01	6.08			2.42E+01	6.08E+00
F	9	1332.10	2.14E+01	6.07			2.14E+01	6.07E+00
F	10	1460.33	4.73E+02	21.94	5.63E+01	8.57E+00	4.16E+02	2.35E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C10-SB

WTB L1-010-101 10/18/17

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\ Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.97	1460.75	*	10.67	6.13E-06	3.86E-07
CS-137	0.99	661.65	*	85.12	2.21E-07	2.15E-08
PB-212	0.99	77.11	*	17.50	1.92E-07	3.46E-08
		238.63	*	44.60	1.73E-07	1.50E-08
BI-214	0.57	609.31	*	46.30	6.63E-08	2.53E-08
		1120.29	*	15.10	2.00E-07	5.04E-08
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.973	6.13E-06	3.86E-07	
CS-137	0.995	2.21E-07	2.15E-08	
PB-212	0.997	1.76E-07	1.38E-08	
BI-214	0.575	9.32E-08	2.26E-08	

Analysis Report for L1-010-101-FS-GS-C10-SB

WTB L1-010-101 10/18/17

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C10-SB
 WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 3:30:25PM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F	3	582.92	2.41677E-02		Tl-208
F	6	910.69	1.11508E-02	Tol.	AC-228 ✓ PA-228 ✓
F	7	969.14	1.02168E-02	Tol.	AC-228
F	9	1332.10	5.94642E-03	Tol.	CO-60 <i>NOTED NO NO JUSTICE REPEAT 1173 KEV 1460 513 Jan 2018 10/20/17</i>

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

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Daifland_NPPLibrary\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	6.13E-06	6.54E-07
+	AR-41	1293.64	99.16	3.96E+00	4.19E+01	4.19E+01
+	✓ CO-60	1173.22	100.00	7.18E-08	6.48E-08	7.09E-08
		1332.49	100.00	6.10E-08		6.48E-08
+	KR-85	513.99	0.43	1.03E-05	1.15E-05	1.15E-05
+	Y-88	898.04	93.70	-7.10E-09	3.39E-08	5.25E-08
		1836.06	99.20	-4.86E-10		3.39E-08
+	NB-94	702.63	100.00	-1.53E-08	4.32E-08	4.32E-08
		871.10	100.00	1.83E-08		4.86E-08
+	I-131	284.30	6.06	-4.55E-07	5.40E-08	6.78E-07
		364.48	81.20	-3.69E-09		5.40E-08

Analysis Report for L1-010-101-FS-GS-C10-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
	I-131	636.97	7.27	-1.36E-07	5.40E-08	7.19E-07
+	CS-134	604.70	97.60	3.63E-08	5.34E-08	5.34E-08
		795.84	85.40	5.78E-10		5.38E-08
+	✓ CS-137	661.65	* 85.12	2.21E-07	6.52E-08	6.52E-08
+	CE-144	80.12	1.36	-1.67E-06	2.94E-07	3.81E-06
		133.51	11.09	1.87E-07		2.94E-07
+	✓ EU-152	121.78	28.40	4.97E-08	1.15E-07	1.15E-07
		244.69	7.49	-1.72E-07		5.45E-07
		964.00	14.44	3.60E-07		4.32E-07
+	✓ EU-154	1408.00	20.74	8.58E-08		2.46E-07
		123.07	40.40	3.50E-08	8.18E-08	8.18E-08
		247.94	6.60	-8.02E-07		5.60E-07
		723.30	19.70	7.75E-08		2.49E-07
		873.20	11.50	5.97E-08		4.18E-07
		1004.76	17.90	-1.07E-07		2.70E-07
		1274.51	35.50	7.45E-08		1.56E-07
+	EU-155	86.54	32.80	-9.04E-08	1.32E-07	1.32E-07
		105.31	21.80	1.14E-07		1.62E-07
+	BI-214	609.31	* 46.30	6.63E-08	9.04E-08	9.04E-08
		1120.29	* 15.10	2.00E-07		2.35E-07
		1238.11	5.94	-4.20E-07		1.17E-06
		1377.67	4.11	-2.71E-07		1.02E-06
		1407.98	2.48	7.17E-07		2.06E-06
		1509.19	2.19	3.94E-07		1.77E-06
		1764.49	15.80	2.18E-07		3.23E-07
+	PB-214	77.11	10.70	6.37E-07	1.16E-07	5.17E-07
		295.21	19.20	3.71E-07		2.09E-07
		351.92	37.20	8.25E-08		1.16E-07
+	PA-228	89.95	22.00	6.17E-07	6.17E-07	1.05E-06
		93.35	35.00	1.52E-07		6.17E-07
		105.00	16.30	3.68E-07		1.19E-06
		129.22	2.97	4.33E-06		6.13E-06
		338.32	5.30	2.86E-06		4.22E-06
		463.00	13.80	9.50E-08		1.71E-06
		911.23	16.70	1.38E-06		1.97E-06
+	✓ AM-241	59.54	36.30	-6.25E-08	2.38E-07	2.38E-07
+	CM-243	103.76	23.00	-6.50E-08	1.53E-07	1.53E-07
		228.18	10.60	1.29E-07		3.18E-07
		277.60	14.00	2.16E-07		2.57E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C10-SB
WTB L1-010-101 10/18/17

Analysis Report for L1-010-101-FS-GS-C11-SB
WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification	: L1-010-101-FS-GS-C11-SB
Sample Description	: WTB L1-010-101 10/18/17
Sample Type	: 500 ml Marinelli
Unit	:
Sample Point	:
Sample Size	: 7.976E+02 grams ✓
Facility	: Dairyland_NPP
Sample Taken On	: 10/18/2017 11:25:00AM
Acquisition Started	: 10/20/2017 3:31:43PM
Procedure	: 500ml Marinelli
Operator	: Administrator
Detector Name	: HOTLAB
Geometry	: 500ml Marinelli ✓
Live Time	: 3600.0 seconds ✓
Real Time	: 3611.4 seconds
Dead Time	: 0.31 % ✓
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 4096
Peak Area Range (in channels)	: 100 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 7/8/2014
Efficiency Calibration Used Done On	: 7/8/2014
Efficiency Calibration Description	:
Sample Number	: 3546

revised
Jim Dyer
10/20/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 4:31:58PM
Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C11-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.78	147 -	159	154.11	1.09E+02	22.86	5.94E+02	1.72
F	2	92.85	183 -	193	186.24	6.04E+01	15.78	3.81E+02	0.99
F	3	185.47	364 -	377	371.45	8.92E+01	19.20	3.47E+02	2.11
F	4	238.53	473 -	482	477.54	2.25E+02	20.62	2.75E+02	1.23
F	5	295.14	583 -	595	590.74	8.84E+01	13.96	1.67E+02	1.47
F	6	338.30	673 -	681	677.04	4.66E+01	10.85	1.03E+02	1.18
F	7	582.93	1162 -	1171	1166.21	7.47E+01	10.73	4.86E+01	1.44
F	8	609.03	1212 -	1223	1218.39	1.01E+02	11.97	5.37E+01	1.54
F	9	661.47	1314 -	1332	1323.25	3.94E+02	21.10	6.82E+01	1.76
F	10	910.66	1815 -	1829	1821.55	4.70E+01	8.42	3.25E+01	1.90
F	11	1332.07	2659 -	2670	2664.27	3.16E+01	6.93	1.75E+01	1.96
F	12	1460.42	2913 -	2929	2920.94	3.99E+02	20.43	1.67E+01	2.47

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 4:31:58PM

Env. Background File : C:\Canberra\Apex\Root\Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	76.78	1.09E+02	22.86			1.09E+02	2.29E+01
F	2	92.85	6.04E+01	15.78			6.04E+01	1.58E+01
F	3	185.47	8.92E+01	19.20			8.92E+01	1.92E+01
F	4	238.53	2.25E+02	20.62			2.25E+02	2.06E+01
F	5	295.14	8.84E+01	13.96			8.84E+01	1.40E+01
F	6	338.30	4.66E+01	10.85			4.66E+01	1.09E+01
F	7	582.93	7.47E+01	10.73			7.47E+01	1.07E+01
F	8	609.03	1.01E+02	11.97	4.12E+01	1.21E+01	5.98E+01	1.70E+01
F	9	661.47	3.94E+02	21.10	6.61E+01	1.27E+01	3.28E+02	2.46E+01
F	10	910.66	4.70E+01	8.42			4.70E+01	8.42E+00
F	11	1332.07	3.16E+01	6.93			3.16E+01	6.93E+00
F	12	1460.42	3.99E+02	20.43	5.63E+01	8.57E+00	3.42E+02	2.21E+01

Analysis Report for L1-010-101-FS-GS-C11-SB

WTB L1-010-101 10/18/17

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

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.98	1460.75	*	10.67	4.68E-06	3.29E-07
CS-137	0.99	661.65	*	85.12	2.78E-07	2.22E-08
PB-212	0.99	77.11	*	17.50	1.93E-07	4.11E-08
		238.63	*	44.60	1.45E-07	1.38E-08
BI-214	0.34	609.31	*	46.30	8.63E-08	2.47E-08
		1120.29		15.10		
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
RA-226	0.91	186.21	*	3.28	6.58E-07	1.43E-07

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for L1-010-101-FS-GS-C11-SB

WTB L1-010-101 10/18/17

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.982	4.68E-06	3.29E-07	
J CS-137	0.995	2.78E-07	2.22E-08	
PB-212	0.994	1.50E-07	1.31E-08	
BI-214	0.343	8.63E-08	2.47E-08	
RA-226	0.917	6.58E-07	1.43E-07	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C11-SB

WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 4:31:58PM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 2	92.85	1.67726E-02	26.14	Tol.	PA-228 ✓
F 5	295.14	2.45512E-02	15.80	Tol.	PB-214 ✓
F 6	338.30	1.29327E-02	23.31	Tol.	AC-228 ✓ PA-228
F 7	582.93	2.07465E-02	14.37		Tl 208
F 10	910.66	1.30431E-02	17.94	Tol.	AC-228 ✓ PA-228
F 11	1332.07	8.77769E-03	21.92	Tol.	CO-60

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

NOTED TO
 10/20/2017
 REAK AT
 1173 KEV
 Ling B
 10/23/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	4.68E-06	6.42E-07
+	AR-41	1293.64	99.16	-1.06E+01	2.40E+01	2.40E+01
+	CO-60	1173.22	100.00	3.46E-08	5.80E-08	6.99E-08
		1332.49	100.00	1.68E-08		5.80E-08
+	KR-85	513.99	0.43	1.33E-05	1.07E-05	1.07E-05
+	Y-88	898.04	93.70	4.53E-08	3.63E-08	5.41E-08

Analysis Report for L1-010-101-FS-GS-C11-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
	Y-88	1836.06	99.20	6.76E-09	3.63E-08	3.63E-08
+	NB-94	702.63	100.00	-7.51E-09	4.17E-08	4.17E-08
		871.10	100.00	-2.89E-08		4.42E-08
+	I-131	284.30	6.06	-1.50E-07	5.06E-08	6.75E-07
		364.48	81.20	-3.37E-08		5.06E-08
		636.97	7.27	1.76E-07		6.66E-07
+	CS-134	604.70	97.60	6.82E-08	5.11E-08	5.11E-08
		795.84	85.40	2.43E-08		5.56E-08
+	CS-137	661.65	* 85.12	2.78E-07	6.19E-08	6.19E-08
+	CE-144	80.12	1.36	-1.14E-08	2.75E-07	3.41E-06
		133.51	11.09	4.68E-08		2.75E-07
+	EU-152	121.78	28.40	-6.61E-08	1.06E-07	1.06E-07
		244.69	7.49	-4.50E-07		5.14E-07
		964.00	14.44	1.32E-07		3.88E-07
		1408.00	20.74	-5.06E-08		2.21E-07
+	EU-154	123.07	40.40	-5.79E-09	7.49E-08	7.49E-08
		247.94	6.60	-6.99E-07		5.25E-07
		723.30	19.70	9.85E-08		2.20E-07
		873.20	11.50	7.74E-08		3.82E-07
		1004.76	17.90	-6.57E-08		2.86E-07
		1274.51	35.50	4.58E-08		1.59E-07
+	EU-155	86.54	32.80	-9.53E-08	1.13E-07	1.13E-07
		105.31	21.80	8.63E-08		1.45E-07
+	BI-214	609.31	* 46.30	8.63E-08	8.93E-08	8.93E-08
		1120.29	15.10	3.08E-07		3.95E-07
		1238.11	5.94	4.50E-07		1.14E-06
		1377.67	4.11	-1.65E-07		1.07E-06
		1407.98	2.48	-4.23E-07		1.85E-06
		1509.19	2.19	1.21E-06		1.68E-06
		1764.49	15.80	3.24E-07		3.05E-07
+	PB-214	77.11	10.70	6.18E-07	1.06E-07	4.67E-07
		295.21	19.20	8.76E-08		1.91E-07
		351.92	37.20	1.66E-07		1.06E-07
+	PA-228	89.95	22.00	-2.56E-07	5.19E-07	8.68E-07
		93.35	35.00	5.55E-07		5.19E-07
		105.00	16.30	4.69E-07		1.01E-06
		129.22	2.97	2.47E-06		5.29E-06
		338.32	5.30	-8.17E-07		3.51E-06
		463.00	13.80	-1.82E-07		1.54E-06
		911.23	16.70	1.25E-06		1.72E-06
+	AM-241	59.54	36.30	2.23E-07	2.27E-07	2.27E-07
+	CM-243	103.76	23.00	3.76E-08	1.38E-07	1.38E-07
		228.18	10.60	-1.28E-08		3.00E-07
		277.60	14.00	-5.35E-08		2.50E-07

Analysis Report for L1-010-101-FS-GS-C11-SB

WTB L1-010-101 10/18/17

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

Analysis Report for L1-010-101-FS-GS-C12-SB

WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification	: L1-010-101-FS-GS-C12-SB ✓
Sample Description	: WTB L1-010-101 10/18/17
Sample Type	: 500 ml Marinelli ✓
Unit	:
Sample Point	:
Sample Size	: 7.505E+02 grams ✓
Facility	: Dairyland_NPP
Sample Taken On	: 10/18/2017 10:56:00AM
Acquisition Started	: 10/21/2017 6:02:41AM ✓
Procedure	: 500ml Marinelli
Operator	: Administrator
Detector Name	: HOTLAB
Geometry	: 500ml Marinelli ✓
Live Time	: 3600.0 seconds
Real Time	: 3611.3 seconds
Dead Time	: 0.31 % ✓
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 4096
Peak Area Range (in channels)	: 100 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 7/8/2014
Efficiency Calibration Used Done On	: 7/8/2014
Efficiency Calibration Description	:
Sample Number	: 3549

REVIEWED
Joe A. Juk
10/23/17

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/21/2017 7:02:55AM

Peak Analysis From Channel	: 100
Peak Analysis To Channel	: 4096

Analysis Report for L1-010-101-FS-GS-C12-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	92.83	184 -	190	186.21	5.52E+01	16.51	2.88E+02	1.22
F	2	185.74	365 -	376	371.99	7.52E+01	17.83	3.18E+02	1.72
F	3	238.51	469 -	485	477.50	3.22E+02	22.01	2.76E+02	1.46
F	4	294.99	585 -	594	590.44	7.29E+01	12.52	1.17E+02	1.33
F	5	338.49	673 -	685	677.41	6.15E+01	10.40	1.00E+02	1.06
F	6	582.99	1161 -	1170	1166.31	5.43E+01	9.40	5.12E+01	1.20
F	7	609.01	1211 -	1223	1218.35	7.66E+01	10.73	5.81E+01	1.46
F	8	661.32	1316 -	1331	1322.96	2.39E+02	16.60	5.82E+01	1.67
F	9	910.68	1815 -	1827	1821.60	5.38E+01	9.22	4.06E+01	1.81
F	10	968.48	1933 -	1942	1937.18	3.28E+01	6.82	2.85E+01	0.93
F	11	1237.85	2472 -	2481	2475.86	1.28E+01	4.73	1.90E+01	0.94
F	12	1331.68	2658 -	2669	2663.50	2.43E+01	6.41	2.07E+01	1.64
F	13	1460.25	2914 -	2928	2920.62	4.66E+02	22.23	2.08E+01	2.25

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/21/2017 7:02:55AM

Env. Background File : C:\Canberra\Apex\Root\Daityland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	92.83	5.52E+01	16.51			5.52E+01	1.65E+01
F	2	185.74	7.52E+01	17.83			7.52E+01	1.78E+01
F	3	238.51	3.22E+02	22.01			3.22E+02	2.20E+01
F	4	294.99	7.29E+01	12.52			7.29E+01	1.25E+01
F	5	338.49	6.15E+01	10.40			6.15E+01	1.04E+01
F	6	582.99	5.43E+01	9.40			5.43E+01	9.40E+00
F	7	609.01	7.66E+01	10.73	4.12E+01	1.21E+01	3.55E+01	1.62E+01
F	8	661.32	2.39E+02	16.60	6.61E+01	1.27E+01	1.73E+02	2.09E+01
F	9	910.68	5.38E+01	9.22			5.38E+01	9.22E+00
F	10	968.48	3.28E+01	6.82			3.28E+01	6.82E+00
F	11	1237.85	1.28E+01	4.73			1.28E+01	4.73E+00
F	12	1331.68	2.43E+01	6.41			2.43E+01	6.41E+00
F	13	1460.25	4.66E+02	22.23	5.63E+01	8.57E+00	4.09E+02	2.38E+01

Analysis Report for L1-010-101-FS-GS-C12-SB
 WTB L1-010-101 10/18/17

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

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\ Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.96	1460.75	*	10.67	5.94E-06	3.83E-07
CS-137	0.98	661.65	*	85.12	1.56E-07	1.93E-08
PB-212	0.55	77.11		17.50		
		238.63	*	44.60	2.21E-07	1.62E-08
BI-214	0.43	609.31	*	46.30	5.44E-08	2.49E-08
		1120.29		15.10		
		1238.11	*	5.94	2.89E-07	1.07E-07
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
RA-226	0.96	186.21	*	3.28	5.91E-07	1.41E-07
AC-228	0.56	209.28		4.40		
		338.32	*	11.40	2.23E-07	3.81E-08
		794.70		4.60		
		911.60	*	27.70	1.99E-07	3.43E-08
		964.60		5.20		
		969.11	*	16.60	2.14E-07	4.47E-08

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C12-SB

WTB L1-010-101 10/18/17

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.961	5.94E-06	3.83E-07	
/ CS-137	0.983	1.56E-07	1.93E-08	
PB-212	0.559	2.21E-07	1.62E-08	
BI-214	0.430	6.64E-08	2.42E-08	
RA-226	0.966	5.91E-07	1.41E-07	
AC-228	0.566	2.11E-07	2.21E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C12-SB
WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/21/2017 7:02:55AM
Peak Locate From Channel : 100
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 1	92.83	1.53351E-02	29.91	Tol.	PA-228 ✓
F 4	294.99	2.02370E-02	17.19	Tol.	PB-214 ✓
F 6	582.99	1.50832E-02	17.32		11208
F 12	1331.68	6.73976E-03	26.43		5.206

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

Joe D. J. J. J.
10/23/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	5.94E-06	6.99E-07
+	AR-41	1293.64	99.16	-6.43E+03	7.71E+03	7.71E+03
+	CO-60	1173.22	100.00	6.76E-08	6.57E-08	7.41E-08
		1332.49	100.00	5.34E-08		6.57E-08
+	KR-85	513.99	0.43	1.45E-05	1.07E-05	1.07E-05
+	Y-88	898.04	93.70	-1.21E-08	3.87E-08	5.48E-08
		1836.06	99.20	-3.88E-08		3.87E-08
+	NB-94	702.63	100.00	-1.37E-08	4.29E-08	4.29E-08
		871.10	100.00	-2.99E-08		4.86E-08
+	I-131	284.30	6.06	2.09E-07	5.59E-08	7.21E-07
		364.48	81.20	3.60E-08		5.59E-08
		636.97	7.27	5.32E-07		7.52E-07
+	CS-134	604.70	97.60	2.03E-08	5.11E-08	5.13E-08

Analysis Report for L1-010-101-FS-GS-C12-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)		Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
	CS-134	795.84		85.40	-4.06E-10	5.11E-08	5.11E-08
+	✓ CS-137	661.65	*	85.12	1.56E-07	6.20E-08	6.20E-08
+	CE-144	80.12		1.36	1.54E-06	3.00E-07	3.67E-06
		133.51		11.09	2.13E-08		3.00E-07
+	✓ EU-152	121.78		28.40	-6.70E-08	1.14E-07	1.14E-07
		244.69		7.49	-4.59E-07		5.48E-07
		964.00		14.44	4.48E-07		4.23E-07
+	✓ EU-154	1408.00		20.74	1.75E-07		2.53E-07
		123.07		40.40	1.18E-09	8.18E-08	8.18E-08
		247.94		6.60	-8.50E-07		5.46E-07
		723.30		19.70	7.54E-08		2.35E-07
		873.20		11.50	4.39E-07		4.38E-07
		1004.76		17.90	1.42E-07		2.89E-07
		1274.51		35.50	3.06E-08		1.63E-07
+	EU-155	86.54		32.80	-1.26E-07	1.26E-07	1.26E-07
		105.31		21.80	-6.85E-08		1.53E-07
+	BI-214	609.31	*	46.30	5.44E-08	9.73E-08	9.73E-08
		1120.29		15.10	3.85E-07		4.30E-07
		1238.11	*	5.94	2.89E-07		5.54E-07
		1377.67		4.11	2.87E-07		1.24E-06
		1407.98		2.48	1.46E-06		2.11E-06
		1509.19		2.19	-9.27E-07		1.63E-06
		1764.49		15.80	3.43E-07		3.47E-07
+	PB-214	77.11		10.70	6.95E-07	1.11E-07	5.02E-07
		295.21		19.20	1.49E-07		1.93E-07
		351.92		37.20	1.61E-07		1.11E-07
+	PA-228	89.95		22.00	7.68E-07	9.30E-07	1.54E-06
		93.35		35.00	6.31E-07		9.30E-07
		105.00		16.30	-1.32E-06		1.72E-06
		129.22		2.97	-8.41E-07		9.26E-06
		338.32		5.30	-2.29E-06		5.47E-06
		463.00		13.80	-6.59E-07		2.51E-06
		911.23		16.70	8.46E-07		3.14E-06
+	✓ AM-241	59.54		36.30	5.97E-08	2.39E-07	2.39E-07
+	CM-243	103.76		23.00	-5.90E-08	1.46E-07	1.46E-07
		228.18		10.60	-1.47E-07		3.01E-07
		277.60		14.00	2.27E-08		2.47E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C12-SB
WTB L1-010-101 10/18/17

Analysis Report for L1-010-101-FS-GS-C13-SB

WTB L1-010-101 10/16/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C13-SB ✓
Sample Description : WTB L1-010-101 10/16/17
Sample Type : 500 ml Marinelli ✓
Unit :
Sample Point :

Sample Size : 9.381E+02 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/16/2017 3:35:00PM
Acquisition Started : 10/17/2017 8:38:36AM ✓

Procedure : 500ml Marinelli ✓
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli
Live Time : 3600.0 seconds ✓
Real Time : 3610.9 seconds

Dead Time : 0.30 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3528

*Reviewed
Jm OJm
10/17/17*

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/17/2017 9:38:50AM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

L1-010-101-FS-GS-C13-SB

WTB L1-010-101 10/16/17

<i>ide e</i>	<i>Nuclide Id Confidence</i>	<i>Wt mean Activity (uCi/grams)</i>	<i>Wt mean Activity Uncertainty</i>	<i>Comments</i>	<i>num unts</i>	<i>FWHM (keV)</i>
					E+02	1.17
					E+02	1.18
					E+02	1.42
					E+02	1.46
					E+02	1.10
					E+02	1.65
					E+01	1.72
					E+01	1.88
					E+01	1.69
					E+01	2.15
					E+01	2.33
					E+00	2.54
					E+00	2.18
ide is part of an undetermined solution						
ide rejected by the interference analysis						
ide contains energy lines not used in Weighted Mean Activity						
at 1.000sigma						

<i>d a</i>	<i>Subtracted Uncert.</i>
1	1.69E+01
1	1.82E+01
2	2.27E+01
1	1.44E+01
1	1.11E+01
1	2.43E+01
1	1.20E+01
1	1.75E+01
2	2.84E+01
1	1.05E+01
1	8.21E+00
2	2.47E+01
1	7.59E+00

Analysis Report for L1-010-101-FS-GS-C13-SB

WTB L1-010-101 10/16/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/17/2017 9:38:50AM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
M 1	74.86	1.83020E-02	25.66		<i>Pb214</i>
F 5	338.33	1.45401E-02	21.12	Tol.	AC-228 ✓ PA-228
F 7	582.89	2.19294E-02	15.25		<i>Tl208</i> ✓
F 10	910.81	1.97960E-02	14.69	Tol.	AC-228 PA-228
F 11	1332.38	1.23498E-02	18.47	Tol.	CO-60 <i>mis ID NO NOY SURGE PEAK AT 1173 keV like 175:206</i>

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

J O J
10/17/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	5.24E-06	4.89E-07
+	✓ AR-41	1293.64	99.16	-1.48E-05	3.69E-05	3.69E-05
+	CO-60	1173.22	100.00	5.32E-08	5.69E-08	6.08E-08
		1332.49	100.00	6.38E-08		5.69E-08
+	KR-85	513.99	0.43	8.67E-06	9.37E-06	9.37E-06
+	Y-88	898.04	93.70	1.84E-08	2.86E-08	4.27E-08
		1836.06	99.20	-1.44E-08		2.86E-08

Analysis Report for L1-010-101-FS-GS-C13-SB

WTB L1-010-101 10/16/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	NB-94	702.63	100.00	4.08E-08	3.82E-08	3.82E-08
		871.10	100.00	-1.47E-08		4.02E-08
+	I-131	284.30	6.06	-5.30E-08	4.23E-08	4.95E-07
		364.48	81.20	3.16E-08		4.23E-08
		636.97	7.27	2.62E-07		5.24E-07
+	CS-134	604.70	97.60	-6.97E-09	4.43E-08	4.43E-08
		795.84	85.40	1.66E-09		4.65E-08
+	CS-137	661.65	* 85.12	3.56E-07	5.30E-08	5.30E-08
+	CE-144	80.12	1.36	-7.91E-07	2.43E-07	3.05E-06
		133.51	11.09	1.33E-07		2.43E-07
+	EU-152	121.78	28.40	-3.45E-10	9.43E-08	9.43E-08
		244.69	7.49	-1.78E-07		4.72E-07
		964.00	14.44	2.06E-07		3.42E-07
+	EU-154	1408.00	20.74	2.77E-09		1.75E-07
		123.07	40.40	1.10E-08	6.65E-08	6.65E-08
		247.94	6.60	-1.80E-07		4.84E-07
		723.30	19.70	-1.27E-08		1.88E-07
		873.20	11.50	3.43E-08		3.53E-07
		1004.76	17.90	-1.32E-07		2.35E-07
		1274.51	35.50	2.43E-08		1.38E-07
+	EU-155	86.54	32.80	-3.72E-08	1.07E-07	1.07E-07
		105.31	21.80	4.89E-08		1.34E-07
+	BI-214	609.31	* 46.30	8.20E-08	7.91E-08	7.91E-08
		1120.29	15.10	2.01E-07		3.61E-07
		1238.11	5.94	5.56E-07		1.05E-06
		1377.67	4.11	2.17E-08		8.67E-07
		1407.98	2.48	2.32E-08		1.46E-06
		1509.19	2.19	5.77E-07		1.66E-06
		1764.49	* 15.80	1.11E-07		2.29E-07
+	PB-214	77.11	* 10.70	2.11E-07	9.06E-08	2.31E-07
		295.21	* 19.20	1.29E-07		1.13E-07
		351.92	* 37.20	4.59E-08		9.06E-08
+	PA-228	89.95	22.00	-2.08E-08	1.60E-07	2.67E-07
		93.35	35.00	-8.13E-09		1.60E-07
		105.00	16.30	2.05E-07		3.13E-07
		129.22	2.97	-4.41E-08		1.57E-06
		338.32	5.30	8.00E-07		1.07E-06
		463.00	13.80	-1.56E-07		4.42E-07
		911.23	16.70	5.05E-07		5.45E-07
+	AM-241	59.54	36.30	-6.95E-08	1.89E-07	1.89E-07
+	CM-243	103.76	23.00	-5.78E-08	1.28E-07	1.28E-07
		228.18	10.60	-1.93E-07		2.66E-07
		277.60	14.00	2.48E-08		2.08E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C13-SB
WTB L1-010-101 10/16/17

Analysis Report for L1-010-101-FS-GS-C14-SB

WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C14-SB ✓
Sample Description : WTB L1-010-101 10/18/17 ✓
Sample Type : 500 ml Marinelli ✓
Unit :
Sample Point :

Sample Size : 7.807E+02 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/18/2017 9:36:00AM ✓
Acquisition Started : 10/21/2017 7:34:53AM ✓

Procedure : 500ml Marinelli
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli ✓
Live Time : 3600.0 seconds ✓
Real Time : 3610.8 seconds

Dead Time : 0.30 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3550

*Reviewed
Jan 2 Jan
10/23/17*

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/21/2017 8:35:07AM

Peak Analysis From Channel : 100

Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C14-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.81	147 -	161	154.16	2.46E+02	31.99	6.83E+02	4.03
F	2	92.69	181 -	191	185.92	5.65E+01	18.60	4.86E+02	1.24
F	3	238.53	470 -	485	477.53	3.05E+02	23.74	4.50E+02	1.61
M	4	295.10	585 -	604	590.64	1.00E+02	16.27	2.25E+02	1.83
m	5	299.96	585 -	604	600.37	6.08E+01	13.32	1.72E+02	1.84
F	6	351.81	699 -	708	704.06	1.62E+02	16.56	1.33E+02	1.53
F	7	582.79	1160 -	1170	1165.91	8.77E+01	11.88	7.30E+01	1.40
F	8	609.21	1211 -	1227	1218.75	1.15E+02	12.93	7.65E+01	2.07
F	9	661.31	1315 -	1330	1322.94	1.69E+03	42.28	7.40E+01	1.58
F	10	910.56	1817 -	1827	1821.36	3.40E+01	7.94	3.78E+01	1.46
F	11	968.85	1931 -	1945	1937.92	4.02E+01	8.55	3.79E+01	2.34
F	12	1172.42	2338 -	2352	2345.01	7.54E+01	10.01	2.43E+01	2.71
F	13	1331.97	2659 -	2669	2664.08	3.07E+01	6.54	2.14E+01	1.06
F	14	1460.12	2914 -	2929	2920.36	4.40E+02	21.52	2.00E+01	2.34

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/21/2017 8:35:07AM

Env. Background File : C:\Canberra\Apex\Root\Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	76.81	2.46E+02	31.99			2.46E+02	3.20E+01
F	2	92.69	5.65E+01	18.60			5.65E+01	1.86E+01
F	3	238.53	3.05E+02	23.74			3.05E+02	2.37E+01
M	4	295.10	1.00E+02	16.27			1.00E+02	1.63E+01
m	5	299.96	6.08E+01	13.32			6.08E+01	1.33E+01
F	6	351.81	1.62E+02	16.56	8.36E+01	1.86E+01	7.81E+01	2.49E+01
F	7	582.79	8.77E+01	11.88			8.77E+01	1.19E+01
F	8	609.21	1.15E+02	12.93	4.12E+01	1.21E+01	7.36E+01	1.77E+01
F	9	661.31	1.69E+03	42.28	6.61E+01	1.27E+01	1.63E+03	4.41E+01
F	10	910.56	3.40E+01	7.94			3.40E+01	7.94E+00
F	11	968.85	4.02E+01	8.55			4.02E+01	8.55E+00
F	12	1172.42	7.54E+01	10.01	4.55E+01	8.62E+00	2.99E+01	1.32E+01
F	13	1331.97	3.07E+01	6.54			3.07E+01	6.54E+00
F	14	1460.12	4.40E+02	21.52	5.63E+01	8.57E+00	3.84E+02	2.32E+01

Analysis Report for L1-010-101-FS-GS-C14-SB

WTB L1-010-101 10/18/17

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

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPPLibrary\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.93	1460.75	*	10.67	5.35E-06	3.56E-07
CO-60	0.93	1173.22	*	100.00	3.68E-08	1.63E-08
		1332.49	*	100.00	4.23E-08	9.07E-09
CS-137	0.98	661.65	*	85.12	1.41E-06	5.39E-08
PB-212	0.99	77.11	*	17.50	4.47E-07	5.98E-08
		238.63	*	44.60	2.01E-07	1.65E-08
BI-214	0.34	609.31	*	46.30	1.09E-07	2.63E-08
		1120.29		15.10		
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
PB-214	0.99	77.11	*	10.70	7.31E-07	9.79E-08
		295.21	*	19.20	1.84E-07	3.01E-08
		351.92	*	37.20	8.64E-08	2.76E-08

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C14-SB

WTB L1-010-101 10/18/17

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
/ K-40	0.939	5.35E-06	3.56E-07	
/ CO-60	0.931	4.10E-08	7.93E-09	
/ CS-137	0.982	1.41E-06	5.39E-08	
PB-212	0.995	2.12E-07	1.60E-08	
BI-214	0.349	1.09E-07	2.63E-08	
PB-214	0.996	1.41E-07	2.00E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C14-SB

WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/21/2017 8:35:07AM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 2	92.69	1.56877E-02	32.94	Tol.	PA-228 ✓
m 5	299.96	1.69002E-02	21.90		Pb 212
F 7	582.79	2.43647E-02	13.55		Tl 208
F 10	910.56	9.43628E-03	23.37	Tol.	PA-228 ✓
F 11	968.85	1.11736E-02	21.25	Tol.	AC-228 ✓

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

Joe J. J.
 10/23/17

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Daivland_NPPLibrary\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	* 10.67	5.35E-06	6.67E-07	6.67E-07
+	AR-41	1293.64	99.16	1.95E+04	2.30E+04	2.30E+04
+	CO-60	1173.22	* 100.00	3.68E-08	3.70E-08	5.92E-08
		1332.49	* 100.00	4.23E-08		3.70E-08
+	KR-85	513.99	0.43	7.12E-06	1.24E-05	1.24E-05
+	Y-88	898.04	93.70	2.08E-08	3.08E-08	5.58E-08
		1836.06	99.20	7.61E-09		3.08E-08
+	NB-94	702.63	100.00	1.09E-08	4.11E-08	4.11E-08
		871.10	100.00	3.34E-09		4.99E-08

Analysis Report for L1-010-101-FS-GS-C14-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	I-131	284.30	6.06	5.93E-07	6.65E-08	8.43E-07
		364.48	81.20	-1.49E-08		6.65E-08
		636.97	7.27	-1.05E-07		8.32E-07
+	CS-134	604.70	97.60	2.28E-09	5.04E-08	5.49E-08
		795.84	85.40	-5.82E-08		5.04E-08
+	CS-137	661.65	* 85.12	1.41E-06	6.27E-08	6.27E-08
+	CE-144	80.12	1.36	-1.60E-06	3.18E-07	3.70E-06
		133.51	11.09	9.69E-08		3.18E-07
+	EU-152	121.78	28.40	-5.12E-08	1.19E-07	1.19E-07
		244.69	7.49	-4.24E-07		5.73E-07
		964.00	14.44	3.78E-08		3.98E-07
		1408.00	20.74	2.25E-08		2.13E-07
+	EU-154	123.07	40.40	6.73E-08	8.44E-08	8.44E-08
		247.94	6.60	-1.18E-06		5.86E-07
		723.30	19.70	-1.06E-07		2.29E-07
		873.20	11.50	2.43E-07		4.35E-07
		1004.76	17.90	-2.05E-07		2.83E-07
		1274.51	35.50	5.54E-08		1.72E-07
+	EU-155	86.54	32.80	-2.68E-08	1.26E-07	1.26E-07
		105.31	21.80	-1.81E-08		1.66E-07
+	BI-214	609.31	* 46.30	1.09E-07	1.04E-07	1.04E-07
		1120.29	15.10	2.35E-08		4.10E-07
		1238.11	5.94	8.36E-07		1.18E-06
		1377.67	4.11	-4.74E-07		1.04E-06
		1407.98	2.48	1.88E-07		1.78E-06
		1509.19	2.19	1.38E-06		1.82E-06
		1764.49	15.80	3.28E-07		3.29E-07
+	PB-214	77.11	* 10.70	7.31E-07	1.01E-07	4.42E-07
		295.21	* 19.20	1.84E-07		1.33E-07
		351.92	* 37.20	8.64E-08		1.01E-07
+	PA-228	89.95	22.00	6.32E-07	1.02E-06	1.71E-06
		93.35	35.00	-1.19E-08		1.02E-06
		105.00	16.30	4.61E-07		2.06E-06
		129.22	2.97	-2.33E-06		1.06E-05
		338.32	5.30	3.04E-06		7.41E-06
		463.00	13.80	1.44E-06		3.53E-06
		911.23	16.70	4.97E-06		3.30E-06
+	AM-241	59.54	36.30	5.73E-09	2.41E-07	2.41E-07
+	CM-243	103.76	23.00	5.31E-08	1.60E-07	1.60E-07
		228.18	10.60	-1.22E-07		3.46E-07
		277.60	14.00	-2.43E-07		2.72E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C14-SB
WTB L1-010-101 10/18/17

Analysis Report for L1-010-101-FS-GS-C15-SB

WTB L1-010-101 10/18/17

GAMMA SPECTRUM ANALYSIS

Sample Identification : L1-010-101-FS-GS-C15-SB ✓
Sample Description : WTB L1-010-101 10/18/17
Sample Type : 500 ml Marinelli ✓
Unit :
Sample Point :

Sample Size : 7.595E+02 grams ✓
Facility : Dairyland_NPP

Sample Taken On : 10/18/2017 9:55:00AM
Acquisition Started : 10/20/2017 4:33:01PM

Procedure : 500ml Marinelli
Operator : Administrator
Detector Name : HOTLAB
Geometry : 500ml Marinelli ✓
Live Time : 3600.0 seconds
Real Time : 3611.5 seconds

Dead Time : 0.32 % ✓

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 1.000 keV

Energy Calibration Used Done On : 7/8/2014
Efficiency Calibration Used Done On : 7/8/2014
Efficiency Calibration Description :

Sample Number : 3547

*Reviewed
Joe D. Jones
10/20/17*

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/20/2017 5:33:15PM

Peak Analysis From Channel : 100
Peak Analysis To Channel : 4096

Analysis Report for L1-010-101-FS-GS-C15-SB

WTB L1-010-101 10/18/17

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	77.03	147 -	159	154.61	1.21E+02	18.76	5.54E+02	1.02
F	2	92.46	183 -	189	185.45	4.94E+01	15.53	2.73E+02	0.92
F	3	185.77	366 -	379	372.05	5.73E+01	15.83	4.03E+02	1.30
F	4	238.57	474 -	485	477.61	2.09E+02	19.74	2.85E+02	1.30
F	5	295.13	582 -	595	590.71	7.40E+01	13.44	2.08E+02	1.24
F	6	338.33	671 -	681	677.10	4.63E+01	10.60	1.37E+02	1.00
F	7	510.15	1015 -	1028	1020.68	6.16E+01	11.67	8.65E+01	2.32
F	8	583.14	1162 -	1170	1166.62	7.96E+01	10.64	4.04E+01	1.33
F	9	609.18	1212 -	1222	1218.70	8.96E+01	11.12	4.92E+01	1.27
F	10	661.49	1318 -	1329	1323.29	3.40E+02	19.97	6.00E+01	1.55
F	11	910.68	1816 -	1827	1821.60	5.34E+01	8.78	3.17E+01	1.55
F	12	968.76	1933 -	1942	1937.75	1.92E+01	5.81	3.12E+01	1.48
F	13	1332.19	2660 -	2669	2664.52	3.34E+01	6.70	1.01E+01	1.97
F	14	1460.44	2912 -	2929	2920.99	4.92E+02	22.77	1.35E+01	2.25

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 10/20/2017 5:33:15PM

Env. Background File : C:\Canberra\Apex\Root\ Dairyland_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	77.03	1.21E+02	18.76			1.21E+02	1.88E+01
F	2	92.46	4.94E+01	15.53			4.94E+01	1.55E+01
F	3	185.77	5.73E+01	15.83			5.73E+01	1.58E+01
F	4	238.57	2.09E+02	19.74			2.09E+02	1.97E+01
F	5	295.13	7.40E+01	13.44			7.40E+01	1.34E+01
F	6	338.33	4.63E+01	10.60			4.63E+01	1.06E+01
F	7	510.15	6.16E+01	11.67			6.16E+01	1.17E+01
F	8	583.14	7.96E+01	10.64			7.96E+01	1.06E+01
F	9	609.18	8.96E+01	11.12	4.12E+01	1.21E+01	4.84E+01	1.64E+01
F	10	661.49	3.40E+02	19.97	6.61E+01	1.27E+01	2.74E+02	2.37E+01
F	11	910.68	5.34E+01	8.78			5.34E+01	8.78E+00
F	12	968.76	1.92E+01	5.81			1.92E+01	5.81E+00
F	13	1332.19	3.34E+01	6.70			3.34E+01	6.70E+00
F	14	1460.44	4.92E+02	22.77	5.63E+01	8.57E+00	4.36E+02	2.43E+01

Analysis Report for L1-010-101-FS-GS-C15-SB

WTB L1-010-101 10/18/17

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

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (uCi/grams)	Activity Uncertainty
K-40	0.98	1460.75	*	10.67	6.25E-06	3.90E-07
CS-137	0.99	661.65	*	85.12	2.43E-07	2.21E-08
PB-212	0.99	77.11	*	17.50	2.25E-07	3.56E-08
		238.63	*	44.60	1.42E-07	1.39E-08
BI-214	0.34	609.31	*	46.30	7.34E-08	2.50E-08
		1120.29		15.10		
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
RA-226	0.97	186.21	*	3.28	4.45E-07	1.23E-07
AC-228	0.57	209.28		4.40		
		338.32	*	11.40	1.66E-07	3.82E-08
		794.70		4.60		
		911.60	*	27.70	1.95E-07	3.23E-08
		964.60		5.20		
		969.11	*	16.60	1.23E-07	3.75E-08

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C15-SB

WTB L1-010-101 10/18/17

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/grams)	Wt mean Activity Uncertainty	Comments
✓ K-40	0.985	6.25E-06	3.90E-07	
CS-137	0.996	2.43E-07	2.21E-08	
PB-212	0.999	1.53E-07	1.29E-08	
BI-214	0.348	7.34E-08	2.50E-08	
RA-226	0.970	4.45E-07	1.23E-07	
AC-228	0.576	1.65E-07	2.06E-08	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000sigma

Analysis Report for L1-010-101-FS-GS-C15-SB

WTB L1-010-101 10/18/17

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/20/2017 5:33:15PM
 Peak Locate From Channel : 100
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
F 2	92.46	1.37148E-02	31.46	Tol.	PA-228 ✓
F 5	295.13	2.05609E-02	18.15	Tol.	PB-214 ✓
F 7	510.15	1.71079E-02	18.95		Tl-208 ✓
F 8	583.14	2.21101E-02	13.37		Tl-208 ✓
F 13	1332.19	9.28142E-03	20.04	Tol.	CO-60 ✓

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

Handwritten notes:
 10/23/17
 51206

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Dairyland_NPP\Library\HOTLAB.NLB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	K-40	1460.75	*	10.67	6.25E-06	6.60E-07
+	AR-41	1293.64		99.16	8.91E+00	6.99E+01
+	CO-60	1173.22	100.00	9.39E-08	6.20E-08	7.51E-08
		1332.49	100.00	4.81E-08		6.20E-08
+	KR-85	513.99	0.43	1.13E-05	1.07E-05	1.07E-05
+	Y-88	898.04	93.70	-9.82E-09	3.44E-08	5.20E-08
		1836.06	99.20	-1.73E-08		3.44E-08
+	NB-94	702.63	100.00	-3.62E-09	4.49E-08	4.49E-08
		871.10	100.00	5.21E-09		4.71E-08
+	I-131	284.30	6.06	-8.46E-08	5.43E-08	7.13E-07
		364.48	81.20	1.13E-08		5.43E-08
		636.97	7.27	-3.23E-07		7.39E-07

Analysis Report for L1-010-101-FS-GS-C15-SB

WTB L1-010-101 10/18/17

	Nuclide Name	Energy (keV)	Yield(%)	Activity (uCi/grams)	Nuclide MDA (uCi/grams)	Line MDA (uCi/grams)
+	CS-134	604.70	97.60	5.64E-08	5.30E-08	5.30E-08
		795.84	85.40	-3.75E-10		5.46E-08
+	CS-137	661.65	* 85.12	2.43E-07	5.93E-08	5.93E-08
+	CE-144	80.12	1.36	1.02E-07	2.93E-07	3.62E-06
		133.51	11.09	1.51E-07		2.93E-07
+	EU-152	121.78	28.40	-9.07E-08	1.15E-07	1.15E-07
		244.69	7.49	-3.51E-07		5.33E-07
		964.00	14.44	1.90E-07		3.94E-07
		1408.00	20.74	-1.48E-09		2.16E-07
+	EU-154	123.07	40.40	-2.22E-08	8.09E-08	8.09E-08
		247.94	6.60	-7.01E-07		5.54E-07
		723.30	19.70	4.98E-08		2.18E-07
		873.20	11.50	3.00E-07		4.19E-07
		1004.76	17.90	2.00E-07		3.05E-07
		1274.51	35.50	-1.78E-08		1.59E-07
+	EU-155	86.54	32.80	-6.10E-08	1.23E-07	1.23E-07
		105.31	21.80	1.66E-08		1.55E-07
+	BI-214	609.31	* 46.30	7.34E-08	9.12E-08	9.12E-08
		1120.29	15.10	5.29E-08		4.20E-07
		1238.11	5.94	8.26E-07		1.23E-06
		1377.67	4.11	3.56E-07		1.19E-06
		1407.98	2.48	-1.24E-08		1.81E-06
		1509.19	2.19	-3.84E-07		1.69E-06
		1764.49	15.80	2.47E-07		3.29E-07
+	PB-214	77.11	10.70	3.05E-07	1.13E-07	4.85E-07
		295.21	19.20	1.55E-07		2.03E-07
		351.92	37.20	1.89E-07		1.13E-07
+	PA-228	89.95	22.00	-1.63E-07	5.94E-07	9.93E-07
		93.35	35.00	2.29E-07		5.94E-07
		105.00	16.30	-2.13E-07		1.17E-06
		129.22	2.97	1.99E-06		6.18E-06
		338.32	5.30	8.48E-07		4.16E-06
		463.00	13.80	7.38E-07		1.71E-06
		911.23	16.70	2.29E-06		1.99E-06
+	AM-241	59.54	36.30	-2.40E-08	2.31E-07	2.31E-07
+	CM-243	103.76	23.00	-6.22E-08	1.47E-07	1.47E-07
		228.18	10.60	-2.23E-07		3.01E-07
		277.60	14.00	3.92E-08		2.61E-07

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

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

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

Analysis Report for L1-010-101-FS-GS-C15-SB
WTB L1-010-101 10/18/17

ATTACHMENT 8

GEL LABORATORIES ANALYTICAL REPORTS



a member of **The GEL Group** INC



PO Box 30712 Charleston, SC 29417
2040 Savage Road Charleston, SC 29407
P 843.556.8171
F 843.766.1178

gel.com

January 18, 2018

Mr. Jason Q. Spaide
LaCrosseSolutions
S4601 State Hwy 35
Genoa, Wisconsin 54632

Re: LACBWR Site Restoration Project
Work Order: 441559

Dear Mr. Spaide:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on October 30, 2017. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4453.

Sincerely,


Kaitlyn Stone for
Edith Kent
Project Manager

Purchase Order: 672583
Enclosures



GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis Report for

ENRG070 LaCrosseSolutions, LLC (672583)

Client SDG: 441559 GEL Work Order: 441559

The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- ** Analyte is a surrogate compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by



GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: January 18, 2018

Company : LaCrosseSolutions
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632
Contact: Mr. Jason Q. Spaide
Project: LACBWR Site Restoration Project

Client Sample ID: L1-010-101-FS-GS-C06-SB
Sample ID: 441559001
Matrix: Soil
Collect Date: 18-OCT-17 08:30
Receive Date: 30-OCT-17
Collector: Client

Project: ENRG07001
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis													
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	U	-0.00303	+/-0.00419	0.00929	0.010	pCi/g			HAKB	01/17/18	0951	1731815	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	10/31/17	0808	1731648

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	ASTM C 1475-00 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			96	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: January 18, 2018

Company : LaCrosseSolutions
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632
Contact: Mr. Jason Q. Spaide
Project: LACBWR Site Restoration Project

Client Sample ID: L1-010-101-FS-GS-C14-SB
Sample ID: 441559002
Matrix: Soil
Collect Date: 18-OCT-17 09:36
Receive Date: 30-OCT-17
Collector: Client

Project: ENRG07001
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis													
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	U	0.000405	+/-0.00307	0.00583	0.010	pCi/g			HAKB	01/17/18	0951	1731815	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	10/31/17	0808	1731648

The following Analytical Methods were performed:

Method	Description	Analyst Comments
I	ASTM C 1475-00 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			104	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: January 18, 2018

Page 1 of 1

LaCrosseSolutions
S4601 State Hwy 35
Genoa, Wisconsin

Contact: Mr. Jason Q. Spaide

Workorder: 441559

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Alpha Spec											
Batch	1731815										
QC1203952679	441559001	DUP									
Neptunium-237		U	-0.00303	U	0.00432	pCi/g	N/A		N/AHAKB	01/17/18	09:53
		Uncertainty	+/-0.00419		+/-0.00468						
QC1203952680	LCS										
Neptunium-237		1.45		1.54	pCi/g		106	(75%-125%)		01/17/18	09:51
		Uncertainty		+/-0.0514							
QC1203952678	MB										
Neptunium-237			U	-0.0024	pCi/g					01/17/18	09:53
		Uncertainty		+/-0.00332							

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- ** Analyte is a Tracer compound
- < Result is less than value reported
- > Result is greater than value reported
- BD Results are either below the MDC or tracer recovery is low
- FA Failed analysis.
- H Analytical holding time was exceeded
- J Value is estimated
- K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
- L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
- M M if above MDC and less than LLD
- M REMP Result > MDC/CL and < RDL
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UI Gamma Spectroscopy--Uncertain identification
- UJ Gamma Spectroscopy--Uncertain identification

GEL LABORATORIES LLC

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QC Summary

Workorder: 441559

Page 2 of 2

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
UL	Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.										
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Y	Other specific qualifiers were required to properly define the results. Consult case narrative.										
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.										
h	Preparation or preservation holding time was exceeded										

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

**Radiochemistry
Technical Case Narrative
LaCrosseSolutions, LLC (ENRG)
SDG #: 441559**

Product: Alphaspec Np, Solid
Analytical Method: ASTM C 1475-00 Modified
Analytical Procedure: GL-RAD-A-032 REV# 21
Analytical Batch: 1731815

Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1731648

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
441559001	L1-010-101-FS-GS-C06-SB
441559002	L1-010-101-FS-GS-C14-SB
1203952678	Method Blank (MB)
1203952679	441559001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203952680	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Dry Weight
Preparation Method: Dry Soil Prep
Preparation Procedure: GL-RAD-A-021 REV# 22
Preparation Batch: 1731648

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
441559001	L1-010-101-FS-GS-C06-SB
441559002	L1-010-101-FS-GS-C14-SB

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Miscellaneous Information

Additional Comments

These samples are re-logs. Data transferred from Batch# 1714238.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

VEI 1 AW - E1 E

PM (or PMA) review: Initials EM Date 10/31/17 Page 6 of 1

List of current GEL Certifications as of 18 January 2018

State	Certification
Alaska	UST-0110
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
Delaware	SC00012
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (A133904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122018-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S.Carolina Radchem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-17-12
Utah NELAP	SC000122017-25
Vermont	VT87156
Virginia NELAP	460202
Washington	C780
West Virginia	997404

November 22, 2017

Mr. Jason Q. Spaide
LaCrosseSolutions
S4601 State Hwy 35
Genoa, Wisconsin 54632

Re: LACBWR Site Restoration Project
Work Order: 436542

Dear Mr. Spaide:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on October 30, 2017. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4453.

Sincerely,

Edith M. Kent

Edith Kent
Project Manager

Purchase Order: 672583
Enclosures



GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 – (843) 556-8171 – www.gel.com

Certificate of Analysis Report for

ENRG070 LaCrosseSolutions, LLC (672583)

Client SDG: 436542 GEL Work Order: 436542

The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- ** Analyte is a surrogate compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by

Edith M. Kent

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: November 22, 2017

Company : LaCrosseSolutions
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632
Contact: Mr. Jason Q. Spaide
Project: LACBWR Site Restoration Project

Client Sample ID: L1-010-101-FS-GS-C06-SB
Sample ID: 436542001
Matrix: Soil
Collect Date: 18-OCT-17 08:30
Receive Date: 30-OCT-17
Collector: Client

Project: ENRG07001
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	U	0.149	+/-0.182	0.308	0.400	pCi/g			KSD1	11/16/17	1412	1717213	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	10/31/17	0808	1714238

The following Analytical Methods were performed:

Method	Description	Analyst Comments			
1	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified				
Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			89.2	(25%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: November 22, 2017

Company : LaCrosseSolutions
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632
Contact: Mr. Jason Q. Spaide
Project: LACBWR Site Restoration Project

Client Sample ID: L1-010-101-FS-GS-C14-SB
Sample ID: 436542002
Matrix: Soil
Collect Date: 18-OCT-17 09:36
Receive Date: 30-OCT-17
Collector: Client

Project: ENRG07001
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	U	-0.0977	+/-0.167	0.337	0.400	pCi/g			KSD1	11/16/17	1413	1717213	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	10/31/17	0808	1714238

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			84.1	(25%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

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QC Summary

Report Date: November 22, 2017

Page 1 of 2

LaCrosseSolutions
S4601 State Hwy 35
Genoa, Wisconsin

Contact: Mr. Jason Q. Spaide

Workorder: 436542

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1717213										
QC1203915501	436541005	DUP									
Strontium-90		U	0.0795	U	0.169	pCi/g	N/A		N/A KSD1	11/16/17	14:13
		Uncertainty	+/-0.159		+/-0.154						
QC1203915502	LCS										
Strontium-90		13.8			12.1	pCi/g	87.5	(75%-125%)		11/16/17	14:13
		Uncertainty			+/-0.695						
QC1203915500	MB										
Strontium-90			U	0.0523	pCi/g					11/16/17	14:13
		Uncertainty		+/-0.140							

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- ** Analyte is a Tracer compound
- < Result is less than value reported
- > Result is greater than value reported
- BD Results are either below the MDC or tracer recovery is low
- FA Failed analysis.
- H Analytical holding time was exceeded
- J Value is estimated
- K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
- L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
- M M if above MDC and less than LLD
- M REMP Result > MDC/CL and < RDL
- N/A RPD or %Recovery limits do not apply.
- NI See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UI Gamma Spectroscopy--Uncertain identification
- UJ Gamma Spectroscopy--Uncertain identification

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QC Summary

Workorder: 436542

Page 2 of 2

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
UL	Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.										
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Y	Other specific qualifiers were required to properly define the results. Consult case narrative.										
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.										
h	Preparation or preservation holding time was exceeded										

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

**Radiochemistry
Technical Case Narrative
LaCrosseSolutions, LLC (ENRG)
SDG #: 436542**

Product: Dry Weight

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1714238

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
436542001	L1-010-101-FS-GS-C06-SB
436542002	L1-010-101-FS-GS-C14-SB

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: GFPC, Sr90, Solid

Analytical Method: EPA 905.0 Modified/DOE RP501 Rev. 1 Modified

Analytical Procedure: GL-RAD-A-004 REV# 19

Analytical Batch: 1717213

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1714238

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
436542001	L1-010-101-FS-GS-C06-SB
436542002	L1-010-101-FS-GS-C14-SB
1203915500	Method Blank (MB)
1203915501	436541005(LI-SUB-CDR-FSGS-014-SB) Sample Duplicate (DUP)
1203915502	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration,

continuing calibration, instrument controls and process controls where applicable.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Chain of Custody Signatures				Sample Shipping and Delivery Details	
Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1 <i>Jessie Smith</i>	10/24/17	1300	<i>Maranda Black</i>	10/30/17	8:50
2			2		
3			3		

GEL PM:	
Method of Shipment:	Date Shipped:
Airbill #:	
Airbill #:	

For Lab Receiving Use Only
Custody Seal Intact? YES NO
Cooler Temp: C

WHITE = LABORATORY **YELLOW = FILE** **PINK = CLIENT**

SAMPLE RECEIPT & REVIEW FORM

Client: <u>ENRG</u>		SDG/AR/COC/Work Order:	
Received By: <u>AA</u>		Date Received: <u>10/30/17</u>	
Carrier and Tracking Number		Circle Applicable: FedEx Express <u>FedEx Ground</u> UPS Field Services Courier Other	
		<u>7705 6606 1987</u>	
Suspected Hazard Information	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.	
Shipped as a DOT Hazardous?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Hazard Class Shipped: _____ UN#: _____	
COC/Samples marked or classified as radioactive?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): <u>0</u> CPM / mR/Hr Classified as: <u>Rad 1</u> Rad 2 Rad 3	
Is package, COC, and/or Samples marked HAZ?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other: _____	

Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1 Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2 Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3 Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Preservation Method: Wet Ice Ice Packs Dry ice <u>None</u> Other: *all temperatures are recorded in Celsius TEMP: <u>17°</u>
4 Daily check performed and passed on IR temperature gun?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temperature Device Serial #: <u>TH2-17</u> Secondary Temperature Device Serial # (If Applicable): _____
5 Sample containers intact and sealed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6 Samples requiring chemical preservation at proper pH?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Sample ID's and Containers Affected: <u>3rd Qtr. Composite arrived unpreserved</u> If Preservation added, Lot#: <u>171004</u>
7 Do any samples require Volatile Analysis?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If Yes, Are Encores or Soil Kits present? Yes ___ No ___ (If yes, take to VOA Freezer) Do VOA vials contain acid preservation? Yes ___ No ___ N/A (If unknown, select No) VOA vials free of headspace? Yes ___ No ___ N/A Sample ID's and containers affected: _____
8 Samples received within holding time?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	ID's and tests affected:
9 Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sample ID's and containers affected:
10 Date & time on COC match date & time on bottles?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sample ID's affected:
11 Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sample ID's affected:
12 Are sample containers identifiable as GEL provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
13 COC form is properly signed in relinquished/received sections?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials EM Date 10/31/17 Page 1 of 1

List of current GEL Certifications as of 22 November 2017

State	Certification
Alaska	UST-0110
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
Delaware	SC00012
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA170010
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122018-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S.Carolina Radchem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-17-12
Utah NELAP	SC000122017-24
Vermont	VT87156
Virginia NELAP	460202
Washington	C780
West Virginia	997404



December 30, 2017

Mr. Jason Q. Spaide
LaCrosseSolutions
S4601 State Hwy 35
Genoa, Wisconsin 54632

Re: LACBWR Site Restoration Project
Work Order: 439334

Dear Mr. Spaide:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on October 30, 2017. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4453.

Sincerely,

Edith Kent
Project Manager

Purchase Order: 672583
Enclosures



GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 – (843) 556-8171 – www.gel.com

Certificate of Analysis Report for

ENRG070 LaCrosseSolutions, LLC (672583)

Client SDG: 439334 GEL Work Order: 439334

The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- ** Analyte is a surrogate compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UI Gamma Spectroscopy—Uncertain identification

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by



GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 30, 2017

Company : LaCrosseSolutions
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

Contact: Mr. Jason Q. Spaide
Project: LACBWR Site Restoration Project

Client Sample ID: L1-010-101-FS-GS-C06-SB
Sample ID: 439334001
Matrix: Soil
Collect Date: 18-OCT-17 08:30
Receive Date: 30-OCT-17
Collector: Client

Project: ENRG07001
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis													
Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"													
Americium-241	U	0.0163	+/-0.028	0.0245	0.400	pCi/g			BXA4	12/13/17	0904	1724194	1
Americium-243	U	0.028	+/-0.0294	0.0367	0.400	pCi/g							
Curium-243/244	U	0.00421	+/-0.0234	0.0448	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	U	-0.00501	+/-0.0752	0.176	0.400	pCi/g			BXA4	12/13/17	0857	1724195	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	U	-0.00381	+/-0.0168	0.044	0.400	pCi/g			BXA4	12/12/17	1809	1724196	3
Plutonium-239/240	U	0.020	+/-0.0317	0.0439	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	U	-1.18	+/-2.45	4.22	5.00	pCi/g			BXA4	12/15/17	0637	1724197	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	U	-2.26	+/-1.59	2.44	5.00	pCi/g			TXJ1	12/20/17	0859	1724705	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137		0.251	+/-0.048	0.0272	1.00	pCi/g			MXR1	12/08/17	1531	1724290	6
Cobalt-60	U	0.0127	+/-0.0174	0.0379		pCi/g							
Europium-152	U	0.0172	+/-0.0339	0.0665		pCi/g							
Europium-154	U	0.0218	+/-0.0432	0.0935		pCi/g							
Europium-155	U	0.0328	+/-0.0256	0.057		pCi/g							
Niobium-94	U	0.00615	+/-0.0142	0.0285		pCi/g							
Rad Liquid Scintillation Analysis													
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	U	-0.225	+/-0.955	1.65	2.00	pCi/g			CXS7	12/26/17	0925	1724677	7
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	U	-0.184	+/-4.88	6.96	10.0	pCi/g			TXJ1	12/20/17	2138	1724667	8
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	U	-0.0288	+/-1.72	2.99	5.00	pCi/g			TXJ1	12/20/17	1918	1724671	9

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	12/07/17	0618	1724141

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 30, 2017

Company : LaCrosseSolutions
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

Contact: Mr. Jason Q. Spaide
Project: LACBWR Site Restoration Project

Client Sample ID: L1-010-101-FS-GS-C06-SB
Sample ID: 439334001

Project: ENRG07001
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time Batch	Method
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The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	ASTM C 1475-00 Modified	
3	DOE EML HASL-300, Pu-11-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE RESL Ni-1	
6	DOE HASL 300, 4.5.2.3/Ga-01-R	
7	DOE EML HASL-300, Tc-02-RC Modified	
8	DOE RESL Fe-1, Modified	
9	DOE RESL Ni-1, Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			80.5	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			95.5	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			104	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			66.5	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			66.5	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			99.8	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			60.2	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			76.6	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			76.6	(25%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 30, 2017

Company : LaCrosseSolutions
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

Contact: Mr. Jason Q. Spaide
Project: LACBWR Site Restoration Project

Client Sample ID: L1-010-101-FS-GS-C14-SB
Sample ID: 439334002
Matrix: Soil
Collect Date: 18-OCT-17 09:36
Receive Date: 30-OCT-17
Collector: Client

Project: ENRG07001
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis													
Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"													
Americium-241	U	0.0234	+/-0.0276	0.0298	0.400	pCi/g			BXA4	12/13/17	0904	1724194	1
Americium-243	U	0.0238	+/-0.0334	0.0519	0.400	pCi/g							
Curium-243/244	U	-0.00296	+/-0.0131	0.0341	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	U	-0.00491	+/-0.0737	0.172	0.400	pCi/g			BXA4	12/13/17	0857	1724195	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	U	-0.00161	+/-0.0139	0.0322	0.400	pCi/g			BXA4	12/12/17	1809	1724196	3
Plutonium-239/240	U	-0.00295	+/-0.0204	0.0496	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	U	0.302	+/-2.10	3.57	5.00	pCi/g			BXA4	12/15/17	0839	1724197	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	U	0.209	+/-1.40	2.84	5.00	pCi/g			TXJ1	12/20/17	0900	1724705	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137		1.27	+/-0.117	0.040	1.00	pCi/g			MXR1	12/13/17	0558	1724290	6
Cobalt-60		0.089	+/-0.0349	0.0403		pCi/g							
Europium-152	U	0.00854	+/-0.0708	0.140		pCi/g							
Europium-154	U	0.0494	+/-0.072	0.162		pCi/g							
Europium-155	U	-0.00317	+/-0.0762	0.131		pCi/g							
Niobium-94	U	0.0112	+/-0.0192	0.0417		pCi/g							
Rad Liquid Scintillation Analysis													
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	U	0.599	+/-0.618	1.04	2.00	pCi/g			CXS7	12/26/17	1028	1724677	7
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	U	3.81	+/-4.94	6.84	10.0	pCi/g			TXJ1	12/20/17	2209	1724667	8
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	U	1.16	+/-1.80	3.06	5.00	pCi/g			TXJ1	12/20/17	1940	1724671	9

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	LYT1	12/07/17	0618	1724141

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 30, 2017

Company : LaCrosseSolutions
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

Contact: Mr. Jason Q. Spaide
Project: LACBWR Site Restoration Project

Client Sample ID: L1-010-101-FS-GS-C14-SB
Sample ID: 439334002

Project: ENRG07001
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time Batch	Method
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The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	ASTM C 1475-00 Modified	
3	DOE EML HASL-300, Pu-11-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE RESL Ni-1	
6	DOE HASL 300, 4.5.2.3/Ga-01-R	
7	DOE EML HASL-300, Tc-02-RC Modified	
8	DOE RESL Fe-1, Modified	
9	DOE RESL Ni-1, Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			88.8	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			85.8	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			99	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			79.1	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			79.1	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			96.4	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			88.2	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			77.7	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			73.8	(25%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

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QC Summary

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LaCrosseSolutions
S4601 State Hwy 35
Genoa, Wisconsin

Contact: Mr. Jason Q. Spaide

Workorder: 439334

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<hr/>											
Rad Alpha Spec											
Batch	1724194										
QC1203933168	439334001	DUP									
Americium-241	U	0.0163	U	0.020	pCi/g	N/A		N/A BXA4		12/13/17	09:04
	Uncertainty	+/-0.028		+/-0.0326							
Americium-243	U	0.028	U	-0.00308	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0294		+/-0.0287							
Curium-243/244	U	0.00421	U	0.0049	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0234		+/-0.0184							
QC1203933169	LCS										
Americium-241	1.94			2.17	pCi/g		112	(75%-125%)		12/13/17	09:04
	Uncertainty			+/-0.240							
Americium-243			U	0.00371	pCi/g			(75%-125%)			
	Uncertainty			+/-0.0239							
Curium-243/244	2.45			2.49	pCi/g		102	(75%-125%)			
	Uncertainty			+/-0.255							
QC1203933167	MB										
Americium-241			U	0.0133	pCi/g					12/13/17	09:04
	Uncertainty			+/-0.0211							
Americium-243			U	0.000273	pCi/g						
	Uncertainty			+/-0.0202							
Curium-243/244			U	0.00395	pCi/g						
	Uncertainty			+/-0.0148							
<hr/>											
Batch	1724195										
QC1203933171	439334001	DUP									
Neptunium-237	U	-0.00501	U	-0.0885	pCi/g	N/A		N/A BXA4		12/13/17	08:57
	Uncertainty	+/-0.0752		+/-0.0747							
QC1203933172	LCS										
Neptunium-237	20.5			20.8	pCi/g		102	(75%-125%)		12/13/17	08:57
	Uncertainty			+/-1.47							
QC1203933170	MB										
Neptunium-237			U	-0.0279	pCi/g					12/13/17	08:57
	Uncertainty			+/-0.132							

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QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Alpha Spec											
Batch	1724196										
QC1203933174	439334001	DUP									
Plutonium-238	U	-0.00381	U	-0.00298	pCi/g	N/A		N/A BXA4		12/12/17	18:09
	Uncertainty	+/-0.0168		+/-0.045							
Plutonium-239/240	U	0.020	U	-0.00186	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0317		+/-0.0279							
QC1203933175	LCS										
Plutonium-238				0.023	pCi/g					12/12/17	18:09
	Uncertainty			+/-0.0303							
Plutonium-239/240	1.95			1.96	pCi/g		101	(75%-125%)			
	Uncertainty			+/-0.242							
QC1203933173	MB										
Plutonium-238			U	0.0146	pCi/g					12/12/17	18:09
	Uncertainty			+/-0.0785							
Plutonium-239/240			U	-0.0153	pCi/g						
	Uncertainty			+/-0.0517							
Batch	1724197										
QC1203933177	439334001	DUP									
Plutonium-241	U	-1.18	U	-1.33	pCi/g	N/A		N/A BXA4		12/15/17	12:43
	Uncertainty	+/-2.45		+/-2.50							
QC1203933178	LCS										
Plutonium-241				71.3	pCi/g		101	(75%-125%)		12/15/17	14:45
	Uncertainty			+/-3.23							
QC1203933176	MB										
Plutonium-241			U	-2.85	pCi/g					12/15/17	10:41
	Uncertainty			+/-5.09							
Rad Gamma Spec											
Batch	1724290										
QC1203933442	439334001	DUP									
Cesium-137		0.251		0.252	pCi/g	0.397		(0%-20%) MXR1		12/12/17	08:51
	Uncertainty	+/-0.048		+/-0.0401							
Cobalt-60	U	0.0127	UI	0.00	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0174		+/-0.0194							
Europium-152	U	0.0172	U	0.00926	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0339		+/-0.0348							

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gamma Spec											
Batch	1724290										
Europium-154	U	0.0218	U	0.0113	pCi/g	N/A			N/A MXR1	12/12/17	08:51
	Uncertainty	+/-0.0432		+/-0.0531							
Europium-155	U	0.0328	U	0.028	pCi/g	N/A			N/A		
	Uncertainty	+/-0.0256		+/-0.0384							
Niobium-94	U	0.00615	U	0.0219	pCi/g	N/A			N/A		
	Uncertainty	+/-0.0142		+/-0.0196							
QC1203933443 LCS											
Americium-241	488			511	pCi/g		105	(75%-125%)		12/12/17	09:16
	Uncertainty			+/-12.0							
Cesium-137	174			176	pCi/g		101	(75%-125%)			
	Uncertainty			+/-3.47							
Cobalt-60	137			126	pCi/g		92	(75%-125%)			
	Uncertainty			+/-3.44							
Europium-152			U	0.00387	pCi/g						
	Uncertainty			+/-1.49							
Europium-154			U	-0.0573	pCi/g						
	Uncertainty			+/-0.926							
Europium-155			U	-1.09	pCi/g						
	Uncertainty			+/-1.54							
Niobium-94			U	-0.101	pCi/g						
	Uncertainty			+/-0.479							
QC1203933441 MB											
Cesium-137			U	0.000193	pCi/g					12/12/17	08:51
	Uncertainty			+/-0.00861							
Cobalt-60			U	0.012	pCi/g						
	Uncertainty			+/-0.00887							
Europium-152			U	0.000127	pCi/g						
	Uncertainty			+/-0.0274							
Europium-154			U	-0.0143	pCi/g						
	Uncertainty			+/-0.0292							
Europium-155			U	-0.0105	pCi/g						
	Uncertainty			+/-0.0257							

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gamma Spec											
Batch	1724290										
Niobium-94			U	0.00303	pCi/g				MXR1	12/12/17	08:51
	Uncertainty			+/-0.0112							
<hr/>											
Batch	1724705										
QC1203934546	439334001	DUP									
Nickel-59		U	-2.26	U	-0.991	pCi/g	N/A		N/A	TXJ1	12/20/17 11:03
	Uncertainty		+/-1.59		+/-1.12						
QC1203934547	LCS										
Nickel-59		91.1		79.7	pCi/g		87.4	(75%-125%)			12/20/17 12:17
	Uncertainty			+/-5.45							
QC1203934545	MB										
Nickel-59			U	-0.775	pCi/g						12/20/17 11:02
	Uncertainty			+/-1.53							
<hr/>											
Rad Liquid Scintillation											
Batch	1724667										
QC1203934416	439334001	DUP									
Iron-55		U	-0.184	U	0.0679	pCi/g	N/A		N/A	TXJ1	12/20/17 23:13
	Uncertainty		+/-4.88		+/-5.04						
QC1203934417	LCS										
Iron-55		124		120	pCi/g		96.2	(75%-125%)			12/20/17 23:45
	Uncertainty			+/-7.59							
QC1203934415	MB										
Iron-55			U	0.896	pCi/g						12/20/17 22:41
	Uncertainty			+/-4.43							
<hr/>											
Batch	1724671										
QC1203934425	439334001	DUP									
Nickel-63		U	-0.0288	U	-0.679	pCi/g	N/A		N/A	TXJ1	12/20/17 20:23
	Uncertainty		+/-1.72		+/-1.59						
QC1203934426	LCS										
Nickel-63		86.2		83.7	pCi/g		97	(75%-125%)			12/20/17 20:44
	Uncertainty			+/-3.79							
QC1203934424	MB										
Nickel-63			U	-0.163	pCi/g						12/20/17 20:01
	Uncertainty			+/-1.78							

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Liquid Scintillation											
Batch	1724677										
QC1203934444	439334001	DUP									
Technetium-99	U	-0.225	U	0.112	pCi/g	N/A		N/A	CXS7	12/26/17	12:33
	Uncertainty	+/-0.955		+/-0.648							
QC1203934445	LCS										
Technetium-99	37.9			32.0	pCi/g		84.4	(75%-125%)		12/26/17	13:36
	Uncertainty			+/-0.989							
QC1203934443	MB										
Technetium-99			U	0.133	pCi/g					12/26/17	11:31
	Uncertainty			+/-0.600							

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- ** Analyte is a Tracer compound
- < Result is less than value reported
- > Result is greater than value reported
- BD Results are either below the MDC or tracer recovery is low
- FA Failed analysis.
- H Analytical holding time was exceeded
- J Value is estimated
- K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
- L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
- M M if above MDC and less than LLD
- M REMP Result > MDC/CL and < RDL
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UI Gamma Spectroscopy--Uncertain identification
- UJ Gamma Spectroscopy--Uncertain identification
- UL Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Other specific qualifiers were required to properly define the results. Consult case narrative.

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QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
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^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.

h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

**Radiochemistry
Technical Case Narrative
LaCrosseSolutions, LLC (ENRG)
SDG #: 439334**

Product: Alphaspec Isotopic Am241 Am243, Cm243/244, Solid

Analytical Method: DOE EML HASL-300, Am-05-RC Modified

Analytical Procedure: GL-RAD-A-011 REV# 26

Analytical Batch: 1724194

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203933167	Method Blank (MB)
1203933168	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203933169	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Alphaspec Np, Solid

Analytical Method: ASTM C 1475-00 Modified

Analytical Procedure: GL-RAD-A-032 REV# 21

Analytical Batch: 1724195

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203933170	Method Blank (MB)
1203933171	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Alphaspec Pu238, 239/240, Solid

Analytical Method: DOE EML HASL-300, Pu-11-RC Modified

Analytical Procedure: GL-RAD-A-011 REV# 26

Analytical Batch: 1724196

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203933173	Method Blank (MB)
1203933174	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203933175	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Dry Weight

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155

Analytical Method: DOE HASL 300, 4.5.2.3/Ga-01-R

Analytical Procedure: GL-RAD-A-013 REV# 27

Analytical Batch: 1724290

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203933441	Method Blank (MB)
1203933442	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203933443	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Technical Information

Recounts

Sample 439334002 (L1-010-101-FS-GS-C14-SB) was recounted to verify sample results. Recount is reported.

Qualifier Information

Qualifier	Reason	Analyte	Sample	Client Sample
UI	Results are considered a false positive due to no valid peak.	Cobalt-60	1203933442	L1-010-101-FS-GS-C06-SB(439334001DUP)

Product: Gamma Ni59, Solid

Analytical Method: DOE RESL Ni-1

Analytical Procedure: GL-RAD-A-022 REV# 18

Analytical Batch: 1724705

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203934545	Method Blank (MB)
1203934546	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203934547	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Liquid Scint Pu241, Solid

Analytical Method: DOE EML HASL-300, Pu-11-RC Modified

Analytical Procedure: GL-RAD-A-035 REV# 19

Analytical Batch: 1724197

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203933176	Method Blank (MB)
1203933177	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203933178	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Quality Control (QC) Information**RDL Met**

The blank (See Below) did not meet the detection limit due to keeping the blank volume consistent with the other sample aliquots.

Sample	Analyte	Value
1203933176 (MB)	Plutonium-241	Result -2.85 < MDA 8.75 > RDL 5 pCi/g

Technical Information**Recounts**

Sample 1203933178 (LCS) was recounted due to a peak shift. The recount is reported.

Product: Liquid Scint Fe55, Solid

Analytical Method: DOE RESL Fe-1, Modified

Analytical Procedure: GL-RAD-A-040 REV# 13

Analytical Batch: 1724667

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#**Client Sample Identification**

439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203934415	Method Blank (MB)
1203934416	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203934417	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Liquid Scint Ni63, Solid

Analytical Method: DOE RESL Ni-1, Modified

Analytical Procedure: GL-RAD-A-022 REV# 18

Analytical Batch: 1724671

Preparation Method: Dry Soil Prep

Preparation Procedure: GL-RAD-A-021 REV# 22

Preparation Batch: 1724141

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203934424	Method Blank (MB)
1203934425	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203934426	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Liquid Scint Tc99, Solid

Analytical Method: DOE EML HASL-300, Tc-02-RC Modified

Analytical Procedure: GL-RAD-A-059 REV# 5

Analytical Batch: 1724677

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
439334001	L1-010-101-FS-GS-C06-SB
439334002	L1-010-101-FS-GS-C14-SB
1203934443	Method Blank (MB)
1203934444	439334001(L1-010-101-FS-GS-C06-SB) Sample Duplicate (DUP)
1203934445	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

SAMPLE RECEIPT & REVIEW FORM

Client: <u>ENRG</u>		SDG/AR/COC/Work Order:	
Received By: <u>AA</u>		Date Received: <u>10/30/17</u>	
Carrier and Tracking Number		Circle Applicable: FedEx Express <u>FedEx Ground</u> UPS Field Services Courier Other	
		<u>7705 6606 1987</u>	
Suspected Hazard Information	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.	
Shipped as a DOT Hazardous?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Hazard Class Shipped: _____ UN#: _____	
COC/Samples marked or classified as radioactive?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): <u>0</u> CPM / mR/Hr Classified as: <u>Rad 1</u> Rad 2 Rad 3	
Is package, COC, and/or Samples marked HAZ?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other: _____	

Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1 Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2 Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3 Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Preservation Method: Wet Ice Ice Packs Dry ice <u>None</u> Other: _____ *all temperatures are recorded in Celsius TEMP: <u>17°</u>
4 Daily check performed and passed on IR temperature gun?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temperature Device Serial #: <u>TH2-17</u> Secondary Temperature Device Serial # (If Applicable): _____
5 Sample containers intact and sealed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6 Samples requiring chemical preservation at proper pH?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Sample ID's and Containers Affected: <u>3rd Qtr. Composite arrived unpreserved</u> If Preservation added, Lot#: <u>171004</u>
7 Do any samples require Volatile Analysis?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If Yes, Are Encores or Soil Kits present? Yes _____ No _____ (If yes, take to VOA Freezer) Do VOA vials contain acid preservation? Yes _____ No _____ N/A (If unknown, select No) VOA vials free of headspace? Yes _____ No _____ N/A Sample ID's and containers affected: _____
8 Samples received within holding time?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	ID's and tests affected:
9 Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sample ID's and containers affected:
10 Date & time on COC match date & time on bottles?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sample ID's affected:
11 Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sample ID's affected:
12 Are sample containers identifiable as GEL provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
13 COC form is properly signed in relinquished/received sections?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials EM Date 10/31/17 Page 1 of 1

Subject: RE: Possibility of getting more analyses on soils performed on the attached GEL Work Order 436542
From: "Joseph D. Jacobsen" <jdjacobsen@energysolutions.com>
Date: 12/6/2017 11:19 AM
To: Edie Kent <emk@gel.com>
CC: "Jason Q. Spaide" <jqspaide@energysolutions.com>, "Joseph D. Jacobsen" <jdjacobsen@energysolutions.com>

Edie
Good morning.
You got me on that one.
Please scratch the extra Sr-90 request.
Thank You,
Joe Jacobsen

From: Edie Kent [mailto:emk@gel.com]
Sent: Wednesday, December 06, 2017 10:18 AM
To: Joseph D. Jacobsen
Cc: Jason Q. Spaide
Subject: Re: Possibility of getting more analyses on soils performed on the attached GEL Work Order 436542

Joe:

You included Sr90 in your request which we did on the original analysis. Do you need that analysis repeated or should that have not been included in your request?

Edie

On 12/5/2017 5:32 PM, Joseph D. Jacobsen wrote:

Edie,
Sounds good.
Appreciate it.
Joe J

From: Edie Kent [mailto:emk@gel.com]
Sent: Tuesday, December 05, 2017 3:41 PM
To: Joseph D. Jacobsen
Cc: Jason Q. Spaide
Subject: Re: Possibility of getting more analyses on soils performed on the attached GEL Work Order 436542

It looks like we have enough sample so I will be relogging for the additional tests.

Edie

On 12/5/2017 4:28 PM, Joseph D. Jacobsen wrote:

Thank you Edie.

Take Care,

Joe J

From: Edie Kent [<mailto:emk@gel.com>]

Sent: Tuesday, December 05, 2017 3:10 PM

To: Joseph D. Jacobsen

Cc: Jason Q. Spaide

Subject: Re: Possibility of getting more analyses on soils performed on the attached GEL Work Order 436542

Joe:

We'll have the samples pulled to see if we have enough volume for the additional analyses. I'll let you know.

Edie

On 12/5/2017 3:12 PM, Joseph D. Jacobsen wrote:

Good afternoon Edie from Genoa, WI.

I have been asked to look into the possibility of GEL performing additional analyses on the soil samples under the attached GEL Work Order.

The additional analyses would be for:

Fe-55/Ni-59/Ni-63

Co-60/Nb-94/Cs-137/Eu-152/Eu-154/Eu-155

Sr-90/Tc-99

Pu238/239/240/241

Np-237

Am241/243

Cm243/244

For each soil sample with all analyses on normal turnaround.

Edie, could you let me know if GEL can proceed with these analyses on this email direction or what else I would need to do please.

Thanks,

Joe J

--

Edith M. Kent

Project Manager



2040 Savage Road, Charleston, SC 29407 | PO Box 30712, Charleston, SC 29417

Office Direct: 843.769.7385 | Office Main: 843.556.8171 | Fax: 843.766.1178

E-Mail: emk@gel.com | Website: www.gel.com

Environmental | Engineering | Surveying | Analytical Testing

Ask me about GEL's new testing capability for Perfluorinated chemicals (PFCs)!
<http://www.gellaboratories.com>

--

Edith M. Kent
Project Manager



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List of current GEL Certifications as of 30 December 2017

State	Certification
Alaska	UST-0110
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
Delaware	SC00012
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA180011
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122018-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S.Carolina Radchem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-17-12
Utah NELAP	SC000122017-25
Vermont	VT87156
Virginia NELAP	460202
Washington	C780
West Virginia	997404