



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

**SURVEY UNIT L1-010-106  
NORTH LOADING AREA**



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**LIST OF ACRONYMS AND ABBREVIATIONS**

ALARA	As Low As Reasonably Achievable
DQA	Data Quality Assessment
DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
DCGLs	Soil Derived Concentration Guideline Level
FSS	Final Status Survey
GPS	Global Positioning System
HSA	Historical Site Assessment
HTD	Hard-to-Detect
IC	Insignificant Contributors
LACBWR	La Crosse Boiling Water Reactor
LBGR	Lower Bound of the Gray Region
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
NaI	Sodium Iodide
OpDCGLs	Soil Operational Derived Concentration Guideline Level
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Radiological Assessment
ROC	Radionuclides of Concern
SOF	Sum-of-Fractions
TEDE	Total Effective Dose Equivalent
UBGR	Upper Bound of the Gray Region
UCL	Upper Confidence Limit



## 1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for survey unit L1-010-106, North Loading Area, 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* (LACBWR 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).

Survey unit L1-010-106, an open land survey unit, has a MARSSIM classification of 1. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I ( $\alpha$ ) and Type II ( $\beta$ ) decision error rates were set at 0.05. As a systematic sample population, fourteen (14) 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 L1-010-106 indicate that the maximum Sum-of-Fractions (SOF), considering the concentration of all applicable Radionuclides of Concern (ROC) either by direct measurement or by inference, is equal to 0.0656 when applying the respective Operational Derived Concentration Guideline Levels (OpDCGLs) for soil. Therefore, the null hypothesis is rejected and survey unit L1-010-106 is acceptable for unrestricted release. The mean SOF when applying the respective Base Case DCGLs (DCGLs) for soil is 0.0104. This SOF equates to a dose for the survey unit of 0.2603 mrem/yr.

## 2. SURVEY UNIT DESCRIPTION

Survey unit L1-010-106 is an impacted Class 1 open land survey unit. The surface area of the survey unit is 1,936 m<sup>2</sup>.

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 L1-010-106.

## 3. CLASSIFICATION BASIS

Survey unit L1-010-106 was not originally identified in the Historical Site Assessment (HSA) (Reference 5). Portions of survey units L2-011-101 and L3-012-101, as originally

defined in the HSA and during characterization, make up survey unit L1-010-106 in its FSS configuration. The following summarizes the results of the characterization survey for survey units L2-011-101 and L3-012-101.

The initial site characterization surveys performed by *EnergySolutions* were conducted between October 9, 2014, and August 6, 2015. In total, sixteen (16) surface soil samples, nineteen (19) subsurface soil samples, and nine (9) asphalt samples were collected in survey units L2-011-101 and L3-012-101. 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 eight (8) of the samples, at a maximum concentration of 1.39E-01 pCi/g. Co-60 was not detected at concentrations above MDC in any of the surface soil samples. For subsurface soil samples, Cs-137 was detected at concentrations above MDC in two (2) of the samples, at a maximum concentration of 8.80E-02 pCi/g. Co-60 was detected at concentrations above MDC in one (1) of the subsurface soil samples, at a maximum concentration of 1.12E-01 pCi/g. Cs-137 or Co-60 were not identified in the asphalt samples. A summary of the analyses for the surface soil, subsurface soil, and asphalt samples taken during site characterization are presented in Table 3-1.

Four (4) surface soil, four (4) subsurface soil, three (3) sediment, two (2) asphalt, and three (3) concrete 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 3-1 - Statistical Quantities for Cs-137 and Co-60 from the Characterization Survey**

L2-011-101			L3-012-101		
Surface Soil	Co-60	Cs-137	Surface Soil	Co-60	Cs-137
# of Samples	13		# of Samples	3	
# >MDC	0	8	# >MDC	0	0
Mean (pCi/g)	7.30E-02	9.00E-02	Mean (pCi/g)	7.00E-02	7.30E-02
Median (pCi/g)	7.70E-02	1.00E-01	Median (pCi/g)	7.60E-02	7.20E-02
Max (pCi/g)	1.06E-01	1.39E-01	Max (pCi/g)	7.70E-02	8.30E-02
Min (pCi/g)	5.30E-02	4.10E-02	Min (pCi/g)	5.80E-02	6.50E-02
Standard Deviation (pCi/g)	1.60E-02	3.00E-02	Standard Deviation (pCi/g)	1.10E-02	9.00E-03
Subsurface Soil	Co-60	Cs-137	Subsurface Soil	Co-60	Cs-137
# of Samples	16		# of Samples	3	
# >MDC	1	2	# >MDC	0	0
Mean (pCi/g)	5.20E-02	4.90E-02	Mean (pCi/g)	5.10E-02	5.10E-02
Median (pCi/g)	4.60E-02	4.80E-02	Median (pCi/g)	5.30E-02	5.20E-02
Max (pCi/g)	1.12E-01	8.80E-02	Max (pCi/g)	5.40E-02	5.20E-02
Min (pCi/g)	4.00E-02	3.40E-02	Min (pCi/g)	4.60E-02	5.10E-02
Standard Deviation (pCi/g)	1.80E-02	1.20E-02	Standard Deviation (pCi/g)	4.00E-03	1.00E-03
Asphalt	Co-60	Cs-137	Asphalt	Co-60	Cs-137
# of Samples	6		# of Samples	3	
# >MDC	0	0	# >MDC	0	0
Mean (pCi/g)	5.10E-02	5.10E-02	Mean (pCi/g)	3.10E-02	2.90E-02
Median (pCi/g)	5.10E-02	5.10E-02	Median (pCi/g)	3.10E-02	2.70E-02
Max (pCi/g)	5.40E-02	5.40E-02	Max (pCi/g)	3.50E-02	3.30E-02
Min (pCi/g)	4.70E-02	4.70E-02	Min (pCi/g)	2.80E-02	2.60E-02
Standard Deviation (pCi/g)	2.00E-03	3.00E-03	Standard Deviation (pCi/g)	3.00E-03	4.00E-03



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**Table 3-2 – Off-site Analysis for Characterization Samples**

Radionuclide	H-3	C-14	Fe-55	Ni-59	Co-60	Ni-63	Sr-90	Nb-94	Tc-99	Cs-137	Pm-147	Eu-152	Eu-154	Eu-155	Np-237	Pu-238	Pu-239/240	Pu-241	Am-241	Am-243	Cm-243/244
L2011101-CJ-GS-001-SM					<b>0.096</b>			0.011		<b>0.137</b>		0.041	0.098	0.033					0.031		
L2011101-CR-PA-003-AV					0.023			0.016		0.017		0.039	0.131	0.039					0.038		
L2011101-QJ-GS-001-SB	0.518	0.727	2.290	2.660	0.016	4.030	0.273	0.014	0.643	0.015	0.705	0.033	0.108	0.040	0.022	0.028	0.025	2.470	0.015	0.022	0.019
L2011101-QJ-GS-001-SM	<b>2.040</b>	0.707	2.240	2.950	<b>0.049</b>	4.140	0.523	0.018	0.585	<b>0.107</b>	0.615	0.048	0.178	0.049	0.026	0.045	0.021	3.100	0.037	0.036	<b>0.034</b>
L2011101-QJ-GS-001-SS					0.012			0.020		<b>0.080</b>		0.060	0.188	0.091					0.042		
L2011101-QQ-GS-001-SB					0.017			0.012		0.013		0.040	0.127	0.037					0.031		
L2011101-QQ-GS-001-SS	<b>11.810</b>	0.726	2.590	2.600	0.035	3.720	0.255	0.035	0.532	<b>0.103</b>	0.779	0.097	0.205	0.102	0.023	0.037	0.024	2.800	0.019	0.015	0.015
L2011101-QQ-GS-002-SB	<b>2.500</b>	0.731	<b>1.940</b>	2.680	0.017	3.870	0.314	0.014	0.616	0.016	0.697	0.037	0.119	0.041	0.019	0.039	0.016	2.920	0.020	0.028	0.016
L2011101-QQ-PA-001-AV					0.022			0.015		0.015		0.046	0.135	0.042					0.040		
L3012101-CR-GC-001-CV					0.028			0.030		0.026		0.043	0.221	0.059					0.053		
L3012101-CR-GC-002-CV					0.035			0.026		0.033		0.062	0.271	0.056					0.055		
L3012101-CR-GC-003-CV		0.669	2.180	2.020	0.031	3.590	0.374	0.027	0.521	0.027	1.480	0.056	0.249	0.069	0.025	0.046	0.018	1.690	0.019	0.021	0.006
L3012101-CR-GS-003-SS					0.025			0.017		<b>0.113</b>		0.052	0.157	0.059					0.052		
L3012101-QQ-GS-001-SB	<b>18.400</b>	0.717	2.390	2.870	0.016	<b>5.640</b>	0.309	0.014	0.550	0.015	0.899	0.036	0.128	0.036	0.039	0.035	0.022	2.590	0.023	0.029	0.027
L3012101-QQ-GS-001-SS	<b>15.500</b>	0.708	<b>2.330</b>	2.660	0.020	3.890	0.295	0.017	0.603	<b>0.059</b>	1.090	0.047	0.116	0.054	0.028	0.028	0.022	2.640	0.019	0.021	0.006
L3012101-QQ-SL-001-SM	0.364	0.342	<b>2.710</b>	0.739	0.022	<b>1.090</b>	0.152	0.017	0.360	0.020	0.333	0.042	0.153	0.034	0.009	0.016	0.013	0.797	0.009	0.009	0.011

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

A Radiological Assessment (RA) in survey unit L1-010-106 was performed in June of 2019. Seven (7) soil samples were collected and analyzed by the on-site gamma spectroscopy system. The average SOF of the sample set was 0.025, with a standard deviation 0.016. The RA data was used to design the FSS.

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 Table 4 of TSD RS-TD-313196-004, *LACBWR Soil DCGL*, *Basement Concrete DCGL*, and *Buried Pipe DCGL* (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 RA data, and completion of a final Survey Unit Classification Worksheet, the correct final classification of survey unit L1-010-106 was determined to be Class 1.

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

FSS 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, utilized in accordance with MARSSIM, is described in the LACBWR LTP. The appropriate design for a given survey was developed using the DQO process as outlined in Appendix D of MARSSIM. A summary of seven steps of the DQO process are outlined as follows.

The DQO process incorporated hypothesis testing and probabilistic sampling distributions to control decision errors during data analysis. Hypothesis testing is a process based on the

scientific method that compares a baseline condition to an alternate condition. The baseline condition is technically known as the null hypothesis. Hypothesis testing rests on the premise that the null hypothesis is true and that sufficient evidence must be provided for rejection. In designing the survey plan, the underlying assumption, or null hypothesis was that residual activity in the survey unit exceeded the release criteria. Rejection of the null hypothesis would indicate that residual activity within the survey unit does not exceed the release criteria. Therefore, the survey unit would satisfy the primary objective of the FSS sample plan.

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in survey unit L1-010-106 did not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

EnergySolutions 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.

IC 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 IC 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.

The LTP, 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) <sup>(1)</sup>
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.

The 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 (e.g., calculation of surrogate DCGLs, investigation levels). 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).

Multiple ROCs are known to be present at LACBWR. 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<sub>w</sub>. In Class 1 land survey units, the DCGL<sub>w</sub> 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 (i.e., basements, soils, buried pipe, above-ground structures, and

groundwater) for the end-state. 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, Section 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 the LTP, Section 6.16.1 are reproduced in Table 4-2. The IC 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**

<b>Radionuclide</b>	<b>DCGLs (pCi/g)</b>
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 (e.g., calculation of surrogate DCGLs, investigation levels). The OpDCGLs for the unrestricted release of soil are provided in Table 4-3.

**Table 4-3 - Operational DCGLs for Soil**

<b>Radionuclide</b>	<b>OpDCGLs (pCi/g)</b>
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 reported 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” ( $< \text{MDC}$ ). 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 L1-010-106 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 Waste Treatment Building. 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  
 $DCGL_{2,3\dots n}$  = DCGL for radionuclides to be represented by the surrogate  
 $R_n$  = Ratio of concentration (or nuclide mixture fraction) of radionuclide “n” to surrogate radionuclide

Using the Operational DCGLs presented in Table 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 L1-010-106 are based on the Operational DCGL and are presented in Table 5-2.

**Table 5-2 – Action Levels for Survey Unit L1-010-106**

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

- (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 ( $\Delta/\sigma$ ) for the survey unit data set is defined as shift ( $\Delta$ ), which is the Upper Boundary of the Gray Region (UBGR), or the DCGL (SOF of 1), minus the Lower Bound of the Gray Region (LBGR), divided by sigma ( $\sigma$ ), which is the standard deviation of the data set used for survey design. The optimal value for  $\Delta/\sigma$  should range between one (1) and three (3). The largest value the  $\Delta/\sigma$  can have is three (3). If the calculated value of  $\Delta/\sigma$  exceeds three (3), an adjusted value of three (3) will be used for  $\Delta/\sigma$ . The  $\Delta/\sigma$  for survey unit L1-010-106, based on the data for surface soil samples collected during the RA of survey unit L1-010-106, was calculated as follows:

**Equation 3**

$$\Delta/\sigma = (1 - 0.025) / 0.016 = 60.9$$

As the calculated relative shift was greater than three (3), a value of three (3) was used as the adjusted  $\Delta/\sigma$ . Both the Type I error (i.e.,  $\alpha$  value) and the Type II error (i.e.,  $\beta$  value) was set at 0.05. The sample size from Table 5.5 of MARSSIM that equates to the Type I and Type II error of 0.05 for use with the Sign Test is an N value of fourteen (14).

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

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 systematic sampling tool set with a predetermined number (14) of samples. 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 Plane North American Datum 1983 coordinate system.

**Table 5-3 – Systematic Sample Locations**

Sample ID	Northing	Easting
L1-010-106-FSGS-001-SS	571357.2694	1642148.6981
L1-010-106-FSGS-002-SS	571357.2694	1642194.3977
L1-010-106-FSGS-003-SS	571396.8464	1642080.1486
L1-010-106-FSGS-004-SS	571396.8464	1642125.8482
L1-010-106-FSGS-005-SS	571396.8464	1642171.5479
L1-010-106-FSGS-006-SS	571436.4235	1642102.9984
L1-010-106-FSGS-007-SS	571436.4235	1642148.6981
L1-010-106-FSGS-008-SS	571476.0006	1642125.8482
L1-010-106-FSGS-009-SS	571476.0006	1642171.5479
L1-010-106-FSGS-010-SS	571515.5776	1642148.6981
L1-010-106-FSGS-011-SS	571515.5776	1642194.3977
L1-010-106-FSGS-012-SS	571555.1547	1642171.5479
L1-010-106-FSGS-013-SS	571555.1547	1642217.2475
L1-010-106-FSGS-014-SS	571594.7317	1642194.3977

In accordance with the sample plan, at least one (1) judgmental sample is required from the survey unit. The number of judgmental samples actually obtained was two (2). In addition, six (6) investigational samples (labeled as judgmental) were collected due to scan alarms, which brings the total number of samples collected for the FSS of survey unit L1-010-106 to twenty-two (22). Table 5-4 lists the judgmental and investigational samples collected for FSS and the corresponding GPS coordinates.

**Table 5-4 – Judgmental and Investigational Sample Locations**

Sample ID	Northing	Easting
L1-010-106-FJGS-015-SS	571518.3840	1642236.1980
L1-010-106-FJGS-016-SS	571506.0960	1642197.8300
L1-010-106-FJGS-017-SS	571375.9400	1642144.8260
L1-010-106-FJGS-018-SS	571396.7340	1642097.0460
L1-010-106-FSGS-007-SB	571436.4235	1642148.6981
L1-010-106-FSGS-009-SB	571476.0006	1642171.5479
L1-010-106-FJGS-016-SB	571506.0960	1642197.8300
L1-010-106-FJGS-017-SB	571375.9400	1642144.8260

The LACBWR LTP, 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 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 three (3) soil samples (L1-010-106-FSGS-004-SS, L1-010-106-FJGS-017-SS, and L1-010-106-FJGS-018-SS) met the requirement that a minimum of 10% of the samples collected for the FSS of survey unit L1-010-106 be analyzed for HTD ROC.

The implementation of quality control measures as referenced by LTP, 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, L1-010-106-FQGS-004-SS, was designated for split sample QC analysis for the FSS of this survey unit.

The LTP, Section 5.6.4.4 and Table 5-15 specifies that for Class 1 open land survey units, surface scans will be performed on 100% of the surface area in the survey unit. For survey unit L1-010-106, 100% scan coverage equates to 1,936 m<sup>2</sup>. One hundred and seventy (170) scan lanes were established.

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

**Table 5-5 – Investigation Levels**

Classification	Scan Investigation Levels	Direct Investigation Levels
Class 1	>Operational DCGL or >MDC <sub>scan</sub> if MDC <sub>scan</sub> is greater than Operational DCGL	>Operational DCGL

Table 5-6 provides a synopsis of the survey design for survey unit L1-010-106.

**Table 5-6 – Synopsis of Survey Design**

Feature	Design Criteria	Basis
Survey Unit Surface Area	1,936 m <sup>2</sup>	GPS
Number of Systematic Samples (N)	14	<ul style="list-style-type: none"> <li>• <math>\sigma = 0.016</math></li> <li>• UBGR = SOF of 1</li> <li>• LBGR = SOF of 0.025</li> <li>• Type I &amp; II error = 0.05</li> <li>• <math>\Delta/\sigma = 3</math> (adjusted)</li> <li>• MARSSIM Table 5.5</li> </ul>
DCGLS and Action Levels	<ul style="list-style-type: none"> <li>• Co-60: 3.83 pCi/g</li> <li>• Sr-90: 1970.45 pCi/g</li> <li>• Cs-137: 17.39 pCi/g (Surrogate Cs-137 DCGL: 17.31 pCi/g)</li> <li>• Eu-152: 8.51 pCi/g</li> <li>• Eu-154: 7.89 pCi/g</li> </ul>	Operational DCGLs for soil, LTP, Table 5-6, Release Record, Table 5-2
Scan and Direct Investigation Levels	>Operational DCGL	LTP, Table 5-16
Scan Areal Coverage	1,936 m <sup>2</sup> , 100% areal coverage	LTP, Table 5-15
Judgmental Samples	1 2	Per Survey Design Actual Number Obtained
HTD ROC Analysis	1 3	LTP, Section 5.1 Actual Number Obtained
QC	1 split sample selected at random 4	LTP, Section 5.9 Actual Number Obtained

## 6. SURVEY IMPLEMENTATION

For survey unit L1-010-106, 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 August 27, 2019, prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths, and identify



potentially hazardous conditions. At the time of survey, the soil in the survey unit was dry and free of any considerable constraint for the 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. FSS field activities were projected to take four (4) working days to complete. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. A "Field Log" was used to document field activities and other information pertaining to the performance of the FSS. FSS field activities commenced on August 27, 2019, and were concluded on August 28, 2019.

A total of one hundred and seventy (170) different scan lanes, constituting an areal coverage of 1,936 m<sup>2</sup>, were scanned using a Ludlum 2350-1 paired with a Ludlum Model 44-10 (2"x 2") sodium iodide (NaI) detector. The background was established as the average of five (5) 1-minute static measurements, while maintaining the detector 6" from the soil. In survey unit L1-010-106, background ranged from 2,827 cpm up to 7,617 cpm.

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), 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.

The fourteen (14) systematic sample locations were marked with flags based on GPS coordinates provided. Each soil sample consisted of approximately one (1) liter of soil. The soil 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 12), and in accordance with LC-FS-PR-004, *Sample Media Collection for Site Characterization and Final Status Survey* (Reference 13), LC-FS-PR-005, *Sample Media Preparation for Site Characterization and Final Status Survey* (Reference 14), and LC-FS-PR-001, *Sample Storage* (Reference 15).

The LTP, Section 5.7.1.5.2 states that in Class 1 open land survey units, a subsurface soil sample will be taken at 10% of the systematic surface soil sample locations in the survey unit with the location(s) selected at random. In addition, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicates the

potential presence of residual radioactivity at a concentration of 75% of the soil Operational DCGL, then biased subsurface soil sample(s) will be taken to the appropriate depth within the area of concern as part of the investigation. Two (2) judgmental subsurface soil samples (L1-010-106-FSGS-007-SB and L1-010-106-FSGS-009-SB) were collected to satisfy the 10% requirement from the LTP. In addition, six (6) investigational samples (labeled as judgmental) were collected in the survey unit for FSS. Two (2) of the investigational samples collected were collected to a subsurface depth because they exceeded the 75% Operational DCGL threshold for gamma count rates from the LTP. Subsurface soil samples were collected using a hand auger.

The survey design specified that a minimum of one (1) sample was required for HTD ROC analysis. In total, three (3) samples (L1-010-106-FSGS-004-SS, L1-010-106-FJGS-017-SS, and L1-010-106-FJGS-018-SS) were selected for HTD radionuclide analysis.

The implementation of survey specific QC measures included the collection of four (4) samples (L1-010-106-FQGS-003-SS, L1-010-106-FQGS-004-SS, L1-010-106-FSGS-004-SS SPLIT, and L1-010-106-FSGS-009-SS SPLIT) for split and duplicate sample analysis.

## 7. SURVEY RESULTS

All areas identified in the FSS sample plan were scanned for elevated activity levels. A total of ten (10) alarms were verified during scanning, which prompted the collection of six (6) investigational soil samples (4 surface soil and 2 subsurface soil). Table 7-1 provides an overview of the scan results for all scan lanes (identified as 01 through 170), the 1 m<sup>2</sup> scan areas around each sample location before and after sample collection (identified with “SP”), and QC locations (identified with a “QC”). Complete scan results are provided in Attachment 2.

**Table 7-1 – Synopsis of Scan Results**

Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
01	7,346	7,863	0	0
02	7,952	7,863	1	1
03	7,968	7,863	1	
04	7,598	7,863	0	0
05	6,873	7,863	0	0
06	6,377	7,863	0	0

Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
07	5,839	7,863	0	0
08	5,710	7,863	0	0
09	5,636	7,863	0	0
10	5,014	7,863	0	0
11	5,592	6,410	0	0
12	5,188	6,410	0	0
13	6,115	6,410	0	0
14	5,326	6,410	0	0
15	5,205	6,410	0	0
16	5,243	6,410	0	0
17	5,138	6,410	0	0
18	5,298	6,410	0	0
19	5,149	6,410	0	0
20	4,884	6,410	0	0
21	5,182	6,410	0	0
22	5,044	6,410	0	0
23	4,902	6,410	0	0
24	5,516	6,410	0	0
25	8,722	6,410	1	1
25	5,771	6,410	0	0
26	5,343	6,410	0	0
27	4,705	6,410	0	0
28	4,377	6,410	0	0
29	4,344	6,410	0	0
30	3,943	6,410	0	0
31	3,941	6,410	0	0
32	3,996	6,410	0	0
33	4,459	6,410	0	0
34	4,262	6,410	0	0
35	3,972	6,410	0	0
36	4,141	6,410	0	0
37	4,169	6,410	0	0

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Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
38	4,286	6,410	0	0
39	4,418	6,410	0	0
40	4,504	6,410	0	0
41	4,525	6,410	0	0
42	4,164	6,410	0	0
43	3,979	6,410	0	0
44	4,358	6,410	0	0
45	5,165	6,410	0	0
46	4,031	6,410	0	0
47	4,300	6,410	0	0
48	4,381	6,410	0	0
49	4,285	6,410	0	0
50	3,947	6,410	0	0
51	4,295	6,410	0	0
52	4,112	6,410	0	0
53	4,113	6,410	0	0
54	4,530	6,410	0	0
55	3,997	6,410	0	0
56	4,343	6,410	0	0
57	4,308	6,410	0	0
58	4,443	6,410	0	0
59	4,670	6,410	0	0
60	4,158	6,410	0	0
61	4,728	8,883	0	0
62	7,267	8,883	0	0
63	6,854	8,883	0	0
64	8,283	8,883	0	0
65	8,443	8,883	0	0
66	10,837	8,883	1	1
67	10,316	8,883	1	1
68	11,857	8,883	1	
69	8,808	8,883	0	0

Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
70	8,560	8,883	0	0
71	5,902	8,883	0	0
72	5,429	8,883	0	0
73	4,989	8,883	0	0
74	5,409	8,883	0	0
75	3,008	4,672	0	0
76	3,242	4,672	0	0
77	3,027	4,672	0	0
78	3,124	4,672	0	0
79	3,275	4,672	0	0
80	2,983	4,672	0	0
81	3,286	4,672	0	0
82	3,167	4,672	0	0
83	3,030	4,672	0	0
84	3,116	4,672	0	0
85	3,917	4,589	0	0
86	3,416	4,589	0	0
87	3,744	4,589	0	0
88	3,664	4,589	0	0
89	3,763	4,589	0	0
90	3,726	4,589	0	0
91	3,687	4,589	0	0
92	3,900	4,589	0	0
93	3,743	4,589	0	0
94	3,616	4,589	0	0
95	3,525	4,589	0	0
96	4,096	4,589	0	0
97	4,099	4,589	0	0
98	4,132	4,589	0	0
99	4,438	4,589	0	0
100	4,328	4,589	0	0
101	3,734	4,589	0	0

Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
102	3,697	4,589	0	0
103	3,664	4,589	0	0
104	3,685	4,589	0	0
105	3,722	4,589	0	0
106	3,656	4,589	0	0
107	4,056	4,589	0	0
108	3,822	4,589	0	0
109	3,617	4,589	0	0
110	3,962	4,589	0	0
111	3,632	4,589	0	0
112	3,685	4,589	0	0
113	3,792	4,589	0	0
114	3,773	4,589	0	0
115	3,559	4,589	0	0
116	3,621	4,589	0	0
117	3,042	5,052	0	0
118	3,102	5,052	0	0
119	3,030	5,052	0	0
120	3,348	5,052	0	0
121	3,522	5,052	0	0
122	3,237	5,052	0	0
123	3,457	5,052	0	0
124	3,415	5,052	0	0
125	3,350	5,052	0	0
126	3,318	5,052	0	0
127	3,270	5,052	0	0
128	3,082	5,052	0	0
129	3,776	5,052	0	0
130	3,934	5,052	0	0
131	3,770	5,052	0	0
132	3,799	5,052	0	0
133	3,689	5,052	0	0



Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
134	4,123	5,052	0	0
135	4,130	5,052	0	0
136	3,966	5,052	0	0
137	4,191	5,052	0	0
138	4,101	5,052	0	0
139	4,667	5,052	0	0
140	4,429	5,052	0	0
141	4,338	5,052	0	0
142	3,788	5,052	0	0
143	3,487	5,052	0	0
144	4,006	5,052	0	0
145	3,670	5,052	0	0
146	3,769	5,052	0	0
147	3,619	5,052	0	0
148	3,952	5,052	0	0
149	4,198	5,052	0	0
150	3,975	5,052	0	0
151	3,960	5,052	0	0
152	4,256	5,052	0	0
153	4,135	5,052	0	0
154	3,721	5,052	0	0
155	3,838	5,052	0	0
156	3,467	5,052	0	0
157	3,617	5,052	0	0
158	3,468	5,052	0	0
159	3,568	5,052	0	0
160	3,784	5,052	0	0
161	3,965	5,052	0	0
162	3,813	5,052	0	0
163	3,719	5,052	0	0
164	3,450	5,052	0	0
165	3,493	5,052	0	0

Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
166	3,721	5,052	0	0
167	3,384	5,052	0	0
168	3,161	5,052	0	0
169	3,456	5,052	0	0
170	3,884	5,052	0	0
01 SP	3,844	5,550	0	0
02 SP	3,003	5,550	0	0
03 SP QC	5,197	6,446	0	0
03 SP	3,015	5,550	0	0
04 SP QC	4,535	6,446	0	0
04 SP	3,617	5,550	0	0
05 SP	2,963	5,550	0	0
06 SP	3,172	5,550	0	0
07 SP	3,027	5,550	0	0
08 SP	3,036	5,550	0	0
09 SP	2,825	5,550	0	0
10 SP	2,790	5,550	0	0
11 SP	3,496	5,550	0	0
12 SP	2,946	5,550	0	0
13 SP	3,909	5,550	0	0
14 SP	2,666	5,550	0	0
15 SP	8,446	8,482	0	0
16 SP	8,066	5,550	2	1
17 SP	12,213	9,389	2	1
18 SP	8,359	9,389	0	0
75 QC	3,008	4,672	0	0
76 QC	3,242	4,672	0	0
77 QC	3,027	4,672	0	0
78 QC	3,124	4,672	0	0
79 QC	3,275	4,672	0	0
80 QC	2,983	4,672	0	0
81 QC	3,286	4,672	0	0

Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
82 QC	3,167	4,672	0	0
83 QC	3,030	4,672	0	0
84 QC	3,116	4,672	0	0

(1) Action Level based on the average background plus 1,762 cpm (50% OpDCGL equivalent).

The on-site laboratory analyzed the fourteen (14) soil samples taken for non-parametric statistical testing using the on-site gamma spectroscopy system. A summary of the results for the fourteen (14) samples collected for non-parametric statistical testing is provided in Table 7-2. Gamma spectroscopy results revealed that no ROC were positively identified in any systematic sample. 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 are summarized in Table 7-3.

**Table 7-2 - Summary of Gamma Spectroscopy Results for 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)
L1-010-106-FSGS-001-SS	9.58E-03	4.08E-02	8.52E-02	2.57E-02	2.05E-02
L1-010-106-FSGS-002-SS	1.66E-02	2.65E-02	4.70E-02	8.66E-02	1.33E-02
L1-010-106-FSGS-003-SS	5.10E-02	6.29E-02	6.38E-02	9.08E-02	3.16E-02
L1-010-106-FSGS-004-SS	6.40E-03	8.24E-02	4.86E-02	1.29E-01	4.14E-02
L1-010-106-FSGS-005-SS	2.68E-02	6.72E-02	3.95E-02	6.91E-02	3.37E-02
L1-010-106-FSGS-006-SS	0.00E+00	7.28E-02	2.13E-01	9.54E-02	3.65E-02
L1-010-106-FSGS-007-SS	4.12E-02	7.40E-03	7.14E-02	2.96E-02	3.71E-03
L1-010-106-FSGS-008-SS	5.85E-02	2.51E-02	0.00E+00	1.39E-01	1.26E-02
L1-010-106-FSGS-009-SS	1.27E-02	3.28E-02	3.45E-02	5.60E-02	1.65E-02
L1-010-106-FSGS-010-SS	4.01E-02	7.59E-02	8.56E-02	8.38E-02	3.81E-02
L1-010-106-FSGS-011-SS	5.70E-02	3.19E-02	1.49E-01	2.00E-01	1.60E-02
L1-010-106-FSGS-012-SS	3.86E-03	7.37E-02	1.27E-02	1.01E-01	3.70E-02
L1-010-106-FSGS-013-SS	2.57E-02	7.86E-02	0.00E+00	6.79E-02	3.95E-02
L1-010-106-FSGS-014-SS	5.68E-02	2.13E-02	6.02E-02	1.62E-02	1.07E-02

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	2.90E-02	2.63E-02	5.85E-02	0.00E+00	2.14E-02	1.06E+01	0.0027	0.0684
Cs-137	5.00E-02	5.19E-02	8.24E-02	7.40E-03	2.57E-02	4.83E+01	0.0010	0.0259
Eu-152	6.50E-02	5.44E-02	2.13E-01	0.00E+00	5.77E-02	2.36E+01	0.0028	0.0689
Eu-154	8.50E-02	8.52E-02	2.00E-01	1.62E-02	4.90E-02	2.19E+01	0.0039	0.0970
Sr-90	2.51E-02	2.60E-02	4.14E-02	3.71E-03	1.29E-02	5.47E+03	0.0000	0.0001

The off-site laboratory, GEL Laboratories, processed the three (3) samples selected for HTD ROC analysis. Samples L1-010-106-FSGS-004-SS, L1-010-106-FJGS-017-SS, and L1-010-106-FJGS-018-SS were selected. Only the HTD ROC Sr-90 was included in the analysis. All analyses met the required MDC.

Sr-90 was not detected in the off-site analysis of samples L1-010-106-FSGS-004-SS, L1-010-106-FJGS-017-SS, and L1-010-106-FJGS-018-SS. The results are provided in Table 7-4.

**Table 7-4 - Off-Site Analysis Results**

Sample ID	ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
L1-010-106-FSGS-004-SS	Sr-90	2.40E-02	6.48E-02	1.17E-01	No
L1-010-106-FJGS-017-SS	Sr-90	-2.30E-02	3.97E-02	8.72E-02	No
L1-010-106-FJGS-018-SS	Sr-90	3.71E-02	9.84E-02	1.74E-01	No

The on-site laboratory analyzed the eight (8) judgmental/investigational soil samples and using the on-site gamma spectroscopy system. A summary of the analytical results for the judgmental and investigational soil samples is provided in Table 7-5. Gamma spectroscopy results revealed that no ROC were positively identified in any judgmental or investigational sample. The concentrations for Sr-90 were inferred based on the ratio specified in Table 5-1. The complete gamma spectroscopy reports are presented in Attachment 7.

**Table 7-5 - Summary of Gamma Spectroscopy Results for Judgmental and Investigational Samples**

Sample ID	Co-60 (pCi/g)	Cs-137 (pCi/g)	Eu-152 (pCi/g)	Eu-154 (pCi/g)	Sr-90 (pCi/g)
L1-010-106-FJGS-015-SS	1.44E-01	1.15E-01	8.68E-02	2.11E-01	5.77E-02
L1-010-106-FJGS-016-SS	4.51E-02	1.22E-01	0.00E+00	3.07E-01	6.12E-02
L1-010-106-FJGS-017-SS	8.95E-02	6.72E-02	1.18E+00	7.80E-02	3.37E-02
L1-010-106-FJGS-018-SS	1.05E-01	4.78E-02	8.07E-01	5.06E-02	2.40E-02
L1-010-106-FSGS-007-SB	1.97E-02	2.18E-02	2.71E-02	4.65E-02	1.09E-02
L1-010-106-FSGS-009-SB	5.36E-02	7.59E-02	0.00E+00	6.09E-02	3.81E-02
L1-010-106-FJGS-016-SB	1.02E-01	0.00E+00	0.00E+00	3.17E-02	0.00E+00
L1-010-106-FJGS-017-SB	4.77E-02	1.26E-02	1.96E-01	6.44E-03	6.33E-03

**Note: Bold values indicate concentrations greater than MDC.**

The implementation of survey specific QC measures included the collection of four (4) samples (L1-010-106-FQGS-003-SS, L1-010-106-FQGS-004-SS, L1-010-106-FSGS-004-SS SPLIT, and L1-010-106-FSGS-009-SS SPLIT) for split and duplicate sample analysis. The on-site laboratory analyzed the QC samples using the on-site gamma spectroscopy system. A summary of the analytical results for the QC sample is provided in Table 7-6. Gamma spectroscopy results revealed that no ROC were positively identified in any QC sample. The concentration for Sr-90 was inferred based on the ratio specified in Table 5-1.

**Table 7-6 - Summary of Gamma Spectroscopy Results for QC Samples**

Sample ID	Co-60 (pCi/g)	Cs-137 (pCi/g)	Eu-152 (pCi/g)	Eu-154 (pCi/g)	Sr-90 (pCi/g)
L1-010-106-FQGS-003-SS	1.70E-02	2.74E-02	5.71E-02	5.51E-03	1.38E-02
L1-010-106-FQGS-004-SS	7.57E-02	8.00E-02	0.00E+00	3.71E-02	4.02E-02
L1-010-106-FSGS-004-SS SPLIT	1.99E-02	6.35E-02	2.18E-01	1.10E-01	3.19E-02
L1-010-106-FSGS-009-SS SPLIT	4.18E-02	5.82E-02	1.00E-02	2.41E-02	2.92E-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 L1-010-106 are provided in Table 7-7.

**Table 7-7 - Sum-of-Fractions for Systematic and QC Samples**

Sample ID	Fraction of Operational DCGL					SOF
	Co-60	Cs-137	Eu-152	Eu-154	Sr-90	
L1-010-106-FSGS-001-SS	0.0025	0.0023	0.0100	0.0033	0.0000	0.0181
L1-010-106-FSGS-002-SS	0.0043	0.0015	0.0055	0.0110	0.0000	0.0224
L1-010-106-FSGS-003-SS	0.0133	0.0036	0.0075	0.0115	0.0000	0.0360
L1-010-106-FSGS-004-SS	0.0017	0.0047	0.0057	0.0163	0.0000	0.0285
L1-010-106-FSGS-005-SS	0.0070	0.0039	0.0046	0.0088	0.0000	0.0243
L1-010-106-FSGS-006-SS	0.0000	0.0042	0.0250	0.0121	0.0000	0.0413
L1-010-106-FSGS-007-SS	0.0108	0.0004	0.0084	0.0038	0.0000	0.0233
L1-010-106-FSGS-008-SS	0.0153	0.0014	0.0000	0.0176	0.0000	0.0343
L1-010-106-FSGS-009-SS	0.0033	0.0019	0.0041	0.0071	0.0000	0.0164
L1-010-106-FSGS-010-SS	0.0105	0.0044	0.0101	0.0106	0.0000	0.0355
L1-010-106-FSGS-011-SS	0.0149	0.0018	0.0175	0.0253	0.0000	0.0596
L1-010-106-FSGS-012-SS	0.0010	0.0042	0.0015	0.0128	0.0000	0.0196
L1-010-106-FSGS-013-SS	0.0067	0.0045	0.0000	0.0086	0.0000	0.0199
L1-010-106-FSGS-014-SS	0.0148	0.0012	0.0071	0.0021	0.0000	0.0252
L1-010-106-FQGS-003-SS	0.0044	0.0016	0.0067	0.0007	0.0000	0.0134
L1-010-106-FQGS-004-SS	0.0198	0.0046	0.0000	0.0047	0.0000	0.0291
L1-010-106-FSGS-004-SS SPLIT	0.0052	0.0037	0.0256	0.0139	0.0000	0.0484
L1-010-106-FSGS-009-SS SPLIT	0.0109	0.0033	0.0012	0.0031	0.0000	0.0185

### Systematic Samples

Number of Systematic Samples =	14
# of Systematic Samples with SOF $\geq 1$ =	0
# of Systematic Samples with SOF $> 0.1$ (HTD Assessment) =	0
Max Individual Systematic Sample SOF =	0.0596
Mean Systematic Sample SOF =	0.0289

The results of the unity rule calculation for the ROC in the judgmental and investigational sample populations for survey unit L1-010-106 are provided in Table 7-8.

**Table 7-8 – Sum-of-Fractions for Judgmental and Investigational Samples**

Sample ID	Fraction of Operational DCGL					SOF
	Co-60	Cs-137	Eu-152	Eu-154	Sr-90	
L1-010-106-FJGS-015-SS	0.0376	0.0066	0.0102	0.0267	0.0000	0.0812
L1-010-106-FJGS-016-SS	0.0118	0.0070	0.0000	0.0389	0.0000	0.0577
L1-010-106-FJGS-017-SS	0.0234	0.0039	0.1387	0.0099	0.0000	0.1758
L1-010-106-FJGS-018-SS	0.0274	0.0027	0.0948	0.0064	0.0000	0.1314
L1-010-106-FSGS-007-SB	0.0051	0.0013	0.0032	0.0059	0.0000	0.0155
L1-010-106-FSGS-009-SB	0.0140	0.0044	0.0000	0.0077	0.0000	0.0261
L1-010-106-FJGS-016-SB	0.0266	0.0000	0.0000	0.0040	0.0000	0.0306
L1-010-106-FJGS-017-SB	0.0125	0.0007	0.0230	0.0008	0.0000	0.0370

### Judgmental/Investigational Samples

Number of Judgmental/Investigational Samples =	8
# of Judgmental/Investigational Samples with SOF $\geq 1$ =	0
# of Judgmental/Investigational Samples with SOF $> 0.1$ (HTD Assessment) =	2
Max Individual Judgmental/Investigational Sample SOF =	0.1758

## 8. QUALITY CONTROL

The on-site laboratory processed four (4) split and duplicate samples (L1-010-106-FQGS-003-SS, L1-010-106-FQGS-004-SS, L1-010-106-FSGS-004-SS SPLIT, and L1-010-106-FSGS-009-SS SPLIT) 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 16). K-40 was substituted for the assessment because Cs-137 was not identified in either the standard or



comparison sample. There was acceptable agreement between field split and duplicate results. Refer to Attachment 4 for data and quality control analysis results.

## **9. INVESTIGATIONS AND RESULTS**

Six (6) soil samples were collected to investigate alarms in scan lanes 02, 03, 25, 66, 67, and 68. The samples (L1-010-106-FJGS-015-SS, L1-010-106-FJGS-016-SS, L1-010-106-FJGS-016-SB, L1-010-106-FJGS-017-SS, L1-010-106-FJGS-017-SB, and L1-010-106-FJGS-018-SS) were analyzed using the on-site gamma spectroscopy system. Gamma spectroscopy results revealed that no ROC were positively identified in any investigational sample. The maximum SOF for investigational samples, when compared to the Operational DCGL, is 0.1758.

## **10. REMEDIATION AND RESULTS**

No radiological remedial action as described by MARSSIM Section 5.4 was performed in this survey unit prior to or as a result of the FSS. Chapter 4 of the LTP determined that remediation beyond that required to meet the release criteria is unnecessary and that the remaining residual radioactivity in soil was ALARA.

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

There were no addendums to the FSS plan.

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

The DQO sample design and data were reviewed in accordance with LC-FS-PR-008, *Final Status Survey Data Assessment* (Reference 17) 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 measurement results indicated that all samples were less than a SOF of one (1) when compared to the OpDCGL<sub>S</sub>.

Although MARSSIM states that the Sign Test need not be performed in the instance that no measurements surpass the Operational 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 results of the Sign Test are presented 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 L1-010-106 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 L1-010-106 is 0.2603 mrem/yr TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

Survey unit L1-010-106 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*
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*
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*
11. RS-TD-313196-006, *Ludlum Model 44-10 Detector Sensitivity*
12. LC-FS-PR-012, *Chain of Custody Protocol*
13. LC-FS-PR-004, *Sample Media Collection for Site Characterization and Final Status Survey*
14. LC-FS-PR-005, *Sample Media Preparation for Site Characterization and Final Status Survey*
15. LC-FS-PR-001, *Sample Storage*
16. USNRC Inspection Procedure No. 84750, *Radioactive Waste Treatment, and Effluent and Environmental Monitoring*
17. LC-FS-PR-008, *Final Status Survey Data Assessment*

## 16. ATTACHMENTS

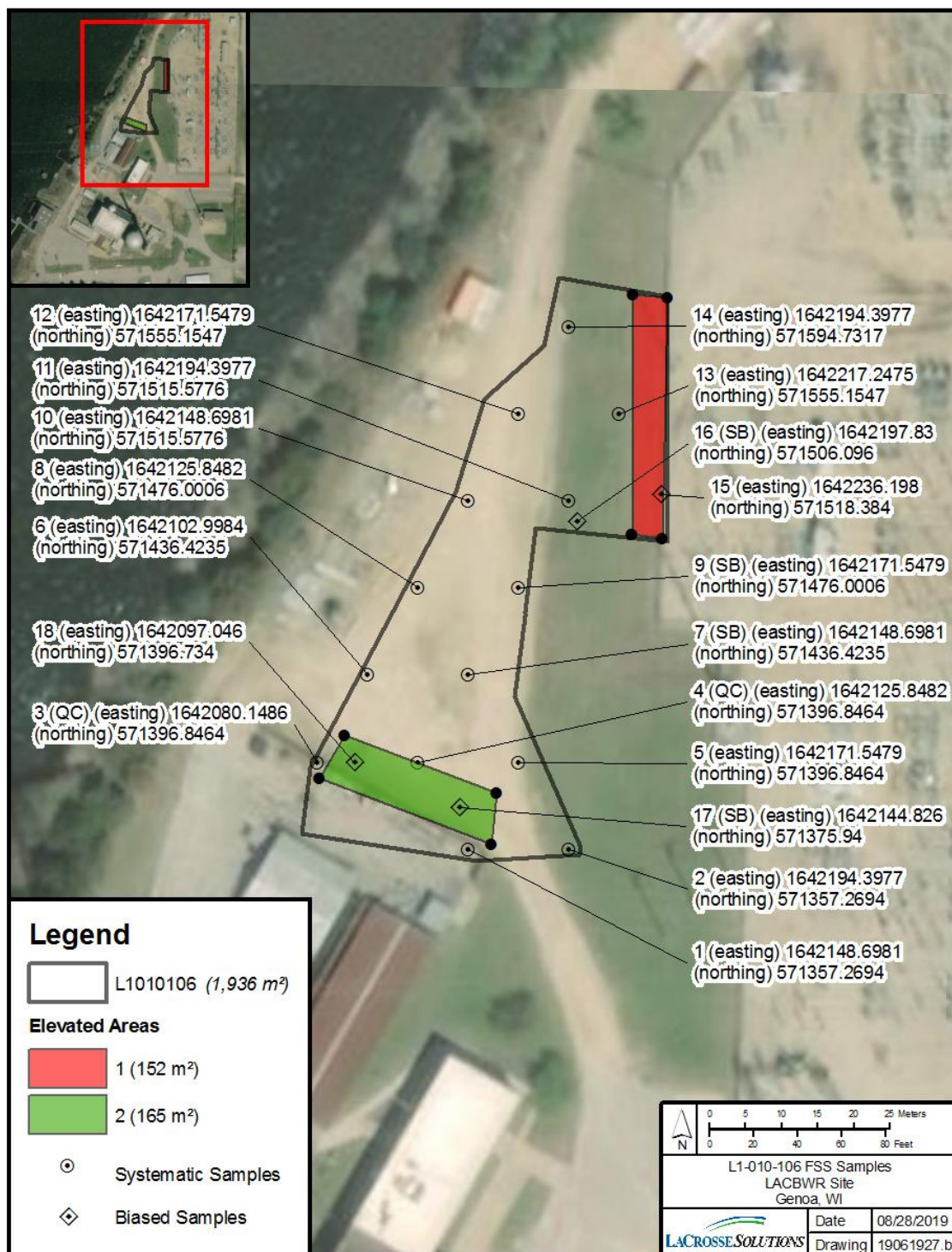
- Attachment 1 – Figure
- Attachment 2 – Scan Data
- Attachment 3 – Sign Test
- Attachment 4 – Quality Control Assessment
- Attachment 5 – Consultation Triggers for Residential Soil Concentrations
- Attachment 6 – Graphical Presentations
- Attachment 7 – Sample Analytical Reports

Attachment 8 – GEL Laboratories Analytical Reports

# **ATTACHMENT 1**

## **FIGURE**

**Figure 16-1 - Survey Unit L1-010-106 Systematic and Judgmental Sample Locations Map**



# **ATTACHMENT 2**

## **SCAN DATA**



**Table 16-1 – Survey Unit L1-010-106 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	211680	98620	01	7,346	6,101	7,863	0
44-10	211680	98620	02	7,952	6,101	7,863	1
44-10	211680	98620	03	7,968	6,101	7,863	1
44-10	211680	98620	04	7,598	6,101	7,863	0
44-10	211680	98620	05	6,873	6,101	7,863	0
44-10	211680	98620	06	6,377	6,101	7,863	0
44-10	211680	98620	07	5,839	6,101	7,863	0
44-10	211680	98620	08	5,710	6,101	7,863	0
44-10	211680	98620	09	5,636	6,101	7,863	0
44-10	211680	98620	10	5,014	6,101	7,863	0
44-10	215123	216185	11	5,592	4,648	6,410	0
44-10	215123	216185	12	5,188	4,648	6,410	0
44-10	215123	216185	13	6,115	4,648	6,410	0
44-10	215123	216185	14	5,326	4,648	6,410	0
44-10	215123	216185	15	5,205	4,648	6,410	0
44-10	215123	216185	16	5,243	4,648	6,410	0
44-10	215123	216185	17	5,138	4,648	6,410	0
44-10	215123	216185	18	5,298	4,648	6,410	0
44-10	215123	216185	19	5,149	4,648	6,410	0
44-10	215123	216185	20	4,884	4,648	6,410	0
44-10	215123	216185	21	5,182	4,648	6,410	0
44-10	215123	216185	22	5,044	4,648	6,410	0
44-10	215123	216185	23	4,902	4,648	6,410	0
44-10	215123	216185	24	5,516	4,648	6,410	0
44-10	215123	216185	25	8,722	4,648	6,410	1
44-10	215123	216185	25	5,771	4,648	6,410	0
44-10	215123	216185	26	5,343	4,648	6,410	0
44-10	215123	216185	27	4,705	4,648	6,410	0
44-10	215123	216185	28	4,377	4,648	6,410	0
44-10	215123	216185	29	4,344	4,648	6,410	0
44-10	215123	216185	30	3,943	4,648	6,410	0

Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	215123	216185	31	3,941	4,648	6,410	0
44-10	215123	216185	32	3,996	4,648	6,410	0
44-10	215123	216185	33	4,459	4,648	6,410	0
44-10	215123	216185	34	4,262	4,648	6,410	0
44-10	215123	216185	35	3,972	4,648	6,410	0
44-10	215123	216185	36	4,141	4,648	6,410	0
44-10	215123	216185	37	4,169	4,648	6,410	0
44-10	215123	216185	38	4,286	4,648	6,410	0
44-10	215123	216185	39	4,418	4,648	6,410	0
44-10	215123	216185	40	4,504	4,648	6,410	0
44-10	215123	216185	41	4,525	4,648	6,410	0
44-10	215123	216185	42	4,164	4,648	6,410	0
44-10	215123	216185	43	3,979	4,648	6,410	0
44-10	215123	216185	44	4,358	4,648	6,410	0
44-10	215123	216185	45	5,165	4,648	6,410	0
44-10	215123	216185	46	4,031	4,648	6,410	0
44-10	215123	216185	47	4,300	4,648	6,410	0
44-10	215123	216185	48	4,381	4,648	6,410	0
44-10	215123	216185	49	4,285	4,648	6,410	0
44-10	215123	216185	50	3,947	4,648	6,410	0
44-10	215123	216185	51	4,295	4,648	6,410	0
44-10	215123	216185	52	4,112	4,648	6,410	0
44-10	215123	216185	53	4,113	4,648	6,410	0
44-10	215123	216185	54	4,530	4,648	6,410	0
44-10	215123	216185	55	3,997	4,648	6,410	0
44-10	215123	216185	56	4,343	4,648	6,410	0
44-10	215123	216185	57	4,308	4,648	6,410	0
44-10	215123	216185	58	4,443	4,648	6,410	0
44-10	215123	216185	59	4,670	4,648	6,410	0
44-10	215123	216185	60	4,158	4,648	6,410	0
44-10	211680	98620	61	4,728	7,121	8,883	0
44-10	211680	98620	62	7,267	7,121	8,883	0

Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	211680	98620	63	6,854	7,121	8,883	0
44-10	211680	98620	64	8,283	7,121	8,883	0
44-10	211680	98620	65	8,443	7,121	8,883	0
44-10	211680	98620	66	10,837	7,121	8,883	1
44-10	211680	98620	67	10,316	7,121	8,883	1
44-10	211680	98620	68	11,857	7,121	8,883	1
44-10	211680	98620	69	8,808	7,121	8,883	0
44-10	211680	98620	70	8,560	7,121	8,883	0
44-10	211680	98620	71	5,902	7,121	8,883	0
44-10	211680	98620	72	5,429	7,121	8,883	0
44-10	211680	98620	73	4,989	7,121	8,883	0
44-10	211680	98620	74	5,409	7,121	8,883	0
44-10	215123	216185	75	3,667	2,827	4,589	0
44-10	215123	216185	76	3,691	2,827	4,589	0
44-10	215123	216185	77	3,622	2,827	4,589	0
44-10	215123	216185	78	3,465	2,827	4,589	0
44-10	215123	216185	79	3,493	2,827	4,589	0
44-10	215123	216185	80	3,748	2,827	4,589	0
44-10	215123	216185	81	3,797	2,827	4,589	0
44-10	215123	216185	82	3,506	2,827	4,589	0
44-10	215123	216185	83	3,823	2,827	4,589	0
44-10	215123	216185	84	3,580	2,827	4,589	0
44-10	215123	216185	85	3,917	2,827	4,589	0
44-10	215123	216185	86	3,416	2,827	4,589	0
44-10	215123	216185	87	3,744	2,827	4,589	0
44-10	215123	216185	88	3,664	2,827	4,589	0
44-10	215123	216185	89	3,763	2,827	4,589	0
44-10	215123	216185	90	3,726	2,827	4,589	0
44-10	215123	216185	91	3,687	2,827	4,589	0
44-10	215123	216185	92	3,900	2,827	4,589	0
44-10	215123	216185	93	3,743	2,827	4,589	0
44-10	215123	216185	94	3,616	2,827	4,589	0

Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	215123	216185	95	3,525	2,827	4,589	0
44-10	215123	216185	96	4,096	2,827	4,589	0
44-10	215123	216185	97	4,099	2,827	4,589	0
44-10	215123	216185	98	4,132	2,827	4,589	0
44-10	215123	216185	99	4,438	2,827	4,589	0
44-10	215123	216185	100	4,328	2,827	4,589	0
44-10	215123	216185	101	3,734	2,827	4,589	0
44-10	215123	216185	102	3,697	2,827	4,589	0
44-10	215123	216185	103	3,664	2,827	4,589	0
44-10	215123	216185	104	3,685	2,827	4,589	0
44-10	215123	216185	105	3,722	2,827	4,589	0
44-10	215123	216185	106	3,656	2,827	4,589	0
44-10	215123	216185	107	4,056	2,827	4,589	0
44-10	215123	216185	108	3,822	2,827	4,589	0
44-10	215123	216185	109	3,617	2,827	4,589	0
44-10	215123	216185	110	3,962	2,827	4,589	0
44-10	215123	216185	111	3,632	2,827	4,589	0
44-10	215123	216185	112	3,685	2,827	4,589	0
44-10	215123	216185	113	3,792	2,827	4,589	0
44-10	215123	216185	114	3,773	2,827	4,589	0
44-10	215123	216185	115	3,559	2,827	4,589	0
44-10	215123	216185	116	3,621	2,827	4,589	0
44-10	211680	98620	117	3,042	3,290	5,052	0
44-10	211680	98620	118	3,102	3,290	5,052	0
44-10	211680	98620	119	3,030	3,290	5,052	0
44-10	211680	98620	120	3,348	3,290	5,052	0
44-10	211680	98620	121	3,522	3,290	5,052	0
44-10	211680	98620	122	3,237	3,290	5,052	0
44-10	211680	98620	123	3,457	3,290	5,052	0
44-10	211680	98620	124	3,415	3,290	5,052	0
44-10	211680	98620	125	3,350	3,290	5,052	0
44-10	211680	98620	126	3,318	3,290	5,052	0

Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	211680	98620	127	3,270	3,290	5,052	0
44-10	211680	98620	128	3,082	3,290	5,052	0
44-10	211680	98620	129	3,776	3,290	5,052	0
44-10	211680	98620	130	3,934	3,290	5,052	0
44-10	211680	98620	131	3,770	3,290	5,052	0
44-10	211680	98620	132	3,799	3,290	5,052	0
44-10	211680	98620	133	3,689	3,290	5,052	0
44-10	211680	98620	134	4,123	3,290	5,052	0
44-10	211680	98620	135	4,130	3,290	5,052	0
44-10	211680	98620	136	3,966	3,290	5,052	0
44-10	211680	98620	137	4,191	3,290	5,052	0
44-10	211680	98620	138	4,101	3,290	5,052	0
44-10	211680	98620	139	4,667	3,290	5,052	0
44-10	211680	98620	140	4,429	3,290	5,052	0
44-10	211680	98620	141	4,338	3,290	5,052	0
44-10	211680	98620	142	3,788	3,290	5,052	0
44-10	211680	98620	143	3,487	3,290	5,052	0
44-10	211680	98620	144	4,006	3,290	5,052	0
44-10	211680	98620	145	3,670	3,290	5,052	0
44-10	211680	98620	146	3,769	3,290	5,052	0
44-10	211680	98620	147	3,619	3,290	5,052	0
44-10	211680	98620	148	3,952	3,290	5,052	0
44-10	211680	98620	149	4,198	3,290	5,052	0
44-10	211680	98620	150	3,975	3,290	5,052	0
44-10	211680	98620	151	3,960	3,290	5,052	0
44-10	211680	98620	152	4,256	3,290	5,052	0
44-10	211680	98620	153	4,135	3,290	5,052	0
44-10	211680	98620	154	3,721	3,290	5,052	0
44-10	211680	98620	155	3,838	3,290	5,052	0
44-10	211680	98620	156	3,467	3,290	5,052	0
44-10	211680	98620	157	3,617	3,290	5,052	0
44-10	211680	98620	158	3,468	3,290	5,052	0

Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	211680	98620	159	3,568	3,290	5,052	0
44-10	211680	98620	160	3,784	3,290	5,052	0
44-10	211680	98620	161	3,965	3,290	5,052	0
44-10	211680	98620	162	3,813	3,290	5,052	0
44-10	211680	98620	163	3,719	3,290	5,052	0
44-10	211680	98620	164	3,450	3,290	5,052	0
44-10	211680	98620	165	3,493	3,290	5,052	0
44-10	211680	98620	166	3,721	3,290	5,052	0
44-10	211680	98620	167	3,384	3,290	5,052	0
44-10	211680	98620	168	3,161	3,290	5,052	0
44-10	211680	98620	169	3,456	3,290	5,052	0
44-10	211680	98620	170	3,884	3,290	5,052	0
44-10	211680	98620	01 SP	3,844	3,788	5,550	0
44-10	211680	98620	01 PS	3,802	3,788	5,550	0
44-10	211680	98620	02 SP	2,979	3,788	5,550	0
44-10	211680	98620	02 SP	3,003	3,788	5,550	0
44-10	211680	98620	03 SP	2,937	3,788	5,550	0
44-10	215123	216185	03 SP QC	5,197	4,684	6,446	0
44-10	211680	98620	03 SP	3,015	3,788	5,550	0
44-10	215123	216185	03 SP QC	4,194	4,684	6,446	0
44-10	211680	98620	04 SP	3,393	3,788	5,550	0
44-10	215123	216185	04 SP QC	4,535	4,684	6,446	0
44-10	211680	98620	04 SP	3,617	3,788	5,550	0
44-10	215123	216185	04 SP QC	4,208	4,684	6,446	0
44-10	211680	98620	05 SP	2,877	3,788	5,550	0
44-10	211680	98620	05 SP	2,963	3,788	5,550	0
44-10	211680	98620	06 SP	3,078	3,788	5,550	0
44-10	211680	98620	06 SP	3,172	3,788	5,550	0
44-10	211680	98620	07 SP	3,027	3,788	5,550	0
44-10	211680	98620	07 SP	2,813	3,788	5,550	0
44-10	211680	98620	08 SP	2,827	3,788	5,550	0
44-10	211680	98620	08 SP	3,036	3,788	5,550	0

Detector Type	Detector ID	M2350-1 ID	Location	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	211680	98620	09 SP	2,825	3,788	5,550	0
44-10	211680	98620	09 SP	2,674	3,788	5,550	0
44-10	211680	98620	10 SP	2,748	3,788	5,550	0
44-10	211680	98620	10 SP	2,790	3,788	5,550	0
44-10	211680	98620	11 SP	3,496	3,788	5,550	0
44-10	211680	98620	11 SP	3,138	3,788	5,550	0
44-10	211680	98620	12 SP	2,946	3,788	5,550	0
44-10	211680	98620	12 SP	2,886	3,788	5,550	0
44-10	211680	98620	13 SP	3,909	3,788	5,550	0
44-10	211680	98620	13 SP	3,900	3,788	5,550	0
44-10	211680	98620	14 SP	2,666	3,788	5,550	0
44-10	211680	98620	14 SP	2,636	3,788	5,550	0
44-10	211680	98620	15 SP	8,418	6,720	8,482	0
44-10	211680	98620	15 SP	8,446	6,720	8,482	0
44-10	211680	98620	16 SP	8,039	3,788	5,550	1
44-10	211680	98620	16 SP	8,066	3,788	5,550	1
44-10	211680	98620	17 SP	12,213	7,617	9,389	1
44-10	211680	98620	17 SP	11,537	7,617	9,389	1
44-10	211680	98620	18 SP	8,226	7,617	9,389	0
44-10	211680	98620	18 SP	8,359	7,617	9,389	0
44-10	211680	98620	75 QC	3,008	2,910	4,672	0
44-10	211680	98620	76 QC	3,242	2,910	4,672	0
44-10	211680	98620	77 QC	3,027	2,910	4,672	0
44-10	211680	98620	78 QC	3,124	2,910	4,672	0
44-10	211680	98620	79 QC	3,275	2,910	4,672	0
44-10	211680	98620	80 QC	2,983	2,910	4,672	0
44-10	211680	98620	81 QC	3,286	2,910	4,672	0
44-10	211680	98620	82 QC	3,167	2,910	4,672	0
44-10	211680	98620	83 QC	3,030	2,910	4,672	0
44-10	211680	98620	84 QC	3,116	2,910	4,672	0



# **ATTACHMENT 3**

## **SIGN TEST**

**Table 16-2 – Survey Unit L1-010-106 Sign Test**

#	SOF (W <sub>s</sub> )	1-W <sub>s</sub>	Sign
1	0.0181	0.98	+1
2	0.0224	0.98	+1
3	0.0360	0.96	+1
4	0.0285	0.98	+1
5	0.0243	0.98	+1
6	0.0413	0.96	+1
7	0.0233	0.98	+1
8	0.0343	0.97	+1
9	0.0164	0.98	+1
10	0.0355	0.96	+1
11	0.0596	0.93	+1
12	0.0196	0.98	+1
13	0.0199	0.98	+1
14	0.0252	0.97	+1

Number of positive differences (S+) 14

Critical Value 10

Survey Unit Meets  
 the Acceptance  
 Criteria

# **ATTACHMENT 4**

## **QUALITY CONTROL ASSESSMENT**

**Table 16-3 – Survey Unit L1-010-106 QC Assessment**

STANDARD							COMPARISON			
Sample ID	Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range (Low to High)		Sample ID	Activity Value	Comparison Ratio	Acceptable (Y/N)
L1-010-106-FSGS-003-SS	K-40	2.06E+00	5.70E-01	4	0.5	2	L1-010-106-FQGS-003-SS	2.36E+00	1.15	Y
L1-010-106-FSGS-004-SS	K-40	4.46E+00	8.35E-01	5	0.5	2	L1-010-106-FQGS-004-SS	4.93E+00	1.11	Y
							L1-010-106-FSGS-004-SS SPLIT	4.97E+00	1.11	Y
L1-010-106-FSGS-009-SS	K-40	2.69E+00	6.36E-01	4	0.5	2	L1-010-106-FSGS-009-SS SPLIT	3.50E+00	1.30	Y
Comments/Corrective Actions: K-40 was substituted for the assessment because Cs-137 was not identified in either the standard or comparison sample.							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.

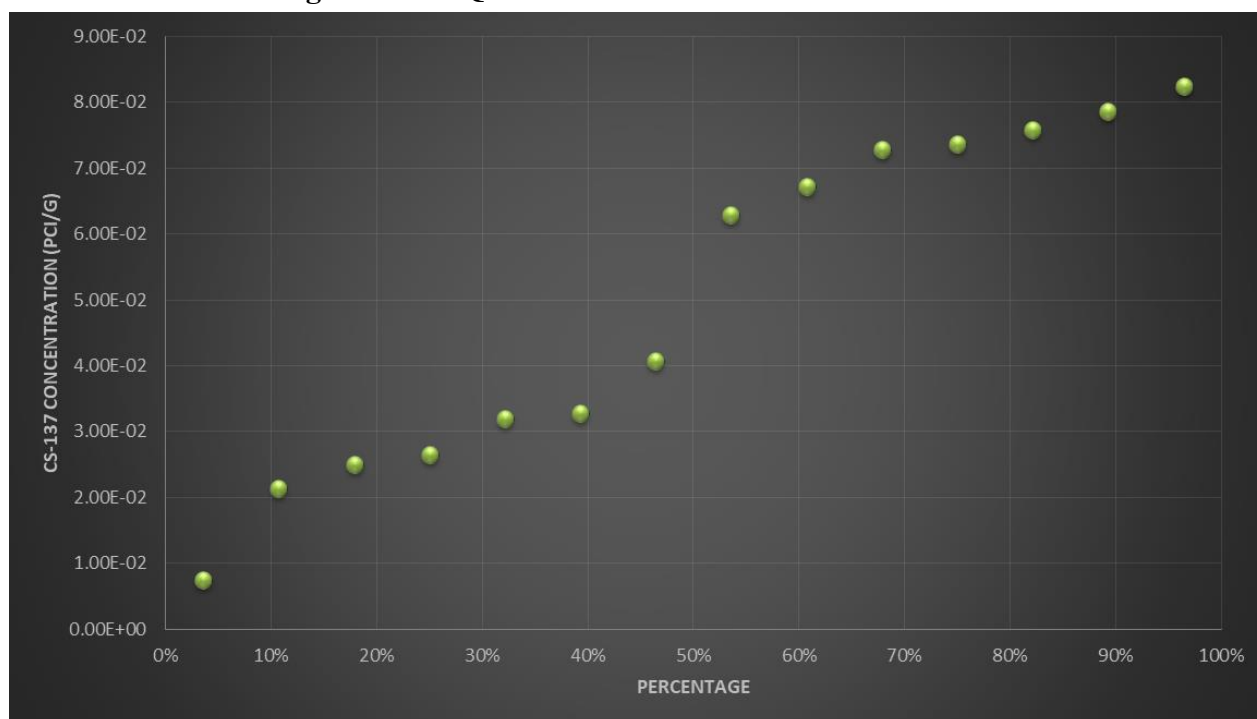
Radionuclide	Residential Soil Concentration	Industrial/Commercial Soil Concentration
H-3	228 pCi/g	423 pCi/g
C-14	46 pCi/g	123,000 pCi/g
Na-22	9 pCi/g	14 pCi/g
S-35	19,600 pCi/g	32,200,000 pCi/g
Cl-36	6 pCi/g	10,700 pCi/g
Ca-45	13,500 pCi/g	3,740,000 pCi/g
Sc-46	105 pCi/g	169 pCi/g
Mn-54	69 pCi/g	112 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**

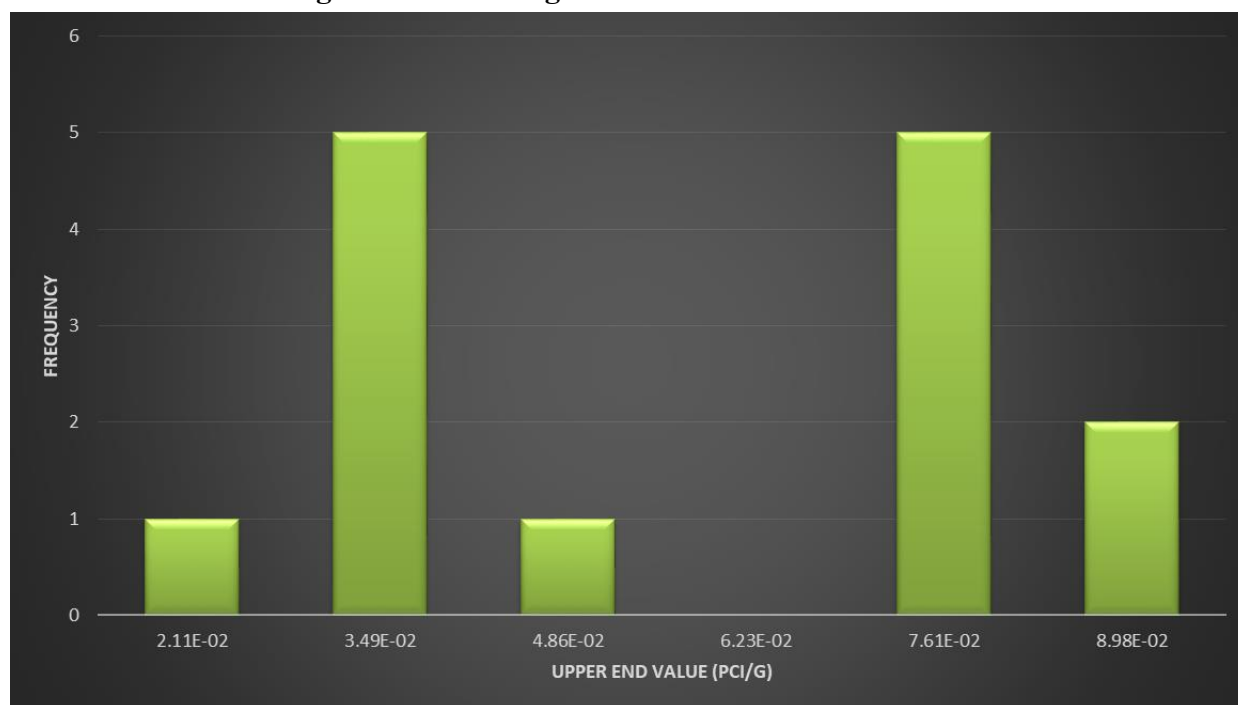
## **GRAPHICAL PRESENTATIONS**



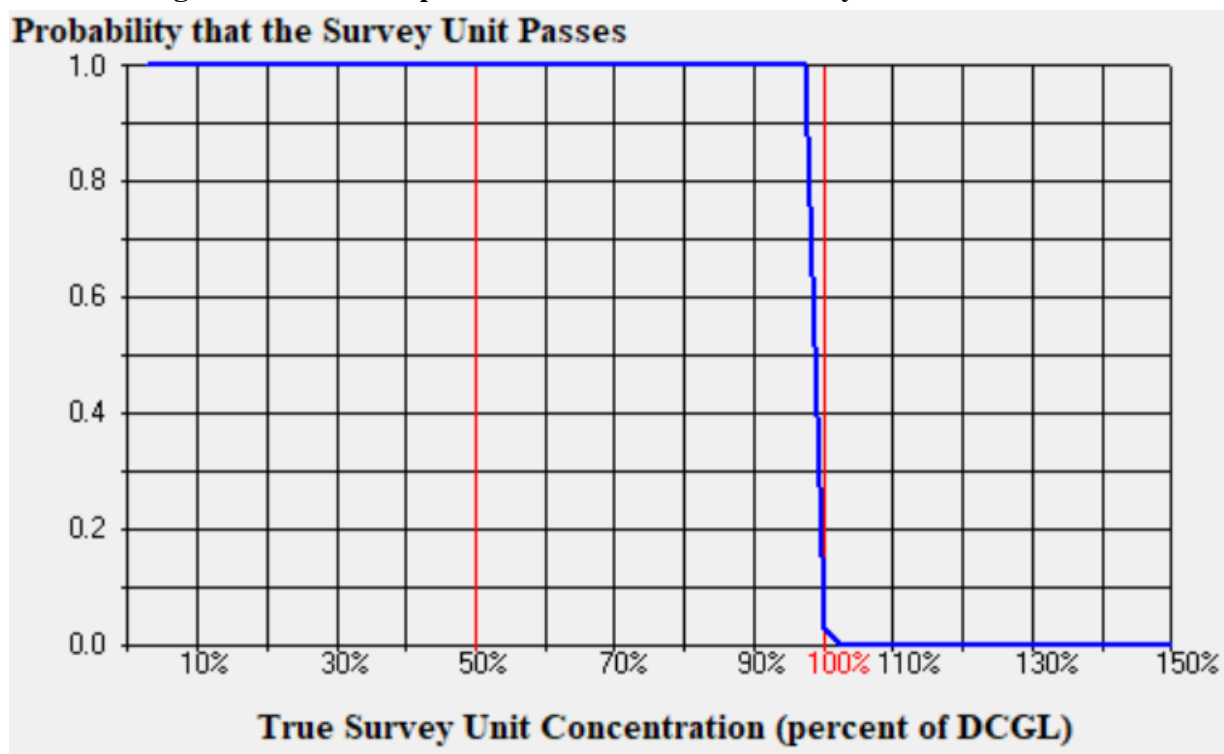
**Figure 16-2 - Quantile Plot for Cs-137 Concentration**



**Figure 16-3 - Histogram for Cs-137 Concentration**



**Figure 16-4 - Retrospective Power Curve for Survey Unit L1-010-106**



# **ATTACHMENT 7**

## **SAMPLE ANALYTICAL REPORTS**

Analysis Report for L1-010-106-FSGS-001-SS

L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-001-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.570E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 10:27:00AM  
Acquisition Started : 9/3/2019 10:19:07AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.8 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 : 7381

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 10:49:16AM

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

Analysis Report for L1-010-106-FSGS-001-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	238.63	471 -	485	477.74	9.42E+01	30.17	3.56E+02	2.10
F	2	295.27	587 -	596	590.99	7.29E+01	21.35	1.40E+02	1.09
F	3	351.89	699 -	709	704.20	9.02E+01	23.50	1.37E+02	1.39
F	4	608.96	1213 -	1222	1218.25	7.97E+01	20.73	6.50E+01	1.41
F	5	1460.41	2913 -	2929	2920.93	2.86E+02	34.73	2.95E+01	2.45

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 10:49:16AM

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	238.63	9.42E+01	30.17			9.42E+01	3.02E+01
F	2	295.27	7.29E+01	21.35			7.29E+01	2.13E+01
F	3	351.89	9.02E+01	23.50	4.18E+01	1.86E+01	4.84E+01	3.00E+01
F	4	608.96	7.97E+01	20.73	2.06E+01	1.21E+01	5.91E+01	2.40E+01
F	5	1460.41	2.86E+02	34.73	2.82E+01	8.57E+00	2.58E+02	3.58E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Analysis Report for L1-010-106-FSGS-001-SS

L1-010-106

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>
K-40	0.98	1460.75	*	10.67	5.86E+00	8.77E-01
PB-212	0.56	77.11		17.50		
		238.63	*	44.60	1.02E-01	3.29E-02
BI-214	0.33	609.31	*	46.30	1.42E-01	5.83E-02
		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	2.18E-01	6.47E-02
		351.92	*	37.20	8.74E-02	5.43E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.981	5.86E+00	8.77E-01	
PB-212	0.560	1.02E-01	3.29E-02	
BI-214	0.339	1.42E-01	5.83E-02	
PB-214	0.721	1.41E-01	4.16E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-001-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/3/2019 10:49:16AM  
 Peak Locate From Channel : 100  
 Peak Locate To Channel : 4096

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

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	* 10.67	5.86E+00	7.82E-01	7.82E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	9.58E-03	7.15E-02	7.80E-02
		1332.49	100.00	8.22E-03		7.15E-02
+	KR-85	513.99	0.43	5.77E+00	1.19E+01	1.19E+01
+	Y-88	898.04	93.70	-5.77E-02	4.35E-02	5.78E-02
		1836.06	99.20	-1.80E-02		4.35E-02
+	NB-94	702.63	100.00	7.73E-03	4.88E-02	4.88E-02
		871.10	100.00	-3.24E-02		5.44E-02
+	I-131	284.30	6.06	-2.01E-01	8.82E-02	1.11E+00
		364.48	81.20	6.85E-04		8.82E-02
		636.97	7.27	6.38E-01		1.11E+00
+	CS-134	604.70	97.60	6.79E-02	6.68E-02	7.16E-02
		795.84	85.40	1.92E-02		6.68E-02
+	CS-137	661.65	85.12	4.08E-02	6.92E-02	6.92E-02
+	CE-144	80.12	1.36	3.10E+00	3.46E-01	4.47E+00
		133.51	11.09	2.73E-02		3.46E-01
+	EU-152	121.78	28.40	-5.07E-02	1.36E-01	1.36E-01



## Analysis Report for L1-010-106-FSGS-001-SS

## L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
	EU-152	344.28	26.60	-5.71E-02	1.36E-01	1.69E-01
		1408.00	20.74	8.52E-02		3.05E-01
+	EU-154	123.07	40.40	-2.43E-02	9.65E-02	9.65E-02
		723.30	19.70	2.57E-02		2.53E-01
		1274.51	35.50	-1.27E-01		2.02E-01
+	EU-155	86.54	32.80	-1.60E-01	1.51E-01	1.51E-01
		105.31	21.80	9.05E-02		1.87E-01
+	BI-214	609.31	* 46.30	1.42E-01	9.69E-02	9.69E-02
		1120.29	15.10	6.31E-02		5.46E-01
		1238.11	5.94	1.28E+00		1.65E+00
		1377.67	4.11	1.32E-01		1.38E+00
		1407.98	2.48	7.12E-01		2.55E+00
		1509.19	2.19	1.09E+00		2.68E+00
		1764.49	15.80	4.14E-01		4.51E-01
+	PB-214	77.11	10.70	4.14E-01	1.06E-01	5.97E-01
		295.21	* 19.20	2.18E-01		1.32E-01
		351.92	* 37.20	8.74E-02		1.06E-01
+	PA-228	89.95	22.00	1.81E+01	1.21E+01	2.08E+01
		93.35	35.00	5.87E+00		1.21E+01
		105.00	16.30	1.07E-01		2.32E+01
		129.22	2.97	8.08E+01		1.23E+02
		338.32	5.30	1.65E+01		7.51E+01
		463.00	13.80	1.17E+01		3.22E+01
		911.23	16.70	3.06E+01		3.73E+01
+	AM-241	59.54	36.30	-9.66E-02	2.64E-01	2.64E-01
+	CM-243	103.76	23.00	-2.08E-02	1.75E-01	1.75E-01
		228.18	10.60	-2.10E-01		3.44E-01
		277.60	14.00	1.48E-01		3.02E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-002-SS

L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-002-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.093E+02 grams  
Facility : Dairyleland\_NPP

Sample Taken On : 8/28/2019 10:30:00AM  
Acquisition Started : 9/3/2019 11:01:58AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.4 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 : 7382

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 11:32:07AM

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

Analysis Report for L1-010-106-FSGS-002-SS

L1-010-106

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
M	1	238.46	470 -	489	477.39	6.52E+01	23.07	1.96E+02	1.29
m	2	241.96	470 -	489	484.38	3.03E+01	17.90	1.77E+02	1.29
F	3	294.96	585 -	595	590.37	5.73E+01	21.60	1.57E+02	1.49
F	4	351.76	698 -	711	703.95	1.10E+02	24.75	1.27E+02	1.65
F	5	609.05	1210 -	1224	1218.44	8.97E+01	20.89	5.65E+01	2.00
F	6	1119.77	2235 -	2244	2239.72	1.49E+01	9.35	2.93E+01	0.89
F	7	1460.32	2913 -	2928	2920.75	1.97E+02	28.63	1.19E+01	2.46

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 11:32:07AM

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

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
M	1	238.46	6.52E+01	23.07			6.52E+01	2.31E+01
m	2	241.96	3.03E+01	17.90			3.03E+01	1.79E+01
F	3	294.96	5.73E+01	21.60			5.73E+01	2.16E+01
F	4	351.76	1.10E+02	24.75	4.18E+01	1.86E+01	6.82E+01	3.10E+01
F	5	609.05	8.97E+01	20.89	2.06E+01	1.21E+01	6.91E+01	2.41E+01
F	6	1119.77	1.49E+01	9.35			1.49E+01	9.35E+00
F	7	1460.32	1.97E+02	28.63	2.82E+01	8.57E+00	1.69E+02	2.99E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-002-SS

L1-010-106

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>
K-40	0.97	1460.75 *	10.67	4.05E+00	7.51E-01
PB-212	0.55	77.11	17.50		
		238.63 *	44.60	7.40E-02	2.64E-02
BI-214	0.57	609.31 *	46.30	1.75E-01	6.19E-02
		1120.29 *	15.10	2.00E-01	1.26E-01
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	0.71	77.11	10.70		
		295.21 *	19.20	1.80E-01	6.85E-02
		351.92 *	37.20	1.30E-01	5.92E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.971	4.05E+00	7.51E-01	
PB-212	0.557	7.40E-02	2.64E-02	
BI-214	0.573	1.80E-01	5.56E-02	

Analysis Report for L1-010-106-FSGS-002-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.716	1.51E-01	4.48E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-002-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/3/2019 11:32:07AM  
 Peak Locate From Channel : 100  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
m 2	241.96	1.68451E-02	29.52		

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	* 10.67	4.05E+00	6.97E-01	6.97E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	-1.22E-02	6.87E-02	7.82E-02
		1332.49	100.00	1.66E-02		6.87E-02
+	KR-85	513.99	0.43	8.46E+00	1.19E+01	1.19E+01
+	Y-88	898.04	93.70	-3.05E-02	4.25E-02	5.67E-02
		1836.06	99.20	-1.70E-02		4.25E-02
+	NB-94	702.63	100.00	2.66E-02	5.05E-02	5.05E-02
		871.10	100.00	-2.45E-02		5.27E-02
+	I-131	284.30	6.06	-3.49E-01	8.28E-02	1.18E+00
		364.48	81.20	-3.25E-03		8.28E-02
		636.97	7.27	8.21E-02		1.06E+00
+	CS-134	604.70	97.60	2.15E-03	6.33E-02	7.28E-02
		795.84	85.40	2.17E-02		6.33E-02
+	CS-137	661.65	85.12	2.65E-02	6.59E-02	6.59E-02

## Analysis Report for L1-010-106-FSGS-002-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	CE-144	80.12	1.36	1.83E+00	3.41E-01	4.36E+00
		133.51	11.09	2.72E-02		3.41E-01
+	EU-152	121.78	28.40	-2.73E-02	1.36E-01	1.36E-01
		344.28	26.60	4.70E-02		1.83E-01
		1408.00	20.74	1.71E-01		2.75E-01
+	EU-154	123.07	40.40	-1.51E-02	9.54E-02	9.54E-02
		723.30	19.70	4.40E-02		2.84E-01
		1274.51	35.50	8.66E-02		1.96E-01
+	EU-155	86.54	32.80	-1.07E-01	1.51E-01	1.51E-01
		105.31	21.80	-1.05E-03		1.83E-01
+	BI-214	609.31	* 46.30	1.75E-01	1.06E-01	1.06E-01
		1120.29	* 15.10	2.00E-01		2.91E-01
		1238.11	5.94	1.30E+00		1.43E+00
		1377.67	4.11	-9.07E-01		1.33E+00
		1407.98	2.48	1.43E+00		2.30E+00
		1509.19	2.19	1.05E+00		2.76E+00
		1764.49	15.80	3.55E-03		4.04E-01
+	PB-214	77.11	10.70	4.99E-01	1.14E-01	5.85E-01
		295.21	* 19.20	1.80E-01		1.50E-01
		351.92	* 37.20	1.30E-01		1.14E-01
+	PA-228	89.95	22.00	7.56E+00	1.24E+01	2.08E+01
		93.35	35.00	4.95E+00		1.24E+01
		105.00	16.30	-3.30E+00		2.33E+01
		129.22	2.97	-1.51E+01		1.22E+02
		338.32	5.30	3.29E+01		8.28E+01
		463.00	13.80	9.81E+00		3.06E+01
		911.23	16.70	1.48E+01		3.72E+01
+	AM-241	59.54	36.30	4.87E-02	2.72E-01	2.72E-01
+	CM-243	103.76	23.00	-1.02E-01	1.73E-01	1.73E-01
		228.18	10.60	2.27E-01		3.64E-01
		277.60	14.00	-2.33E-02		3.02E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-003-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-003-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.531E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 10:35:00AM  
Acquisition Started : 9/3/2019 12:06:28PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.5 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 : 7383

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 12:36:37PM

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



Analysis Report for L1-010-106-FSGS-003-SS

L1-010-106

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
F	1	186.07	367 -	378	372.64	4.09E+01	20.09	3.04E+02	0.87
F	2	295.05	585 -	595	590.56	8.45E+01	23.53	1.74E+02	1.21
F	3	351.74	695 -	708	703.90	1.49E+02	27.89	1.32E+02	1.70
F	4	583.01	1163 -	1171	1166.37	1.95E+01	11.82	4.24E+01	1.23
F	5	608.99	1213 -	1224	1218.31	1.09E+02	22.11	2.60E+01	1.88
F	6	1120.07	2236 -	2245	2240.31	1.38E+01	9.17	1.86E+01	1.38
F	7	1460.31	2915 -	2928	2920.74	1.18E+02	22.89	1.82E+01	2.50

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 12:36:37PM

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

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
F	1	186.07	4.09E+01	20.09			4.09E+01	2.01E+01
F	2	295.05	8.45E+01	23.53			8.45E+01	2.35E+01
F	3	351.74	1.49E+02	27.89	4.18E+01	1.86E+01	1.07E+02	3.35E+01
F	4	583.01	1.95E+01	11.82			1.95E+01	1.18E+01
F	5	608.99	1.09E+02	22.11	2.06E+01	1.21E+01	8.80E+01	2.52E+01
F	6	1120.07	1.38E+01	9.17			1.38E+01	9.17E+00
F	7	1460.31	1.18E+02	22.89	2.82E+01	8.57E+00	9.00E+01	2.44E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-003-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.75 *	10.67	2.06E+00	5.70E-01
BI-214	0.57	609.31 *	46.30	2.13E-01	6.20E-02
		1120.29 *	15.10	1.76E-01	1.18E-01
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	0.71	77.11	10.70		
		295.21 *	19.20	2.53E-01	7.17E-02
		351.92 *	37.20	1.94E-01	6.15E-02
RA-226	0.99	186.21 *	3.28	5.07E-01	2.50E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.970	2.06E+00	5.70E-01	
BI-214	0.575	2.05E-01	5.49E-02	
PB-214	0.717	2.19E-01	4.67E-02	
RA-226	0.997	5.07E-01	2.50E-01	

## Analysis Report for L1-010-106-FSGS-003-SS

L1-010-106

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

Errors quoted at 2.000sigma

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Analysis Report for L1-010-106-FSGS-003-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/3/2019 12:36:37PM  
 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	583.01	1.08416E-02	30.28		

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	2.06E+00	6.93E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	5.10E-02	6.27E-02	7.06E-02
		1332.49	100.00	1.72E-02		6.27E-02
+	KR-85	513.99	0.43	4.68E+00	1.08E+01	1.08E+01
+	Y-88	898.04	93.70	2.77E-02	5.39E-02	5.99E-02
		1836.06	99.20	2.01E-03		5.39E-02
+	NB-94	702.63	100.00	2.89E-02	4.97E-02	5.20E-02
		871.10	100.00	-9.16E-02		4.97E-02
+	I-131	284.30	6.06	4.42E-01	7.74E-02	1.12E+00
		364.48	81.20	1.90E-02		7.74E-02
		636.97	7.27	8.78E-01		9.99E-01
+	CS-134	604.70	97.60	-5.39E-02	6.36E-02	6.98E-02
		795.84	85.40	-2.99E-02		6.36E-02
+	CS-137	661.65	85.12	6.29E-02	6.78E-02	6.78E-02
+	CE-144	80.12	1.36	4.16E+00	3.36E-01	4.23E+00
		133.51	11.09	1.50E-02		3.36E-01

## Analysis Report for L1-010-106-FSGS-003-SS

## L1-010-106

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	EU-152	121.78	28.40	-9.19E-02	1.26E-01	1.26E-01
		344.28	26.60	6.38E-02		1.70E-01
		1408.00	20.74	-1.64E-02		2.74E-01
+	EU-154	123.07	40.40	9.08E-03	9.00E-02	9.00E-02
		723.30	19.70	4.77E-02		2.52E-01
		1274.51	35.50	1.01E-02		1.62E-01
+	EU-155	86.54	32.80	-1.68E-01	1.45E-01	1.45E-01
		105.31	21.80	1.20E-01		1.86E-01
+	BI-214	609.31	* 46.30	2.13E-01	8.17E-02	8.17E-02
		1120.29	* 15.10	1.76E-01		2.43E-01
		1238.11	5.94	-9.20E-02		1.24E+00
		1377.67	4.11	1.93E-01		1.44E+00
		1407.98	2.48	-1.37E-01		2.29E+00
		1509.19	2.19	-1.56E+00		2.16E+00
		1764.49	15.80	5.97E-01		5.32E-01
+	PB-214	77.11	10.70	4.08E-01	1.11E-01	5.57E-01
		295.21	* 19.20	2.53E-01		1.50E-01
		351.92	* 37.20	1.94E-01		1.11E-01
+	PA-228	89.95	22.00	2.13E+01	1.24E+01	2.11E+01
		93.35	35.00	1.10E-01		1.24E+01
		105.00	16.30	2.03E+01		2.44E+01
		129.22	2.97	6.63E+01		1.23E+02
		338.32	5.30	7.40E+01		7.90E+01
		463.00	13.80	-1.24E+01		3.13E+01
		911.23	16.70	-6.67E+00		3.78E+01
+	AM-241	59.54	36.30	8.07E-02	2.65E-01	2.65E-01
+	CM-243	103.76	23.00	6.74E-02	1.74E-01	1.74E-01
		228.18	10.60	-1.58E-01		3.33E-01
		277.60	14.00	-3.56E-02		2.73E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-004-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-004-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.344E+02 grams  
Facility : Dalryland\_NPP

Sample Taken On : 8/28/2019 10:39:00AM  
Acquisition Started : 9/3/2019 12:37:42PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.7 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 : 7384

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 1:07:52PM

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

Analysis Report for L1-010-106-FSGS-004-SS

L1-010-106

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
F	1	76.23	147 -	161	153.00	2.03E+02	52.97	9.69E+02	3.20
F	2	186.20	368 -	380	372.89	9.90E+01	32.28	4.51E+02	1.76
M	3	238.43	469 -	488	477.34	2.14E+02	34.58	2.39E+02	1.46
m	4	241.71	469 -	488	483.89	8.71E+01	24.83	2.33E+02	1.46
F	5	295.09	586 -	596	590.64	1.69E+02	31.77	2.26E+02	1.43
F	6	338.35	672 -	683	677.13	6.61E+01	23.29	1.54E+02	2.01
F	7	351.77	697 -	712	703.97	2.65E+02	35.50	1.62E+02	1.63
F	8	582.72	1160 -	1174	1165.78	8.31E+01	20.60	7.60E+01	1.58
F	9	609.03	1210 -	1225	1218.38	2.19E+02	31.18	8.00E+01	1.71
F	10	911.08	1818 -	1829	1822.40	3.09E+01	13.64	3.85E+01	1.78
F	11	968.80	1931 -	1943	1937.82	3.32E+01	14.63	4.77E+01	2.00
F	12	1119.94	2235 -	2246	2240.07	4.14E+01	15.71	4.20E+01	2.04
F	13	1237.22	2470 -	2480	2474.59	1.98E+01	10.68	2.77E+01	1.22
F	14	1460.19	2911 -	2928	2920.49	1.99E+02	29.31	3.17E+01	2.62

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 1:07:52PM

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

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
F	1	76.23	2.03E+02	52.97			2.03E+02	5.30E+01
F	2	186.20	9.90E+01	32.28			9.90E+01	3.23E+01
M	3	238.43	2.14E+02	34.58			2.14E+02	3.46E+01
m	4	241.71	8.71E+01	24.83			8.71E+01	2.48E+01
F	5	295.09	1.69E+02	31.77			1.69E+02	3.18E+01
F	6	338.35	6.61E+01	23.29			6.61E+01	2.33E+01
F	7	351.77	2.65E+02	35.50	4.18E+01	1.86E+01	2.23E+02	4.01E+01
F	8	582.72	8.31E+01	20.60			8.31E+01	2.06E+01
F	9	609.03	2.19E+02	31.18	2.06E+01	1.21E+01	1.99E+02	3.34E+01
F	10	911.08	3.09E+01	13.64			3.09E+01	1.36E+01
F	11	968.80	3.32E+01	14.63			3.32E+01	1.46E+01
F	12	1119.94	4.14E+01	15.71			4.14E+01	1.57E+01
F	13	1237.22	1.98E+01	10.68			1.98E+01	1.07E+01
F	14	1460.19	1.99E+02	29.31	2.82E+01	8.57E+00	1.71E+02	3.05E+01

Analysis Report for L1-010-106-FSGS-004-SS

L1-010-106

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

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.95	1460.75	*	10.67	4.46E+00	8.35E-01
PB-212	0.96	77.11	*	17.50	6.97E-01	1.88E-01
		238.63	*	44.60	2.64E-01	4.49E-02
BI-214	0.65	609.31	*	46.30	5.49E-01	9.72E-02
		1120.29	*	15.10	6.06E-01	2.32E-01
		1238.11	*	5.94	8.05E-01	4.36E-01
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
PB-214	0.97	77.11	*	10.70	1.14E+00	3.07E-01
		295.21	*	19.20	5.78E-01	1.13E-01
		351.92	*	37.20	4.62E-01	8.60E-02
RA-226	1.00	186.21	*	3.28	1.40E+00	4.63E-01
AC-228	0.61	209.28		4.40		
		338.32	*	11.40	4.31E-01	1.53E-01
		794.70		4.60		
		911.60	*	27.70	2.06E-01	9.11E-02
		964.60		5.20		
		969.11	*	16.60	3.89E-01	1.72E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma



Analysis Report for L1-010-106-FSGS-004-SS

L1-010-106

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**INTERFERENCE CORRECTED REPORT**

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<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.951	4.46E+00	8.35E-01	
PB-212	0.962	2.71E-01	4.37E-02	
BI-214	0.656	5.67E-01	8.78E-02	
PB-214	0.978	5.14E-01	6.68E-02	
RA-226	1.000	1.40E+00	4.63E-01	
AC-228	0.612	2.86E-01	7.13E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

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Analysis Report for L1-010-106-FSGS-004-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/3/2019 1:07:52PM  
 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 4	241.71	4.83659E-02	14.26		
F 8	582.72	4.61782E-02	12.39		

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	4.46E+00	9.22E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	-3.84E-02	8.00E-02	9.68E-02
		1332.49	100.00	6.40E-03		8.00E-02
+	KR-85	513.99	0.43	1.89E+01	1.63E+01	1.63E+01
+	Y-88	898.04	93.70	4.94E-02	6.41E-02	8.00E-02
		1836.06	99.20	-1.27E-02		6.41E-02
+	NB-94	702.63	100.00	-1.64E-02	6.30E-02	6.30E-02
		871.10	100.00	9.73E-03		6.64E-02
+	I-131	284.30	6.06	4.39E-01	1.05E-01	1.49E+00
		364.48	81.20	6.27E-02		1.05E-01
		636.97	7.27	-2.12E-01		1.30E+00
+	CS-134	604.70	97.60	-8.99E-03	8.20E-02	1.10E-01
		795.84	85.40	-4.04E-02		8.20E-02

## Analysis Report for L1-010-106-FSGS-004-SS

## L1-010-106

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	CS-137	661.65	85.12	8.24E-02	8.45E-02	8.45E-02
+	CE-144	80.12	1.36	-2.25E+00	4.61E-01	5.86E+00
		133.51	11.09	1.60E-01		4.61E-01
+	EU-152	121.78	28.40	-1.00E-01	1.70E-01	1.70E-01
		344.28	26.60	-3.31E-02		2.29E-01
		1408.00	20.74	4.86E-02		3.73E-01
+	EU-154	123.07	40.40	-6.49E-02	1.20E-01	1.20E-01
		723.30	19.70	-1.08E-01		3.61E-01
		1274.51	35.50	1.29E-01		2.19E-01
+	EU-155	86.54	32.80	-5.72E-02	1.99E-01	1.99E-01
		105.31	21.80	5.32E-02		2.34E-01
+	BI-214	609.31	* 46.30	5.49E-01	1.29E-01	1.29E-01
		1120.29	* 15.10	6.06E-01		3.90E-01
		1238.11	* 5.94	8.05E-01		8.82E-01
		1377.67	4.11	-3.17E-01		1.97E+00
		1407.98	2.48	4.06E-01		3.12E+00
		1509.19	2.19	4.14E-01		2.71E+00
		1764.49	15.80	2.63E-01		6.48E-01
+	PB-214	77.11	* 10.70	1.14E+00	1.37E-01	7.10E-01
		295.21	* 19.20	5.78E-01		1.95E-01
		351.92	* 37.20	4.62E-01		1.37E-01
+	PA-228	89.95	22.00	2.24E+01	1.75E+01	2.93E+01
		93.35	35.00	6.95E+00		1.75E+01
		105.00	16.30	-3.10E+00		3.11E+01
		129.22	2.97	1.17E+02		1.72E+02
		338.32	5.30	1.00E+02		1.09E+02
		463.00	13.80	1.60E+01		4.41E+01
		911.23	16.70	3.82E+01		5.09E+01
+	AM-241	59.54	36.30	-7.65E-02	3.51E-01	3.51E-01
+	CM-243	103.76	23.00	-5.09E-02	2.24E-01	2.24E-01
		228.18	10.60	-5.71E-02		4.68E-01
		277.60	14.00	2.54E-02		3.83E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-005-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-005-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :  
  
Sample Size : 1.026E+03 grams  
Facility : Dairyland\_NPP  
  
Sample Taken On : 8/28/2019 10:41:00AM  
Acquisition Started : 9/3/2019 1:08:17PM  
  
Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.8 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 : 7385

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 1:38:27PM

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

Analysis Report for L1-010-106-FSGS-005-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	238.64	473 -	481	477.75	3.05E+01	36.61	2.79E+02	1.71
F	2	295.16	587 -	596	590.78	7.61E+01	22.76	1.56E+02	1.26
F	3	351.69	698 -	712	703.82	1.40E+02	26.07	9.39E+01	1.61
F	4	582.77	1162 -	1171	1165.88	2.93E+01	14.20	4.55E+01	1.75
F	5	609.11	1212 -	1224	1218.54	7.53E+01	18.97	3.88E+01	1.69
F	6	1119.80	2234 -	2245	2239.78	2.31E+01	11.74	2.08E+01	2.15
F	7	1460.24	2914 -	2928	2920.58	1.71E+02	26.53	8.33E+00	2.55

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 1:38:27PM

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.
	1	238.64	3.05E+01	36.61			3.05E+01	3.66E+01
F	2	295.16	7.61E+01	22.76			7.61E+01	2.28E+01
F	3	351.69	1.40E+02	26.07	4.18E+01	1.86E+01	9.80E+01	3.20E+01
F	4	582.77	2.93E+01	14.20			2.93E+01	1.42E+01
F	5	609.11	7.53E+01	18.97	2.06E+01	1.21E+01	5.47E+01	2.25E+01
F	6	1119.80	2.31E+01	11.74			2.31E+01	1.17E+01
F	7	1460.24	1.71E+02	26.53	2.82E+01	8.57E+00	1.43E+02	2.79E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-005-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.95	1460.75 *	10.67	3.03E+00	6.16E-01
PB-212	0.56	77.11	17.50		
		238.63 *	44.60	3.07E-02	3.69E-02
BI-214	0.57	609.31 *	46.30	1.23E-01	5.10E-02
		1120.29 *	15.10	2.75E-01	1.40E-01
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	0.71	77.11	10.70		
		295.21 *	19.20	2.12E-01	6.43E-02
		351.92 *	37.20	1.65E-01	5.45E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.959	3.03E+00	6.16E-01	
PB-212	0.560	3.07E-02	3.69E-02	
BI-214	0.575	1.40E-01	4.79E-02	

Analysis Report for L1-010-106-FSGS-005-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.717	1.85E-01	4.16E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-005-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/3/2019 1:38:27PM  
 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	582.77	1.62754E-02	24.23		

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	3.03E+00	5.96E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	2.68E-02	5.64E-02	6.17E-02
		1332.49	100.00	-1.29E-02		5.64E-02
+	KR-85	513.99	0.43	4.51E+00	1.07E+01	1.07E+01
+	Y-88	898.04	93.70	6.19E-03	4.79E-02	5.68E-02
		1836.06	99.20	-3.31E-02		4.79E-02
+	NB-94	702.63	100.00	1.10E-03	4.22E-02	4.22E-02
		871.10	100.00	-7.91E-03		4.98E-02
+	I-131	284.30	6.06	1.61E-01	7.39E-02	1.02E+00
		364.48	81.20	3.66E-02		7.39E-02
		636.97	7.27	2.03E-01		9.78E-01
+	CS-134	604.70	97.60	4.86E-03	5.81E-02	6.06E-02
		795.84	85.40	-4.27E-02		5.81E-02
+	CS-137	661.65	85.12	6.72E-02	6.08E-02	6.08E-02
+	CE-144	80.12	1.36	-9.89E-01	3.04E-01	3.88E+00
		133.51	11.09	-3.82E-02		3.04E-01



## Analysis Report for L1-010-106-FSGS-005-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	EU-152	121.78	28.40	-3.86E-02	1.22E-01	1.22E-01
		344.28	26.60	3.95E-02		1.53E-01
		1408.00	20.74	1.72E-01		2.80E-01
+	EU-154	123.07	40.40	-9.83E-03	8.55E-02	8.55E-02
		723.30	19.70	6.91E-02		2.32E-01
		1274.51	35.50	-3.40E-03		1.67E-01
+	EU-155	86.54	32.80	-1.07E-01	1.33E-01	1.33E-01
		105.31	21.80	-1.66E-02		1.68E-01
+	BI-214	609.31	* 46.30	1.23E-01	8.29E-02	8.29E-02
		1120.29	* 15.10	2.75E-01		2.32E-01
		1238.11	5.94	4.76E-01		1.13E+00
		1377.67	4.11	8.19E-01		1.48E+00
		1407.98	2.48	1.44E+00		2.34E+00
		1509.19	2.19	1.20E+00		2.21E+00
		1764.49	15.80	3.36E-01		3.95E-01
+	PB-214	77.11	10.70	4.09E-01	9.44E-02	5.27E-01
		295.21	* 19.20	2.12E-01		1.30E-01
		351.92	* 37.20	1.65E-01		9.44E-02
+	PA-228	89.95	22.00	2.21E+01	1.17E+01	2.00E+01
		93.35	35.00	-4.83E+00		1.17E+01
		105.00	16.30	-4.48E+00		2.27E+01
		129.22	2.97	5.01E+01		1.16E+02
		338.32	5.30	4.71E+01		7.38E+01
		463.00	13.80	1.45E+01		3.01E+01
		911.23	16.70	1.20E+01		3.42E+01
+	AM-241	59.54	36.30	1.73E-01	2.51E-01	2.51E-01
+	CM-243	103.76	23.00	1.14E-01	1.61E-01	1.61E-01
		228.18	10.60	6.37E-02		3.28E-01
		277.60	14.00	7.55E-03		2.54E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-006-SS  
L1-010-106

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## **GAMMA SPECTRUM ANALYSIS**

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Sample Identification : L1-010-106-FSGS-006-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.297E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 10:45:00AM  
Acquisition Started : 9/3/2019 1:38:51PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.4 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 : 7386

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## **PEAK ANALYSIS REPORT**

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Peak Analysis Performed on : 9/3/2019 2:09:01PM

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

Analysis Report for L1-010-106-FSGS-006-SS

L1-010-106

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
F	1	238.60	473 -	485	477.68	1.25E+02	28.77	2.69E+02	1.47
F	2	295.13	587 -	597	590.71	7.35E+01	21.26	1.67E+02	0.95
F	3	337.89	672 -	684	676.22	2.93E+01	16.04	1.13E+02	1.50
F	4	351.84	699 -	709	704.12	1.24E+02	25.46	9.77E+01	1.50
F	5	583.07	1163 -	1172	1166.47	3.83E+01	14.88	4.74E+01	1.26
F	6	609.17	1213 -	1226	1218.67	8.98E+01	21.60	7.30E+01	1.68
F	7	1460.26	2913 -	2929	2920.64	1.94E+02	28.09	4.62E+00	2.32
F	8	1764.51	3524 -	3533	3529.08	1.76E+01	9.59	7.09E+00	2.45

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 2:09:01PM

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

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
F	1	238.60	1.25E+02	28.77			1.25E+02	2.88E+01
F	2	295.13	7.35E+01	21.26			7.35E+01	2.13E+01
F	3	337.89	2.93E+01	16.04			2.93E+01	1.60E+01
F	4	351.84	1.24E+02	25.46	4.18E+01	1.86E+01	8.22E+01	3.15E+01
F	5	583.07	3.83E+01	14.88			3.83E+01	1.49E+01
F	6	609.17	8.98E+01	21.60	2.06E+01	1.21E+01	6.93E+01	2.48E+01
F	7	1460.26	1.94E+02	28.09	2.82E+01	8.57E+00	1.66E+02	2.94E+01
F	8	1764.51	1.76E+01	9.59	7.59E+00	4.90E+00	1.00E+01	1.08E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-006-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.75 *	10.67	4.36E+00	8.08E-01
PB-212	0.56	77.11	17.50		
		238.63 *	44.60	1.56E-01	3.67E-02
BI-214	0.55	609.31 *	46.30	1.92E-01	6.96E-02
		1120.29	15.10		
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49 *	15.80	2.09E-01	2.24E-01
PB-214	0.72	77.11	10.70		
		295.21 *	19.20	2.54E-01	7.43E-02
		351.92 *	37.20	1.71E-01	6.62E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.963	4.36E+00	8.08E-01	
PB-212	0.560	1.56E-01	3.67E-02	
BI-214	0.551	1.94E-01	6.64E-02	

Analysis Report for L1-010-106-FSGS-006-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.721	2.08E-01	4.94E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-006-SS

L1-010-106

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/3/2019 2:09:01PM  
 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	337.89	1.62897E-02	27.35	Tol.	AC-228 PA-228
F 5	583.07	2.12579E-02	19.44		

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

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**NUCLIDE MDA REPORT**


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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	* 10.67	4.36E+00	7.07E-01	7.07E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	-9.29E-03	7.43E-02	9.67E-02
		1332.49	100.00	-3.11E-02		7.43E-02
+	KR-85	513.99	0.43	1.31E+01	1.42E+01	1.42E+01
+	Y-88	898.04	93.70	3.65E-03	6.45E-02	6.60E-02
		1836.06	99.20	-2.00E-02		6.45E-02
+	NB-94	702.63	100.00	-1.25E-02	5.58E-02	5.58E-02
		871.10	100.00	-3.80E-02		6.03E-02
+	I-131	284.30	6.06	-2.52E-01	9.15E-02	1.27E+00
		364.48	81.20	4.43E-02		9.15E-02
		636.97	7.27	-1.01E+00		1.27E+00
+	CS-134	604.70	97.60	9.01E-04	6.27E-02	8.26E-02
		795.84	85.40	-1.73E-02		6.27E-02

## Analysis Report for L1-010-106-FSGS-006-SS

## L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	CS-137	661.65	85.12	7.28E-02	7.63E-02	7.63E-02
+	CE-144	80.12	1.36	-8.64E-01	3.94E-01	4.78E+00
		133.51	11.09	2.71E-01		3.94E-01
+	EU-152	121.78	28.40	-6.42E-02	1.49E-01	1.49E-01
		344.28	26.60	-2.72E-02		1.82E-01
		1408.00	20.74	2.13E-01		3.46E-01
+	EU-154	123.07	40.40	-5.56E-02	1.04E-01	1.04E-01
		723.30	19.70	8.40E-02		3.33E-01
		1274.51	35.50	9.54E-02		2.23E-01
+	EU-155	86.54	32.80	-1.65E-04	1.65E-01	1.65E-01
		105.31	21.80	2.85E-02		2.03E-01
+	BI-214	609.31	* 46.30	1.92E-01	1.22E-01	1.22E-01
		1120.29	15.10	4.61E-01		5.88E-01
		1238.11	5.94	2.39E-01		1.63E+00
		1377.67	4.11	-1.46E-01		1.59E+00
		1407.98	2.48	1.78E+00		2.89E+00
		1509.19	2.19	2.85E-01		2.95E+00
		1764.49	* 15.80	2.09E-01		3.78E-01
+	PB-214	77.11	10.70	6.41E-01	1.13E-01	6.53E-01
		295.21	* 19.20	2.54E-01		1.71E-01
		351.92	* 37.20	1.71E-01		1.13E-01
+	PA-228	89.95	22.00	2.62E+01	1.40E+01	2.45E+01
		93.35	35.00	-9.75E+00		1.40E+01
		105.00	16.30	1.30E+01		2.79E+01
		129.22	2.97	-5.75E+01		1.45E+02
		338.32	5.30	3.34E+01		8.77E+01
		463.00	13.80	1.32E+01		3.84E+01
		911.23	16.70	5.83E+01		4.86E+01
+	AM-241	59.54	36.30	5.68E-02	3.10E-01	3.10E-01
+	CM-243	103.76	23.00	4.06E-02	1.91E-01	1.91E-01
		228.18	10.60	-9.78E-02		3.87E-01
		277.60	14.00	-7.63E-02		3.22E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-007-SS

L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-007-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.916E+02 grams  
Facility : Dalryland\_NPP

Sample Taken On : 8/28/2019 10:48:00AM  
Acquisition Started : 9/3/2019 2:10:10PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.5 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 : 7387

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 2:40:19PM

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



Analysis Report for L1-010-106-FSGS-007-SS

L1-010-106

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
F	1	238.47	471 -	481	477.42	9.18E+01	25.85	2.52E+02	1.15
F	2	294.98	585 -	595	590.40	7.15E+01	23.62	1.43E+02	1.90
F	3	351.81	699 -	708	704.04	1.13E+02	24.83	9.23E+01	1.51
F	4	608.99	1212 -	1222	1218.31	8.01E+01	20.11	4.10E+01	1.87
F	5	1119.73	2235 -	2244	2239.65	2.06E+01	11.06	1.96E+01	1.62
F	6	1460.52	2914 -	2927	2921.16	1.71E+02	27.06	1.74E+01	2.24

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 2:40:19PM

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

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
F	1	238.47	9.18E+01	25.85			9.18E+01	2.59E+01
F	2	294.98	7.15E+01	23.62			7.15E+01	2.36E+01
F	3	351.81	1.13E+02	24.83	4.18E+01	1.86E+01	7.17E+01	3.10E+01
F	4	608.99	8.01E+01	20.11	2.06E+01	1.21E+01	5.95E+01	2.35E+01
F	5	1119.73	2.06E+01	11.06			2.06E+01	1.11E+01
F	6	1460.52	1.71E+02	27.06	2.82E+01	8.57E+00	1.43E+02	2.84E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-007-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.75	*	10.67	3.14E+00	6.48E-01
PB-212	0.55	77.11		17.50		
		238.63	*	44.60	9.55E-02	2.73E-02
BI-214	0.56	609.31	*	46.30	1.38E-01	5.50E-02
		1120.29	*	15.10	2.54E-01	1.37E-01
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49		15.80		
PB-214	0.71	77.11		10.70		
		295.21	*	19.20	2.06E-01	6.89E-02
		351.92	*	37.20	1.25E-01	5.44E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.992	3.14E+00	6.48E-01	
PB-212	0.557	9.55E-02	2.73E-02	
BI-214	0.569	1.54E-01	5.11E-02	

## Analysis Report for L1-010-106-FSGS-007-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.718	1.56E-01	4.27E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-007-SS

L1-010-106

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## UNIDENTIFIED PEAKS

---

Peak Locate Performed on : 9/3/2019 2:40:19PM  
 Peak Locate From Channel : 100  
 Peak Locate To Channel : 4096

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

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	3.14E+00	6.66E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	1.77E-02	6.48E-02	6.79E-02
		1332.49	100.00	4.12E-02		6.48E-02
+	KR-85	513.99	0.43	6.49E+00	1.16E+01	1.16E+01
+	Y-88	898.04	93.70	-3.92E-02	4.47E-02	5.88E-02
		1836.06	99.20	7.33E-03		4.47E-02
+	NB-94	702.63	100.00	4.13E-03	4.78E-02	5.07E-02
		871.10	100.00	5.53E-03		4.78E-02
+	I-131	284.30	6.06	-2.94E-01	8.44E-02	1.05E+00
		364.48	81.20	5.72E-02		8.44E-02
		636.97	7.27	3.18E-01		1.03E+00
+	CS-134	604.70	97.60	9.57E-02	5.53E-02	6.55E-02
		795.84	85.40	-1.45E-02		5.53E-02
+	CS-137	661.65	85.12	7.40E-03	5.75E-02	5.75E-02
+	CE-144	80.12	1.36	3.56E+00	3.23E-01	4.20E+00
		133.51	11.09	1.06E-01		3.23E-01
+	EU-152	121.78	28.40	-6.13E-02	1.20E-01	1.20E-01

## Analysis Report for L1-010-106-FSGS-007-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
	EU-152	344.28	26.60	7.14E-02	1.20E-01	1.61E-01
		1408.00	20.74	6.42E-02		2.63E-01
+	EU-154	123.07	40.40	-4.44E-03	8.65E-02	8.65E-02
		723.30	19.70	7.99E-03		2.46E-01
		1274.51	35.50	2.96E-02		1.87E-01
+	EU-155	86.54	32.80	-2.02E-02	1.39E-01	1.39E-01
		105.31	21.80	-7.72E-02		1.59E-01
+	BI-214	609.31	* 46.30	1.38E-01	8.49E-02	8.49E-02
		1120.29	* 15.10	2.54E-01		2.24E-01
		1238.11	5.94	7.38E-01		1.25E+00
		1377.67	4.11	6.64E-01		1.57E+00
		1407.98	2.48	5.37E-01		2.20E+00
		1509.19	2.19	7.74E-01		2.53E+00
		1764.49	15.80	2.96E-01		3.81E-01
+	PB-214	77.11	10.70	3.17E-01	9.22E-02	5.60E-01
		295.21	* 19.20	2.06E-01		1.31E-01
		351.92	* 37.20	1.25E-01		9.22E-02
+	PA-228	89.95	22.00	-1.38E+01	1.22E+01	2.02E+01
		93.35	35.00	8.93E+00		1.22E+01
		105.00	16.30	-1.77E+01		2.22E+01
		129.22	2.97	4.39E+01		1.26E+02
		338.32	5.30	2.64E+01		8.07E+01
		463.00	13.80	2.56E+01		3.49E+01
		911.23	16.70	5.36E+01		4.23E+01
+	AM-241	59.54	36.30	-4.87E-03	2.44E-01	2.44E-01
+	CM-243	103.76	23.00	-1.30E-01	1.53E-01	1.53E-01
		228.18	10.60	2.08E-02		3.31E-01
		277.60	14.00	7.77E-04		2.77E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-008-SS

L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-008-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.875E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 12:12:00PM  
Acquisition Started : 9/3/2019 3:14:28PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.7 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 : 7389

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 3:44:38PM

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

Analysis Report for L1-010-106-FSGS-008-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.37	148 -	162	153.29	1.73E+02	47.31	6.74E+02	4.65
F	2	92.49	182 -	192	185.52	5.25E+01	28.16	4.84E+02	1.23
F	3	185.83	368 -	379	372.15	6.54E+01	27.78	3.91E+02	1.44
M	4	238.45	470 -	490	477.37	1.51E+02	30.19	2.34E+02	1.54
m	5	241.81	470 -	490	484.09	7.20E+01	22.53	1.79E+02	1.55
F	6	295.22	587 -	596	590.89	1.09E+02	26.56	1.75E+02	1.38
F	7	338.23	672 -	681	676.90	3.09E+01	15.75	1.30E+02	0.91
F	8	351.83	698 -	711	704.10	1.60E+02	28.84	1.75E+02	1.36
F	9	583.39	1162 -	1171	1167.13	3.80E+01	15.02	4.63E+01	1.45
F	10	609.13	1213 -	1223	1218.59	1.38E+02	26.03	6.31E+01	1.67
F	11	910.73	1817 -	1826	1821.70	1.85E+01	10.14	4.48E+01	1.24
F	12	1460.41	2914 -	2927	2920.93	2.12E+02	29.69	1.40E+01	2.16

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 3:44:38PM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	76.37	1.73E+02	47.31			1.73E+02	4.73E+01
F	2	92.49	5.25E+01	28.16			5.25E+01	2.82E+01
F	3	185.83	6.54E+01	27.78			6.54E+01	2.78E+01
M	4	238.45	1.51E+02	30.19			1.51E+02	3.02E+01
m	5	241.81	7.20E+01	22.53			7.20E+01	2.25E+01
F	6	295.22	1.09E+02	26.56			1.09E+02	2.66E+01
F	7	338.23	3.09E+01	15.75			3.09E+01	1.57E+01
F	8	351.83	1.60E+02	28.84	4.18E+01	1.86E+01	1.18E+02	3.43E+01
F	9	583.39	3.80E+01	15.02			3.80E+01	1.50E+01
F	10	609.13	1.38E+02	26.03	2.06E+01	1.21E+01	1.17E+02	2.87E+01
F	11	910.73	1.85E+01	10.14			1.85E+01	1.01E+01
F	12	1460.41	2.12E+02	29.69	2.82E+01	8.57E+00	1.84E+02	3.09E+01

Analysis Report for L1-010-106-FSGS-008-SS

L1-010-106

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

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	4.06E+00	7.18E-01
PB-212	0.97	77.11 *	17.50	5.01E-01	1.41E-01
		238.63 *	44.60	1.57E-01	3.26E-02
BI-214	0.34	609.31 *	46.30	2.73E-01	6.87E-02
		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	0.98	77.11 *	10.70	8.19E-01	2.30E-01
		295.21 *	19.20	3.16E-01	7.85E-02
		351.92 *	37.20	2.06E-01	6.09E-02
RA-226	0.97	186.21 *	3.28	7.81E-01	3.34E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT



Analysis Report for L1-010-106-FSGS-008-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.982	4.06E+00	7.18E-01	
PB-212	0.972	1.67E-01	3.18E-02	
BI-214	0.347	2.73E-01	6.87E-02	
PB-214	0.986	2.60E-01	4.71E-02	
RA-226	0.977	7.81E-01	3.34E-01	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-008-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/3/2019 3:44:38PM  
 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	92.49	2.91614E-02	26.82	Tol.	PA-228
m 5	241.81	4.00155E-02	15.64		
F 7	338.23	1.71475E-02	25.51	Tol.	AC-228 PA-228
F 9	583.39	2.11009E-02	19.77		
F 11	910.73	1.02513E-02	27.48	Tol.	AC-228 PA-228

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	4.06E+00	6.48E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	-1.17E-02	6.24E-02	6.95E-02
		1332.49	100.00	5.85E-02		6.24E-02
+	KR-85	513.99	0.43	8.46E+00	1.17E+01	1.17E+01

## Analysis Report for L1-010-106-FSGS-008-SS

## L1-010-106

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	Y-88	898.04	93.70	-4.10E-02	6.13E-02	6.13E-02
		1836.06	99.20	-6.06E-02		6.19E-02
+	NB-94	702.63	100.00	1.53E-02	4.91E-02	4.91E-02
		871.10	100.00	-1.02E-01		5.37E-02
+	I-131	284.30	6.06	3.24E-01	8.60E-02	1.19E+00
		364.48	81.20	1.23E-02		8.60E-02
		636.97	7.27	-5.00E-01		1.14E+00
+	CS-134	604.70	97.60	1.32E-01	6.52E-02	7.57E-02
		795.84	85.40	1.35E-02		6.52E-02
+	CS-137	661.65	85.12	2.51E-02	7.55E-02	7.55E-02
+	CE-144	80.12	1.36	-5.52E-01	3.57E-01	4.43E+00
		133.51	11.09	-2.74E-02		3.57E-01
+	EU-152	121.78	28.40	-2.74E-02	1.38E-01	1.38E-01
		344.28	26.60	-2.52E-02		1.78E-01
		1408.00	20.74	-3.01E-01		3.15E-01
+	EU-154	123.07	40.40	-2.19E-02	9.72E-02	9.72E-02
		723.30	19.70	1.39E-01		2.60E-01
		1274.51	35.50	-1.07E-01		2.00E-01
+	EU-155	86.54	32.80	-2.96E-02	1.48E-01	1.48E-01
		105.31	21.80	3.71E-02		1.81E-01
+	BI-214	609.31	* 46.30	2.73E-01	9.46E-02	9.46E-02
		1120.29	15.10	6.45E-02		5.32E-01
		1238.11	5.94	9.41E-01		1.43E+00
		1377.67	4.11	4.86E-01		1.51E+00
		1407.98	2.48	-2.51E+00		2.63E+00
		1509.19	2.19	-9.06E-01		2.66E+00
		1764.49	15.80	4.54E-01		4.61E-01
+	PB-214	77.11	* 10.70	8.19E-01	1.15E-01	5.00E-01
		295.21	* 19.20	3.16E-01		1.43E-01
		351.92	* 37.20	2.06E-01		1.15E-01
+	PA-228	89.95	22.00	-1.30E+00	1.35E+01	2.29E+01
		93.35	35.00	4.94E+00		1.35E+01
		105.00	16.30	1.31E+01		2.52E+01
		129.22	2.97	2.18E+01		1.38E+02
		338.32	5.30	-7.93E+00		8.43E+01
		463.00	13.80	5.38E+00		3.28E+01
		911.23	16.70	1.71E+01		4.12E+01
+	AM-241	59.54	36.30	4.98E-02	2.74E-01	2.74E-01
+	CM-243	103.76	23.00	7.57E-03	1.72E-01	1.72E-01
		228.18	10.60	-4.05E-02		3.55E-01
		277.60	14.00	-5.95E-02		2.95E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-008-SS  
L1-010-106

Analysis Report for L1-010-106-FSGS-009-SS

L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-009-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.223E+02 grams  
Facility : Dalryland\_NPP

Sample Taken On : 8/28/2019 12:17:00PM  
Acquisition Started : 9/3/2019 3:45:57PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.6 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 : 7390

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 4:16:10PM

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

## Analysis Report for L1-010-106-FSGS-009-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	238.44	474 -	488	477.36	9.27E+01	24.52	1.51E+02	1.23
m	2	241.61	474 -	488	483.69	3.79E+01	18.14	1.65E+02	1.24
F	3	295.01	585 -	595	590.47	7.55E+01	22.87	1.49E+02	1.45
F	4	351.70	698 -	708	703.83	1.22E+02	25.14	1.07E+02	1.33
F	5	477.39	952 -	960	955.15	1.67E+01	11.06	4.63E+01	0.99
F	6	582.86	1162 -	1171	1166.07	2.28E+01	12.71	5.57E+01	1.14
F	7	608.93	1211 -	1223	1218.20	9.04E+01	21.53	5.43E+01	1.92
F	8	910.30	1817 -	1826	1820.83	1.28E+01	8.20	2.00E+01	0.63
F	9	1460.36	2915 -	2927	2920.84	1.42E+02	24.74	1.66E+01	2.09

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 4:16:10PM

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	238.44	9.27E+01	24.52			9.27E+01	2.45E+01
m	2	241.61	3.79E+01	18.14			3.79E+01	1.81E+01
F	3	295.01	7.55E+01	22.87			7.55E+01	2.29E+01
F	4	351.70	1.22E+02	25.14	4.18E+01	1.86E+01	8.03E+01	3.13E+01
F	5	477.39	1.67E+01	11.06			1.67E+01	1.11E+01
F	6	582.86	2.28E+01	12.71			2.28E+01	1.27E+01
F	7	608.93	9.04E+01	21.53	2.06E+01	1.21E+01	6.98E+01	2.47E+01
F	8	910.30	1.28E+01	8.20			1.28E+01	8.20E+00
F	9	1460.36	1.42E+02	24.74	2.82E+01	8.57E+00	1.14E+02	2.62E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-009-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.75 *	10.67	2.69E+00	6.36E-01
PB-212	0.55	77.11	17.50		
		238.63 *	44.60	1.04E-01	2.79E-02
BI-214	0.33	609.31 *	46.30	1.74E-01	6.24E-02
		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	0.71	77.11	10.70		
		295.21 *	19.20	2.34E-01	7.18E-02
		351.92 *	37.20	1.50E-01	5.90E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.976	2.69E+00	6.36E-01	
PB-212	0.556	1.04E-01	2.79E-02	
BI-214	0.338	1.74E-01	6.24E-02	

Analysis Report for L1-010-106-FSGS-009-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.715	1.84E-01	4.56E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma



Analysis Report for L1-010-106-FSGS-009-SS

L1-010-106

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/3/2019 4:16:10PM  
 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 2	241.61	2.10752E-02	23.91		
F 5	477.39	9.30525E-03	33.02	Sum	
F 6	582.86	1.26901E-02	27.81		
F 8	910.30	7.12961E-03	31.96	Tol.	PA-228

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

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**NUCLIDE MDA REPORT**


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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	2.69E+00	7.08E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	1.27E-02	6.06E-02	7.16E-02
		1332.49	100.00	3.08E-03		6.06E-02
+	KR-85	513.99	0.43	1.08E+00	1.22E+01	1.22E+01
+	Y-88	898.04	93.70	7.89E-04	5.08E-02	6.13E-02
		1836.06	99.20	1.19E-02		5.08E-02
+	NB-94	702.63	100.00	-3.21E-03	4.69E-02	4.69E-02
		871.10	100.00	4.97E-03		5.37E-02
+	I-131	284.30	6.06	2.40E-01	8.21E-02	1.12E+00
		364.48	81.20	3.94E-02		8.21E-02
		636.97	7.27	2.04E-01		1.07E+00

## Analysis Report for L1-010-106-FSGS-009-SS

L1-010-106

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	CS-134	604.70	97.60	1.09E-01	6.07E-02	7.33E-02
		795.84	85.40	-4.08E-02		6.07E-02
+	CS-137	661.65	85.12	3.28E-02	6.68E-02	6.68E-02
+	CE-144	80.12	1.36	3.30E+00	3.41E-01	4.26E+00
		133.51	11.09	1.60E-01		3.41E-01
+	EU-152	121.78	28.40	3.45E-02	1.31E-01	1.31E-01
		344.28	26.60	1.03E-01		1.68E-01
		1408.00	20.74	1.80E-01		2.77E-01
+	EU-154	123.07	40.40	5.60E-02	9.29E-02	9.29E-02
		723.30	19.70	-9.59E-03		2.56E-01
		1274.51	35.50	2.86E-03		1.83E-01
+	EU-155	86.54	32.80	-8.96E-02	1.47E-01	1.47E-01
		105.31	21.80	6.13E-02		1.81E-01
+	BI-214	609.31	* 46.30	1.74E-01	9.98E-02	9.98E-02
		1120.29	15.10	-1.96E-01		4.89E-01
		1238.11	5.94	5.59E-01		1.24E+00
		1377.67	4.11	5.44E-01		1.49E+00
		1407.98	2.48	1.50E+00		2.32E+00
		1509.19	2.19	-5.94E-01		2.59E+00
		1764.49	15.80	2.11E-01		4.09E-01
+	PB-214	77.11	10.70	2.95E-01	1.04E-01	5.63E-01
		295.21	* 19.20	2.34E-01		1.44E-01
		351.92	* 37.20	1.50E-01		1.04E-01
+	PA-228	89.95	22.00	7.98E+00	1.30E+01	2.21E+01
		93.35	35.00	1.04E+01		1.30E+01
		105.00	16.30	1.16E+01		2.56E+01
		129.22	2.97	2.81E+00		1.31E+02
		338.32	5.30	3.19E+01		8.28E+01
		463.00	13.80	5.75E-01		2.92E+01
		911.23	16.70	1.02E+01		4.00E+01
+	AM-241	59.54	36.30	9.80E-02	2.74E-01	2.74E-01
+	CM-243	103.76	23.00	1.15E-02	1.72E-01	1.72E-01
		228.18	10.60	6.65E-02		3.62E-01
		277.60	14.00	-5.08E-02		2.89E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-010-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-010-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.875E+02 grams  
Facility : Dalryland\_NPP

Sample Taken On : 8/28/2019 12:46:00PM  
Acquisition Started : 9/4/2019 6:10:42AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.4 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 : 7393

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 6:40:51AM

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

Analysis Report for L1-010-106-FSGS-010-SS

L1-010-106

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
F	1	185.56	367 -	375	371.61	3.28E+01	21.04	2.46E+02	1.06
F	2	295.00	584 -	595	590.46	6.41E+01	20.41	1.41E+02	1.20
F	3	351.73	698 -	712	703.89	1.12E+02	24.00	1.10E+02	1.51
F	4	583.33	1162 -	1172	1167.00	1.98E+01	11.74	6.05E+01	0.98
F	5	609.02	1210 -	1224	1218.37	9.05E+01	21.02	4.46E+01	2.18
F	6	910.98	1818 -	1827	1822.19	1.80E+01	9.82	1.78E+01	1.21
F	7	1460.35	2912 -	2929	2920.81	2.05E+02	29.27	1.80E+01	2.45

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 6:40:51AM

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

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
F	1	185.56	3.28E+01	21.04			3.28E+01	2.10E+01
F	2	295.00	6.41E+01	20.41			6.41E+01	2.04E+01
F	3	351.73	1.12E+02	24.00	4.18E+01	1.86E+01	7.05E+01	3.04E+01
F	4	583.33	1.98E+01	11.74			1.98E+01	1.17E+01
F	5	609.02	9.05E+01	21.02	2.06E+01	1.21E+01	6.99E+01	2.43E+01
F	6	910.98	1.80E+01	9.82			1.80E+01	9.82E+00
F	7	1460.35	2.05E+02	29.27	2.82E+01	8.57E+00	1.77E+02	3.05E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-010-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.75	*	10.67	4.34E+00	7.86E-01
BI-214	0.34	609.31	*	46.30	1.81E-01	6.37E-02
		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	0.71	77.11		10.70		
		295.21	*	19.20	2.07E-01	6.65E-02
		351.92	*	37.20	1.37E-01	5.95E-02
RA-226	0.93	186.21	*	3.28	4.35E-01	2.80E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.974	4.34E+00	7.86E-01	
BI-214	0.343	1.81E-01	6.37E-02	
PB-214	0.716	1.68E-01	4.43E-02	
RA-226	0.934	4.35E-01	2.80E-01	

## Analysis Report for L1-010-106-FSGS-010-SS

L1-010-106

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

Errors quoted at 2.000sigma

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Analysis Report for L1-010-106-FSGS-010-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/4/2019 6:40:51AM  
 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	583.33	1.09833E-02	29.70		
F 6	910.98	1.00272E-02	27.21	Tol.	AC-228 PA-228

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	4.34E+00	7.70E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	4.01E-02	5.95E-02	7.51E-02
		1332.49	100.00	-2.94E-02		5.95E-02
+	KR-85	513.99	0.43	9.85E+00	1.33E+01	1.33E+01
+	Y-88	898.04	93.70	2.43E-03	4.71E-02	5.83E-02
		1836.06	99.20	-6.72E-02		4.71E-02
+	NB-94	702.63	100.00	2.97E-02	5.22E-02	5.22E-02
		871.10	100.00	-6.29E-03		5.86E-02
+	I-131	284.30	6.06	-2.67E-01	8.52E-02	1.19E+00
		364.48	81.20	2.24E-02		8.52E-02
		636.97	7.27	1.03E+00		1.32E+00
+	CS-134	604.70	97.60	3.27E-03	6.31E-02	7.34E-02
		795.84	85.40	-2.51E-02		6.31E-02

## Analysis Report for L1-010-106-FSGS-010-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	CS-137	661.65	85.12	7.59E-02	7.57E-02	7.57E-02
+	CE-144	80.12	1.36	1.99E+00	3.63E-01	4.39E+00
		133.51	11.09	9.39E-03		3.63E-01
+	EU-152	121.78	28.40	-8.33E-02	1.34E-01	1.34E-01
		344.28	26.60	8.56E-02		1.64E-01
		1408.00	20.74	-7.42E-02		2.39E-01
+	EU-154	123.07	40.40	-5.26E-02	9.42E-02	9.42E-02
		723.30	19.70	3.16E-01		2.95E-01
		1274.51	35.50	8.38E-02		2.16E-01
+	EU-155	86.54	32.80	-8.66E-02	1.50E-01	1.50E-01
		105.31	21.80	-1.41E-02		1.85E-01
+	BI-214	609.31	* 46.30	1.81E-01	1.01E-01	1.01E-01
		1120.29	15.10	3.59E-01		5.25E-01
		1238.11	5.94	-4.41E-01		1.37E+00
		1377.67	4.11	-9.57E-02		1.29E+00
		1407.98	2.48	-6.20E-01		1.99E+00
		1509.19	2.19	2.21E+00		2.76E+00
		1764.49	15.80	3.30E-01		4.25E-01
+	PB-214	77.11	10.70	5.83E-01	1.14E-01	5.93E-01
		295.21	* 19.20	2.07E-01		1.50E-01
		351.92	* 37.20	1.37E-01		1.14E-01
+	PA-228	89.95	22.00	2.96E+01	2.12E+01	3.59E+01
		93.35	35.00	1.02E+01		2.12E+01
		105.00	16.30	-1.10E+01		4.00E+01
		129.22	2.97	6.76E+01		2.16E+02
		338.32	5.30	6.75E+01		1.31E+02
		463.00	13.80	1.06E+01		4.85E+01
		911.23	16.70	2.09E+01		6.07E+01
+	AM-241	59.54	36.30	-1.66E-01	2.71E-01	2.71E-01
+	CM-243	103.76	23.00	-6.59E-02	1.75E-01	1.75E-01
		228.18	10.60	2.42E-02		3.54E-01
		277.60	14.00	6.19E-02		3.04E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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



Analysis Report for L1-010-106-FSGS-011-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-011-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.340E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 12:50:00PM  
Acquisition Started : 9/4/2019 8:57:51AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.7 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 : 7394

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 7:28:01AM

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

Analysis Report for L1-010-106-FSGS-011-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	185.93	364 -	379	372.36	5.82E+01	24.78	4.68E+02	1.23
F	2	238.65	469 -	485	477.78	1.44E+02	31.33	3.97E+02	1.60
F	3	294.91	584 -	595	590.27	7.82E+01	23.08	2.16E+02	1.11
F	4	338.23	673 -	682	676.89	2.87E+01	14.39	1.11E+02	0.83
F	5	351.64	698 -	710	703.72	1.56E+02	29.40	1.59E+02	1.72
F	6	583.08	1159 -	1172	1166.50	5.35E+01	17.00	5.21E+01	1.59
F	7	609.23	1213 -	1225	1218.79	1.34E+02	25.36	7.35E+01	1.60
F	8	1460.27	2915 -	2930	2920.66	1.78E+02	27.21	1.38E+01	2.72
F	9	1763.56	3523 -	3532	3527.18	2.51E+01	10.42	5.00E+00	1.22

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 7:28:01AM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	185.93	5.82E+01	24.78			5.82E+01	2.48E+01
F	2	238.65	1.44E+02	31.33			1.44E+02	3.13E+01
F	3	294.91	7.82E+01	23.08			7.82E+01	2.31E+01
F	4	338.23	2.87E+01	14.39			2.87E+01	1.44E+01
F	5	351.64	1.56E+02	29.40	4.18E+01	1.86E+01	1.14E+02	3.48E+01
F	6	583.08	5.35E+01	17.00			5.35E+01	1.70E+01
F	7	609.23	1.34E+02	25.36	2.06E+01	1.21E+01	1.13E+02	2.81E+01
F	8	1460.27	1.78E+02	27.21	2.82E+01	8.57E+00	1.50E+02	2.85E+01
F	9	1763.56	2.51E+01	10.42			2.51E+01	1.04E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-011-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.75	*	10.67	3.50E+00	6.93E-01
PB-212	0.56	77.11		17.50		
		238.63	*	44.60	1.60E-01	3.56E-02
BI-214	0.52	609.31	*	46.30	2.79E-01	7.10E-02
		1120.29		15.10		
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49	*	15.80	4.63E-01	1.94E-01
PB-214	0.71	77.11		10.70		
		295.21	*	19.20	2.39E-01	7.16E-02
		351.92	*	37.20	2.10E-01	6.51E-02
RA-226	0.98	186.21	*	3.28	7.35E-01	3.15E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.964	3.50E+00	6.93E-01	
PB-212	0.560	1.60E-01	3.56E-02	

Analysis Report for L1-010-106-FSGS-011-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
BI-214	0.528	3.01E-01	6.67E-02	
PB-214	0.711	2.23E-01	4.82E-02	
RA-226	0.988	7.35E-01	3.15E-01	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-011-SS

L1-010-106

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## UNIDENTIFIED PEAKS

---

Peak Locate Performed on : 9/4/2019 7:28:01AM  
 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	338.23	1.59334E-02	25.09	Tol.	AC-228 PA-228
F 6	583.08	2.97243E-02	15.89		

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

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## NUCLIDE MDA REPORT

---

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	3.50E+00	6.88E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	5.70E-02	6.97E-02	7.74E-02
		1332.49	100.00	3.53E-02		6.97E-02
+	KR-85	513.99	0.43	4.46E+00	1.25E+01	1.25E+01
+	Y-88	898.04	93.70	-2.02E-02	3.81E-02	6.14E-02
		1836.06	99.20	-6.15E-02		3.81E-02
+	NB-94	702.63	100.00	2.01E-02	5.42E-02	5.42E-02
		871.10	100.00	-6.08E-02		5.57E-02
+	I-131	284.30	6.06	-8.62E-01	8.42E-02	1.15E+00
		364.48	81.20	-4.89E-02		8.42E-02
		636.97	7.27	-9.24E-01		1.23E+00
+	CS-134	604.70	97.60	-3.16E-02	6.33E-02	8.25E-02
		795.84	85.40	-3.85E-02		6.33E-02

## Analysis Report for L1-010-106-FSGS-011-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	CS-137	661.65	85.12	3.19E-02	7.16E-02	7.16E-02
+	CE-144	80.12	1.36	5.51E-01	3.68E-01	4.56E+00
		133.51	11.09	7.20E-02		3.68E-01
+	EU-152	121.78	28.40	-3.67E-02	1.42E-01	1.42E-01
		344.28	26.60	-5.58E-02		1.86E-01
		1408.00	20.74	1.49E-01		2.91E-01
+	EU-154	123.07	40.40	-7.01E-02	9.99E-02	9.99E-02
		723.30	19.70	2.00E-01		2.83E-01
		1274.51	35.50	-1.23E-03		1.96E-01
+	EU-155	86.54	32.80	-3.28E-02	1.55E-01	1.55E-01
		105.31	21.80	-1.01E-01		1.94E-01
+	BI-214	609.31	* 46.30	2.79E-01	1.07E-01	1.07E-01
		1120.29	15.10	2.67E-01		5.26E-01
		1238.11	5.94	5.79E-01		1.51E+00
		1377.67	4.11	-7.57E-01		1.38E+00
		1407.98	2.48	1.25E+00		2.43E+00
		1509.19	2.19	1.37E+00		2.87E+00
		1764.49	* 15.80	4.63E-01		1.95E-01
+	PB-214	77.11	10.70	8.29E-01	1.17E-01	6.26E-01
		295.21	* 19.20	2.39E-01		1.74E-01
		351.92	* 37.20	2.10E-01		1.17E-01
+	PA-228	89.95	22.00	3.12E+01	2.29E+01	3.82E+01
		93.35	35.00	1.46E+01		2.29E+01
		105.00	16.30	-4.19E+00		4.34E+01
		129.22	2.97	1.02E+02		2.27E+02
		338.32	5.30	9.42E+01		1.45E+02
		463.00	13.80	3.17E+01		5.70E+01
		911.23	16.70	2.57E+01		7.36E+01
+	AM-241	59.54	36.30	-1.17E-01	2.84E-01	2.84E-01
+	CM-243	103.76	23.00	-3.59E-02	1.85E-01	1.85E-01
		228.18	10.60	-7.16E-02		3.81E-01
		277.60	14.00	-2.81E-02		2.89E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-012-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-012-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.733E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 12:54:00PM  
Acquisition Started : 9/4/2019 7:28:33AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.3 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 : 7395

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 7:58:42AM

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

Analysis Report for L1-010-106-FSGS-012-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	77.10	148 -	158	154.74	6.02E+01	28.11	4.42E+02	1.24
F	2	238.48	473 -	481	477.44	8.65E+01	25.84	2.56E+02	1.03
F	3	294.98	583 -	595	590.41	7.80E+01	22.63	1.50E+02	1.58
F	4	338.29	673 -	683	677.01	3.23E+01	14.56	8.39E+01	1.02
F	5	351.77	698 -	711	703.98	9.92E+01	22.79	1.22E+02	1.25
F	6	582.99	1163 -	1173	1166.32	4.00E+01	14.29	3.48E+01	1.31
F	7	609.06	1212 -	1224	1218.45	7.13E+01	19.57	6.18E+01	1.70
F	8	1460.45	2913 -	2928	2921.02	1.72E+02	27.16	2.00E+01	2.46

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 7:58:42AM

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	77.10	6.02E+01	28.11			6.02E+01	2.81E+01
F	2	238.48	8.65E+01	25.84			8.65E+01	2.58E+01
F	3	294.98	7.80E+01	22.63			7.80E+01	2.26E+01
F	4	338.29	3.23E+01	14.56			3.23E+01	1.46E+01
F	5	351.77	9.92E+01	22.79	4.18E+01	1.86E+01	5.74E+01	2.94E+01
F	6	582.99	4.00E+01	14.29			4.00E+01	1.43E+01
F	7	609.06	7.13E+01	19.57	2.06E+01	1.21E+01	5.07E+01	2.30E+01
F	8	1460.45	1.72E+02	27.16	2.82E+01	8.57E+00	1.44E+02	2.85E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma



Analysis Report for L1-010-106-FSGS-012-SS

L1-010-106

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	3.59E+00	7.38E-01
PB-212	0.99	77.11 *	17.50	1.94E-01	9.15E-02
		238.63 *	44.60	1.02E-01	3.10E-02
BI-214	0.34	609.31 *	46.30	1.34E-01	6.11E-02
		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	3.18E-01	1.50E-01
		295.21 *	19.20	2.55E-01	7.51E-02
		351.92 *	37.20	1.14E-01	5.85E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.986	3.59E+00	7.38E-01	
PB-212	0.998	1.01E-01	2.95E-02	
BI-214	0.344	1.34E-01	6.11E-02	

Analysis Report for L1-010-106-FSGS-012-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.996	1.66E-01	4.43E-02	

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-012-SS

L1-010-106

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/4/2019 7:58:42AM  
 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	338.29	1.79250E-02	22.56	Tol.	AC-228 PA-228
F 6	582.99	2.22143E-02	17.87		

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

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**NUCLIDE MDA REPORT**


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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	3.59E+00	7.85E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	3.86E-03	7.16E-02	7.71E-02
		1332.49	100.00	-3.57E-02		7.16E-02
+	KR-85	513.99	0.43	7.04E+00	1.27E+01	1.27E+01
+	Y-88	898.04	93.70	-5.28E-02	4.79E-02	6.43E-02
		1836.06	99.20	4.24E-04		4.79E-02
+	NB-94	702.63	100.00	-3.00E-02	4.95E-02	4.95E-02
		871.10	100.00	0.00E+00		5.11E-02
+	I-131	284.30	6.06	-7.81E-02	9.37E-02	1.19E+00
		364.48	81.20	5.42E-02		9.37E-02
		636.97	7.27	-1.73E-01		1.29E+00
+	CS-134	604.70	97.60	3.66E-03	6.16E-02	7.29E-02
		795.84	85.40	6.05E-03		6.16E-02

## Analysis Report for L1-010-106-FSGS-012-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	CS-137	661.65	85.12	7.37E-02	7.25E-02	7.25E-02
+	CE-144	80.12	1.36	-3.30E+00	3.59E-01	4.53E+00
		133.51	11.09	-1.54E-01		3.59E-01
+	EU-152	121.78	28.40	-9.40E-03	1.39E-01	1.39E-01
		344.28	26.60	1.27E-02		1.81E-01
		1408.00	20.74	-1.15E-01		2.93E-01
+	EU-154	123.07	40.40	1.01E-01	9.90E-02	9.90E-02
		723.30	19.70	-2.65E-01		2.68E-01
		1274.51	35.50	-1.18E-02		2.07E-01
+	EU-155	86.54	32.80	-5.30E-02	1.59E-01	1.59E-01
		105.31	21.80	-4.26E-02		1.92E-01
+	BI-214	609.31	* 46.30	1.34E-01	1.09E-01	1.09E-01
		1120.29	15.10	1.70E-01		5.12E-01
		1238.11	5.94	-4.30E-01		1.38E+00
		1377.67	4.11	2.45E-01		1.74E+00
		1407.98	2.48	-9.62E-01		2.45E+00
		1509.19	2.19	5.94E-01		2.59E+00
		1764.49	15.80	5.53E-01		5.39E-01
+	PB-214	77.11	* 10.70	3.18E-01	1.17E-01	4.15E-01
		295.21	* 19.20	2.55E-01		1.60E-01
		351.92	* 37.20	1.14E-01		1.17E-01
+	PA-228	89.95	22.00	1.96E+01	2.28E+01	3.87E+01
		93.35	35.00	-4.74E+00		2.28E+01
		105.00	16.30	-1.57E+01		4.35E+01
		129.22	2.97	8.40E+00		2.23E+02
		338.32	5.30	2.03E+01		1.44E+02
		463.00	13.80	-4.69E+01		5.35E+01
		911.23	16.70	3.87E+01		7.21E+01
+	AM-241	59.54	36.30	8.78E-02	2.82E-01	2.82E-01
+	CM-243	103.76	23.00	-1.22E-01	1.83E-01	1.83E-01
		228.18	10.60	-2.89E-01		3.64E-01
		277.60	14.00	-3.72E-02		2.89E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-013-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-013-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.533E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 12:58:00PM  
Acquisition Started : 9/4/2019 8:05:18AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.6 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 : 7396

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 8:35:28AM

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

Analysis Report for L1-010-106-FSGS-013-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	87.17	169 -	192	174.89	5.43E+01	27.81	4.57E+02	1.45
m	2	92.30	169 -	192	185.13	6.56E+01	28.39	4.05E+02	1.46
M	3	238.57	472 -	488	477.62	1.67E+02	31.94	2.34E+02	1.39
m	4	241.63	472 -	488	483.73	5.67E+01	21.63	2.03E+02	1.40
F	5	294.97	587 -	595	590.40	5.66E+01	22.06	1.82E+02	1.19
F	6	337.85	671 -	680	676.13	2.95E+01	18.76	1.47E+02	1.51
F	7	351.82	700 -	708	704.07	1.25E+02	26.63	1.20E+02	1.40
F	8	582.92	1161 -	1170	1166.18	5.11E+01	17.59	5.48E+01	1.67
F	9	609.22	1213 -	1225	1218.78	1.00E+02	22.47	7.86E+01	1.43
F	10	726.38	1449 -	1458	1453.06	2.17E+01	12.09	3.44E+01	1.53
F	11	806.36	1610 -	1617	1612.98	9.95E+00	7.62	1.82E+01	0.86
F	12	910.76	1816 -	1827	1821.76	4.17E+01	15.07	3.89E+01	1.64
F	13	1120.13	2234 -	2245	2240.44	2.98E+01	13.23	2.69E+01	2.21
F	14	1332.14	2660 -	2669	2664.42	1.96E+01	9.21	4.00E+00	1.33
F	15	1460.32	2914 -	2929	2920.75	2.49E+02	32.26	2.16E+01	2.37

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 8:35:28AM

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.
M	1	87.17	5.43E+01	27.81			5.43E+01	2.78E+01
m	2	92.30	6.56E+01	28.39			6.56E+01	2.84E+01
M	3	238.57	1.67E+02	31.94			1.67E+02	3.19E+01
m	4	241.63	5.67E+01	21.63			5.67E+01	2.16E+01
F	5	294.97	5.66E+01	22.06			5.66E+01	2.21E+01
F	6	337.85	2.95E+01	18.76			2.95E+01	1.88E+01
F	7	351.82	1.25E+02	26.63	4.18E+01	1.86E+01	8.28E+01	3.25E+01
F	8	582.92	5.11E+01	17.59			5.11E+01	1.76E+01
F	9	609.22	1.00E+02	22.47	2.06E+01	1.21E+01	7.98E+01	2.55E+01
F	10	726.38	2.17E+01	12.09			2.17E+01	1.21E+01
F	11	806.36	9.95E+00	7.62			9.95E+00	7.62E+00
F	12	910.76	4.17E+01	15.07			4.17E+01	1.51E+01
F	13	1120.13	2.98E+01	13.23			2.98E+01	1.32E+01
F	14	1332.14	1.96E+01	9.21			1.96E+01	9.21E+00

Analysis Report for L1-010-106-FSGS-013-SS

L1-010-106

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F 15	1460.32	2.49E+02	32.26	2.82E+01	8.57E+00	2.21E+02	3.34E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\ApexiRoot\Dairyland\_NPP\Library\HOTLAB.NLB

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.75 *	10.67	5.64E+00	9.08E-01
BI-212	0.53	727.17 *	11.80	2.70E-01	1.51E-01
		785.42	2.00		
		1620.56	2.75		
PB-212	0.56	77.11	17.50		
		238.63 *	44.60	2.02E-01	4.00E-02
BI-214	0.58	609.31 *	46.30	2.15E-01	6.99E-02
		1120.29 *	15.10	4.27E-01	1.91E-01
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	0.71	77.11	10.70		
		295.21 *	19.20	1.90E-01	7.45E-02
		351.92 *	37.20	1.68E-01	6.63E-02

\* = 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 2.000sigma

Analysis Report for L1-010-106-FSGS-013-SS

L1-010-106

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**INTERFERENCE CORRECTED REPORT**

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<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.971	5.64E+00	9.08E-01	
BI-212	0.537	2.70E-01	1.51E-01	
PB-212	0.560	2.02E-01	4.00E-02	
BI-214	0.584	2.41E-01	6.56E-02	
PB-214	0.718	1.77E-01	4.95E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

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Analysis Report for L1-010-106-FSGS-013-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/4/2019 8:35:28AM  
 Peak Locate From Channel : 100  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
M 1	87.17	3.01721E-02	25.61	Tol.	EU-155
m 2	92.30	3.64716E-02	21.62		
m 4	241.63	3.15160E-02	19.07		
F 6	337.85	1.63850E-02	31.81	Tol.	AC-228 PA-228
F 8	582.92	2.84024E-02	17.21		
F 11	806.36	5.52811E-03	38.27		
F 12	910.76	2.31533E-02	18.07	Tol.	AC-228 PA-228
F 14	1332.14	1.08824E-02	23.50		

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

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## NUCLIDE MDA REPORT

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

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
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## Analysis Report for L1-010-106-FSGS-013-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	K-40	1460.75	*	10.67	5.64E+00	8.08E-01	8.08E-01
+	@ AR-41	1293.64		99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22		100.00	2.42E-02	7.63E-02	9.15E-02
		1332.49		100.00	2.57E-02		7.63E-02
+	KR-85	513.99		0.43	1.23E+01	1.43E+01	1.43E+01
+	Y-88	898.04		93.70	6.43E-03	6.30E-02	6.99E-02
		1836.06		99.20	1.91E-02		6.30E-02
+	NB-94	702.63		100.00	-4.28E-02	5.43E-02	5.43E-02
		871.10		100.00	-3.02E-02		5.68E-02
+	I-131	284.30		6.06	-2.47E+00	9.64E-02	1.38E+00
		364.48		81.20	-2.41E-02		9.64E-02
		636.97		7.27	1.32E+00		1.51E+00
+	CS-134	604.70		97.60	-8.00E-03	7.82E-02	8.36E-02
		795.84		85.40	5.07E-02		7.82E-02
+	CS-137	661.65		85.12	7.86E-02	8.33E-02	8.33E-02
+	CE-144	80.12		1.36	3.09E+00	4.06E-01	5.10E+00
		133.51		11.09	9.43E-02		4.06E-01
+	EU-152	121.78		28.40	-1.17E-01	1.52E-01	1.52E-01
		344.28		26.60	-3.46E-01		2.07E-01
		1408.00		20.74	-1.31E-01		3.25E-01
+	EU-154	123.07		40.40	-2.47E-02	1.08E-01	1.08E-01
		723.30		19.70	4.67E-01		3.68E-01
		1274.51		35.50	6.79E-02		2.20E-01
+	EU-155	86.54		32.80	-6.74E-03	1.78E-01	1.78E-01
		105.31		21.80	-5.46E-02		2.11E-01
+	BI-214	609.31	*	46.30	2.15E-01	1.20E-01	1.20E-01
		1120.29	*	15.10	4.27E-01		3.18E-01
		1238.11		5.94	1.06E+00		1.70E+00
		1377.67		4.11	-1.34E+00		1.86E+00
		1407.98		2.48	-1.10E+00		2.71E+00
		1509.19		2.19	-5.52E-01		2.41E+00
		1764.49		15.80	3.18E-01		5.34E-01
+	PB-214	77.11		10.70	6.81E-01	1.12E-01	6.93E-01
		295.21	*	19.20	1.90E-01		1.64E-01
		351.92	*	37.20	1.68E-01		1.12E-01
+	PA-228	89.95		22.00	5.03E+01	2.56E+01	4.43E+01
		93.35		35.00	1.99E+00		2.56E+01
		105.00		16.30	-5.95E+00		4.82E+01
		129.22		2.97	-1.23E+02		2.47E+02
		338.32		5.30	1.04E+02		1.71E+02
		463.00		13.80	-6.24E+01		5.81E+01
		911.23		16.70	9.02E+01		9.17E+01
+	AM-241	59.54		36.30	2.50E-02	3.14E-01	3.14E-01
+	CM-243	103.76		23.00	2.13E-02	2.01E-01	2.01E-01
		228.18		10.60	1.63E-01		4.21E-01
		277.60		14.00	1.59E-01		3.39E-01

Analysis Report for L1-010-106-FSGS-013-SS

L1-010-106

- 
- + = 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 L1-010-106-FSGS-014-SS

L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-014-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.652E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 1:02:00PM  
Acquisition Started : 9/4/2019 8:46:34AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.8 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 : 7397

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 9:16:48AM

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

Analysis Report for L1-010-106-FSGS-014-SS

L1-010-106

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
F	1	238.40	472 -	482	477.27	6.53E+01	24.91	2.82E+02	1.28
F	2	294.94	587 -	597	590.32	4.56E+01	18.88	1.56E+02	1.15
F	3	351.71	698 -	710	703.84	1.09E+02	24.02	1.02E+02	1.55
F	4	583.32	1163 -	1173	1166.97	2.17E+01	11.98	4.71E+01	1.15
F	5	609.04	1212 -	1224	1218.42	9.57E+01	21.01	3.86E+01	1.66
F	6	911.00	1817 -	1827	1822.25	2.19E+01	11.53	3.05E+01	1.40
F	7	1460.34	2912 -	2929	2920.80	1.61E+02	26.30	2.28E+01	2.66

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 9:16:48AM

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

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
F	1	238.40	6.53E+01	24.91			6.53E+01	2.49E+01
F	2	294.94	4.56E+01	18.88			4.56E+01	1.89E+01
F	3	351.71	1.09E+02	24.02	4.18E+01	1.86E+01	6.71E+01	3.04E+01
F	4	583.32	2.17E+01	11.98			2.17E+01	1.20E+01
F	5	609.04	9.57E+01	21.01	2.06E+01	1.21E+01	7.51E+01	2.42E+01
F	6	911.00	2.19E+01	11.53			2.19E+01	1.15E+01
F	7	1460.34	1.61E+02	26.30	2.82E+01	8.57E+00	1.32E+02	2.77E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-014-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.75 *	10.67	2.99E+00	6.46E-01
PB-212	0.55	77.11	17.50		
		238.63 *	44.60	6.97E-02	2.69E-02
BI-214	0.34	609.31 *	46.30	1.79E-01	5.87E-02
		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	0.71	77.11	10.70		
		295.21 *	19.20	1.35E-01	5.63E-02
		351.92 *	37.20	1.20E-01	5.47E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.974	2.99E+00	6.46E-01	
PB-212	0.554	6.97E-02	2.69E-02	
BI-214	0.344	1.79E-01	5.87E-02	

## Analysis Report for L1-010-106-FSGS-014-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.714	1.27E-01	3.92E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-014-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/4/2019 9:16:48AM  
 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	583.32	1.20825E-02	27.54		
F 6	911.00	1.21821E-02	26.29	Tol.	AC-228 PA-228

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	2.99E+00	7.42E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	-2.95E-02	6.29E-02	7.11E-02
		1332.49	100.00	5.68E-02		6.29E-02
+	KR-85	513.99	0.43	7.92E+00	1.13E+01	1.13E+01
+	Y-88	898.04	93.70	-2.35E-02	5.30E-02	5.30E-02
		1836.06	99.20	3.07E-04		5.35E-02
+	NB-94	702.63	100.00	-2.17E-03	4.56E-02	4.56E-02
		871.10	100.00	-4.64E-02		4.80E-02
+	I-131	284.30	6.06	-1.25E+00	8.13E-02	1.00E+00
		364.48	81.20	-6.54E-03		8.13E-02
		636.97	7.27	-4.88E-01		1.11E+00
+	CS-134	604.70	97.60	-2.88E-02	6.44E-02	6.44E-02
		795.84	85.40	3.53E-02		6.48E-02



## Analysis Report for L1-010-106-FSGS-014-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	CS-137	661.65	85.12	2.13E-02	6.28E-02	6.28E-02
+	CE-144	80.12	1.36	-9.22E-01	3.24E-01	4.00E+00
		133.51	11.09	9.57E-02		3.24E-01
+	EU-152	121.78	28.40	6.02E-02	1.31E-01	1.31E-01
		344.28	26.60	4.55E-02		1.58E-01
		1408.00	20.74	1.58E-01		2.27E-01
+	EU-154	123.07	40.40	1.62E-02	9.15E-02	9.15E-02
		723.30	19.70	1.56E-01		2.64E-01
		1274.51	35.50	1.18E-01		2.11E-01
+	EU-155	86.54	32.80	-1.64E-01	1.38E-01	1.38E-01
		105.31	21.80	6.14E-02		1.73E-01
+	BI-214	609.31	* 46.30	1.79E-01	8.79E-02	8.79E-02
		1120.29	15.10	2.16E-01		4.51E-01
		1238.11	5.94	9.63E-01		1.36E+00
		1377.67	4.11	0.00E+00		1.31E+00
		1407.98	2.48	1.32E+00		1.89E+00
		1509.19	2.19	-2.26E-01		2.20E+00
		1764.49	15.80	3.04E-01		3.91E-01
+	PB-214	77.11	10.70	4.66E-01	1.00E-01	5.44E-01
		295.21	* 19.20	1.35E-01		1.42E-01
		351.92	* 37.20	1.20E-01		1.00E-01
+	PA-228	89.95	22.00	3.79E+01	2.10E+01	3.62E+01
		93.35	35.00	4.85E+00		2.10E+01
		105.00	16.30	1.86E+01		4.05E+01
		129.22	2.97	-2.68E+02		2.06E+02
		338.32	5.30	2.52E+01		1.28E+02
		463.00	13.80	1.46E+01		4.69E+01
		911.23	16.70	2.10E+01		6.72E+01
+	AM-241	59.54	36.30	-6.59E-04	2.59E-01	2.59E-01
+	CM-243	103.76	23.00	7.66E-02	1.63E-01	1.63E-01
		228.18	10.60	2.43E-02		3.28E-01
		277.60	14.00	1.25E-01		2.82E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FJGS-015-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FJGS-015-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.456E+02 grams  
Facility : Dairylead\_NPP

Sample Taken On : 8/28/2019 1:31:00PM  
Acquisition Started : 9/4/2019 9:55:50AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.9 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 : 7399

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 10:26:01AM

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

Analysis Report for L1-010-106-FJGS-015-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.36	147 -	161	153.27	2.70E+02	60.45	1.14E+03	4.10
F	2	186.01	366 -	378	372.52	7.03E+01	30.74	6.90E+02	1.19
F	3	238.51	473 -	485	477.49	3.00E+02	43.89	5.22E+02	1.51
F	4	295.00	585 -	596	590.45	1.22E+02	31.53	2.99E+02	1.85
F	5	338.03	672 -	681	676.50	5.27E+01	22.19	1.74E+02	1.49
F	6	351.80	699 -	710	704.04	1.95E+02	32.85	2.19E+02	1.44
F	7	511.00	1017 -	1030	1022.38	7.36E+01	23.21	1.36E+02	2.39
F	8	583.10	1160 -	1171	1166.54	7.25E+01	22.01	1.44E+02	1.46
F	9	609.08	1213 -	1225	1218.49	1.59E+02	28.70	1.23E+02	1.73
F	10	911.10	1816 -	1828	1822.45	5.07E+01	18.55	1.22E+02	1.34
F	11	932.56	1861 -	1870	1865.35	2.28E+01	12.92	5.04E+01	1.34
F	12	968.81	1933 -	1942	1937.83	2.67E+01	15.14	7.13E+01	1.59
F	13	1120.28	2235 -	2245	2240.73	3.61E+01	16.81	7.15E+01	1.90
F	14	1460.41	2911 -	2929	2920.93	9.16E+02	61.90	3.31E+01	2.53
F	15	1592.59	3181 -	3190	3185.26	1.55E+01	8.54	5.00E+00	1.88

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 10:26:01AM

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	76.36	2.70E+02	60.45			2.70E+02	6.05E+01
F	2	186.01	7.03E+01	30.74			7.03E+01	3.07E+01
F	3	238.51	3.00E+02	43.89			3.00E+02	4.39E+01
F	4	295.00	1.22E+02	31.53			1.22E+02	3.15E+01
F	5	338.03	5.27E+01	22.19			5.27E+01	2.22E+01
F	6	351.80	1.95E+02	32.85	4.18E+01	1.86E+01	1.53E+02	3.78E+01
F	7	511.00	7.36E+01	23.21	3.64E+01	1.43E+01	3.72E+01	2.72E+01
F	8	583.10	7.25E+01	22.01			7.25E+01	2.20E+01
F	9	609.08	1.59E+02	28.70	2.06E+01	1.21E+01	1.38E+02	3.12E+01
F	10	911.10	5.07E+01	18.55			5.07E+01	1.86E+01
F	11	932.56	2.28E+01	12.92			2.28E+01	1.29E+01
F	12	968.81	2.67E+01	15.14			2.67E+01	1.51E+01
F	13	1120.28	3.61E+01	16.81			3.61E+01	1.68E+01
F	14	1460.41	9.16E+02	61.90	2.82E+01	8.57E+00	8.88E+02	6.25E+01

Analysis Report for L1-010-106-FJGS-015-SS

L1-010-106

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F 15	1592.59	1.55E+01	8.54			1.55E+01	8.54E+00

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

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	2.29E+01	2.05E+00
PB-212	0.97	77.11 *	17.50	9.16E-01	2.13E-01
		238.63 *	44.60	3.66E-01	5.68E-02
BI-214	0.58	609.31 *	46.30	3.76E-01	8.74E-02
		1120.29 *	15.10	5.22E-01	2.44E-01
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	0.98	77.11 *	10.70	1.50E+00	3.48E-01
		295.21 *	19.20	4.13E-01	1.09E-01
		351.92 *	37.20	3.13E-01	7.86E-02
RA-226	0.99	186.21 *	3.28	9.81E-01	4.32E-01
AC-228	0.61	209.28	4.40		
		338.32 *	11.40	3.39E-01	1.44E-01
		794.70	4.60		
		911.60 *	27.70	3.32E-01	1.23E-01
		964.60	5.20		
		969.11 *	16.60	3.09E-01	1.76E-01

Analysis Report for L1-010-106-FJGS-015-SS  
L1-010-106

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.982	2.29E+01	2.05E+00	
PB-212	0.973	3.88E-01	5.49E-02	
BI-214	0.581	3.92E-01	8.23E-02	
PB-214	0.982	3.64E-01	6.27E-02	
RA-226	0.993	9.81E-01	4.32E-01	
AC-228	0.612	3.29E-01	8.23E-02	

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FJGS-015-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/4/2019 10:26:01AM

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	511.00	2.06796E-02	36.58		
F 8	583.10	4.02721E-02	15.18		
F 11	932.56	1.26929E-02	28.27		
F 15	1592.59	8.58626E-03	27.62		

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M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	* 10.67	2.29E+01	9.26E-01	9.26E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	1.44E-01	1.09E-01	1.52E-01
		1332.49	100.00	2.24E-02		1.09E-01
+	KR-85	513.99	0.43	4.95E+00	1.85E+01	1.85E+01
+	Y-88	898.04	93.70	-6.19E-02	4.94E-02	9.90E-02
		1836.06	99.20	-9.38E-02		4.94E-02
+	NB-94	702.63	100.00	-4.48E-03	8.44E-02	8.44E-02
		871.10	100.00	-2.47E-03		9.58E-02
+	I-131	284.30	6.06	-2.59E-01	1.32E-01	1.72E+00
		364.48	81.20	-2.54E-02		1.32E-01
		636.97	7.27	1.61E+00		1.92E+00
+	CS-134	604.70	97.60	-5.36E-02	1.05E-01	1.08E-01
		795.84	85.40	-8.72E-02		1.05E-01

## Analysis Report for L1-010-106-FJGS-015-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	CS-137	661.65	85.12	1.15E-01	9.90E-02	9.90E-02
+	CE-144	80.12	1.36	-3.40E+00	5.01E-01	6.49E+00
		133.51	11.09	2.94E-02		5.01E-01
+	EU-152	121.78	28.40	-1.84E-01	1.89E-01	1.89E-01
		344.28	26.60	-1.10E-01		2.45E-01
		1408.00	20.74	8.68E-02		4.08E-01
+	EU-154	123.07	40.40	-5.83E-02	1.34E-01	1.34E-01
		723.30	19.70	1.07E-01		4.53E-01
		1274.51	35.50	2.11E-01		3.77E-01
+	EU-155	86.54	32.80	-1.06E-01	2.16E-01	2.16E-01
		105.31	21.80	2.08E-02		2.71E-01
+	BI-214	609.31	* 46.30	3.76E-01	1.40E-01	1.40E-01
		1120.29	* 15.10	5.22E-01		4.78E-01
		1238.11	5.94	-6.92E-01		2.57E+00
		1377.67	4.11	1.96E+00		2.47E+00
		1407.98	2.48	7.25E-01		3.41E+00
		1509.19	2.19	1.78E+00		3.29E+00
		1764.49	15.80	5.14E-01		5.75E-01
+	PB-214	77.11	* 10.70	1.50E+00	1.41E-01	7.56E-01
		295.21	* 19.20	4.13E-01		2.25E-01
		351.92	* 37.20	3.13E-01		1.41E-01
+	PA-228	89.95	22.00	2.83E+01	3.28E+01	5.55E+01
		93.35	35.00	-2.12E+01		3.28E+01
		105.00	16.30	4.82E+01		6.56E+01
		129.22	2.97	4.29E+02		3.35E+02
		338.32	5.30	2.35E+01		2.12E+02
		463.00	13.80	3.99E+01		9.03E+01
		911.23	16.70	1.28E+02		1.28E+02
+	AM-241	59.54	36.30	-1.30E-01	3.83E-01	3.83E-01
+	CM-243	103.76	23.00	2.43E-02	2.58E-01	2.58E-01
		228.18	10.60	-3.19E-01		4.95E-01
		277.60	14.00	-5.52E-02		4.20E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FJGS-016-SS  
L1-010-106

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## **GAMMA SPECTRUM ANALYSIS**

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Sample Identification : L1-010-106-FJGS-016-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.261E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 1:08:00PM  
Acquisition Started : 9/4/2019 10:27:10AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1806.1 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 : 7400

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## **PEAK ANALYSIS REPORT**

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Peak Analysis Performed on : 9/4/2019 10:57:20AM

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



Analysis Report for L1-010-106-FJGS-016-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.76	142 -	161	150.06	3.42E+02	54.86	1.34E+03	1.23
m	2	76.98	142 -	161	154.51	5.83E+02	64.33	1.41E+03	1.23
M	3	87.20	172 -	191	174.95	2.40E+02	54.29	1.31E+03	1.37
m	4	92.88	172 -	191	186.31	2.54E+02	53.65	1.27E+03	1.38
F	5	128.91	252 -	263	258.35	1.10E+02	44.40	1.61E+03	1.04
F	6	185.94	366 -	380	372.37	2.46E+02	51.30	1.49E+03	1.52
F	7	209.05	413 -	422	418.58	1.21E+02	43.48	9.58E+02	1.41
M	8	238.51	469 -	491	477.49	1.47E+03	83.68	6.72E+02	1.52
m	9	241.70	469 -	491	483.87	3.57E+02	47.50	6.18E+02	1.52
M	10	270.15	534 -	558	540.76	1.21E+02	36.04	5.87E+02	1.60
m	11	277.23	534 -	558	554.92	7.24E+01	30.58	4.36E+02	1.61
M	12	295.09	583 -	606	590.63	4.91E+02	52.23	3.71E+02	1.43
m	13	300.17	583 -	606	600.79	7.84E+01	28.18	4.41E+02	1.44
M	14	327.88	651 -	685	656.21	7.05E+01	27.85	4.27E+02	1.51
m	15	338.27	651 -	685	676.98	2.41E+02	39.30	3.55E+02	1.52
F	16	351.82	695 -	710	704.07	9.36E+02	66.71	4.77E+02	1.58
F	17	409.07	815 -	822	818.54	4.39E+01	21.71	2.05E+02	1.07
F	18	462.95	921 -	930	926.28	7.92E+01	26.26	2.50E+02	1.42
F	19	510.37	1016 -	1029	1021.11	1.19E+02	29.00	2.63E+02	1.79
F	20	583.02	1159 -	1172	1166.39	4.13E+02	45.20	1.96E+02	1.61
M	21	609.15	1211 -	1241	1218.64	6.91E+02	55.93	1.32E+02	1.62
m	22	618.34	1211 -	1241	1237.01	1.73E+01	14.38	1.01E+02	1.63
F	23	727.01	1450 -	1461	1454.32	9.77E+01	23.90	1.19E+02	1.63
F	24	768.39	1531 -	1541	1537.06	2.96E+01	17.51	1.77E+02	1.05
F	25	794.82	1586 -	1595	1589.92	3.56E+01	16.63	9.00E+01	1.38
F	26	860.60	1716 -	1727	1721.45	5.10E+01	19.87	1.15E+02	1.80
F	27	911.04	1814 -	1829	1822.31	2.68E+02	35.37	1.16E+02	2.01
F	28	934.06	1863 -	1873	1868.35	3.10E+01	16.13	7.13E+01	1.98
M	29	964.68	1924 -	1944	1929.59	2.91E+01	16.70	1.29E+02	1.87
m	30	968.55	1924 -	1944	1937.33	1.18E+02	26.12	1.21E+02	1.87
F	31	1120.06	2233 -	2249	2240.30	1.22E+02	25.72	1.08E+02	2.16
F	32	1237.58	2467 -	2480	2475.31	4.12E+01	17.90	8.75E+01	2.17
F	33	1460.43	2912 -	2929	2920.98	3.35E+02	37.83	5.39E+01	2.32
F	34	1764.04	3521 -	3534	3528.15	8.81E+01	20.07	2.08E+01	2.30

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 10:57:20AM

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

Analysis Report for L1-010-106-FJGS-016-SS

L1-010-106

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
M	1	74.76	3.42E+02	54.86			3.42E+02	5.49E+01
m	2	76.98	5.83E+02	64.33			5.83E+02	6.43E+01
M	3	87.20	2.40E+02	54.29			2.40E+02	5.43E+01
m	4	92.88	2.54E+02	53.65			2.54E+02	5.37E+01
F	5	128.91	1.10E+02	44.40			1.10E+02	4.44E+01
F	6	185.94	2.46E+02	51.30			2.46E+02	5.13E+01
F	7	209.05	1.21E+02	43.48			1.21E+02	4.35E+01
M	8	238.51	1.47E+03	83.68			1.47E+03	8.37E+01
m	9	241.70	3.57E+02	47.50			3.57E+02	4.75E+01
M	10	270.15	1.21E+02	36.04			1.21E+02	3.60E+01
m	11	277.23	7.24E+01	30.58			7.24E+01	3.06E+01
M	12	295.09	4.91E+02	52.23			4.91E+02	5.22E+01
m	13	300.17	7.84E+01	28.18			7.84E+01	2.82E+01
M	14	327.88	7.05E+01	27.85			7.05E+01	2.79E+01
m	15	338.27	2.41E+02	39.30			2.41E+02	3.93E+01
F	16	351.82	9.36E+02	66.71	4.18E+01	1.86E+01	8.94E+02	6.93E+01
F	17	409.07	4.39E+01	21.71			4.39E+01	2.17E+01
F	18	462.95	7.92E+01	26.26			7.92E+01	2.63E+01
F	19	510.37	1.19E+02	29.00	3.64E+01	1.43E+01	8.31E+01	3.23E+01
F	20	583.02	4.13E+02	45.20			4.13E+02	4.52E+01
M	21	609.15	6.91E+02	55.93	2.06E+01	1.21E+01	6.71E+02	5.72E+01
m	22	618.34	1.73E+01	14.38			1.73E+01	1.44E+01
F	23	727.01	9.77E+01	23.90			9.77E+01	2.39E+01
F	24	768.39	2.96E+01	17.51			2.96E+01	1.75E+01
F	25	794.82	3.56E+01	16.63			3.56E+01	1.66E+01
F	26	860.60	5.10E+01	19.87			5.10E+01	1.99E+01
F	27	911.04	2.68E+02	35.37			2.68E+02	3.54E+01
F	28	934.06	3.10E+01	16.13			3.10E+01	1.61E+01
M	29	964.68	2.91E+01	16.70			2.91E+01	1.67E+01
m	30	968.55	1.18E+02	26.12			1.18E+02	2.61E+01
F	31	1120.06	1.22E+02	25.72			1.22E+02	2.57E+01
F	32	1237.58	4.12E+01	17.90			4.12E+01	1.79E+01
F	33	1460.43	3.35E+02	37.83	2.82E+01	8.57E+00	3.07E+02	3.88E+01
F	34	1764.04	8.81E+01	20.07	7.59E+00	4.90E+00	8.06E+01	2.07E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FJGS-016-SS

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *		10.67	7.22E+00	9.97E-01
BI-212	0.60	727.17 *		11.80	1.12E+00	2.80E-01
		785.42		2.00		
		1620.56		2.75		
PB-212	0.99	77.11 *		17.50	1.78E+00	2.27E-01
		238.63 *		44.60	1.64E+00	1.26E-01
BI-214	0.86	609.31 *		46.30	1.67E+00	1.70E-01
		1120.29 *		15.10	1.62E+00	3.48E-01
		1238.11 *		5.94	1.51E+00	6.60E-01
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49 *		15.80	1.50E+00	3.96E-01
PB-214	0.99	77.11 *		10.70	2.91E+00	3.72E-01
		295.21 *		19.20	1.52E+00	1.77E-01
		351.92 *		37.20	1.67E+00	1.53E-01
RA-226	0.98	186.21 *		3.28	3.14E+00	6.75E-01
AC-228	0.96	209.28 *		4.40	1.24E+00	4.50E-01
		338.32 *		11.40	1.42E+00	2.41E-01
		794.70 *		4.60	1.13E+00	5.33E-01
		911.60 *		27.70	1.61E+00	2.23E-01
		964.60 *		5.20	9.77E-01	5.62E-01
		969.11 *		16.60	1.24E+00	2.81E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

Analysis Report for L1-010-106-FJGS-016-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.984	7.22E+00	9.97E-01	
BI-212	0.603	1.12E+00	2.80E-01	
PB-212	0.998	1.45E+00	1.11E-01	
BI-214	0.865	1.63E+00	1.39E-01	
PB-214	0.998	1.51E+00	1.12E-01	
RA-226	0.988	3.14E+00	6.75E-01	
AC-228	0.968	1.39E+00	1.27E-01	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FJGS-016-SS

L1-010-106

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 UNIDENTIFIED PEAKS
 

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Peak Locate Performed on : 9/4/2019 10:57:20AM  
 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	74.76	1.89855E-01	8.03		
M 3	87.20	1.33368E-01	11.31	Tol.	EU-155
m 4	92.88	1.41295E-01	10.55		
F 5	128.91	6.13834E-02	20.09		
m 9	241.70	1.98570E-01	6.64		
M 10	270.15	6.73323E-02	14.87		
m 11	277.23	4.02349E-02	21.11		
m 13	300.17	4.35754E-02	17.96		
M 14	327.88	3.91616E-02	19.76		
F 17	409.07	2.44076E-02	24.70		
F 18	462.95	4.39756E-02	16.59	Tol.	SB-125
F 19	510.37	4.61700E-02	19.44		
F 20	583.02	2.29320E-01	5.47		
m 22	618.34	9.63699E-03	41.46		
F 24	768.39	1.64323E-02	29.61		
F 26	860.60	2.83407E-02	19.47		
F 28	934.06	1.72473E-02	25.98		

Analysis Report for L1-010-106-FJGS-016-SS

L1-010-106

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

## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	7.22E+00	9.60E-01	9.60E-01
+	@ AR-41	1293.64		99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22		100.00	4.51E-02	1.08E-01	1.13E-01
		1332.49		100.00	3.62E-02		1.08E-01
+	KR-85	513.99		0.43	2.97E+01	2.18E+01	2.18E+01
+	Y-88	898.04		93.70	-5.28E-02	8.89E-02	1.02E-01
		1836.06		99.20	-1.05E-01		8.89E-02
+	NB-94	702.63		100.00	-2.93E-02	9.01E-02	9.35E-02
		871.10		100.00	8.44E-03		9.01E-02
+	I-131	284.30		6.06	-9.20E-01	1.62E-01	2.27E+00
		364.48		81.20	8.45E-03		1.62E-01
		636.97		7.27	4.70E-01		2.14E+00
+	CS-134	604.70		97.60	3.59E-03	1.19E-01	1.70E-01
		795.84		85.40	-1.07E-01		1.19E-01
+	CS-137	661.65		85.12	1.22E-01	1.09E-01	1.09E-01
+	CE-144	80.12		1.36	-6.87E+00	6.86E-01	9.23E+00
		133.51		11.09	4.04E-01		6.86E-01
+	EU-152	121.78		28.40	-1.53E-01	2.48E-01	2.48E-01
		344.28		26.60	-9.14E-02		3.56E-01
		1408.00		20.74	-5.58E-02		5.30E-01
+	EU-154	123.07		40.40	-7.94E-02	1.78E-01	1.78E-01
		723.30		19.70	5.45E-01		5.58E-01
		1274.51		35.50	3.07E-01		3.13E-01
+	EU-155	86.54		32.80	-2.54E-01	3.04E-01	3.04E-01
		105.31		21.80	-4.38E-02		3.47E-01
+	BI-214	609.31	*	46.30	1.67E+00	1.19E-01	1.19E-01
		1120.29	*	15.10	1.62E+00		6.00E-01
		1238.11	*	5.94	1.51E+00		1.42E+00
		1377.67		4.11	8.70E-01		2.62E+00
		1407.98		2.48	-4.66E-01		4.42E+00
		1509.19		2.19	-2.59E+00		4.67E+00
		1764.49	*	15.80	1.50E+00		4.48E-01
+	PB-214	77.11	*	10.70	2.91E+00	1.84E-01	6.30E-01

## Analysis Report for L1-010-106-FJGS-016-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
	PB-214	295.21	*	19.20	1.52E+00	1.84E-01	2.04E-01
		351.92	*	37.20	1.67E+00		1.84E-01
+	PA-228	89.95		22.00	-2.93E+01	4.75E+01	8.33E+01
		93.35		35.00	-1.78E+01		4.75E+01
		105.00		16.30	-1.13E+01		8.53E+01
		129.22		2.97	1.50E+02		4.55E+02
		338.32		5.30	-1.55E+00		3.08E+02
		463.00		13.80	8.95E+01		1.19E+02
		911.23		16.70	5.23E+02		1.76E+02
+	AM-241	59.54		36.30	7.46E-02	4.94E-01	4.94E-01
+	CM-243	103.76		23.00	6.84E-02	3.30E-01	3.30E-01
		228.18		10.60	-2.96E-01		6.61E-01
		277.60		14.00	-1.28E-01		5.71E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FJGS-017-SS  
L1-010-106

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## **GAMMA SPECTRUM ANALYSIS**

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Sample Identification : L1-010-106-FJGS-017-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.071E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 2:31:00PM  
Acquisition Started : 9/4/2019 10:59:14AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1806.5 seconds

Dead Time : 0.36 %

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 : 7401

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## **PEAK ANALYSIS REPORT**

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Peak Analysis Performed on : 9/4/2019 11:29:28AM

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



## Analysis Report for L1-010-106-FJGS-017-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.66	142 -	161	149.88	4.47E+02	62.62	1.86E+03	1.41
m	2	76.97	142 -	161	154.49	7.37E+02	72.78	1.57E+03	1.42
M	3	87.13	170 -	192	174.80	2.92E+02	57.77	1.63E+03	1.36
m	4	89.71	170 -	192	179.97	1.34E+02	47.06	1.67E+03	1.37
m	5	92.76	170 -	192	186.05	2.68E+02	53.74	1.51E+03	1.37
F	6	185.94	367 -	378	372.39	4.39E+02	62.18	1.56E+03	1.45
M	7	238.55	471 -	489	477.58	8.70E+02	69.76	8.12E+02	1.45
m	8	241.79	471 -	489	484.06	5.10E+02	56.38	8.27E+02	1.45
M	9	295.07	586 -	604	590.59	1.02E+03	71.71	5.14E+02	1.49
m	10	299.96	586 -	604	600.38	6.53E+01	28.13	4.77E+02	1.49
M	11	327.90	651 -	685	656.25	7.19E+01	27.49	4.06E+02	1.48
m	12	338.23	651 -	685	676.90	2.02E+02	37.67	3.88E+02	1.49
F	13	351.79	696 -	709	704.00	1.67E+03	86.90	5.65E+02	1.46
F	14	510.59	1014 -	1029	1021.55	9.52E+01	27.33	3.43E+02	1.57
F	15	583.03	1157 -	1172	1166.41	2.41E+02	35.85	2.74E+02	1.71
F	16	609.16	1213 -	1225	1218.65	1.26E+03	74.81	2.15E+02	1.72
F	17	768.09	1527 -	1544	1536.47	1.39E+02	28.12	1.48E+02	2.56
F	18	785.74	1565 -	1575	1571.76	3.70E+01	17.78	1.21E+02	1.35
F	19	910.86	1813 -	1828	1821.96	1.82E+02	30.35	1.20E+02	2.19
F	20	933.83	1862 -	1872	1867.90	4.53E+01	19.27	1.37E+02	1.40
F	21	968.82	1933 -	1944	1937.86	6.33E+01	21.44	1.59E+02	1.39
F	22	1120.05	2232 -	2247	2240.28	2.61E+02	35.33	1.28E+02	2.21
F	23	1237.74	2469 -	2485	2475.65	1.04E+02	24.37	1.04E+02	2.61
F	24	1377.47	2750 -	2763	2755.07	4.58E+01	17.21	5.81E+01	2.31
F	25	1460.60	2916 -	2931	2921.32	3.68E+02	39.59	5.61E+01	2.38
F	26	1764.16	3520 -	3536	3528.40	2.09E+02	28.99	4.17E+00	2.83

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 11:29:28AM

Env. Background File : C:\Canberra\Apex\Roof\Dauryland\_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	74.66	4.47E+02	62.62			4.47E+02	6.26E+01
m	2	76.97	7.37E+02	72.78			7.37E+02	7.28E+01
M	3	87.13	2.92E+02	57.77			2.92E+02	5.78E+01

Analysis Report for L1-010-106-FJGS-017-SS

L1-010-106

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	4	89.71	1.34E+02	47.06			1.34E+02	4.71E+01
m	5	92.76	2.68E+02	53.74			2.68E+02	5.37E+01
F	6	185.94	4.39E+02	62.18			4.39E+02	6.22E+01
M	7	238.55	8.70E+02	69.76			8.70E+02	6.98E+01
m	8	241.79	5.10E+02	56.38			5.10E+02	5.64E+01
M	9	295.07	1.02E+03	71.71			1.02E+03	7.17E+01
m	10	299.96	6.53E+01	28.13			6.53E+01	2.81E+01
M	11	327.90	7.19E+01	27.49			7.19E+01	2.75E+01
m	12	338.23	2.02E+02	37.67			2.02E+02	3.77E+01
F	13	351.79	1.67E+03	86.90	4.18E+01	1.86E+01	1.63E+03	8.89E+01
F	14	510.59	9.52E+01	27.33	3.64E+01	1.43E+01	5.88E+01	3.08E+01
F	15	583.03	2.41E+02	35.85			2.41E+02	3.59E+01
F	16	609.16	1.26E+03	74.81	2.06E+01	1.21E+01	1.24E+03	7.58E+01
F	17	768.09	1.39E+02	28.12			1.39E+02	2.81E+01
F	18	785.74	3.70E+01	17.78			3.70E+01	1.78E+01
F	19	910.86	1.82E+02	30.35			1.82E+02	3.03E+01
F	20	933.83	4.53E+01	19.27			4.53E+01	1.93E+01
F	21	968.82	6.33E+01	21.44			6.33E+01	2.14E+01
F	22	1120.05	2.61E+02	35.33			2.61E+02	3.53E+01
F	23	1237.74	1.04E+02	24.37			1.04E+02	2.44E+01
F	24	1377.47	4.58E+01	17.21			4.58E+01	1.72E+01
F	25	1460.60	3.68E+02	39.59	2.82E+01	8.57E+00	3.40E+02	4.05E+01
F	26	1764.16	2.09E+02	28.99	7.59E+00	4.90E+00	2.01E+02	2.94E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.75 *	10.67	9.19E+00	1.21E+00
PB-212	0.99	77.11 *	17.50	2.58E+00	3.05E-01
		238.63 *	44.60	1.11E+00	1.06E-01
BI-214	0.92	609.31 *	46.30	3.54E+00	2.93E-01
		1120.29 *	15.10	3.95E+00	5.66E-01
		1238.11 *	5.94	4.37E+00	1.05E+00

Analysis Report for L1-010-106-FJGS-017-SS  
L1-010-106

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BI-214	0.92	1377.67 *		4.11	3.06E+00	1.16E+00
		1407.98		2.48		
		1509.19		2.19		
PB-214	0.99	1764.49 *		15.80	4.29E+00	6.84E-01
		77.11 *		10.70	4.22E+00	4.98E-01
		295.21 *		19.20	3.61E+00	3.09E-01
		351.92 *		37.20	3.48E+00	2.55E-01
RA-226	0.98	186.21 *		3.28	6.41E+00	9.74E-01
AC-228	0.59	209.28		4.40		
		338.32 *		11.40	1.36E+00	2.62E-01
		794.70		4.60		
		911.60 *		27.70	1.25E+00	2.15E-01
PA-228	0.37	964.60		5.20		
		969.11 *		16.60	7.66E-01	2.62E-01
		89.95 *		22.00	5.48E+01	3.80E+01
		93.35 *		35.00	6.64E+01	4.11E+01
		105.00		16.30		
		129.22		2.97		
		338.32 *		5.30	5.26E+02	2.79E+02
		463.00		13.80		
		911.23 *		16.70	3.73E+02	1.92E+02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.997	9.19E+00	1.21E+00	
PB-212	0.999	1.05E+00	1.01E-01	
BI-214	0.927	3.72E+00	2.32E-01	
PB-214	0.997	3.40E+00	1.84E-01	
RA-226	0.989	6.41E+00	9.74E-01	
AC-228	0.595	1.01E+00	1.43E-01	

Analysis Report for L1-010-106-FJGS-017-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PA-228	0.377	6.37E+01	3.20E+01	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FJGS-017-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/4/2019 11:29:28AM  
 Peak Locate From Channel : 100  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
M 1	74.66	2.48057E-01	7.01		
M 3	87.13	1.62256E-01	9.89		
m 8	241.79	2.83438E-01	5.53		
m 10	299.96	3.62639E-02	21.55		
M 11	327.90	3.99603E-02	19.11	Sum	
F 14	510.59	3.26839E-02	26.20		
F 15	583.03	1.33665E-01	7.45		
F 17	768.09	7.71575E-02	10.12		
F 18	785.74	2.05478E-02	24.03		
F 20	933.83	2.51904E-02	21.25		

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

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## NUCLIDE MDA REPORT

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

## Analysis Report for L1-010-106-FJGS-017-SS

## L1-010-106

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	9.19E+00	1.10E+00	1.10E+00
+	@ AR-41	1293.64		99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22		100.00	8.95E-02	1.28E-01	1.44E-01
		1332.49		100.00	-4.59E-03		1.28E-01
+	KR-85	513.99		0.43	9.86E-01	2.52E+01	2.52E+01
+	Y-88	898.04		93.70	-8.48E-02	1.25E-01	1.30E-01
		1836.06		99.20	-7.16E-02		1.25E-01
+	NB-94	702.63		100.00	3.27E-02	1.11E-01	1.11E-01
		871.10		100.00	-4.73E-02		1.19E-01
+	I-131	284.30		6.06	1.54E+00	2.00E-01	2.78E+00
		364.48		81.20	4.21E-03		2.00E-01
		636.97		7.27	4.62E-01		2.62E+00
+	CS-134	604.70		97.60	-2.82E-01	1.39E-01	2.50E-01
		795.84		85.40	-3.05E-01		1.39E-01
+	CS-137	661.65		85.12	6.72E-02	1.39E-01	1.39E-01
+	CE-144	80.12		1.36	-2.50E+00	8.03E-01	1.14E+01
		133.51		11.09	-7.11E-02		8.03E-01
+	EU-152	121.78		28.40	-2.07E-01	3.05E-01	3.05E-01
		344.28		26.60	-7.08E-03		4.36E-01
		1408.00		20.74	1.18E+00		7.94E-01
+	EU-154	123.07		40.40	7.80E-02	2.16E-01	2.16E-01
		723.30		19.70	4.89E-01		6.50E-01
		1274.51		35.50	-1.22E-01		3.95E-01
+	EU-155	86.54		32.80	-9.24E-02	3.70E-01	3.70E-01
		105.31		21.80	-3.20E-01		4.08E-01
+	BI-214	609.31	*	46.30	3.54E+00	1.81E-01	1.81E-01
		1120.29	*	15.10	3.95E+00		7.31E-01
		1238.11	*	5.94	4.37E+00		1.88E+00
		1377.67	*	4.11	3.06E+00		2.16E+00
		1407.98		2.48	9.85E+00		6.63E+00
		1509.19		2.19	2.19E+00		6.72E+00
		1764.49	*	15.80	4.29E+00		3.72E-01
+	PB-214	77.11	*	10.70	4.22E+00	2.19E-01	7.61E-01
		295.21	*	19.20	3.61E+00		2.74E-01
		351.92	*	37.20	3.48E+00		2.19E-01
+	PA-228	89.95	*	22.00	5.48E+01	3.24E+01	5.58E+01
		93.35	*	35.00	6.64E+01		3.24E+01
		105.00		16.30	-5.41E+01		9.80E+01
		129.22		2.97	1.49E+02		5.26E+02
		338.32	*	5.30	5.26E+02		1.76E+02
		463.00		13.80	1.40E+02		1.31E+02
		911.23	*	16.70	3.73E+02		9.56E+01
+	AM-241	59.54		36.30	1.69E-01	6.17E-01	6.17E-01
+	CM-243	103.76		23.00	-9.45E-02	3.88E-01	3.88E-01
		228.18		10.60	-2.64E-01		8.36E-01
		277.60		14.00	-3.60E-01		6.74E-01

Analysis Report for L1-010-106-FJGS-017-SS

L1-010-106

- 
- + = 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 L1-010-106-FJGS-018-SS

L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FJGS-018-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.807E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 2:51:00PM  
Acquisition Started : 9/4/2019 12:35:21PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1806.2 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 : 7403

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 1:05:33PM

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



Analysis Report for L1-010-106-FJGS-018-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.69	146 -	192	149.92	3.56E+02	57.39	1.33E+03	1.35
m	2	77.02	146 -	192	154.58	6.02E+02	67.58	1.40E+03	1.36
m	3	83.59	146 -	192	167.72	1.50E+02	54.74	1.23E+03	1.37
m	4	87.07	146 -	192	174.69	2.94E+02	58.26	1.15E+03	1.38
m	5	89.91	146 -	192	180.37	1.39E+02	39.53	1.08E+03	1.38
m	6	92.55	146 -	192	185.64	2.78E+02	49.13	1.01E+03	1.39
F	7	185.95	367 -	379	372.40	3.29E+02	57.27	1.46E+03	1.51
M	8	238.58	471 -	488	477.64	7.02E+02	62.97	6.42E+02	1.45
m	9	241.91	471 -	488	484.29	3.96E+02	50.20	6.73E+02	1.45
F	10	269.98	533 -	545	540.43	7.88E+01	37.27	7.64E+02	1.67
M	11	295.14	582 -	604	590.73	7.95E+02	63.61	4.09E+02	1.38
m	12	300.10	582 -	604	600.66	5.74E+01	26.25	3.94E+02	1.38
F	13	338.12	672 -	682	676.68	1.21E+02	33.35	4.41E+02	1.46
F	14	351.82	699 -	712	704.06	1.31E+03	77.66	5.32E+02	1.46
F	15	583.02	1157 -	1174	1166.38	2.00E+02	33.35	2.61E+02	1.87
F	16	609.14	1209 -	1227	1218.62	9.78E+02	65.77	2.47E+02	1.72
F	17	727.04	1451 -	1460	1454.38	3.74E+01	17.37	9.38E+01	1.48
F	18	767.92	1529 -	1542	1536.13	7.64E+01	23.26	1.79E+02	1.63
F	19	785.40	1567 -	1575	1571.08	2.55E+01	15.25	8.95E+01	1.23
F	20	805.63	1607 -	1619	1611.53	3.98E+01	17.76	9.33E+01	1.95
F	21	910.87	1815 -	1828	1821.98	1.25E+02	26.80	1.26E+02	2.15
F	22	933.49	1858 -	1873	1867.22	4.55E+01	21.50	1.34E+02	2.87
F	23	968.83	1933 -	1944	1937.88	6.55E+01	21.82	1.21E+02	1.85
F	24	1119.99	2233 -	2246	2240.16	1.84E+02	30.65	9.81E+01	2.34
F	25	1155.39	2305 -	2315	2310.95	2.09E+01	13.01	7.41E+01	1.19
F	26	1237.68	2467 -	2481	2475.52	4.41E+01	19.50	1.23E+02	2.05
F	27	1377.48	2749 -	2761	2755.09	5.17E+01	16.98	4.19E+01	2.28
F	28	1460.57	2910 -	2930	2921.26	3.88E+02	40.33	5.14E+01	2.28
F	29	1729.27	3452 -	3464	3458.61	2.98E+01	11.97	6.50E+00	2.55
F	30	1764.24	3521 -	3535	3528.56	1.60E+02	26.04	1.87E+01	2.41
F	31	1846.89	3688 -	3700	3693.85	2.40E+01	10.54	6.50E+00	2.48

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 1:05:33PM

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

Analysis Report for L1-010-106-FJGS-018-SS

L1-010-106

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	74.69	3.56E+02	57.39			3.56E+02	5.74E+01
m	2	77.02	6.02E+02	67.58			6.02E+02	6.76E+01
m	3	83.59	1.50E+02	54.74			1.50E+02	5.47E+01
m	4	87.07	2.94E+02	58.26			2.94E+02	5.83E+01
m	5	89.91	1.39E+02	39.53			1.39E+02	3.95E+01
m	6	92.55	2.78E+02	49.13			2.78E+02	4.91E+01
F	7	185.95	3.29E+02	57.27			3.29E+02	5.73E+01
M	8	238.58	7.02E+02	62.97			7.02E+02	6.30E+01
m	9	241.91	3.96E+02	50.20			3.96E+02	5.02E+01
F	10	269.98	7.88E+01	37.27			7.88E+01	3.73E+01
M	11	295.14	7.95E+02	63.61			7.95E+02	6.36E+01
m	12	300.10	5.74E+01	26.25			5.74E+01	2.63E+01
F	13	338.12	1.21E+02	33.35			1.21E+02	3.34E+01
F	14	351.82	1.31E+03	77.66	4.18E+01	1.86E+01	1.26E+03	7.99E+01
F	15	583.02	2.00E+02	33.35			2.00E+02	3.34E+01
F	16	609.14	9.78E+02	65.77	2.06E+01	1.21E+01	9.57E+02	6.69E+01
F	17	727.04	3.74E+01	17.37			3.74E+01	1.74E+01
F	18	767.92	7.64E+01	23.26			7.64E+01	2.33E+01
F	19	785.40	2.55E+01	15.25			2.55E+01	1.52E+01
F	20	805.63	3.98E+01	17.76			3.98E+01	1.78E+01
F	21	910.87	1.25E+02	26.80			1.25E+02	2.68E+01
F	22	933.49	4.55E+01	21.50			4.55E+01	2.15E+01
F	23	968.83	6.55E+01	21.82			6.55E+01	2.18E+01
F	24	1119.99	1.84E+02	30.65			1.84E+02	3.06E+01
F	25	1155.39	2.09E+01	13.01			2.09E+01	1.30E+01
F	26	1237.68	4.41E+01	19.50			4.41E+01	1.95E+01
F	27	1377.48	5.17E+01	16.98			5.17E+01	1.70E+01
F	28	1460.57	3.88E+02	40.33	2.82E+01	8.57E+00	3.59E+02	4.12E+01
F	29	1729.27	2.98E+01	11.97			2.98E+01	1.20E+01
F	30	1764.24	1.60E+02	26.04	7.59E+00	4.90E+00	1.52E+02	2.65E+01
F	31	1846.89	2.40E+01	10.54			2.40E+01	1.05E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Analysis Report for L1-010-106-FJGS-018-SS

L1-010-106

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.75 *		10.67	8.89E+00	1.13E+00
EU-155	0.30	86.54 *		32.80	4.25E-01	9.05E-02
		105.31		21.80		
BI-212	0.80	727.17 *		11.80	4.51E-01	2.11E-01
		785.42 *		2.00	1.95E+00	1.17E+00
		1620.56		2.75		
PB-212	0.99	77.11 *		17.50	1.93E+00	2.50E-01
		238.63 *		44.60	8.23E-01	8.52E-02
BI-214	0.92	609.31 *		46.30	2.50E+00	2.24E-01
		1120.29 *		15.10	2.56E+00	4.42E-01
		1238.11 *		5.94	1.70E+00	7.56E-01
		1377.67 *		4.11	3.16E+00	1.05E+00
		1407.98		2.48		
		1509.19		2.19		
		1764.49 *		15.80	2.98E+00	5.52E-01
PB-214	0.99	77.11 *		10.70	3.15E+00	4.09E-01
		295.21 *		19.20	2.58E+00	2.42E-01
		351.92 *		37.20	2.48E+00	1.98E-01
RA-226	0.98	186.21 *		3.28	4.41E+00	8.04E-01
AC-228	0.59	209.28		4.40		
		338.32 *		11.40	7.47E-01	2.09E-01
		794.70		4.60		
		911.60 *		27.70	7.85E-01	1.72E-01
		964.60		5.20		
		969.11 *		16.60	7.27E-01	2.44E-01
PA-228	0.36	89.95 *		22.00	5.41E+01	3.59E+01
		93.35 *		35.00	6.59E+01	4.05E+01
		105.00		16.30		
		129.22		2.97		
		338.32 *		5.30	3.00E+02	1.71E+02
		463.00		13.80		
		911.23 *		16.70	2.43E+02	1.30E+02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Analysis Report for L1-010-106-FJGS-018-SS

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.995	8.89E+00	1.13E+00	
EU-155	0.304	4.25E-01	9.05E-02	
BI-212	0.801	4.98E-01	2.07E-01	
PB-212	0.999	7.82E-01	8.11E-02	
BI-214	0.926	2.54E+00	1.79E-01	
PB-214	0.999	2.44E+00	1.44E-01	
RA-226	0.989	4.41E+00	8.04E-01	
AC-228	0.596	6.22E-01	1.19E-01	
PA-228	0.366	6.09E+01	3.05E+01	

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FJGS-018-SS

L1-010-106

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/4/2019 1:05:33PM  
 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	74.69	1.97900E-01	8.05		
m 3	83.59	8.33615E-02	18.24		
m 9	241.91	2.20273E-01	6.33		
F 10	269.98	4.37646E-02	23.66		
m 12	300.10	3.18926E-02	22.87		
F 15	583.02	1.11154E-01	8.34		
F 18	767.92	4.24639E-02	15.22		
F 20	805.63	2.20998E-02	22.32		
F 22	933.49	2.52520E-02	23.65		
F 25	1155.39	1.16224E-02	31.10	Sum	
F 29	1729.27	1.65501E-02	20.09	Sum	
F 31	1846.89	1.33504E-02	21.94	Sum	

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

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**NUCLIDE MDA REPORT**


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

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
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## Analysis Report for L1-010-106-FJGS-018-SS

## L1-010-106

+	K-40	1460.75	*	10.67	8.89E+00	1.03E+00	1.03E+00
+	@ AR-41	1293.64		99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22		100.00	1.05E-01	1.12E-01	1.32E-01
		1332.49		100.00	-4.78E-02		1.12E-01
+	KR-85	513.99		0.43	3.55E+01	2.17E+01	2.17E+01
+	Y-88	898.04		93.70	7.24E-03	8.59E-02	1.14E-01
		1836.06		99.20	-2.19E-02		8.59E-02
+	NB-94	702.63		100.00	2.59E-02	9.74E-02	9.74E-02
		871.10		100.00	-1.22E-01		9.77E-02
+	I-131	284.30		6.06	-6.57E-02	1.66E-01	2.35E+00
		364.48		81.20	-6.33E-02		1.66E-01
		636.97		7.27	1.93E+00		2.14E+00
+	CS-134	604.70		97.60	-3.25E-02	1.17E-01	2.03E-01
		795.84		85.40	-3.85E-02		1.17E-01
+	CS-137	661.65		85.12	4.78E-02	1.15E-01	1.15E-01
+	CE-144	80.12		1.36	1.42E+01	6.91E-01	9.75E+00
		133.51		11.09	4.35E-01		6.91E-01
+	EU-152	121.78		28.40	-2.72E-02	2.57E-01	2.57E-01
		344.28		26.60	-6.72E-01		3.71E-01
		1408.00		20.74	8.07E-01		6.28E-01
+	EU-154	123.07		40.40	-1.38E-01	1.81E-01	1.81E-01
		723.30		19.70	3.22E-01		5.14E-01
		1274.51		35.50	5.06E-02		3.64E-01
+	EU-155	86.54	*	32.80	4.25E-01	1.65E-01	1.65E-01
		105.31		21.80	5.00E-03		3.56E-01
+	BI-214	609.31	*	46.30	2.50E+00	1.94E-01	1.94E-01
		1120.29	*	15.10	2.56E+00		5.68E-01
		1238.11	*	5.94	1.70E+00		1.80E+00
		1377.67	*	4.11	3.16E+00		1.66E+00
		1407.98		2.48	6.74E+00		5.24E+00
		1509.19		2.19	6.58E+00		5.78E+00
		1764.49	*	15.80	2.98E+00		4.63E-01
+	PB-214	77.11	*	10.70	3.15E+00	1.96E-01	6.59E-01
		295.21	*	19.20	2.58E+00		2.25E-01
		351.92	*	37.20	2.48E+00		1.96E-01
+	PA-228	89.95	*	22.00	5.41E+01	2.55E+01	4.29E+01
		93.35	*	35.00	6.59E+01		2.55E+01
		105.00		16.30	4.77E+01		8.87E+01
		129.22		2.97	-1.81E+01		4.65E+02
		338.32	*	5.30	3.00E+02		1.94E+02
		463.00		13.80	1.34E+01		1.18E+02
		911.23	*	16.70	2.43E+02		8.97E+01
+	AM-241	59.54		36.30	1.73E-01	5.24E-01	5.24E-01
+	CM-243	103.76		23.00	3.79E-01	3.38E-01	3.38E-01
		228.18		10.60	-8.66E-01		6.97E-01
		277.60		14.00	-1.27E-01		5.90E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FJGS-018-SS

L1-010-106

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Analysis Report for L1-010-106-FSGS-007-SB  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-007-SB  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.949E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 11:00:00AM  
Acquisition Started : 9/3/2019 2:42:28PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.5 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 : 7388

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/3/2019 3:12:37PM

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



Analysis Report for L1-010-106-FSGS-007-SB

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.93	147 -	160	154.40	8.25E+01	34.46	7.10E+02	1.59
F	2	238.46	474 -	485	477.39	1.63E+02	32.22	3.03E+02	1.40
F	3	295.22	584 -	595	590.88	6.88E+01	23.66	1.99E+02	1.62
F	4	338.16	668 -	680	676.75	2.89E+01	15.29	1.69E+02	0.77
F	5	351.84	699 -	712	704.12	1.32E+02	26.50	1.51E+02	1.40
F	6	582.72	1157 -	1171	1165.78	5.83E+01	18.17	7.08E+01	1.68
F	7	608.84	1214 -	1224	1218.01	7.88E+01	20.64	7.27E+01	1.50
F	8	910.61	1817 -	1826	1821.46	3.18E+01	13.93	3.55E+01	1.63
F	9	1120.52	2236 -	2248	2241.23	2.74E+01	12.07	2.21E+01	1.77
F	10	1460.41	2914 -	2929	2920.94	3.47E+02	37.68	1.49E+01	2.38

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 3:12:37PM

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	76.93	8.25E+01	34.46			8.25E+01	3.45E+01
F	2	238.46	1.63E+02	32.22			1.63E+02	3.22E+01
F	3	295.22	6.88E+01	23.66			6.88E+01	2.37E+01
F	4	338.16	2.89E+01	15.29			2.89E+01	1.53E+01
F	5	351.84	1.32E+02	26.50	4.18E+01	1.86E+01	9.00E+01	3.24E+01
F	6	582.72	5.83E+01	18.17			5.83E+01	1.82E+01
F	7	608.84	7.88E+01	20.64	2.06E+01	1.21E+01	5.82E+01	2.39E+01
F	8	910.61	3.18E+01	13.93			3.18E+01	1.39E+01
F	9	1120.52	2.74E+01	12.07			2.74E+01	1.21E+01
F	10	1460.41	3.47E+02	37.68	2.82E+01	8.57E+00	3.18E+02	3.86E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-007-SB

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	7.75E+00	1.03E+00
PB-212	0.99	77.11 *	17.50	2.61E-01	1.10E-01
		238.63 *	44.60	1.88E-01	3.84E-02
BI-214	0.56	609.31 *	46.30	1.50E-01	6.21E-02
		1120.29 *	15.10	3.74E-01	1.66E-01
		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	4.26E-01	1.80E-01
		295.21 *	19.20	2.20E-01	7.64E-02
		351.92 *	37.20	1.74E-01	6.31E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.982	7.75E+00	1.03E+00	
PB-212	0.995	1.83E-01	3.64E-02	
BI-214	0.566	1.77E-01	5.82E-02	

## Analysis Report for L1-010-106-FSGS-007-SB

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.999	1.88E-01	4.71E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-007-SB

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/3/2019 3:12:37PM  
 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	338.16	1.60627E-02	26.44	Tol.	AC-228 PA-228
F 6	582.72	3.23749E-02	15.59		
F 8	910.61	1.76592E-02	21.92	Tol.	AC-228 PA-228

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	* 10.67	7.75E+00	7.27E-01	7.27E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	1.56E-02	8.95E-02	9.08E-02
		1332.49	100.00	1.97E-02		8.95E-02
+	KR-85	513.99	0.43	1.44E+01	1.39E+01	1.39E+01
+	Y-88	898.04	93.70	-2.07E-02	3.96E-02	7.29E-02
		1836.06	99.20	-2.06E-02		3.96E-02
+	NB-94	702.63	100.00	-1.66E-03	5.87E-02	5.87E-02
		871.10	100.00	1.37E-04		6.53E-02
+	I-131	284.30	6.06	6.43E-01	9.62E-02	1.32E+00
		364.48	81.20	2.06E-02		9.62E-02

## Analysis Report for L1-010-106-FSGS-007-SB

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
	I-131	636.97	7.27	4.42E-01	9.62E-02	1.29E+00
+	CS-134	604.70	97.60	-9.34E-02	7.50E-02	7.68E-02
		795.84	85.40	-7.16E-03		7.50E-02
+	CS-137	661.65	85.12	2.18E-02	7.33E-02	7.33E-02
+	CE-144	80.12	1.36	-4.92E-01	3.84E-01	4.98E+00
		133.51	11.09	2.66E-02		3.84E-01
+	EU-152	121.78	28.40	2.71E-02	1.50E-01	1.50E-01
		344.28	26.60	-1.98E-01		1.91E-01
		1408.00	20.74	-9.48E-02		3.04E-01
+	EU-154	123.07	40.40	4.65E-02	1.07E-01	1.07E-01
		723.30	19.70	2.00E-01		3.23E-01
		1274.51	35.50	8.64E-02		2.25E-01
+	EU-155	86.54	32.80	-4.65E-02	1.72E-01	1.72E-01
		105.31	21.80	2.34E-03		2.03E-01
+	BI-214	609.31	* 46.30	1.50E-01	1.10E-01	1.10E-01
		1120.29	* 15.10	3.74E-01		2.80E-01
		1238.11	5.94	-2.04E-02		1.79E+00
		1377.67	4.11	-2.85E-01		1.64E+00
		1407.98	2.48	-7.92E-01		2.54E+00
		1509.19	2.19	-1.80E-01		2.74E+00
		1764.49	15.80	2.33E-01		4.82E-01
+	PB-214	77.11	* 10.70	4.26E-01	1.22E-01	5.48E-01
		295.21	* 19.20	2.20E-01		1.75E-01
		351.92	* 37.20	1.74E-01		1.22E-01
+	PA-228	89.95	22.00	-9.23E+00	1.52E+01	2.56E+01
		93.35	35.00	-1.94E+00		1.52E+01
		105.00	16.30	-3.54E+00		2.88E+01
		129.22	2.97	-5.91E+01		1.50E+02
		338.32	5.30	7.61E+01		1.00E+02
		463.00	13.80	-4.61E+00		3.94E+01
		911.23	16.70	3.58E+01		5.10E+01
+	AM-241	59.54	36.30	1.61E-01	3.00E-01	3.00E-01
+	CM-243	103.76	23.00	7.73E-02	1.97E-01	1.97E-01
		228.18	10.60	-9.53E-02		4.05E-01
		277.60	14.00	-1.31E-01		3.39E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-007-SB  
L1-010-106

Analysis Report for L1-010-106-FSGS-009-SB  
L1-010-106

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## **GAMMA SPECTRUM ANALYSIS**

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Sample Identification : L1-010-106-FSGS-009-SB  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.791E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 12:36:00PM  
Acquisition Started : 9/3/2019 4:16:55PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1806.1 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 : 7391

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## **PEAK ANALYSIS REPORT**

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Peak Analysis Performed on : 9/3/2019 4:47:06PM

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

Analysis Report for L1-010-106-FSGS-009-SB

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	238.64	473 -	491	477.75	1.43E+02	28.97	1.93E+02	1.12
m	2	241.47	473 -	491	483.41	4.47E+01	19.06	1.58E+02	1.13
F	3	295.00	586 -	595	590.46	7.28E+01	23.40	1.80E+02	1.27
F	4	338.19	673 -	680	676.82	3.09E+01	17.18	9.05E+01	1.40
F	5	351.70	696 -	711	703.83	1.22E+02	26.72	1.85E+02	1.68
F	6	583.03	1160 -	1171	1166.40	6.29E+01	18.07	4.48E+01	1.59
F	7	608.95	1214 -	1223	1218.23	8.92E+01	20.97	4.87E+01	1.41
F	8	910.95	1818 -	1828	1822.14	2.69E+01	12.87	3.69E+01	1.58
F	9	1119.94	2234 -	2245	2240.06	2.24E+01	11.66	2.76E+01	1.76
F	10	1460.46	2915 -	2929	2921.04	2.44E+02	31.64	9.00E+00	2.50

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/3/2019 4:47:06PM

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	238.64	1.43E+02	28.97			1.43E+02	2.90E+01
m	2	241.47	4.47E+01	19.06			4.47E+01	1.91E+01
F	3	295.00	7.28E+01	23.40			7.28E+01	2.34E+01
F	4	338.19	3.09E+01	17.18			3.09E+01	1.72E+01
F	5	351.70	1.22E+02	26.72	4.18E+01	1.86E+01	8.02E+01	3.26E+01
F	6	583.03	6.29E+01	18.07			6.29E+01	1.81E+01
F	7	608.95	8.92E+01	20.97	2.06E+01	1.21E+01	6.86E+01	2.42E+01
F	8	910.95	2.69E+01	12.87			2.69E+01	1.29E+01
F	9	1119.94	2.24E+01	11.66			2.24E+01	1.17E+01
F	10	1460.46	2.44E+02	31.64	2.82E+01	8.57E+00	2.15E+02	3.28E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma



Analysis Report for L1-010-106-FSGS-009-SB

L1-010-106

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	4.79E+00	7.77E-01
PB-212	0.56	77.11	17.50		
		238.63 *	44.60	1.50E-01	3.15E-02
BI-214	0.57	609.31 *	46.30	1.61E-01	5.76E-02
		1120.29 *	15.10	2.79E-01	1.46E-01
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49	15.80		
PB-214	0.71	77.11	10.70		
		295.21 *	19.20	2.13E-01	6.91E-02
		351.92 *	37.20	1.41E-01	5.79E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.987	4.79E+00	7.77E-01	
PB-212	0.560	1.50E-01	3.15E-02	
BI-214	0.571	1.77E-01	5.36E-02	

Analysis Report for L1-010-106-FSGS-009-SB

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.715	1.71E-01	4.44E-02	

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-009-SB

L1-010-106

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/3/2019 4:47:06PM

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 2	241.47	2.48556E-02	21.30		
F 4	338.19	1.71519E-02	27.82	Tol.	AC-228 PA-228
F 6	583.03	3.49552E-02	14.36		
F 8	910.95	1.49193E-02	23.96	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 2.000sigma

## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	4.79E+00	6.18E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	5.36E-02	7.31E-02	8.14E-02
		1332.49	100.00	3.99E-02		7.31E-02
+	KR-85	513.99	0.43	6.17E+00	1.25E+01	1.25E+01
+	Y-88	898.04	93.70	9.42E-03	5.25E-02	6.51E-02
		1836.06	99.20	-3.48E-02		5.25E-02
+	NB-94	702.63	100.00	-2.10E-02	4.88E-02	4.88E-02
		871.10	100.00	-1.46E-02		6.40E-02

## Analysis Report for L1-010-106-FSGS-009-SB

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	I-131	284.30	6.06	-6.26E-01	8.09E-02	1.14E+00
		364.48	81.20	7.73E-03		8.09E-02
		636.97	7.27	-3.85E-01		1.09E+00
+	CS-134	604.70	97.60	5.94E-02	6.44E-02	6.65E-02
		795.84	85.40	-5.86E-03		6.44E-02
+	CS-137	661.65	85.12	7.59E-02	7.32E-02	7.32E-02
+	CE-144	80.12	1.36	-1.03E+00	3.44E-01	4.46E+00
		133.51	11.09	1.68E-01		3.44E-01
+	EU-152	121.78	28.40	-6.66E-02	1.31E-01	1.31E-01
		344.28	26.60	-7.25E-02		1.73E-01
		1408.00	20.74	-9.32E-02		2.88E-01
+	EU-154	123.07	40.40	-2.57E-02	9.17E-02	9.17E-02
		723.30	19.70	-4.53E-02		2.49E-01
		1274.51	35.50	6.09E-02		1.94E-01
+	EU-155	86.54	32.80	-5.54E-02	1.58E-01	1.58E-01
		105.31	21.80	4.08E-02		1.80E-01
+	BI-214	609.31	* 46.30	1.61E-01	8.89E-02	8.89E-02
		1120.29	* 15.10	2.79E-01		2.79E-01
		1238.11	5.94	3.27E-01		1.55E+00
		1377.67	4.11	6.10E-01		1.45E+00
		1407.98	2.48	-7.78E-01		2.41E+00
		1509.19	2.19	8.67E-01		2.79E+00
		1764.49	15.80	1.42E-01		3.43E-01
+	PB-214	77.11	10.70	5.74E-01	1.22E-01	5.99E-01
		295.21	* 19.20	2.13E-01		1.46E-01
		351.92	* 37.20	1.41E-01		1.22E-01
+	PA-228	89.95	22.00	3.16E+01	1.39E+01	2.43E+01
		93.35	35.00	-8.85E+00		1.39E+01
		105.00	16.30	6.54E+00		2.53E+01
		129.22	2.97	-5.07E+01		1.29E+02
		338.32	5.30	7.19E+01		8.90E+01
		463.00	13.80	2.35E+01		3.61E+01
		911.23	16.70	2.54E+01		4.58E+01
+	AM-241	59.54	36.30	-8.66E-02	2.81E-01	2.81E-01
+	CM-243	103.76	23.00	5.06E-03	1.71E-01	1.71E-01
		228.18	10.60	5.51E-02		3.70E-01
		277.60	14.00	-3.30E-03		2.98E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-009-SB  
L1-010-106

Analysis Report for L1-010-106-FJGS-016-SB  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FJGS-016-SB  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.112E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 1:13:00PM  
Acquisition Started : 9/4/2019 2:00:34PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.7 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 : 7405

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 2:30:44PM

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

## Analysis Report for L1-010-106-FJGS-016-SB

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.98	147 -	159	154.50	2.41E+02	49.59	1.08E+03	1.63
M	2	87.00	172 -	193	174.55	7.32E+01	34.90	6.38E+02	1.49
m	3	92.77	172 -	193	186.09	8.58E+01	35.79	6.89E+02	1.51
F	4	186.02	364 -	378	372.53	5.96E+01	31.03	7.69E+02	1.34
M	5	238.58	469 -	492	477.63	5.01E+02	50.41	2.81E+02	1.56
m	6	241.69	469 -	492	483.86	1.54E+02	30.44	2.55E+02	1.56
M	7	295.06	583 -	606	590.57	2.09E+02	33.33	1.88E+02	1.27
m	8	299.92	583 -	606	600.30	4.08E+01	18.01	1.54E+02	1.28
F	9	338.15	672 -	684	676.74	7.19E+01	23.76	2.53E+02	1.32
F	10	351.81	695 -	711	704.04	2.88E+02	37.85	2.50E+02	1.54
F	11	462.79	922 -	932	925.98	2.30E+01	14.38	9.46E+01	1.23
F	12	510.14	1014 -	1028	1020.65	5.91E+01	20.47	1.30E+02	1.90
F	13	582.99	1157 -	1175	1166.32	1.32E+02	25.53	1.05E+02	1.90
F	14	609.09	1214 -	1225	1218.52	2.01E+02	31.34	1.07E+02	1.72
F	15	794.44	1583 -	1594	1589.15	2.21E+01	12.07	4.80E+01	1.26
F	16	910.93	1817 -	1830	1822.11	9.74E+01	22.57	7.24E+01	1.85
F	17	968.90	1933 -	1944	1938.01	3.06E+01	13.27	7.45E+01	0.85
F	18	1120.28	2234 -	2246	2240.73	4.09E+01	15.42	4.52E+01	1.76
F	19	1460.33	2913 -	2928	2920.76	2.66E+02	33.39	2.40E+01	2.39
F	20	1764.21	3523 -	3534	3528.49	3.23E+01	12.73	1.13E+01	2.64

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 2:30:44PM

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	76.98	2.41E+02	49.59			2.41E+02	4.96E+01
M	2	87.00	7.32E+01	34.90			7.32E+01	3.49E+01
m	3	92.77	8.58E+01	35.79			8.58E+01	3.58E+01
F	4	186.02	5.96E+01	31.03			5.96E+01	3.10E+01
M	5	238.58	5.01E+02	50.41			5.01E+02	5.04E+01
m	6	241.69	1.54E+02	30.44			1.54E+02	3.04E+01
M	7	295.06	2.09E+02	33.33			2.09E+02	3.33E+01
m	8	299.92	4.08E+01	18.01			4.08E+01	1.80E+01
F	9	338.15	7.19E+01	23.76			7.19E+01	2.38E+01

Analysis Report for L1-010-106-FJGS-016-SB

L1-010-106

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	10	351.81	2.88E+02	37.85	4.18E+01	1.86E+01	2.46E+02	4.22E+01
F	11	462.79	2.30E+01	14.38			2.30E+01	1.44E+01
F	12	510.14	5.91E+01	20.47			5.91E+01	2.05E+01
F	13	582.99	1.32E+02	25.53			1.32E+02	2.55E+01
F	14	609.09	2.01E+02	31.34	2.06E+01	1.21E+01	1.80E+02	3.36E+01
F	15	794.44	2.21E+01	12.07			2.21E+01	1.21E+01
F	16	910.93	9.74E+01	22.57			9.74E+01	2.26E+01
F	17	968.90	3.06E+01	13.27			3.06E+01	1.33E+01
F	18	1120.28	4.09E+01	15.42			4.09E+01	1.54E+01
F	19	1460.33	2.66E+02	33.39	2.82E+01	8.57E+00	2.38E+02	3.45E+01
F	20	1764.21	3.23E+01	12.73	7.59E+00	4.90E+00	2.47E+01	1.36E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.75 *	10.67	6.39E+00	9.91E-01
EU-155	0.31	86.54 *	32.80	1.15E-01	5.55E-02
		105.31	21.80		
PB-212	0.99	77.11 *	17.50	8.39E-01	1.81E-01
		238.63 *	44.60	6.37E-01	7.21E-02
BI-214	0.78	609.31 *	46.30	5.11E-01	9.95E-02
		1120.29 *	15.10	6.16E-01	2.34E-01
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49 *	15.80	5.25E-01	2.92E-01
PB-214	0.99	77.11 *	10.70	1.37E+00	2.96E-01
		295.21 *	19.20	7.38E-01	1.23E-01
		351.92 *	37.20	5.24E-01	9.34E-02
RA-226	0.99	186.21 *	3.28	8.67E-01	4.54E-01
AC-228	0.70	209.28	4.40		
		338.32 *	11.40	4.82E-01	1.61E-01



Analysis Report for L1-010-106-FJGS-016-SB

L1-010-106

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>
AC-228	0.70	794.70 *	4.60	8.05E-01	4.41E-01
		911.60 *	27.70	6.66E-01	1.57E-01
		964.60	5.20		
		969.11 *	16.60	3.69E-01	1.61E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.972	6.39E+00	9.91E-01	
EU-155	0.310	1.15E-01	5.55E-02	
PB-212	0.999	6.15E-01	6.72E-02	
BI-214	0.782	5.27E-01	8.74E-02	
PB-214	0.997	5.88E-01	7.24E-02	
RA-226	0.994	8.67E-01	4.54E-01	
AC-228	0.700	5.21E-01	9.02E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FJGS-016-SB

L1-010-106

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/4/2019 2:30:44PM  
 Peak Locate From Channel : 100  
 Peak Locate To Channel : 4096

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Peak Size (CPS)</b>	<b>Peak CPS (%) Uncertainty</b>	<b>Peak Type</b>	<b>Tolerance Nuclide</b>
m	3	92.77	4.76921E-02	20.85	Tol.	PA-228
m	6	241.69	8.53518E-02	9.91		
m	8	299.92	2.26478E-02	22.09		
F	11	462.79	1.27594E-02	31.30	Tol.	SB-125 PA-228
F	12	510.14	3.28343E-02	17.32		
F	13	582.99	7.33528E-02	9.67		

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

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**NUCLIDE MDA REPORT**


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

	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	K-40	1460.75	*	10.67	6.39E+00	8.75E-01	8.75E-01
+	@ AR-41	1293.64		99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22		100.00	1.02E-01	8.53E-02	9.96E-02
		1332.49		100.00	-2.83E-02		8.53E-02

## Analysis Report for L1-010-106-FJGS-016-SB

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	KR-85	513.99	0.43	1.67E+01	1.75E+01	1.75E+01
+	Y-88	898.04	93.70	-6.48E-03	7.13E-02	9.25E-02
		1836.06	99.20	-6.09E-02		7.13E-02
+	NB-94	702.63	100.00	-1.39E-02	7.30E-02	7.30E-02
		871.10	100.00	-5.24E-03		7.82E-02
+	I-131	284.30	6.06	-1.93E-01	1.41E-01	1.83E+00
		364.48	81.20	3.10E-02		1.41E-01
		636.97	7.27	-4.27E-01		1.83E+00
+	CS-134	604.70	97.60	-1.81E-01	1.00E-01	1.15E-01
		795.84	85.40	-1.49E-02		1.00E-01
+	CS-137	661.65	85.12	-2.49E-03	9.19E-02	9.19E-02
+	CE-144	80.12	1.36	-6.41E+00	5.04E-01	7.07E+00
		133.51	11.09	-9.28E-02		5.04E-01
+	EU-152	121.78	28.40	-2.23E-02	1.94E-01	1.94E-01
		344.28	26.60	-7.72E-02		2.64E-01
		1408.00	20.74	-1.68E-02		3.66E-01
+	EU-154	123.07	40.40	-7.69E-02	1.35E-01	1.35E-01
		723.30	19.70	5.86E-01		4.47E-01
		1274.51	35.50	3.17E-02		2.68E-01
+	EU-155	86.54	* 32.80	1.15E-01	1.35E-01	1.35E-01
		105.31	21.80	4.50E-02		2.71E-01
+	BI-214	609.31	* 46.30	5.11E-01	1.37E-01	1.37E-01
		1120.29	* 15.10	6.16E-01		4.24E-01
		1238.11	5.94	1.69E+00		2.15E+00
		1377.67	4.11	5.31E-01		2.29E+00
		1407.98	2.48	-1.40E-01		3.06E+00
		1509.19	2.19	2.12E+00		3.56E+00
		1764.49	* 15.80	5.25E-01		4.25E-01
+	PB-214	77.11	* 10.70	1.37E+00	1.66E-01	7.22E-01
		295.21	* 19.20	7.38E-01		1.68E-01
		351.92	* 37.20	5.24E-01		1.66E-01
+	PA-228	89.95	22.00	-1.09E+01	4.07E+01	7.11E+01
		93.35	35.00	-6.14E+00		4.07E+01
		105.00	16.30	1.39E+01		7.44E+01
		129.22	2.97	1.59E+02		3.81E+02
		338.32	5.30	2.78E+02		2.60E+02
		463.00	13.80	-1.09E+01		9.25E+01
		911.23	16.70	2.98E+02		1.53E+02
+	AM-241	59.54	36.30	-2.29E-02	4.04E-01	4.04E-01
+	CM-243	103.76	23.00	1.88E-01	2.60E-01	2.60E-01
		228.18	10.60	1.39E-01		5.42E-01
		277.60	14.00	7.30E-02		4.51E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FJGS-016-SB  
L1-010-106

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Analysis Report for L1-010-106-FJGS-017-SB  
L1-010-106

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## **GAMMA SPECTRUM ANALYSIS**

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Sample Identification : L1-010-106-FJGS-017-SB  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.603E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 2:42:00PM  
Acquisition Started : 9/4/2019 12:04:48PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.7 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 : 7402

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## **PEAK ANALYSIS REPORT**

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Peak Analysis Performed on : 9/4/2019 12:34:57PM

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

Analysis Report for L1-010-106-FJGS-017-SB

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	77.05	147 -	161	154.64	7.21E+01	27.96	6.89E+02	0.99
F	2	238.51	470 -	485	477.50	1.71E+02	31.13	2.80E+02	1.45
F	3	295.00	587 -	595	590.46	3.50E+01	17.66	1.43E+02	1.01
F	4	338.37	674 -	682	677.17	2.17E+01	15.59	1.11E+02	1.23
F	5	351.90	695 -	712	704.22	9.50E+01	22.62	1.31E+02	1.59
F	6	583.02	1162 -	1174	1166.39	3.90E+01	16.13	7.15E+01	1.61
F	7	609.33	1212 -	1225	1219.00	6.68E+01	18.15	4.54E+01	1.65
F	8	910.65	1815 -	1828	1821.54	2.88E+01	13.72	3.89E+01	2.09
F	9	1460.48	2914 -	2929	2921.08	2.74E+02	33.29	3.53E+00	2.47

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 12:34:57PM

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	77.05	7.21E+01	27.96			7.21E+01	2.80E+01
F	2	238.51	1.71E+02	31.13			1.71E+02	3.11E+01
F	3	295.00	3.50E+01	17.66			3.50E+01	1.77E+01
F	4	338.37	2.17E+01	15.59			2.17E+01	1.56E+01
F	5	351.90	9.50E+01	22.62	4.18E+01	1.86E+01	5.32E+01	2.93E+01
F	6	583.02	3.90E+01	16.13			3.90E+01	1.61E+01
F	7	609.33	6.68E+01	18.15	2.06E+01	1.21E+01	4.62E+01	2.18E+01
F	8	910.65	2.88E+01	13.72			2.88E+01	1.37E+01
F	9	1460.48	2.74E+02	33.29	2.82E+01	8.57E+00	2.45E+02	3.44E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FJGS-017-SB

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	5.57E+00	8.39E-01
PB-212	0.99	77.11 *	17.50	2.12E-01	8.32E-02
		238.63 *	44.60	1.83E-01	3.48E-02
BI-214	0.35	609.31 *	46.30	1.11E-01	5.27E-02
		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	3.46E-01	1.36E-01
		295.21 *	19.20	1.04E-01	5.28E-02
		351.92 *	37.20	9.58E-02	5.29E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.989	5.57E+00	8.39E-01	
PB-212	0.998	1.79E-01	3.22E-02	
BI-214	0.350	1.11E-01	5.27E-02	

## Analysis Report for L1-010-106-FJGS-017-SB

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
PB-214	0.998	9.67E-02	3.62E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma



Analysis Report for L1-010-106-FJGS-017-SB

L1-010-106

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/4/2019 12:34:57PM  
 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	338.37	1.20485E-02	35.95	Tol.	AC-228 PA-228
F 6	583.02	2.16749E-02	20.67		
F 8	910.65	1.60216E-02	23.79	Tol.	AC-228 PA-228

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

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**NUCLIDE MDA REPORT**


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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	5.57E+00	5.97E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	4.77E-02	6.60E-02	8.36E-02
		1332.49	100.00	8.41E-03		6.60E-02
+	KR-85	513.99	0.43	1.38E+01	1.20E+01	1.20E+01
+	Y-88	898.04	93.70	2.17E-02	4.05E-02	6.16E-02
		1836.06	99.20	-3.24E-03		4.05E-02
+	NB-94	702.63	100.00	-7.57E-04	4.94E-02	4.94E-02
		871.10	100.00	7.32E-03		6.13E-02
+	I-131	284.30	6.06	-5.27E-01	8.70E-02	1.18E+00
		364.48	81.20	8.14E-03		8.70E-02

## Analysis Report for L1-010-106-FJGS-017-SB

## L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
	I-131	636.97	7.27	8.78E-03	8.70E-02	1.19E+00
+	CS-134	604.70	97.60	9.07E-04	5.94E-02	6.34E-02
		795.84	85.40	-1.10E-02		5.94E-02
+	CS-137	661.65	85.12	1.26E-02	6.38E-02	6.38E-02
+	CE-144	80.12	1.36	-1.41E-01	3.47E-01	4.30E+00
		133.51	11.09	-1.51E-01		3.47E-01
+	EU-152	121.78	28.40	-3.84E-02	1.33E-01	1.33E-01
		344.28	26.60	-3.46E-02		1.66E-01
		1408.00	20.74	1.96E-01		2.78E-01
+	EU-154	123.07	40.40	6.44E-03	9.43E-02	9.43E-02
		723.30	19.70	-3.35E-02		2.50E-01
		1274.51	35.50	8.36E-02		2.10E-01
+	EU-155	86.54	32.80	-5.80E-02	1.44E-01	1.44E-01
		105.31	21.80	4.98E-02		1.84E-01
+	BI-214	609.31	* 46.30	1.11E-01	9.28E-02	9.28E-02
		1120.29	15.10	3.51E-01		5.37E-01
		1238.11	5.94	6.27E-01		1.37E+00
		1377.67	4.11	9.69E-01		1.37E+00
		1407.98	2.48	1.64E+00		2.32E+00
		1509.19	2.19	4.26E-01		2.29E+00
		1764.49	15.80	1.93E-01		4.31E-01
+	PB-214	77.11	* 10.70	3.46E-01	1.14E-01	5.13E-01
		295.21	* 19.20	1.04E-01		1.30E-01
		351.92	* 37.20	9.58E-02		1.14E-01
+	PA-228	89.95	22.00	4.56E+00	2.26E+01	3.84E+01
		93.35	35.00	-4.63E+00		2.26E+01
		105.00	16.30	1.27E+01		4.54E+01
		129.22	2.97	1.20E+02		2.41E+02
		338.32	5.30	1.30E+02		1.52E+02
		463.00	13.80	-4.24E+01		5.73E+01
		911.23	16.70	1.95E+01		7.89E+01
+	AM-241	59.54	36.30	1.90E-02	2.61E-01	2.61E-01
+	CM-243	103.76	23.00	2.72E-02	1.75E-01	1.75E-01
		228.18	10.60	6.51E-02		3.42E-01
		277.60	14.00	9.74E-02		2.89E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FJGS-017-SB  
L1-010-106

Analysis Report for L1-010-106-FQGS-003-SS

L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FQGS-003-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 1.023E+03 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 2:59:00PM  
Acquisition Started : 9/4/2019 1:15:01PM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.4 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 : 7404

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 1:45:11PM

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

Analysis Report for L1-010-106-FQGS-003-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	76.98	147 -	157	154.51	6.71E+01	30.47	5.14E+02	1.38
M	2	86.89	169 -	190	174.33	5.34E+01	26.93	3.97E+02	1.30
m	3	92.67	169 -	190	185.88	4.68E+01	26.11	3.90E+02	1.31
F	4	185.94	368 -	379	372.37	6.85E+01	27.20	3.18E+02	1.64
M	5	238.58	474 -	489	477.63	5.53E+01	21.38	1.89E+02	1.16
m	6	241.75	474 -	489	483.97	5.22E+01	20.62	1.72E+02	1.17
F	7	295.13	582 -	596	590.72	1.24E+02	26.47	1.87E+02	1.39
F	8	351.77	698 -	708	703.96	1.75E+02	30.36	1.34E+02	1.50
F	9	582.57	1161 -	1169	1165.48	2.32E+01	12.27	4.95E+01	0.96
F	10	609.19	1213 -	1224	1218.72	1.58E+02	27.52	7.52E+01	1.59
F	11	1119.89	2236 -	2245	2239.97	2.56E+01	12.25	3.00E+01	1.41
F	12	1460.31	2913 -	2928	2920.74	1.39E+02	24.83	3.16E+01	2.40
F	13	1763.62	3523 -	3532	3527.32	1.76E+01	9.68	1.00E+01	2.03

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 1:45:11PM

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	76.98	6.71E+01	30.47			6.71E+01	3.05E+01
M	2	86.89	5.34E+01	26.93			5.34E+01	2.69E+01
m	3	92.67	4.68E+01	26.11			4.68E+01	2.61E+01
F	4	185.94	6.85E+01	27.20			6.85E+01	2.72E+01
M	5	238.58	5.53E+01	21.38			5.53E+01	2.14E+01
m	6	241.75	5.22E+01	20.62			5.22E+01	2.06E+01
F	7	295.13	1.24E+02	26.47			1.24E+02	2.65E+01
F	8	351.77	1.75E+02	30.36	4.18E+01	1.86E+01	1.33E+02	3.56E+01
F	9	582.57	2.32E+01	12.27			2.32E+01	1.23E+01
F	10	609.19	1.58E+02	27.52	2.06E+01	1.21E+01	1.38E+02	3.01E+01
F	11	1119.89	2.56E+01	12.25			2.56E+01	1.22E+01
F	12	1460.31	1.39E+02	24.83	2.82E+01	8.57E+00	1.11E+02	2.63E+01
F	13	1763.62	1.76E+01	9.68			1.76E+01	9.68E+00

Analysis Report for L1-010-106-FQGS-003-SS

L1-010-106

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

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.75	*	10.67	2.36E+00	5.75E-01
EU-155	0.31	86.54	*	32.80	6.66E-02	3.40E-02
		105.31		21.80		
PB-212	0.99	77.11	*	17.50	1.85E-01	8.49E-02
		238.63	*	44.60	5.58E-02	2.17E-02
BI-214	0.76	609.31	*	46.30	3.10E-01	6.99E-02
		1120.29	*	15.10	3.06E-01	1.47E-01
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
PB-214	0.99	1764.49	*	15.80	2.96E-01	1.64E-01
		77.11	*	10.70	3.03E-01	1.39E-01
		295.21	*	19.20	3.46E-01	7.59E-02
		351.92	*	37.20	2.24E-01	6.11E-02
RA-226	0.98	186.21	*	3.28	7.89E-01	3.16E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FQGS-003-SS

L1-010-106

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**INTERFERENCE CORRECTED REPORT**

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<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.970	2.36E+00	5.75E-01	
EU-155	0.319	6.66E-02	3.40E-02	
PB-212	0.999	5.37E-02	2.11E-02	
BI-214	0.762	3.08E-01	5.89E-02	
PB-214	0.997	2.66E-01	4.52E-02	
RA-226	0.988	7.89E-01	3.16E-01	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

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Analysis Report for L1-010-106-FQGS-003-SS

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/4/2019 1:45:11PM  
 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	3	92.67	2.59961E-02	27.90	Tol.	PA-228
m	6	241.75	2.89727E-02	19.77		
F	9	582.57	1.28795E-02	26.46		

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	2.36E+00	7.36E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	1.70E-02	5.37E-02	6.45E-02
		1332.49	100.00	2.19E-04		5.37E-02
+	KR-85	513.99	0.43	9.78E+00	1.04E+01	1.04E+01
+	Y-88	898.04	93.70	-1.36E-02	6.01E-02	6.05E-02
		1836.06	99.20	-7.49E-03		6.01E-02
+	NB-94	702.63	100.00	8.07E-03	4.49E-02	4.49E-02
		871.10	100.00	-3.42E-03		5.09E-02
+	I-131	284.30	6.06	8.55E-02	8.81E-02	1.11E+00
		364.48	81.20	4.11E-02		8.81E-02
		636.97	7.27	-2.27E-01		1.04E+00



## Analysis Report for L1-010-106-FQGS-003-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	CS-134	604.70	97.60	-1.89E-02	5.97E-02	8.03E-02
		795.84	85.40	-6.45E-02		5.97E-02
+	CS-137	661.65	85.12	2.74E-02	6.35E-02	6.35E-02
+	CE-144	80.12	1.36	-2.47E+00	3.33E-01	4.10E+00
		133.51	11.09	-6.01E-02		3.33E-01
+	EU-152	121.78	28.40	-2.21E-02	1.28E-01	1.28E-01
		344.28	26.60	5.71E-02		1.69E-01
		1408.00	20.74	5.58E-02		2.20E-01
+	EU-154	123.07	40.40	5.51E-03	9.03E-02	9.03E-02
		723.30	19.70	1.23E-01		2.23E-01
		1274.51	35.50	5.55E-03		1.79E-01
+	EU-155	86.54	*	32.80	8.51E-02	8.51E-02
		105.31	21.80	2.30E-02		1.70E-01
+	BI-214	609.31	*	46.30	9.72E-02	9.72E-02
		1120.29	*	15.10		2.62E-01
		1238.11		5.94		1.17E+00
		1377.67		4.11		1.24E+00
		1407.98		2.48		1.84E+00
		1509.19		2.19		2.51E+00
		1764.49	*	15.80		2.32E-01
+	PB-214	77.11	*	10.70	9.88E-02	3.80E-01
		295.21	*	19.20		1.59E-01
		351.92	*	37.20		9.88E-02
+	PA-228	89.95		22.00	2.31E+01	4.01E+01
		93.35		35.00		2.31E+01
		105.00		16.30		4.32E+01
		129.22		2.97		2.32E+02
		338.32		5.30		1.50E+02
		463.00		13.80		6.02E+01
		911.23		16.70		7.34E+01
+	AM-241	59.54	36.30	8.30E-02	2.59E-01	2.59E-01
+	CM-243	103.76	23.00	1.30E-01	1.66E-01	1.66E-01
		228.18	10.60	-2.97E-01		3.10E-01
		277.60	14.00	-1.32E-01		2.63E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FQGS-004-SS  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FQGS-004-SS  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.034E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 3:06:00PM  
Acquisition Started : 9/4/2019 9:25:00AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.7 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 : 7398

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/4/2019 9:55:10AM

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

## Analysis Report for L1-010-106-FQGS-004-SS

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	77.00	147 -	161	154.54	1.68E+02	37.93	7.78E+02	1.41
F	2	185.76	368 -	377	372.03	1.27E+02	34.88	3.55E+02	2.02
M	3	238.51	473 -	488	477.50	2.15E+02	35.31	2.51E+02	1.52
m	4	241.81	473 -	488	484.10	6.83E+01	23.79	2.47E+02	1.52
F	5	295.13	587 -	596	590.70	1.46E+02	29.02	1.72E+02	1.38
F	6	338.33	673 -	681	677.10	3.80E+01	19.95	1.51E+02	1.38
F	7	351.64	698 -	709	703.72	2.37E+02	34.36	1.63E+02	1.44
F	8	510.66	1014 -	1030	1021.70	8.53E+01	21.67	6.27E+01	3.22
F	9	583.06	1161 -	1171	1166.46	7.49E+01	20.93	7.92E+01	1.65
F	10	609.15	1212 -	1224	1218.63	1.70E+02	28.19	7.75E+01	1.67
F	11	911.15	1818 -	1829	1822.53	3.28E+01	14.08	4.10E+01	1.71
F	12	968.50	1933 -	1942	1937.23	1.63E+01	12.66	3.74E+01	1.79
F	13	1119.82	2235 -	2246	2239.83	3.02E+01	14.36	4.36E+01	2.02
F	14	1460.25	2912 -	2930	2920.61	2.33E+02	31.28	2.77E+01	2.43

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/4/2019 9:55:10AM

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	77.00	1.68E+02	37.93			1.68E+02	3.79E+01
F	2	185.76	1.27E+02	34.88			1.27E+02	3.49E+01
M	3	238.51	2.15E+02	35.31			2.15E+02	3.53E+01
m	4	241.81	6.83E+01	23.79			6.83E+01	2.38E+01
F	5	295.13	1.46E+02	29.02			1.46E+02	2.90E+01
F	6	338.33	3.80E+01	19.95			3.80E+01	1.99E+01
F	7	351.64	2.37E+02	34.36	4.18E+01	1.86E+01	1.95E+02	3.91E+01
F	8	510.66	8.53E+01	21.67	3.64E+01	1.43E+01	4.89E+01	2.59E+01
F	9	583.06	7.49E+01	20.93			7.49E+01	2.09E+01
F	10	609.15	1.70E+02	28.19	2.06E+01	1.21E+01	1.50E+02	3.07E+01
F	11	911.15	3.28E+01	14.08			3.28E+01	1.41E+01
F	12	968.50	1.63E+01	12.66			1.63E+01	1.27E+01
F	13	1119.82	3.02E+01	14.36			3.02E+01	1.44E+01
F	14	1460.25	2.33E+02	31.28	2.82E+01	8.57E+00	2.05E+02	3.24E+01

Analysis Report for L1-010-106-FQGS-004-SS

L1-010-106

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

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.75	*	10.67	4.93E+00	8.29E-01
PB-212	0.99	77.11	*	17.50	5.26E-01	1.23E-01
		238.63	*	44.60	2.46E-01	4.23E-02
BI-214	0.57	609.31	*	46.30	3.82E-01	8.11E-02
		1120.29	*	15.10	4.09E-01	1.95E-01
		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	8.61E-01	2.02E-01
		295.21	*	19.20	4.61E-01	9.46E-02
		351.92	*	37.20	3.74E-01	7.69E-02
RA-226	0.96	186.21	*	3.28	1.65E+00	4.64E-01
AC-228	0.60	209.28		4.40		
		338.32	*	11.40	2.29E-01	1.21E-01
		794.70		4.60		
		911.60	*	27.70	2.01E-01	8.68E-02
		964.60		5.20		
		969.11	*	16.60	1.76E-01	1.37E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FQGS-004-SS

L1-010-106

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**INTERFERENCE CORRECTED REPORT**

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<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.961	4.93E+00	8.29E-01	
PB-212	0.998	2.49E-01	4.01E-02	
BI-214	0.577	3.86E-01	7.49E-02	
PB-214	0.993	4.12E-01	5.75E-02	
RA-226	0.968	1.65E+00	4.64E-01	
AC-228	0.606	2.03E-01	6.27E-02	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

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Analysis Report for L1-010-106-FQGS-004-SS

L1-010-106

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/4/2019 9:55:10AM  
 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 4	241.81	3.79421E-02	17.41		
F 8	510.66	2.71937E-02	26.49		
F 9	583.06	4.16091E-02	13.97		

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

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**NUCLIDE MDA REPORT**


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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	* 10.67	4.93E+00	8.29E-01	8.29E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	-3.47E-02	7.57E-02	8.70E-02
		1332.49	100.00	6.97E-02		7.57E-02
+	KR-85	513.99	0.43	1.39E+01	1.44E+01	1.44E+01
+	Y-88	898.04	93.70	-2.12E-03	5.95E-02	7.31E-02
		1836.06	99.20	-7.60E-03		5.95E-02
+	NB-94	702.63	100.00	7.46E-03	6.23E-02	6.23E-02
		871.10	100.00	-8.68E-02		6.33E-02
+	I-131	284.30	6.06	3.35E-01	1.02E-01	1.38E+00
		364.48	81.20	5.07E-02		1.02E-01
		636.97	7.27	4.94E-01		1.51E+00
+	CS-134	604.70	97.60	3.59E-03	7.29E-02	9.50E-02

## Analysis Report for L1-010-106-FQGS-004-SS

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
	CS-134	795.84	85.40	-4.18E-02	7.29E-02	7.29E-02
+	CS-137	661.65	85.12	7.92E-02	8.00E-02	8.00E-02
+	CE-144	80.12	1.36	-8.77E-01	4.18E-01	5.28E+00
		133.51	11.09	3.56E-02		4.18E-01
+	EU-152	121.78	28.40	-4.52E-02	1.57E-01	1.57E-01
		344.28	26.60	-1.57E-01		2.11E-01
		1408.00	20.74	-1.50E-01		3.44E-01
+	EU-154	123.07	40.40	3.71E-02	1.12E-01	1.12E-01
		723.30	19.70	-1.71E-01		3.09E-01
		1274.51	35.50	1.33E-01		2.38E-01
+	EU-155	86.54	32.80	-1.18E-01	1.78E-01	1.78E-01
		105.31	21.80	-1.59E-01		2.10E-01
+	BI-214	609.31	* 46.30	3.82E-01	1.13E-01	1.13E-01
		1120.29	* 15.10	4.09E-01		3.66E-01
		1238.11	5.94	-1.75E+00		1.47E+00
		1377.67	4.11	3.93E-01		1.70E+00
		1407.98	2.48	-1.26E+00		2.88E+00
		1509.19	2.19	1.42E+00		2.96E+00
		1764.49	15.80	8.27E-01		6.73E-01
+	PB-214	77.11	* 10.70	8.61E-01	1.20E-01	5.78E-01
		295.21	* 19.20	4.61E-01		1.55E-01
		351.92	* 37.20	3.74E-01		1.20E-01
+	PA-228	89.95	22.00	3.92E+01	2.65E+01	4.43E+01
		93.35	35.00	3.23E+01		2.65E+01
		105.00	16.30	-7.74E+00		4.74E+01
		129.22	2.97	1.19E+02		2.53E+02
		338.32	5.30	7.48E+01		1.70E+02
		463.00	13.80	-1.69E+00		6.07E+01
		911.23	16.70	4.20E+01		8.00E+01
+	AM-241	59.54	36.30	8.20E-02	3.24E-01	3.24E-01
+	CM-243	103.76	23.00	2.94E-02	2.04E-01	2.04E-01
		228.18	10.60	-8.72E-03		4.19E-01
		277.60	14.00	-2.58E-01		3.30E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-004-SS (SPLIT)  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-004-SS (SPLIT)  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 8.085E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 10:39:00AM  
Acquisition Started : 9/5/2019 7:57:01AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.7 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 : 7407

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/5/2019 8:27:11AM

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



Analysis Report for L1-010-106-FSGS-004-SS (SPLIT)

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	185.74	365 -	377	371.97	7.29E+01	27.42	4.13E+02	1.35
M	2	238.43	469 -	490	477.34	2.06E+02	33.96	2.04E+02	1.42
m	3	241.93	469 -	490	484.33	6.67E+01	22.59	1.97E+02	1.43
F	4	294.99	586 -	595	590.43	1.21E+02	27.91	1.84E+02	1.44
F	5	351.77	695 -	709	703.96	1.87E+02	31.12	1.83E+02	1.52
F	6	583.01	1160 -	1172	1166.35	5.95E+01	17.15	5.51E+01	1.16
F	7	609.21	1212 -	1226	1218.75	1.57E+02	27.37	8.00E+01	1.81
F	8	768.63	1533 -	1543	1537.54	2.18E+01	12.61	4.39E+01	1.60
F	9	910.98	1817 -	1827	1822.19	3.97E+01	15.54	3.79E+01	2.00
F	10	968.82	1933 -	1942	1937.87	2.31E+01	12.68	3.71E+01	1.60
F	11	1119.80	2235 -	2245	2239.78	2.85E+01	14.26	4.43E+01	2.00
F	12	1460.43	2912 -	2929	2920.98	2.13E+02	29.63	1.35E+01	2.58
F	13	1763.88	3522 -	3533	3527.84	2.70E+01	11.06	6.00E+00	2.20

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/5/2019 8:27:11AM

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	185.74	7.29E+01	27.42			7.29E+01	2.74E+01
M	2	238.43	2.06E+02	33.96			2.06E+02	3.40E+01
m	3	241.93	6.67E+01	22.59			6.67E+01	2.26E+01
F	4	294.99	1.21E+02	27.91			1.21E+02	2.79E+01
F	5	351.77	1.87E+02	31.12	4.18E+01	1.86E+01	1.46E+02	3.63E+01
F	6	583.01	5.95E+01	17.15			5.95E+01	1.71E+01
F	7	609.21	1.57E+02	27.37	2.06E+01	1.21E+01	1.37E+02	2.99E+01
F	8	768.63	2.18E+01	12.61			2.18E+01	1.26E+01
F	9	910.98	3.97E+01	15.54			3.97E+01	1.55E+01
F	10	968.82	2.31E+01	12.68			2.31E+01	1.27E+01
F	11	1119.80	2.85E+01	14.26			2.85E+01	1.43E+01
F	12	1460.43	2.13E+02	29.63	2.82E+01	8.57E+00	1.84E+02	3.08E+01
F	13	1763.88	2.70E+01	11.06	7.59E+00	4.90E+00	1.94E+01	1.21E+01

Analysis Report for L1-010-106-FSGS-004-SS (SPLIT)

L1-010-106

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

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.75 *	10.67	4.97E+00	8.76E-01
PB-212	0.55	77.11	17.50		
		238.63 *	44.60	2.63E-01	4.54E-02
BI-214	0.77	609.31 *	46.30	3.89E-01	8.80E-02
		1120.29 *	15.10	4.31E-01	2.16E-01
		1238.11	5.94		
		1377.67	4.11		
		1407.98	2.48		
		1509.19	2.19		
		1764.49 *	15.80	4.14E-01	2.59E-01
PB-214	0.71	77.11	10.70		
		295.21 *	19.20	4.29E-01	1.01E-01
		351.92 *	37.20	3.11E-01	7.89E-02
RA-226	0.96	186.21 *	3.28	1.06E+00	4.04E-01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

## Analysis Report for L1-010-106-FSGS-004-SS (SPLIT)

L1-010-106

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.984	4.97E+00	8.76E-01	
PB-212	0.556	2.63E-01	4.54E-02	
BI-214	0.771	3.97E-01	7.77E-02	
PB-214	0.717	3.56E-01	6.22E-02	
RA-226	0.965	1.06E+00	4.04E-01	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 2.000sigma

Analysis Report for L1-010-106-FSGS-004-SS (SPLIT)

L1-010-106

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/5/2019 8:27:11AM  
 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	3	241.93	3.70833E-02	16.92		
F	6	583.01	3.30292E-02	14.42		
F	8	768.63	1.21049E-02	28.94		
F	9	910.98	2.20488E-02	19.57	Tol.	AC-228 PA-228
F	10	968.82	1.28495E-02	27.41	Tol.	AC-228

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

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**NUCLIDE MDA REPORT**


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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	4.97E+00	8.07E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	3.28E-03	8.16E-02	8.33E-02
		1332.49	100.00	1.99E-02		8.16E-02
+	KR-85	513.99	0.43	1.52E+01	1.54E+01	1.54E+01
+	Y-88	898.04	93.70	-9.89E-03	6.95E-02	7.77E-02
		1836.06	99.20	-3.69E-02		6.95E-02

## Analysis Report for L1-010-106-FSGS-004-SS (SPLIT)

L1-010-106

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	NB-94	702.63	100.00	-2.79E-02	6.00E-02	6.00E-02
		871.10	100.00	-1.76E-02		6.38E-02
+	I-131	284.30	6.06	4.84E-01	1.23E-01	1.64E+00
		364.48	81.20	-4.65E-02		1.23E-01
		636.97	7.27	-7.79E-01		1.67E+00
+	CS-134	604.70	97.60	-2.70E-03	8.90E-02	9.93E-02
		795.84	85.40	-3.18E-02		8.90E-02
+	CS-137	661.65	85.12	6.35E-02	8.61E-02	8.61E-02
+	CE-144	80.12	1.36	1.47E-01	4.49E-01	5.85E+00
		133.51	11.09	3.48E-01		4.49E-01
+	EU-152	121.78	28.40	-8.59E-02	1.64E-01	1.64E-01
		344.28	26.60	-1.61E-02		2.09E-01
		1408.00	20.74	2.18E-01		4.12E-01
+	EU-154	123.07	40.40	-1.47E-02	1.18E-01	1.18E-01
		723.30	19.70	-1.79E-01		3.79E-01
		1274.51	35.50	1.10E-01		2.57E-01
+	EU-155	86.54	32.80	-1.43E-01	2.00E-01	2.00E-01
		105.31	21.80	-1.25E-01		2.30E-01
+	BI-214	609.31	* 46.30	3.89E-01	1.31E-01	1.31E-01
		1120.29	* 15.10	4.31E-01		4.03E-01
		1238.11	5.94	1.29E+00		1.75E+00
		1377.67	4.11	9.88E-01		1.88E+00
		1407.98	2.48	1.82E+00		3.44E+00
		1509.19	2.19	1.09E+00		3.10E+00
		1764.49	* 15.80	4.14E-01		3.80E-01
+	PB-214	77.11	10.70	7.19E-01	1.45E-01	7.79E-01
		295.21	* 19.20	4.29E-01		1.78E-01
		351.92	* 37.20	3.11E-01		1.45E-01
+	PA-228	89.95	22.00	1.06E+02	6.58E+01	1.15E+02
		93.35	35.00	1.28E+01		6.58E+01
		105.00	16.30	-4.47E+01		1.20E+02
		129.22	2.97	4.05E+02		6.46E+02
		338.32	5.30	4.23E+00		3.83E+02
		463.00	13.80	1.06E+02		1.78E+02
		911.23	16.70	2.51E+02		2.10E+02
+	AM-241	59.54	36.30	1.75E-01	3.53E-01	3.53E-01
+	CM-243	103.76	23.00	-1.82E-02	2.18E-01	2.18E-01
		228.18	10.60	-2.25E-01		4.47E-01
		277.60	14.00	-1.25E-02		3.61E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

Analysis Report for L1-010-106-FSGS-004-SS (SPLIT)  
L1-010-106

Analysis Report for L1-010-106-FSGS-009-SS (SPLIT)  
L1-010-106

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : L1-010-106-FSGS-009-SS (SPLIT)  
Sample Description : L1-010-106  
Sample Type : 500 ml Marinelli  
Unit :  
Sample Point :

Sample Size : 9.393E+02 grams  
Facility : Dairyland\_NPP

Sample Taken On : 8/28/2019 12:17:00PM  
Acquisition Started : 9/5/2019 8:41:48AM

Procedure : 500ml Marinelli  
Operator : Administrator  
Detector Name : HOTLAB  
Geometry : 500ml Marinelli  
Live Time : 1800.0 seconds  
Real Time : 1805.5 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 : 7408

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/5/2019 9:11:58AM

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

Analysis Report for L1-010-106-FSGS-009-SS (SPLIT)

L1-010-106

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
F	1	294.89	583 -	594	590.23	6.07E+01	21.09	1.74E+02	1.25
F	2	351.78	700 -	710	703.99	1.48E+02	27.50	1.08E+02	1.41
F	3	583.19	1163 -	1171	1166.73	1.94E+01	11.00	3.15E+01	1.15
F	4	609.03	1213 -	1223	1218.38	8.99E+01	20.76	3.03E+01	1.84
F	5	1460.34	2912 -	2930	2920.79	1.79E+02	27.38	1.46E+01	2.75
F	6	1763.87	3523 -	3532	3527.81	1.50E+01	8.27	2.59E+00	1.67

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/5/2019 9:11:58AM

Env. Background File : C:\Canberra\Apex\Roof\Daairyland\_NPP\Data\0000001364.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
F	1	294.89	6.07E+01	21.09			6.07E+01	2.11E+01
F	2	351.78	1.48E+02	27.50	4.18E+01	1.86E+01	1.07E+02	3.32E+01
F	3	583.19	1.94E+01	11.00			1.94E+01	1.10E+01
F	4	609.03	8.99E+01	20.76	2.06E+01	1.21E+01	6.93E+01	2.40E+01
F	5	1460.34	1.79E+02	27.38	2.82E+01	8.57E+00	1.51E+02	2.87E+01
F	6	1763.87	1.50E+01	8.27	7.59E+00	4.90E+00	7.41E+00	9.61E+00

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma



Analysis Report for L1-010-106-FSGS-009-SS (SPLIT)

L1-010-106

## 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 (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.75	*	10.67	3.50E+00	6.93E-01
BI-214	0.53	609.31	*	46.30	1.70E-01	5.97E-02
		1120.29		15.10		
		1238.11		5.94		
		1377.67		4.11		
		1407.98		2.48		
		1509.19		2.19		
		1764.49	*	15.80	1.36E-01	1.77E-01
PB-214	0.71	77.11		10.70		
		295.21	*	19.20	1.85E-01	6.48E-02
		351.92	*	37.20	1.96E-01	6.18E-02

\* = 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 2.000sigma

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.973	3.50E+00	6.93E-01	
BI-214	0.535	1.66E-01	5.65E-02	
PB-214	0.715	1.91E-01	4.47E-02	

## Analysis Report for L1-010-106-FSGS-009-SS (SPLIT)

L1-010-106

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

Errors quoted at 2.000sigma

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Analysis Report for L1-010-106-FSGS-009-SS (SPLIT)

L1-010-106

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/5/2019 9:11:58AM  
 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	583.19	1.07861E-02	28.33		

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

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## NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	K-40	1460.75	*	10.67	3.50E+00	7.08E-01
+	@ AR-41	1293.64	99.16	1.00E+26	1.00E+26	1.00E+26
+	CO-60	1173.22	100.00	4.18E-02	6.56E-02	7.44E-02
		1332.49	100.00	3.53E-02		6.56E-02
+	KR-85	513.99	0.43	9.60E+00	1.13E+01	1.13E+01
+	Y-88	898.04	93.70	-2.50E-03	4.77E-02	6.27E-02
		1836.06	99.20	-2.61E-02		4.77E-02
+	NB-94	702.63	100.00	-4.84E-03	4.30E-02	4.30E-02
		871.10	100.00	-3.71E-02		4.93E-02
+	I-131	284.30	6.06	3.38E-01	9.31E-02	1.27E+00
		364.48	81.20	-2.45E-02		9.31E-02
		636.97	7.27	-4.80E-01		1.34E+00
+	CS-134	604.70	97.60	1.16E-01	5.67E-02	6.92E-02
		795.84	85.40	-8.63E-02		5.67E-02
+	CS-137	661.65	85.12	5.82E-02	6.56E-02	6.56E-02
+	CE-144	80.12	1.36	1.87E+00	3.16E-01	4.16E+00
		133.51	11.09	-3.26E-01		3.16E-01

## Analysis Report for L1-010-106-FSGS-009-SS (SPLIT)

L1-010-106

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>
+	EU-152	121.78	28.40	1.00E-02	1.27E-01	1.27E-01
		344.28	26.60	-4.15E-01		1.46E-01
		1408.00	20.74	1.20E-01		3.01E-01
+	EU-154	123.07	40.40	-7.26E-03	8.88E-02	8.88E-02
		723.30	19.70	-1.70E-01		2.38E-01
		1274.51	35.50	2.41E-02		1.80E-01
+	EU-155	86.54	32.80	-6.57E-02	1.42E-01	1.42E-01
		105.31	21.80	-1.67E-02		1.70E-01
+	BI-214	609.31	* 46.30	1.70E-01	8.45E-02	8.45E-02
		1120.29	15.10	3.12E-01		5.08E-01
		1238.11	5.94	1.32E+00		1.34E+00
		1377.67	4.11	5.15E-01		1.46E+00
		1407.98	2.48	1.00E+00		2.51E+00
		1509.19	2.19	1.59E+00		2.61E+00
		1764.49	* 15.80	1.36E-01		2.96E-01
+	PB-214	77.11	10.70	2.27E-01	1.03E-01	5.55E-01
		295.21	* 19.20	1.85E-01		1.56E-01
		351.92	* 37.20	1.96E-01		1.03E-01
+	PA-228	89.95	22.00	3.36E+01	4.51E+01	7.63E+01
		93.35	35.00	2.79E+01		4.51E+01
		105.00	16.30	-5.60E+01		8.58E+01
		129.22	2.97	1.38E+02		4.61E+02
		338.32	5.30	-5.48E+01		2.60E+02
		463.00	13.80	-2.08E+01		1.20E+02
		911.23	16.70	-7.98E+00		1.35E+02
+	AM-241	59.54	36.30	4.84E-02	2.68E-01	2.68E-01
+	CM-243	103.76	23.00	-7.01E-03	1.62E-01	1.62E-01
		228.18	10.60	3.64E-01		3.36E-01
		277.60	14.00	-1.82E-01		2.68E-01

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

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

# **ATTACHMENT 8**

## **GEL LABORATORIES ANALYTICAL REPORTS**

October 15, 2019

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

Re: LACBWR Site Restoration Project  
Work Order: 490846

Dear Mr. Spaide:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 20, 2019. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at [www.gel.com](http://www.gel.com).

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: 490846 GEL Work Order: 490846

**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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-SUB-TDS-FJGS-A24-SB  
Sample ID: 490846001  
Matrix: Soil  
Collect Date: 03-JUL-19 12:56  
Receive Date: 20-SEP-19  
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	-0.0174	+/-0.0686	0.134	0.400	pCi/g			JXC9	10/07/19	1511	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			88.4	(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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## Certificate of Analysis

Report Date: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-SUB-TDS-FJGS-A25-SB  
Sample ID: 490846002  
Matrix: Soil  
Collect Date: 03-JUL-19 13:01  
Receive Date: 20-SEP-19  
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	0.0855	+/-0.0784	0.128	0.400	pCi/g			JXC9	10/07/19	1511	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			88.4	(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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-SUB-TDS-FJGS-A12A-SB

Project: ENRG07001

Sample ID: 490846003

Client ID: ENRG070

Matrix: Soil

Collect Date: 12-JUL-19 13:02

Receive Date: 20-SEP-19

Collector: Client

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	-0.0271	+/-0.0476	0.104	0.400	pCi/g			JXC9	10/07/19	1511	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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	(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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-107-FJGS-005-SS  
Sample ID: 490846004  
Matrix: Soil  
Collect Date: 08-AUG-19 15:29  
Receive Date: 20-SEP-19  
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	0.033	+/-0.0803	0.145	0.400	pCi/g			JXC9	10/07/19	1511	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			70.7	(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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-107-FJGS-016-SS  
Sample ID: 490846005  
Matrix: Soil  
Collect Date: 09-AUG-19 14:00  
Receive Date: 20-SEP-19  
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	-0.0505	+/-0.0835	0.167	0.400	pCi/g			JXC9	10/07/19	1511	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			81.8	(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

# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: October 15, 2019

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-FJGS-003-SS  
Sample ID: 490846006  
Matrix: Soil  
Collect Date: 08-AUG-19 14:21  
Receive Date: 20-SEP-19  
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	0.00619	+/-0.0654	0.121	0.400	pCi/g			JXC9	10/08/19	0817	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			81.8	(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

# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-102-FJGS-010-SS  
Sample ID: 490846007  
Matrix: Soil  
Collect Date: 15-AUG-19 08:48  
Receive Date: 20-SEP-19  
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	0.0125	+/-0.0576	0.106	0.400	pCi/g			JXC9	10/08/19	1106	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			79.6	(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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-103-FJGS-008-SS  
Sample ID: 490846008  
Matrix: Soil  
Collect Date: 14-AUG-19 10:25  
Receive Date: 20-SEP-19  
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	0.0247	+/-0.0832	0.149	0.400	pCi/g			JXC9	10/07/19	1510	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			90.6	(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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-104-FJGS-006-SS  
Sample ID: 490846009  
Matrix: Soil  
Collect Date: 23-AUG-19 08:44  
Receive Date: 20-SEP-19  
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	-0.0047	+/-0.0675	0.130	0.400	pCi/g			JXC9	10/07/19	1510	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			81.8	(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



# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-105-FJGS-008-SS  
Sample ID: 490846010  
Matrix: Soil  
Collect Date: 23-AUG-19 13:39  
Receive Date: 20-SEP-19  
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	-0.0453	+/-0.0588	0.125	0.400	pCi/g			JXC9	10/08/19	0817	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			77.3	(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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-106-FJGS-004-SS  
Sample ID: 490846011  
Matrix: Soil  
Collect Date: 28-AUG-19 10:39  
Receive Date: 20-SEP-19  
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	0.024	+/-0.0648	0.117	0.400	pCi/g			JXC9	10/07/19	1510	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			92.8	(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

# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-106-FJGS-017-SS  
Sample ID: 490846012  
Matrix: Soil  
Collect Date: 28-AUG-19 14:31  
Receive Date: 20-SEP-19  
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	-0.023	+/-0.0397	0.0872	0.400	pCi/g			JXC9	10/08/19	0817	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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	(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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-106-FJGS-018-SS  
Sample ID: 490846013  
Matrix: Soil  
Collect Date: 28-AUG-19 14:51  
Receive Date: 20-SEP-19  
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	0.0371	+/-0.0984	0.174	0.400	pCi/g			JXC9	10/07/19	1510	1921875	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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"			86.2	(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: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35  
  
Genoa, Wisconsin 54632  
Contact: Mr. Jason Q. Spaide  
Project: LACBWR Site Restoration Project

Client Sample ID: L1-SUB-TDS-CJGS-A01-SB  
Sample ID: 490846014  
Matrix: Soil  
Collect Date: 27-JUN-19 10:51  
Receive Date: 20-SEP-19  
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	0.0233	+/-0.0336	0.0405	0.400	pCi/g			MXS2	10/14/19	0853	1919949	1
Americium-243	U	-0.0154	+/-0.0278	0.0708	0.400	pCi/g							
Curium-243/244	U	-0.00404	+/-0.0179	0.0466	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	U	-0.00044	+/-0.00286	0.0059	0.010	pCi/g			MXS2	10/13/19	1023	1919950	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	U	0.0035	+/-0.0399	0.0848	0.400	pCi/g			MXS2	10/14/19	0738	1919951	3
Plutonium-239/240	U	-0.00481	+/-0.0332	0.0808	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	U	3.99	+/-3.10	5.16	5.00	pCi/g			MXS2	10/14/19	2041	1919952	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	U	-0.464	+/-1.15	1.82	5.00	pCi/g			TXJ1	10/11/19	0816	1921366	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137		0.312	+/-0.0643	0.0341	1.00	pCi/g			MXR1	10/05/19	1250	1919313	6
Cobalt-60	U	0.00967	+/-0.0204	0.0438		pCi/g							
Europium-152	U	0.031	+/-0.0481	0.0992		pCi/g							
Europium-154	U	0.0292	+/-0.0612	0.129		pCi/g							
Europium-155	U	0.00749	+/-0.0528	0.102		pCi/g							
Niobium-94	U	0.00999	+/-0.0155	0.0334		pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	U	0.0873	+/-0.113	0.192	0.400	pCi/g			JXC9	10/07/19	1510	1921875	7
Rad Liquid Scintillation Analysis													
LSC, Tritium Distillation, Solid "As Received"													
Tritium	U	4.06	+/-4.58	7.69	10.0	pCi/g			EW3	10/04/19	0308	1921574	8
Liquid Scint C14, Solid "As Received"													
Carbon-14	U	-2.58	+/-2.02	3.60	5.00	pCi/g			TXP3	10/09/19	1559	1921585	9
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	U	-0.45	+/-0.886	1.55	2.00	pCi/g			JJ3	10/06/19	0743	1921541	10
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	U	-1.7	+/-5.55	7.59	10.0	pCi/g			TXJ1	10/11/19	1543	1921313	11
Liquid Scint Ni63, Solid "Dry Weight Corrected"													

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## Certificate of Analysis

Report Date: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

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

Client Sample ID: L1-SUB-TDS-CJGS-A01-SB  
Sample ID: 490846014

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scintillation Analysis													
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	U	1.70	+/-2.13	3.60	5.00	pCi/g			TXJ1	10/11/19	1554	1921355	12

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	RYH1	09/25/19	1209	1919153

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	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
8	EPA 906.0 Modified	
9	EPA EERF C-01 Modified	
10	DOE EML HASL-300, Tc-02-RC Modified	
11	DOE RESL Fe-1, Modified	
12	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"			71.8	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			84.8	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			97.2	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			55.2	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			55.2	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			108	(25%-125%)
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			86.2	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			104	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			64.4	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			81.5	(25%-125%)

Notes:

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## Certificate of Analysis

Report Date: October 15, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

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

Client Sample ID: L1-SUB-TDS-CJGS-A01-SB  
Sample ID: 490846014

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
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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

Report Date: October 15, 2019

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**LaCrosseSolutions**  
**S4601 State Hwy 35**  
**Genoa, Wisconsin**

**Contact: Mr. Jason Q. Spaide**

**Workorder: 490846**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<hr/>											
Rad Alpha Spec											
Batch	1919949										
QC1204388648	490846014	DUP									
Americium-241	U	0.0233	U	0.0153	pCi/g	N/A		N/A	MXS2	10/14/19	08:53
	Uncertainty	+/-0.0336		+/-0.0404							
Americium-243	U	-0.0154	U	-0.00504	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0278		+/-0.0171							
Curium-243/244	U	-0.00404	U	-0.0184	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0179		+/-0.0318							
QC1204388649	LCS										
Americium-241	1.92			1.77	pCi/g		92.4	(75%-125%)		10/14/19	08:53
	Uncertainty			+/-0.186							
Americium-243			U	-0.0226	pCi/g			(75%-125%)			
	Uncertainty			+/-0.0444							
Curium-243/244	2.26			1.89	pCi/g		83.8	(75%-125%)			
	Uncertainty			+/-0.191							
QC1204388647	MB										
Americium-241			U	-0.00254	pCi/g					10/14/19	08:53
	Uncertainty			+/-0.0237							
Americium-243			U	0.000499	pCi/g						
	Uncertainty			+/-0.0229							
Curium-243/244			U	-0.00426	pCi/g						
	Uncertainty			+/-0.0193							
<hr/>											
Batch	1919950										
QC1204388651	490846014	DUP									
Neptunium-237	U	-0.00044	U	-0.00249	pCi/g	N/A		N/A	MXS2	10/13/19	10:23
	Uncertainty	+/-0.00286		+/-0.00293							
QC1204388652	LCS										
Neptunium-237	1.44			1.55	pCi/g		108	(75%-125%)		10/13/19	10:23
	Uncertainty			+/-0.056							
QC1204388650	MB										
Neptunium-237			U	-0.00178	pCi/g					10/13/19	10:23
	Uncertainty			+/-0.00276							



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## QC Summary

Workorder: 490846

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Alpha Spec</b>											
Batch	1919951										
QC1204388654	490846014	DUP									
Plutonium-238	U	0.0035	U	0.0176	pCi/g	N/A		N/A	MXS2	10/14/19	07:38
	Uncertainty	+/-0.0399		+/-0.0379							
Plutonium-239/240	U	-0.00481	U	-0.0268	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0332		+/-0.0203							
QC1204388655	LCS										
Plutonium-238			U	0.00911	pCi/g					10/14/19	07:38
	Uncertainty			+/-0.0382							
Plutonium-239/240	1.96			1.86	pCi/g		95.3	(75%-125%)			
	Uncertainty			+/-0.244							
QC1204388653	MB										
Plutonium-238			U	-0.00287	pCi/g					10/14/19	07:38
	Uncertainty			+/-0.0268							
Plutonium-239/240			U	0.00918	pCi/g						
	Uncertainty			+/-0.0253							
Batch	1919952										
QC1204388657	490846014	DUP									
Plutonium-241	U	3.99	U	3.44	pCi/g	N/A		N/A	MXS2	10/15/19	02:00
	Uncertainty	+/-3.10		+/-2.41							
QC1204388658	LCS										
Plutonium-241	162			184	pCi/g		113	(75%-125%)		10/15/19	04:04
	Uncertainty			+/-4.54							
QC1204388656	MB										
Plutonium-241			U	1.84	pCi/g					10/14/19	22:45
	Uncertainty			+/-2.15							
<b>Rad Gamma Spec</b>											
Batch	1919313										
QC1204386990	490846014	DUP									
Cesium-137		0.312		0.350	pCi/g	11.5		(0%-20%)	MXR1	10/05/19	15:03
	Uncertainty	+/-0.0643		+/-0.0553							
Cobalt-60	U	0.00967	U	0.0062	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0204		+/-0.0199							
Europium-152	U	0.031	U	-0.00481	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0481		+/-0.0438							

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## QC Summary

Workorder: 490846

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Gamma Spec</b>											
Batch	1919313										
Europium-154	U	0.0292	U	0.00422	pCi/g	N/A		N/A MXR1		10/05/19	15:03
	Uncertainty	+/-0.0612		+/-0.0613							
Europium-155	U	0.00749	U	-0.0257	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0528		+/-0.0382							
Niobium-94	U	0.00999	U	0.0181	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0155		+/-0.0137							
QC1204386991	LCS										
Americium-241	487			510	pCi/g		105	(75%-125%)		10/05/19	12:52
	Uncertainty			+/-5.36							
Cesium-137	167			164	pCi/g		98.3	(75%-125%)			
	Uncertainty			+/-3.96							
Cobalt-60	108			107	pCi/g		98.5	(75%-125%)			
	Uncertainty			+/-3.72							
Europium-152			U	-0.591	pCi/g						
	Uncertainty			+/-1.40							
Europium-154			U	-0.258	pCi/g						
	Uncertainty			+/-0.900							
Europium-155			U	0.655	pCi/g						
	Uncertainty			+/-1.02							
Niobium-94			U	0.231	pCi/g						
	Uncertainty			+/-0.450							
QC1204386989	MB										
Cesium-137			U	-0.00479	pCi/g					10/05/19	12:51
	Uncertainty			+/-0.0152							
Cobalt-60			U	-0.00517	pCi/g						
	Uncertainty			+/-0.0145							
Europium-152			U	-0.000709	pCi/g						
	Uncertainty			+/-0.0424							
Europium-154			U	-0.0286	pCi/g						
	Uncertainty			+/-0.038							
Europium-155			U	0.0641	pCi/g						
	Uncertainty			+/-0.0928							

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## QC Summary

Workorder: 490846

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Gamma Spec</b>											
Batch	1919313										
Niobium-94			U	0.00784	pCi/g				MXR1	10/05/19	12:51
	Uncertainty			+/-0.0142							
<hr/>											
Batch	1921366										
QC1204391968	490846014	DUP									
Nickel-59			U	-0.464	pCi/g	N/A			N/A	TXJ1	10/11/19 08:17
	Uncertainty			+/-1.15							
QC1204391969	LCS										
Nickel-59				100	pCi/g		108	(75%-125%)			10/11/19 09:30
	Uncertainty			+/-6.10							
QC1204391967	MB										
Nickel-59			U	1.07	pCi/g						10/11/19 08:17
	Uncertainty			+/-1.85							
<hr/>											
<b>Rad Gas Flow</b>											
Batch	1921875										
QC1204393106	490846005	DUP									
Strontium-90			U	0.0293	pCi/g	N/A			N/A	JXC9	10/07/19 15:10
	Uncertainty			+/-0.0835							
QC1204393107	LCS										
Strontium-90				5.83	pCi/g		109	(75%-125%)			10/07/19 15:10
	Uncertainty			+/-0.340							
QC1204393105	MB										
Strontium-90			U	0.015	pCi/g						10/07/19 15:10
	Uncertainty			+/-0.0671							
<hr/>											
<b>Rad Liquid Scintillation</b>											
Batch	1921313										
QC1204391802	490846014	DUP									
Iron-55			U	-0.904	pCi/g	N/A			N/A	TXJ1	10/11/19 18:19
	Uncertainty			+/-5.55							
QC1204391803	LCS										
Iron-55				71.5	pCi/g		93.5	(75%-125%)			10/11/19 19:37
	Uncertainty			+/-5.37							
QC1204391801	MB										
Iron-55			U	1.03	pCi/g						10/11/19 17:01
	Uncertainty			+/-4.39							

# GEL LABORATORIES LLC

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## QC Summary

Workorder: 490846

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Liquid Scintillation</b>											
Batch	1921355										
QC1204391926	490846014	DUP									
Nickel-63	U	1.70	U	-0.61	pCi/g	N/A		N/A	TXJ1	10/11/19	16:28
	Uncertainty	+/-2.13		+/-2.12							
QC1204391927	LCS										
Nickel-63	96.5			101	pCi/g		104	(75%-125%)		10/11/19	16:44
	Uncertainty			+/-5.11							
QC1204391925	MB										
Nickel-63			U	-0.418	pCi/g					10/11/19	16:11
	Uncertainty			+/-2.23							
Batch	1921541										
QC1204392284	490846014	DUP									
Technetium-99	U	-0.45	U	-0.161	pCi/g	N/A		N/A	JJ3	10/06/19	08:48
	Uncertainty	+/-0.886		+/-0.901							
QC1204392285	LCS										
Technetium-99	41.1			36.7	pCi/g		89.3	(75%-125%)		10/06/19	09:20
	Uncertainty			+/-1.70							
QC1204392283	MB										
Technetium-99			U	-0.684	pCi/g					10/06/19	08:15
	Uncertainty			+/-0.898							
Batch	1921574										
QC1204392383	490846014	DUP									
Tritium	U	4.06	U	4.45	pCi/g	N/A		N/A	EW3	10/04/19	05:53
	Uncertainty	+/-4.58		+/-4.62							
QC1204392385	LCS										
Tritium	146			129	pCi/g		88.1	(75%-125%)		10/04/19	07:27
	Uncertainty			+/-8.79							
QC1204392382	MB										
Tritium			U	3.98	pCi/g					10/04/19	03:55
	Uncertainty			+/-4.49							
QC1204392384	490846014	MS									
Tritium	149	U	4.06	124	pCi/g		83.3	(75%-125%)		10/04/19	06:40
	Uncertainty		+/-4.58	+/-8.95							

# GEL LABORATORIES LLC

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

## QC Summary

Workorder: 490846

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Liquid Scintillation</b>											
Batch	1921585										
QC1204392425	490846014	DUP									
Carbon-14	U	-2.58	U	-1.82	pCi/g	N/A		N/A	TXP3	10/09/19	17:34
	Uncertainty	+/-2.02		+/-2.01							
QC1204392427	LCS										
Carbon-14	142			133	pCi/g		93.5	(75%-125%)		10/09/19	19:10
	Uncertainty			+/-4.36							
QC1204392424	MB										
Carbon-14			U	0.0484	pCi/g					10/09/19	16:46
	Uncertainty			+/-2.08							
QC1204392426	490846014	MS									
Carbon-14	146 U	-2.58		132	pCi/g		90.2	(75%-125%)		10/09/19	18:23
	Uncertainty	+/-2.02		+/-4.40							

### 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 See case narrative for an explanation
- 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

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## QC Summary

Workorder: 490846

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
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.										
^	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  
SDG #: 490846**

**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# 27

**Analytical Batch:** 1919949

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204388647	Method Blank (MB)
1204388648	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204388649	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**

The Cm-244 portion of sample 1204388647 (MB) was recounted due to results more negative than the three sigma TPU. The recount is reported.

**Product:** Alphaspec Np, Solid

**Analytical Method:** ASTM C 1475-00 Modified

**Analytical Procedure:** GL-RAD-A-032 REV# 22

**Analytical Batch:** 1919950

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204388650	Method Blank (MB)
1204388651	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204388652	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 Pu238, 239/240, Solid

**Analytical Method:** DOE EML HASL-300, Pu-11-RC Modified

**Analytical Procedure:** GL-RAD-A-011 REV# 27

**Analytical Batch:** 1919951

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204388653	Method Blank (MB)
1204388654	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204388655	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# 23

**Preparation Batch:** 1919153



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

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
490846001	L1-SUB-TDS-FJGS-A24-SB
490846002	L1-SUB-TDS-FJGS-A25-SB
490846003	L1-SUB-TDS-FJGS-A12A-SB
490846004	L1-010-107-FJGS-005-SS
490846005	L1-010-107-FJGS-016-SS
490846006	L1-010-101-FJGS-003-SS
490846007	L1-010-102-FJGS-010-SS
490846008	L1-010-103-FJGS-008-SS
490846009	L1-010-104-FJGS-006-SS
490846010	L1-010-105-FJGS-008-SS
490846011	L1-010-106-FJGS-004-SS
490846012	L1-010-106-FJGS-017-SS
490846013	L1-010-106-FJGS-018-SS
490846014	L1-SUB-TDS-CJGS-A01-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:** 1919313

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204386989	Method Blank (MB)
1204386990	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204386991	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:** Gamma Ni59, Solid

**Analytical Method:** DOE RESL Ni-1

**Analytical Procedure:** GL-RAD-A-022 REV# 19

**Analytical Batch:** 1921366

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204391967	Method Blank (MB)
1204391968	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204391969	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:** GFPC, Sr90, Solid

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

**Analytical Procedure:** GL-RAD-A-004 REV# 21

**Analytical Batch:** 1921875

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846001	L1-SUB-TDS-FJGS-A24-SB
490846002	L1-SUB-TDS-FJGS-A25-SB
490846003	L1-SUB-TDS-FJGS-A12A-SB
490846004	L1-010-107-FJGS-005-SS
490846005	L1-010-107-FJGS-016-SS
490846006	L1-010-101-FJGS-003-SS
490846007	L1-010-102-FJGS-010-SS
490846008	L1-010-103-FJGS-008-SS
490846009	L1-010-104-FJGS-006-SS

490846010	L1-010-105-FJGS-008-SS
490846011	L1-010-106-FJGS-004-SS
490846012	L1-010-106-FJGS-017-SS
490846013	L1-010-106-FJGS-018-SS
490846014	L1-SUB-TDS-CJGS-A01-SB
1204393105	Method Blank (MB)
1204393106	490846005(L1-010-107-FJGS-016-SS) Sample Duplicate (DUP)
1204393107	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**

Samples 490846006 (L1-010-101-FJGS-003-SS), 490846007 (L1-010-102-FJGS-010-SS), 490846010 (L1-010-105-FJGS-008-SS) and 490846012 (L1-010-106-FJGS-017-SS) were recounted due to results more negative than the three sigma TPU. The second counts are reported.

#### **Product: Liquid Scint Pu241, Solid**

**Analytical Method:** DOE EML HASL-300, Pu-11-RC Modified

**Analytical Procedure:** GL-RAD-A-035 REV# 21

**Analytical Batch:** 1919952

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204388656	Method Blank (MB)
1204388657	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204388658	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 Fe55, Solid

**Analytical Method:** DOE RESL Fe-1, Modified

**Analytical Procedure:** GL-RAD-A-040 REV# 13

**Analytical Batch:** 1921313

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204391801	Method Blank (MB)
1204391802	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204391803	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**

Samples were recounted due to high MDCs. The recounts are reported.

**Product:** Liquid Scint Ni63, Solid

**Analytical Method:** DOE RESL Ni-1, Modified

**Analytical Procedure:** GL-RAD-A-022 REV# 19

**Analytical Batch:** 1921355

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1919153

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204391925	Method Blank (MB)
1204391926	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204391927	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:** 1921541

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204392283	Method Blank (MB)
1204392284	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204392285	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.

**Product: LSC, Tritium Distillation, Solid**

**Analytical Method:** EPA 906.0 Modified

**Analytical Procedure:** GL-RAD-A-002 REV# 23

**Analytical Batch:** 1921574

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204392382	Method Blank (MB)
1204392383	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204392384	490846014(L1-SUB-TDS-CJGS-A01-SB) Matrix Spike (MS)
1204392385	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.

**Product:** Liquid Scint C14, Solid

**Analytical Method:** EPA EERF C-01 Modified

**Analytical Procedure:** GL-RAD-A-003 REV# 16

**Analytical Batch:** 1921585

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
490846014	L1-SUB-TDS-CJGS-A01-SB
1204392424	Method Blank (MB)
1204392425	490846014(L1-SUB-TDS-CJGS-A01-SB) Sample Duplicate (DUP)
1204392426	490846014(L1-SUB-TDS-CJGS-A01-SB) Matrix Spike (MS)
1204392427	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.

490846

Page: <u>1</u> of <u>2</u>		 <b>GEL Laboratories LLC</b> Chemistry   Radiochemistry   Radiobioassay   Specialty Analytics <b>Chain of Custody and Analytical Request</b>		GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 Phone: (843) 556-8171 Fax: (843) 766-1178	
Project # <u>LACBWR</u> Site					
GEL Quote #:					
COC Number <sup>(1)</sup> :					
PO Number: 672583		<b>GEL Work Order Number:</b>		<b>GEL Project Manager:</b>	
Client Name: La Crosse Solutions		Phone # 608-689-4259		Sample Analysis Requested <sup>(5)</sup> (Fill in the number of containers for each test)	
Project/Site Name: LACBWR-Genoa WI		Fax #		Should this sample be considered:	
Address: 54601 State Road 35				Total number of containers	
Collected By: Kevin L Murray		Send Results To: Scott Zoller sgzoller@energysolutions.com		(7) Known or possible Hazards Total number of containers SR90 <-- Preservative Type (6)	
Sample ID <i>* For composites - indicate start and stop date/time</i>	*Date Collected (mm-dd-yy)	*Time Collected (Military) (hhmm)	QC Code (a)	Field Filtered (b)	Sample Matrix (c)
L1-SUB-TDS-FJGS-A24-SB	07/03/19	12:56	N	N	SO
L1-SUB-TDS-FJGS-A25-SB	07/03/19	13:01	N	N	SO
L1-SUB-TDS-FJGS-A12A-SB	07/12/19	13:02	N	N	SO
L1-010-107-FSGS-005-SS	08/08/19	15:29	N	N	SO
L1-010-107-FJGS-016-SS	08/09/19	14:00	N	N	SO
L1-010-101-FSGS-003-SS	08/08/19	14:21	N	N	SO
L1-010-102-FSGS-010-SB	08/15/19	8:48	N	N	SO
L1-010-103-FSGS-008-SS	08/14/19	10:25	N	N	SO
L1-010-104-FSGS-006-SS	08/23/19	8:44	N	N	SO
L1-010-105-FSGS-008-SS	08/23/19	13:39	N	N	SO
Chain of Custody Signatures			TAT Requested: Normal: <u>X</u> Rush: _____ Specify: _____ (Subject to Surcharge)		
Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1. Kevin L Murray	9/18/19	0900	1. [Signature]	9/20/19	08:55
2			2		
3			3		
Fax Results: [ ] Yes [X] No			Select Deliverable: [ ] C of A [ ] QC Summary [ ] Level 1 [X] Level 2 [ ] Level 3 [ ] Level 4		
Additional Remarks: None			For Lab Receiving Use Only: Custody Seal Intact? [ ] Yes [ ] No Cooler Temp: _____ °C		
> For sample shipping and delivery details, see Sample Receipt & Review form (SRR.)			Sample Collection Time Zone: [ ] Eastern [ ] Pacific [X] Central [ ] Mountain [ ] Other:		
1.) Chain of Custody Number = Client Determined 2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite 3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered. 4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal 5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1). 6.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank					
7.) <b>KNOWN OR POSSIBLE HAZARDS</b>		Characteristic Hazards	Listed Waste	Other	
RCRA Metals		FL = Flammable/Ignitable	LW = Listed Waste	OT = Other / Unknown	
As = Arsenic Hg = Mercury		CO = Corrosive	(F, K, P and U-listed wastes.)	(i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.)	
Ba = Barium Se = Selenium		RE = Reactive	Waste code(s):	Description:	
Cd = Cadmium Ag = Silver		TSCA Regulated			
Cr = Chromium MR = Misc. RCRA metals		PCB = Polychlorinated			
Pb = Lead		biphenyls			
Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)					

490846

Page: <u>2</u> of <u>2</u>		<b>Laboratories LLC</b> <small>Chemistry   Radiochemistry   Radiobiology   Specialty Analytics</small> <b>Chain of Custody and Analytical Request</b>		GEL Laboratories, LLC	
Project # <u>LACBWR</u> Site				2040 Savage Road	
GEL Quote #:				Charleston, SC 29407	
COC Number <sup>(1)</sup> :				Phone: (843) 556-8171	
PO Number: 672583		GEL Work Order Number:		GEL Project Manager:	
Client Name: La Crosse Solutions		Phone # 608-689-4259		Sample Analysis Requested <sup>(5)</sup> (Fill in the number of containers for each test)	
Project/Site Name: LACBWR-Genoa W1		Fax #		Should this sample be considered: (7) Known or possible Hazards Total number of containers Si90 Ni59, Co60, Nb94 Cs137, Eu152, Eu154 Eu155, Pu241 H3, C14, Fe55 Ni63, Tc99 Np237, Pu238 Pu239, Pu240 Am241, Am243 Cm243, Cm244 <-- Preservative Type (6)	
Address: 54601 State Road 35					
Collected By: Kevin L Murray		Send Results To: Scott Zoller sgzoller@energysolutions.com		Comments Note: extra sample is required for sample specific QC	
Sample ID <i>* For composites - indicate start and stop date/time</i>		*Date Collected (mm-dd-yy) *Time Collected (Military) (hhmm) QC Code <sup>(3)</sup> Field Filtered <sup>(4)</sup> Sample Matrix <sup>(4)</sup>			
L1-010-106-FSGS-004-SS		08/28/19 10:39 N N SO N N 1 1			
L1-010-106-FJGS-017-SS		08/28/19 14:31 N N SO N N 1 1			
L1-010-106-FJGS-018-SS		08/28/19 14:51 N N SO N N 1 1			
L1-SUB-TDS-CJGS-A01-SB		06/27/19 10:51 N N SO N N 1 1 1 1 1 1 1 1 1 1 1 1 1 1		MDC <0.01pCi Np-237	
N A					
Chain of Custody Signatures				TAT Requested: Normal: <input checked="" type="checkbox"/> Rush: <input type="checkbox"/> Specify: <input type="text"/> (Subject to Surcharge)	
Relinquished By (Signed) _____ Date _____ Time _____		Received by (signed) _____ Date _____ Time _____		Fax Results: [ ] Yes [X] No	
1. Kevin L Murray <i>Kevin L Murray</i> 9/18/19 0900		1 <i>Scott Zoller</i> 9/20/19 855		Select Deliverable: [ ] C of A [ ] QC Summary [ ] Level 1 [X] Level 2 [ ] Level 3 [ ] Level 4	
2 _____		2 _____		Additional Remarks: None	
3 _____		3 _____		For Lab Receiving Use Only: Custody Seal Intact? [ ] Yes [ ] No Cooler Temp: _____ °C	
> For sample shipping and delivery details, see Sample Receipt & Review form (SRR.)				Sample Collection Time Zone: [ ] Eastern [ ] Pacific [X] Central [ ] Mountain [ ] Other:	
1.) Chain of Custody Number = Client Determined 2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite 3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered. 4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal 5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1). 6.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank					
<b>7.) KNOWN OR POSSIBLE HAZARDS</b> <b>RCRA Metals</b> As = Arsenic Hg= Mercury Ba = Barium Se= Selenium Cd = Cadmium Ag= Silver Cr = Chromium MR= Misc. RCRA metals Pb = Lead		<b>Characteristic Hazards</b> FL = Flammable/Ignitable CO = Corrosive RE = Reactive  <b>TSCA Regulated</b> PCB = Polychlorinated biphenyls		<b>Listed Waste</b> LW= Listed Waste (F,K,P and U-listed wastes.) Waste code(s): _____  <b>Other</b> OT= Other / Unknown (i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.) Description: _____ _____ _____	
Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)					



## SAMPLE RECEIPT &amp; REVIEW FORM

Client: <b>ENRG</b>		SDG/AR/COC/Work Order: <b>490846</b>	
Received By: <b>STACY BOONE</b>		Date Received: <b>20 - SEPT - 19</b>	
Carrier and Tracking Number		Circle Applicable: FedEx Express    FedEx Ground    UPS    Field Services    Courier    Other	
		<b>7762 7528 4418</b>	
Suspected Hazard Information	Yes	No	* If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
A) Shipped as a DOT Hazardous?			Hazard Class Shipped: _____ UN#: _____ If UN2910, Is the Radioactive Shipment Survey Compliant? Yes ___ No ___
B) Did the client designate the samples are to be received as radioactive?			COC notation or radioactive stickers on containers equal client designation.
C) Did the RSO classify the samples as radioactive?			Maximum Net Counts Observed* (Observed Counts - Area Background Counts): <u>0</u> CPM / mR/Hr Classified as: Rad 1    Rad 2    Rad 3
D) Did the client designate samples are hazardous?			COC notation or hazard labels on containers equal client designation.
E) Did the RSO identify possible hazards?			If D or E is yes, select Hazards below: PCB's    Flammable    Foreign Soil    RCRA    Asbestos    Beryllium    Other: _____
Sample Receipt Criteria		Yes	NA
1	Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>	
2	Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>	
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	<input checked="" type="checkbox"/>	
4	Daily check performed and passed on IR temperature gun?	<input checked="" type="checkbox"/>	
5	Sample containers intact and sealed?	<input checked="" type="checkbox"/>	
6	Samples requiring chemical preservation at proper pH?	<input checked="" type="checkbox"/>	
7	Do any samples require Volatile Analysis?	<input checked="" type="checkbox"/>	
8	Samples received within holding time?	<input checked="" type="checkbox"/>	
9	Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>	
10	Date & time on COC match date & time on bottles?	<input checked="" type="checkbox"/>	
11	Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>	
12	Are sample containers identifiable as GEL provided?	<input checked="" type="checkbox"/>	
13	COC form is properly signed in relinquished/received sections?	<input checked="" type="checkbox"/>	
Comments (Use Continuation Form if needed):			

 PM (or PMA) review: Initials MB Date 9/23/19 Page 1 of 1

**List of current GEL Certifications as of 15 October 2019**

<b>State</b>	<b>Certification</b>
Alaska	17-018
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
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	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019-165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780



November 14, 2019

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

Re: LACBWR Site Restoration Project  
Work Order: 493624

Dear Mr. Spaide:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on October 21, 2019. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

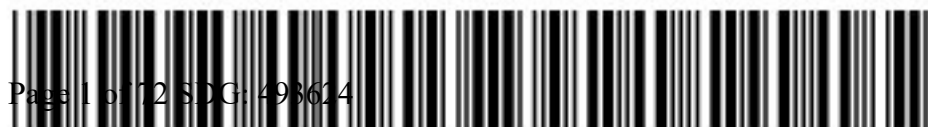
Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at [www.gel.com](http://www.gel.com).

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: 493624 GEL Work Order: 493624

**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
- H Analytical holding time was exceeded
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- h Preparation or preservation holding time was exceeded

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: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-101-RAGS-002-SS  
Sample ID: 493624001  
Matrix: Soil  
Collect Date: 08-SEP-16 11:05  
Receive Date: 21-OCT-19  
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	HUh	0.0084	+/-0.0467	0.0895	0.400	pCi/g			HAKB	11/06/19	0953	1929693	1
Americium-243	HUh	0.0346	+/-0.0974	0.104	0.400	pCi/g							
Curium-243/244	HUh	-0.00429	+/-0.037	0.0857	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	HUh	0.00125	+/-0.00299	0.00529	0.010	pCi/g			HAKB	11/11/19	1231	1929694	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	HUh	0.00487	+/-0.0271	0.0519	0.400	pCi/g			HAKB	11/06/19	0922	1929695	3
Plutonium-239/240	HUh	-0.00402	+/-0.0278	0.0676	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	HUh	-1.25	+/-2.38	4.12	5.00	pCi/g			HAKB	11/09/19	0252	1929696	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	HUh	-0.18	+/-1.68	3.01	5.00	pCi/g			TXJ1	10/30/19	0619	1931847	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137	Hh	0.113	+/-0.0594	0.0518	1.00	pCi/g			MXR1	10/30/19	0857	1929624	6
Cobalt-60	HUh	0.036	+/-0.0349	0.0881		pCi/g							
Europium-152	HUh	-0.00616	+/-0.0669	0.115		pCi/g							
Europium-154	HUh	-0.0128	+/-0.0717	0.149		pCi/g							
Europium-155	HUh	0.0587	+/-0.0622	0.134		pCi/g							
Niobium-94	HUh	0.0376	+/-0.0275	0.0407		pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	HUh	0.0238	+/-0.0658	0.120	0.400	pCi/g			JXC9	11/06/19	1419	1933651	7
Rad Liquid Scintillation Analysis													
LSC, Tritium Distillation, Solid "As Received"													
Tritium	HU	1.65	+/-5.62	9.75	10.0	pCi/g			EW3	10/28/19	2327	1929721	8
Liquid Scint C14, Solid "As Received"													
Carbon-14	HU	1.92	+/-1.76	2.94	5.00	pCi/g			TXP3	11/08/19	1739	1934551	9
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	HU	-0.00734	+/-0.483	0.861	2.00	pCi/g			JJ3	11/05/19	2229	1929739	10
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	HUh	-1.57	+/-12.1	18.7	10.0	pCi/g			RP1	11/01/19	0908	1931683	11
Liquid Scint Ni63, Solid "Dry Weight Corrected"													

# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-101-RAGS-002-SS  
Sample ID: 493624001

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scintillation Analysis													
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	HUh	-0.424	+/-1.17	2.08	5.00	pCi/g			RP1	10/30/19	1251	1931689	12

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
8	EPA 906.0 Modified	
9	EPA EERF C-01 Modified	
10	DOE EML HASL-300, Tc-02-RC Modified	
11	DOE RESL Fe-1, Modified	
12	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"			35	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			18.2	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			91.7	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			79.9	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			79.9	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			98.8	(25%-125%)
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			92.8	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			92.1	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			20.5	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			97.4	(25%-125%)

Notes:

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

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

Client Sample ID: L3-012-101-RAGS-002-SS  
Sample ID: 493624001

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
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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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-101-RAGS-004-SS  
Sample ID: 493624002  
Matrix: Soil  
Collect Date: 13-SEP-16 11:00  
Receive Date: 21-OCT-19  
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	HUh	-0.00947	+/-0.0286	0.0803	0.400	pCi/g			HAKB	11/06/19	0953	1929693	1
Americium-243	HUh	0.049	+/-0.0706	0.0851	0.400	pCi/g							
Curium-243/244	HUh	-0.0105	+/-0.0316	0.0888	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	HUh	0.00322	+/-0.00457	0.00708	0.010	pCi/g			HAKB	11/11/19	1407	1929694	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	HUh	0.0216	+/-0.043	0.0698	0.400	pCi/g			HAKB	11/06/19	0922	1929695	3
Plutonium-239/240	HUh	0.00537	+/-0.0299	0.0572	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	HUh	-0.71	+/-2.66	4.58	5.00	pCi/g			HAKB	11/09/19	0453	1929696	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	HUh	0.790	+/-1.61	1.85	5.00	pCi/g			TXJ1	10/30/19	0732	1931847	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137	HUh	-0.00991	+/-0.0244	0.0436	1.00	pCi/g			MXR1	10/30/19	2007	1929624	6
Cobalt-60	HUh	-0.0119	+/-0.0357	0.0682		pCi/g							
Europium-152	HUh	0.0185	+/-0.085	0.158		pCi/g							
Europium-154	HUh	-0.0397	+/-0.0855	0.151		pCi/g							
Europium-155	HUh	0.0322	+/-0.121	0.245		pCi/g							
Niobium-94	HUh	0.00172	+/-0.0225	0.0424		pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	HUh	-0.0186	+/-0.0688	0.136	0.400	pCi/g			JXC9	11/07/19	0654	1933651	7
Rad Liquid Scintillation Analysis													
LSC, Tritium Distillation, Solid "As Received"													
Tritium	HU	6.63	+/-5.88	9.76	10.0	pCi/g			EW3	10/29/19	0019	1929721	8
Liquid Scint C14, Solid "As Received"													
Carbon-14	HU	0.791	+/-1.54	2.62	5.00	pCi/g			TXP3	11/10/19	1745	1934551	9
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	HU	0.117	+/-0.461	0.809	2.00	pCi/g			JJ3	11/05/19	2312	1929739	10
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	HUh	-8.13	+/-10.8	16.8	10.0	pCi/g			RP1	11/01/19	1112	1931683	11
Liquid Scint Ni63, Solid "Dry Weight Corrected"													



# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

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

Client Sample ID: L3-012-101-RAGS-004-SS  
Sample ID: 493624002

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scintillation Analysis													
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	HUh	-0.325	+/-1.16	2.04	5.00	pCi/g			RP1	10/30/19	1308	1931689	12

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
8	EPA 906.0 Modified	
9	EPA EERF C-01 Modified	
10	DOE EML HASL-300, Tc-02-RC Modified	
11	DOE RESL Fe-1, Modified	
12	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"			45.5	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			29.7	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			77.2	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			72.9	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			72.9	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			106	(25%-125%)
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			75.1	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			95.4	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			23.8	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			101	(25%-125%)

Notes:

# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

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

Client Sample ID: L3-012-101-RAGS-004-SS  
Sample ID: 493624002

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
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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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-101-RBGS-004-SS  
Sample ID: 493624003  
Matrix: Soil  
Collect Date: 14-OCT-16 09:02  
Receive Date: 21-OCT-19  
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	HUh	0.00515	+/-0.0286	0.0549	0.400	pCi/g			HAKB	11/11/19	2243	1929693	1
Americium-243	HUh	0.0273	+/-0.0467	0.0409	0.400	pCi/g							
Curium-243/244	HUh	0.0083	+/-0.0311	0.0524	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	HUh	0.00372	+/-0.00542	0.00881	0.010	pCi/g			HAKB	11/11/19	1407	1929694	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	HUh	0.00351	+/-0.0367	0.0765	0.400	pCi/g			HAKB	11/06/19	0922	1929695	3
Plutonium-239/240	HUh	0.0186	+/-0.0427	0.0677	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	HUh	-2.96	+/-3.25	5.69	5.00	pCi/g			HAKB	11/09/19	0654	1929696	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	HUh	-1.19	+/-1.81	3.10	5.00	pCi/g			TXJ1	10/30/19	0732	1931847	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137	Hh	0.165	+/-0.0676	0.0583	1.00	pCi/g			MXR1	10/30/19	2007	1929624	6
Cobalt-60	HUh	0.00774	+/-0.0495	0.104		pCi/g							
Europium-152	HUh	0.00852	+/-0.0674	0.143		pCi/g							
Europium-154	HUh	-0.0312	+/-0.128	0.242		pCi/g							
Europium-155	HUh	0.0809	+/-0.0975	0.216		pCi/g							
Niobium-94	HUh	0.0112	+/-0.0238	0.0472		pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	HUh	-0.0302	+/-0.0603	0.125	0.400	pCi/g			JXC9	11/06/19	1419	1933651	7
Rad Liquid Scintillation Analysis													
LSC, Tritium Distillation, Solid "As Received"													
Tritium	HU	2.06	+/-5.54	9.58	10.0	pCi/g			EW3	10/29/19	0111	1929721	8
Liquid Scint C14, Solid "As Received"													
Carbon-14	HU	1.88	+/-1.91	3.20	5.00	pCi/g			TXP3	11/08/19	1914	1934551	9
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	HU	0.210	+/-0.757	1.32	2.00	pCi/g			JJ3	11/05/19	2354	1929739	10
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	HUh	-3.06	+/-10.9	16.7	10.0	pCi/g			RP1	11/01/19	1316	1931683	11
Liquid Scint Ni63, Solid "Dry Weight Corrected"													

# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

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

Client Sample ID: L3-012-101-RBGS-004-SS  
Sample ID: 493624003

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scintillation Analysis													
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	HUh	-0.265	+/-1.50	2.64	5.00	pCi/g			RP1	10/30/19	1324	1931689	12

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
8	EPA 906.0 Modified	
9	EPA EERF C-01 Modified	
10	DOE EML HASL-300, Tc-02-RC Modified	
11	DOE RESL Fe-1, Modified	
12	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"			63.2	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			38.5	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			67	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			58.2	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			58.2	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			84.1	(25%-125%)
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			90.6	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			83.5	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			24.3	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			77.5	(25%-125%)

Notes:

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Address : S4601 State Hwy 35

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

Client Sample ID: L3-012-101-RBGS-004-SS  
Sample ID: 493624003

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
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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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Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-101-RBGS-007-SS  
Sample ID: 493624004  
Matrix: Soil  
Collect Date: 24-OCT-16 09:05  
Receive Date: 21-OCT-19  
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	HUh	0.0113	+/-0.0385	0.0714	0.400	pCi/g			HAKB	11/06/19	0953	1929693	1
Americium-243	HUh	0.0127	+/-0.0397	0.0744	0.400	pCi/g							
Curium-243/244	HUh	-0.00764	+/-0.0449	0.107	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	HUh	0.00296	+/-0.00441	0.00677	0.010	pCi/g			HAKB	11/11/19	1407	1929694	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	HUh	0.0131	+/-0.0504	0.0977	0.400	pCi/g			HAKB	11/07/19	0836	1929695	3
Plutonium-239/240	HUh	-0.0113	+/-0.0263	0.0779	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	HUh	-3.33	+/-2.87	5.04	5.00	pCi/g			HAKB	11/09/19	0856	1929696	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	HUh	0.384	+/-1.43	2.69	5.00	pCi/g			TXJ1	10/30/19	0901	1931847	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137	Hh	0.174	+/-0.128	0.107	1.00	pCi/g			MXR1	10/30/19	2008	1929624	6
Cobalt-60	HUh	0.010	+/-0.0701	0.154		pCi/g							
Europium-152	HUh	-0.0434	+/-0.125	0.241		pCi/g							
Europium-154	HUh	0.0975	+/-0.198	0.446		pCi/g							
Europium-155	HUh	0.184	+/-0.157	0.316		pCi/g							
Niobium-94	HUh	-0.0248	+/-0.0531	0.0943		pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	HUh	-0.0921	+/-0.0818	0.172	0.400	pCi/g			JXC9	11/06/19	1419	1933651	7
Rad Liquid Scintillation Analysis													
LSC, Tritium Distillation, Solid "As Received"													
Tritium	HU	-0.242	+/-5.47	9.57	10.0	pCi/g			EW3	10/30/19	0546	1929721	8
Liquid Scint C14, Solid "As Received"													
Carbon-14	HU	1.60	+/-1.86	3.13	5.00	pCi/g			TXP3	11/08/19	2000	1934551	9
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	HU	0.0756	+/-0.755	1.33	2.00	pCi/g			JJ3	11/06/19	0037	1929739	10
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	HUh	-2.34	+/-9.51	14.1	10.0	pCi/g			RP1	11/01/19	1519	1931683	11
Liquid Scint Ni63, Solid "Dry Weight Corrected"													

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

Client Sample ID: L3-012-101-RBGS-007-SS  
Sample ID: 493624004

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scintillation Analysis													
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	HUh	-0.239	+/-1.48	2.61	5.00	pCi/g			RP1	10/30/19	1340	1931689	12

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
8	EPA 906.0 Modified	
9	EPA EERF C-01 Modified	
10	DOE EML HASL-300, Tc-02-RC Modified	
11	DOE RESL Fe-1, Modified	
12	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"			57.8	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			55.4	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			61.1	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			67.4	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			67.4	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			77.8	(25%-125%)
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			88.4	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			79.7	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			33.8	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			75.7	(25%-125%)

Notes:

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Address : S4601 State Hwy 35

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

Client Sample ID: L3-012-101-RBGS-007-SS  
Sample ID: 493624004

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
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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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Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L4-OFF-SOL-IJGS-A01-SS NE  
Sample ID: 493624005  
Matrix: Soil  
Collect Date: 04-MAY-17 08:25  
Receive Date: 21-OCT-19  
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	HUh	0.00418	+/-0.0437	0.0913	0.400	pCi/g			HAKB	11/06/19	0953	1929693	1
Americium-243	HUh	0.0805	+/-0.113	0.180	0.400	pCi/g							
Curium-243/244	HUh	0.0123	+/-0.046	0.0774	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	HUh	0.0027	+/-0.0048	0.00826	0.010	pCi/g			HAKB	11/11/19	1407	1929694	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	HUh	0.00535	+/-0.0297	0.057	0.400	pCi/g			HAKB	11/07/19	0919	1929695	3
Plutonium-239/240	HUh	0.00565	+/-0.0365	0.0746	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	HUh	-1.69	+/-2.64	4.58	5.00	pCi/g			HAKB	11/09/19	1057	1929696	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	HUh	-0.319	+/-1.80	3.04	5.00	pCi/g			TXJ1	10/30/19	0902	1931847	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137	HUh	-0.0202	+/-0.0335	0.062	1.00	pCi/g			MXR1	10/31/19	1914	1929624	6
Cobalt-60	HUh	-0.000764	+/-0.0486	0.105		pCi/g							
Europium-152	HUh	-0.0349	+/-0.0944	0.189		pCi/g							
Europium-154	HUh	0.0419	+/-0.107	0.261		pCi/g							
Europium-155	HUh	0.0633	+/-0.0849	0.189		pCi/g							
Niobium-94	HUh	-0.0074	+/-0.0313	0.0606		pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	HUh	-0.0141	+/-0.058	0.117	0.400	pCi/g			JXC9	11/06/19	1419	1933651	7
Rad Liquid Scintillation Analysis													
LSC, Tritium Distillation, Solid "As Received"													
Tritium	HU	3.03	+/-5.68	9.73	10.0	pCi/g			EW3	10/29/19	0406	1929721	8
Liquid Scint C14, Solid "As Received"													
Carbon-14	HU	2.67	+/-1.65	2.70	5.00	pCi/g			TXP3	11/08/19	2047	1934551	9
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	HU	0.468	+/-0.587	0.992	2.00	pCi/g			JJ3	11/06/19	0235	1929739	10
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	HUh	-2.65	+/-8.40	12.7	10.0	pCi/g			RP1	11/01/19	1723	1931683	11
Liquid Scint Ni63, Solid "Dry Weight Corrected"													

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Genoa, Wisconsin 54632

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

Client Sample ID: L4-OFF-SOL-IJGS-A01-SS NE  
Sample ID: 493624005

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scintillation Analysis													
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	HUh	0.190	+/-1.16	2.01	5.00	pCi/g			RP1	10/30/19	1357	1931689	12

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
8	EPA 906.0 Modified	
9	EPA EERF C-01 Modified	
10	DOE EML HASL-300, Tc-02-RC Modified	
11	DOE RESL Fe-1, Modified	
12	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"			40	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			32.4	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			89.7	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			71.9	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			71.9	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			98	(25%-125%)
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			88.4	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			95.2	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			28.8	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			101	(25%-125%)

Notes:

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

Client Sample ID: L4-OFF-SOL-IJGS-A01-SS NE  
Sample ID: 493624005

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
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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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Company : LaCrosseSolutions  
Address : S4601 State Hwy 35  
  
Genoa, Wisconsin 54632  
Contact: Mr. Jason Q. Spaide  
Project: LACBWR Site Restoration Project

Client Sample ID: L4-OFF-SOL-IJGS-A03-SS SW  
Sample ID: 493624006  
Matrix: Soil  
Collect Date: 04-MAY-17 09:30  
Receive Date: 21-OCT-19  
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	HUh	-0.00883	+/-0.0399	0.101	0.400	pCi/g			HAKB	11/06/19	0953	1929693	1
Americium-243	HUh	0.00791	+/-0.0933	0.197	0.400	pCi/g							
Curium-243/244	HUh	-0.00337	+/-0.0291	0.0673	0.400	pCi/g							
Alphaspec Np, Solid "Dry Weight Corrected"													
Neptunium-237	HUh	0.00226	+/-0.004	0.00662	0.010	pCi/g			HAKB	11/11/19	1407	1929694	2
Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"													
Plutonium-238	HUh	-0.0135	+/-0.0384	0.0935	0.400	pCi/g			HAKB	11/06/19	0953	1929695	3
Plutonium-239/240	HUh	0.00711	+/-0.0355	0.071	0.400	pCi/g							
Liquid Scint Pu241, Solid "Dry Weight Corrected"													
Plutonium-241	HUh	-1.48	+/-2.38	4.14	5.00	pCi/g			HAKB	11/09/19	1258	1929696	4
Rad Gamma Spec Analysis													
Gamma Ni59, Solid "Dry Weight Corrected"													
Nickel-59	HUh	0.850	+/-0.613	1.77	5.00	pCi/g			TXJ1	10/30/19	0902	1931847	5
Gamma, Cs137, Co60, Nb94, Eu152, Eu154, Eu155 "Dry Weight Corrected"													
Cesium-137	HUh	-0.0164	+/-0.0249	0.0423	1.00	pCi/g			MXR1	11/01/19	0622	1929624	6
Cobalt-60	HUh	0.00904	+/-0.0233	0.0583		pCi/g							
Europium-152	HUh	0.123	+/-0.0925	0.150		pCi/g							
Europium-154	HUh	-0.097	+/-0.081	0.110		pCi/g							
Europium-155	HUh	0.0555	+/-0.0883	0.181		pCi/g							
Niobium-94	HUh	0.0103	+/-0.0227	0.049		pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, Solid "Dry Weight Corrected"													
Strontium-90	HUh	-0.0582	+/-0.055	0.122	0.400	pCi/g			JXC9	11/06/19	1419	1933651	7
Rad Liquid Scintillation Analysis													
LSC, Tritium Distillation, Solid "As Received"													
Tritium	HU	3.85	+/-5.29	8.96	10.0	pCi/g			EW3	10/29/19	0458	1929721	8
Liquid Scint C14, Solid "As Received"													
Carbon-14	HU	1.65	+/-1.66	2.79	5.00	pCi/g			TXP3	11/10/19	1832	1934551	9
Liquid Scint Tc99, Solid "As Received"													
Technetium-99	HU	-0.11	+/-1.09	1.95	2.00	pCi/g			JJ3	11/06/19	0317	1929739	10
Liquid Scint Fe55, Solid "Dry Weight Corrected"													
Iron-55	HUh	-1.18	+/-6.18	8.97	10.0	pCi/g			RP1	11/01/19	1927	1931683	11
Liquid Scint Ni63, Solid "Dry Weight Corrected"													

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Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L4-OFF-SOL-IJGS-A03-SS SW  
Sample ID: 493624006

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scintillation Analysis													
Liquid Scint Ni63, Solid "Dry Weight Corrected"													
Nickel-63	HUh	-0.546	+/-1.17	2.08	5.00	pCi/g			RP1	10/30/19	1413	1931689	12

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
8	EPA 906.0 Modified	
9	EPA EERF C-01 Modified	
10	DOE EML HASL-300, Tc-02-RC Modified	
11	DOE RESL Fe-1, Modified	
12	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"			42.8	(15%-125%)
Curium-243/244 Tracer	Alphaspec Isotopic Am241 Am243, Cm243/244, Solid "Dry Weight Corrected"			27.2	(15%-125%)
Americium-243 Tracer	Alphaspec Np, Solid "Dry Weight Corrected"			69.5	(15%-125%)
Plutonium-242 Tracer	Alphaspec Pu238, 239/240, Solid "Dry Weight Corrected"			80	(15%-125%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			80	(15%-125%)
Nickel Carrier	Gamma Ni59, Solid "Dry Weight Corrected"			98.4	(25%-125%)
Strontium Carrier	GFPC, Sr90, Solid "Dry Weight Corrected"			95	(25%-125%)
Technetium-99m Tracer	Liquid Scint Tc99, Solid "As Received"			63.8	(15%-125%)
Iron-59 Tracer	Liquid Scint Fe55, Solid "Dry Weight Corrected"			43.4	(15%-125%)
Nickel Carrier	Liquid Scint Ni63, Solid "Dry Weight Corrected"			96.5	(25%-125%)

Notes:

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

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

Client Sample ID: L4-OFF-SOL-IJGS-A03-SS SW  
Sample ID: 493624006

Project: ENRG07001  
Client ID: ENRG070

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
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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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: S3-012-109B-FJGS-062-SM  
Sample ID: 493624007  
Matrix: Soil  
Collect Date: 22-AUG-19 10:05  
Receive Date: 21-OCT-19  
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	0.0139	+/-0.0617	0.113	0.400	pCi/g			JXC9	11/06/19	1419	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			110	(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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: S3-012-109B-FJGS-063-SM  
Sample ID: 493624008  
Matrix: Soil  
Collect Date: 22-AUG-19 10:14  
Receive Date: 21-OCT-19  
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	-0.00923	+/-0.0636	0.121	0.400	pCi/g			JXC9	11/06/19	1419	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			104	(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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: S3-012-109B-FJGS-064-SM  
Sample ID: 493624009  
Matrix: Soil  
Collect Date: 22-AUG-19 13:12  
Receive Date: 21-OCT-19  
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	-0.0355	+/-0.0445	0.0974	0.400	pCi/g			JXC9	11/06/19	1419	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			104	(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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L2-011-101-FSGS-013-SS  
Sample ID: 493624010  
Matrix: Soil  
Collect Date: 20-SEP-19 10:43  
Receive Date: 21-OCT-19  
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	0.0706	+/-0.085	0.144	0.400	pCi/g			JXC9	11/06/19	1419	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			97.2	(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

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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L2-011-104-FSGS-001-SS  
Sample ID: 493624011  
Matrix: Soil  
Collect Date: 09-SEP-19 14:08  
Receive Date: 21-OCT-19  
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	-0.0354	+/-0.0446	0.096	0.400	pCi/g			JXC9	11/06/19	1419	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			113	(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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L2-011-104-FSGS-010-SS  
Sample ID: 493624012  
Matrix: Soil  
Collect Date: 09-SEP-19 14:46  
Receive Date: 21-OCT-19  
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	-0.0194	+/-0.0367	0.0792	0.400	pCi/g			JXC9	11/07/19	0654	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			97.2	(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 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-101-FSGS-004-SS

Project: ENRG07001

Sample ID: 493624013

Client ID: ENRG070

Matrix: Soil

Collect Date: 05-SEP-19 08:58

Receive Date: 21-OCT-19

Collector: Client

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	0.112	+/-0.084	0.133	0.400	pCi/g			JXC9	11/06/19	1419	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			92.8	(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

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-109-FSGS-005-SS

Project: ENRG07001

Sample ID: 493624014

Client ID: ENRG070

Matrix: Soil

Collect Date: 24-SEP-19 08:05

Receive Date: 21-OCT-19

Collector: Client

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	0.0801	+/-0.0672	0.107	0.400	pCi/g			JXC9	11/06/19	1419	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			88.4	(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 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-109-FSGS-006-SS  
Sample ID: 493624015  
Matrix: Soil  
Collect Date: 24-SEP-19 10:36  
Receive Date: 21-OCT-19  
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	-0.0454	+/-0.038	0.0913	0.400	pCi/g			JXC9	11/06/19	1419	1933651	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			104	(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 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-109-FSGS-011-SS  
Sample ID: 493624016  
Matrix: Soil  
Collect Date: 23-SEP-19 14:09  
Receive Date: 21-OCT-19  
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	-0.0482	+/-0.0493	0.111	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			92.8	(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



# GEL LABORATORIES LLC

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

## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-107-FSGS-008-SS  
Sample ID: 493624017  
Matrix: Soil  
Collect Date: 08-AUG-19 15:00  
Receive Date: 21-OCT-19  
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	-0.0295	+/-0.0766	0.151	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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	(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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## Certificate of Analysis

Report Date: November 14, 2019

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-FSGS-015-SS  
Sample ID: 493624018  
Matrix: Soil  
Collect Date: 08-AUG-19 15:12  
Receive Date: 21-OCT-19  
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	-0.0436	+/-0.0544	0.118	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			88.4	(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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-102-FSGS-007-SS  
Sample ID: 493624019  
Matrix: Soil  
Collect Date: 14-AUG-19 15:18  
Receive Date: 21-OCT-19  
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	-0.0969	+/-0.0724	0.155	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			88.4	(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 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-103-FSGS-005-SS  
Sample ID: 493624020  
Matrix: Soil  
Collect Date: 14-AUG-19 10:13  
Receive Date: 21-OCT-19  
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	-0.0229	+/-0.0522	0.109	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1024	1929602

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"			90.6	(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

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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-104-FSGS-016-SS  
Sample ID: 493624021  
Matrix: Soil  
Collect Date: 23-AUG-19 09:57  
Receive Date: 21-OCT-19  
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	0.0967	+/-0.087	0.141	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			79.6	(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

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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-010-105-FSGS-007-SS  
Sample ID: 493624022  
Matrix: Soil  
Collect Date: 23-AUG-19 13:29  
Receive Date: 21-OCT-19  
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	0.0341	+/-0.0859	0.154	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			79.6	(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

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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L2-011-101-FSGS-005-SS

Project: ENRG07001

Sample ID: 493624023

Client ID: ENRG070

Matrix: Soil

Collect Date: 20-SEP-19 14:01

Receive Date: 21-OCT-19

Collector: Client

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	-0.0135	+/-0.0736	0.141	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			88.4	(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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L2-011-104-FSGS-011-SS  
Sample ID: 493624024  
Matrix: Soil  
Collect Date: 09-SEP-19 14:52  
Receive Date: 21-OCT-19  
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	-0.058	+/-0.0508	0.117	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			88.4	(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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-101-FSGS-005-SS  
Sample ID: 493624025  
Matrix: Soil  
Collect Date: 05-SEP-19 13:00  
Receive Date: 21-OCT-19  
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	0.0836	+/-0.0864	0.144	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			102	(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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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-109-FSGS-014-SS

Project: ENRG07001

Sample ID: 493624026

Client ID: ENRG070

Matrix: Soil

Collect Date: 23-SEP-19 14:21

Receive Date: 21-OCT-19

Collector: Client

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	0.0202	+/-0.0604	0.110	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			97.2	(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

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## Certificate of Analysis

Report Date: November 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L3-012-109-FSGS-017-SS  
Sample ID: 493624027  
Matrix: Soil  
Collect Date: 24-SEP-19 13:52  
Receive Date: 21-OCT-19  
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	0.0116	+/-0.0446	0.0829	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			115	(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 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-PAD-GR5-AJGS-006-SS  
Sample ID: 493624028  
Matrix: Soil  
Collect Date: 12-JUL-19 12:22  
Receive Date: 21-OCT-19  
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	0.0456	+/-0.0691	0.119	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			104	(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 14, 2019

Company : LaCrosseSolutions  
Address : S4601 State Hwy 35

Genoa, Wisconsin 54632

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

Client Sample ID: L1-PAD-GR10-AJGS-007-SS

Project: ENRG07001

Sample ID: 493624029

Client ID: ENRG070

Matrix: Soil

Collect Date: 13-JUL-19 13:48

Receive Date: 21-OCT-19

Collector: Client

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	0.0349	+/-0.0546	0.0954	0.400	pCi/g			JXC9	11/06/19	1526	1933654	1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	10/22/19	1034	1929603

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"			97.2	(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

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## QC Summary

Report Date: November 14, 2019

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LaCrosseSolutions  
S4601 State Hwy 35  
Genoa, Wisconsin

Contact: Mr. Jason Q. Spaide

Workorder: 493624

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<hr/>											
Rad Alpha Spec											
Batch	1929693										
<hr/>											
QC1204411092	493624001	DUP									
Americium-241	HUh	0.0084	HU	0.0166	pCi/g	N/A			N/AHAKB	11/06/19	09:53
	Uncertainty	+/-0.0467		+/-0.0457							
Americium-243	HUh	0.0346	HU	-0.012	pCi/g	N/A			N/A		
	Uncertainty	+/-0.0974		+/-0.0532							
Curium-243/244	HUh	-0.00429	HU	-0.0069	pCi/g	N/A			N/A		
	Uncertainty	+/-0.037		+/-0.0305							
QC1204411093	LCS										
Americium-241	1.92			1.99	pCi/g		104	(75%-125%)		11/07/19	09:18
	Uncertainty			+/-0.348							
Americium-243			U	0.00469	pCi/g			(75%-125%)			
	Uncertainty			+/-0.0491							
Curium-243/244	2.26			2.33	pCi/g		103	(75%-125%)			
	Uncertainty			+/-0.373							
QC1204411091	MB										
Americium-241			U	0.014	pCi/g					11/06/19	09:53
	Uncertainty			+/-0.0279							
Americium-243			U	0.0163	pCi/g						
	Uncertainty			+/-0.0371							
Curium-243/244			U	0.00352	pCi/g						
	Uncertainty			+/-0.0196							
Batch	1929694										
<hr/>											
QC1204411095	493624003	DUP									
Neptunium-237	HUh	0.00372	HU	0.00341	pCi/g	N/A			N/AHAKB	11/11/19	14:07
	Uncertainty	+/-0.00542		+/-0.00442							
QC1204411096	LCS										
Neptunium-237	0.869			1.01	pCi/g		116	(75%-125%)		11/11/19	14:07
	Uncertainty			+/-0.0485							
QC1204411094	MB										
Neptunium-237			U	-0.000288	pCi/g					11/11/19	14:07
	Uncertainty			+/-0.00229							

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## QC Summary

Workorder: 493624

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Alpha Spec</b>											
Batch	1929695										
QC1204411098	493624001	DUP									
Plutonium-238	HUh	0.00487	HU	0.0052	pCi/g	N/A		N/AHAKB		11/06/19	09:53
	Uncertainty	+/-0.0271		+/-0.0366							
Plutonium-239/240	HUh	-0.00402	HU	-0.00169	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0278		+/-0.0254							
QC1204411099	LCS										
Plutonium-238			U	-0.00294	pCi/g					11/06/19	09:53
	Uncertainty			+/-0.0203							
Plutonium-239/240	1.96			2.06	pCi/g		105	(75%-125%)			
	Uncertainty			+/-0.231							
QC1204411097	MB										
Plutonium-238			U	0.00862	pCi/g					11/06/19	09:53
	Uncertainty			+/-0.0295							
Plutonium-239/240			U	0.00663	pCi/g						
	Uncertainty			+/-0.0297							
Batch	1929696										
QC1204411101	493624001	DUP									
Plutonium-241	HUh	-1.25	HU	-2.36	pCi/g	N/A		N/AHAKB		11/09/19	17:00
	Uncertainty	+/-2.38		+/-2.42							
QC1204411102	LCS										
Plutonium-241	162			155	pCi/g		95.5	(75%-125%)		11/09/19	19:02
	Uncertainty			+/-4.78							
QC1204411100	MB										
Plutonium-241			U	-0.546	pCi/g					11/09/19	14:59
	Uncertainty			+/-1.98							
<b>Rad Gamma Spec</b>											
Batch	1929624										
QC1204410975	493624001	DUP									
Cesium-137	Hh	0.113	H	0.0865	pCi/g	26.4		(0% - 100%)	MXR1	11/01/19	06:24
	Uncertainty	+/-0.0594		+/-0.0561							
Cobalt-60	HUh	0.036	HU	0.0428	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0349		+/-0.0446							
Europium-152	HUh	-0.00616	HU	0.070	pCi/g	N/A		N/A			
	Uncertainty	+/-0.0669		+/-0.0644							

# GEL LABORATORIES LLC

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## QC Summary

Workorder: 493624

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Gamma Spec</b>											
Batch	1929624										
Europium-154	HUh	-0.0128	HU	-0.0196	pCi/g	N/A			N/A MXR1	11/01/19	06:24
	Uncertainty	+/-0.0717		+/-0.109							
Europium-155	HUh	0.0587	HU	0.0597	pCi/g	N/A			N/A		
	Uncertainty	+/-0.0622		+/-0.088							
Niobium-94	HUh	0.0376	HU	-0.0216	pCi/g	N/A			N/A		
	Uncertainty	+/-0.0275		+/-0.0246							
QC1204410976	LCS										
Americium-241	487			512	pCi/g		105	(75%-125%)		11/01/19	06:24
	Uncertainty			+/-6.27							
Cesium-137	167			166	pCi/g		99.4	(75%-125%)			
	Uncertainty			+/-3.92							
Cobalt-60	107			106	pCi/g		98.5	(75%-125%)			
	Uncertainty			+/-3.73							
Europium-152			U	-1.13	pCi/g						
	Uncertainty			+/-1.44							
Europium-154			U	-0.069	pCi/g						
	Uncertainty			+/-1.07							
Europium-155			U	-1.32	pCi/g						
	Uncertainty			+/-1.03							
Niobium-94			U	-0.276	pCi/g						
	Uncertainty			+/-0.508							
QC1204410974	MB										
Cesium-137			U	0.00323	pCi/g					11/01/19	06:23
	Uncertainty			+/-0.0103							
Cobalt-60			U	0.0164	pCi/g						
	Uncertainty			+/-0.0236							
Europium-152			U	0.0135	pCi/g						
	Uncertainty			+/-0.0399							
Europium-154			U	0.0106	pCi/g						
	Uncertainty			+/-0.0612							
Europium-155			U	-0.00293	pCi/g						
	Uncertainty			+/-0.0231							



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## QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Gamma Spec</b>											
Batch	1929624										
Niobium-94			U	0.00978	pCi/g				MXR1	11/01/19	06:23
	Uncertainty			+/-0.020							
Batch	1931847										
QC1204415727	493624001	DUP									
Nickel-59	HUh	-0.18	HU	-0.803	pCi/g	N/A			N/A	TXJ1	10/30/19 10:43
	Uncertainty	+/-1.68		+/-1.60							
QC1204415728	LCS										
Nickel-59	90.3			73.2	pCi/g		81.1	(75%-125%)			10/30/19 10:44
	Uncertainty			+/-6.52							
QC1204415726	MB										
Nickel-59			U	-0.45	pCi/g						10/30/19 10:43
	Uncertainty			+/-1.04							
<b>Rad Gas Flow</b>											
Batch	1933651										
QC1204420255	493624005	DUP									
Strontium-90	HUh	-0.0141	HU	-0.134	pCi/g	N/A			N/A	JXC9	11/06/19 14:18
	Uncertainty	+/-0.058		+/-0.105							
QC1204420256	LCS										
Strontium-90	5.40			4.94	pCi/g		91.4	(75%-125%)			11/06/19 14:20
	Uncertainty			+/-0.313							
QC1204420254	MB										
Strontium-90			U	-0.00246	pCi/g						11/06/19 14:18
	Uncertainty			+/-0.0478							
Batch	1933654										
QC1204420263	493624025	DUP									
Strontium-90	U	0.0836	U	0.0226	pCi/g	N/A			N/A	JXC9	11/06/19 15:26
	Uncertainty	+/-0.0864		+/-0.0608							
QC1204420264	LCS										
Strontium-90	5.51			6.75	pCi/g		122	(75%-125%)			11/07/19 06:45
	Uncertainty			+/-0.356							
QC1204420262	MB										
Strontium-90			U	-0.02	pCi/g						11/06/19 15:26
	Uncertainty			+/-0.0423							

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## QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Liquid Scintillation</b>											
Batch	1929721										
QC1204411179	493624001	DUP									
Tritium	HU	1.65	HU	-3.61	pCi/g	N/A		N/A	EW3	10/30/19	06:58
	Uncertainty	+/-5.62		+/-5.09							
QC1204411181	LCS										
Tritium	142			152	pCi/g		107	(75%-125%)		10/29/19	07:49
	Uncertainty			+/-17.1							
QC1204411178	MB										
Tritium			U	0.00583	pCi/g					10/29/19	05:50
	Uncertainty			+/-4.35							
QC1204411180	493624001	MS									
Tritium	171 HU	1.65	H	138	pCi/g		80.3	(75%-125%)		10/29/19	07:33
	Uncertainty	+/-5.62		+/-17.9							
Batch	1929739										
QC1204411223	493624001	DUP									
Technetium-99	HU	-0.00734	HU	0.523	pCi/g	N/A		N/A	JJ3	11/06/19	04:42
	Uncertainty	+/-0.483		+/-0.575							
QC1204411224	LCS										
Technetium-99	38.8			37.5	pCi/g		96.7	(75%-125%)		11/06/19	05:25
	Uncertainty			+/-2.62							
QC1204411222	MB										
Technetium-99			U	0.488	pCi/g					11/06/19	04:00
	Uncertainty			+/-0.492							
Batch	1931683										
QC1204415380	493624001	DUP									
Iron-55	HUh	-1.57	HU	-9.54	pCi/g	N/A		N/A	RP1	11/01/19	21:31
	Uncertainty	+/-12.1		+/-8.16							
QC1204415381	LCS										
Iron-55	75.4			73.8	pCi/g		97.8	(75%-125%)		10/31/19	18:25
	Uncertainty			+/-4.98							
QC1204415379	MB										
Iron-55			U	2.24	pCi/g					10/31/19	16:19
	Uncertainty			+/-3.57							

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## QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Liquid Scintillation</b>											
Batch	1931689										
QC1204415395	493624001	DUP									
Nickel-63	HUh	-0.424	HU	-0.114	pCi/g	N/A		N/A	RP1	10/30/19	14:46
	Uncertainty	+/-1.17		+/-1.26							
QC1204415396	LCS										
Nickel-63	70.5			60.2	pCi/g		85.4	(75%-125%)		10/30/19	15:03
	Uncertainty			+/-3.12							
QC1204415394	MB										
Nickel-63			U	-0.312	pCi/g					10/30/19	14:30
	Uncertainty			+/-1.36							
Batch	1934551										
QC1204422492	493624001	DUP									
Carbon-14	HU	1.92	HU	1.76	pCi/g	N/A		N/A	TXP3	11/08/19	22:21
	Uncertainty	+/-1.76		+/-1.72							
QC1204422494	LCS										
Carbon-14	128			125	pCi/g		97.6	(75%-125%)		11/08/19	23:55
	Uncertainty			+/-3.84							
QC1204422491	MB										
Carbon-14			U	1.00	pCi/g					11/09/19	12:08
	Uncertainty			+/-1.18							
QC1204422493	493624001	MS									
Carbon-14	150 HU	1.92	H	146	pCi/g		97.3	(75%-125%)		11/08/19	23:08
	Uncertainty	+/-1.76		+/-4.51							

### 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 See case narrative for an explanation
- 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.

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## QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
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.										
^	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  
SDG #: 493624**

**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# 27

**Analytical Batch:** 1929693

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204411091	Method Blank (MB)
1204411092	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204411093	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**

**Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

Sample	Value
1204411092 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

**Recounts**

The Am-243 traced portion of sample 493624003 (L3-012-101-RBGS-004-SS) was recounted due to a suspected false positive. The recount is reported.

**Product: Alphaspec Np, Solid**

**Analytical Method:** ASTM C 1475-00 Modified

**Analytical Procedure:** GL-RAD-A-032 REV# 22

**Analytical Batch:** 1929694

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204411094	Method Blank (MB)
1204411095	493624003(L3-012-101-RBGS-004-SS) Sample Duplicate (DUP)
1204411096	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****Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

<b>Sample</b>	<b>Value</b>
1204411095 (L3-012-101-RBGS-004-SSDUP)	Received 21-OCT-19, out of holding 12-APR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17

**Product:** Alphaspec Pu238, 239/240, Solid

**Analytical Method:** DOE EML HASL-300, Pu-11-RC Modified

**Analytical Procedure:** GL-RAD-A-011 REV# 27

**Analytical Batch:** 1929695

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b>GEL Sample ID#</b>	<b>Client Sample Identification</b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204411097	Method Blank (MB)
1204411098	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204411099	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**

##### **Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

<b>Sample</b>	<b>Value</b>
1204411098 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

**Recounts**

Samples 493624004 (L3-012-101-RBGS-007-SS) and 493624005 (L4-OFF-SOL-IJGS-A01-SS NE) were recounted due to a peak shift. The recounts are reported.

**Miscellaneous Information****Additional Comments**

The tracer peak centroid for sample 493624005 (L4-OFF-SOL-IJGS-A01-SS NE) is greater than 50 keV from the expected library energy value for the tracer; however, the tracer yield requirement was met and the tracer peak is within the tracer region of interest.

**Product: Dry Weight**

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
493624007	S3-012-109B-FJGS-062-SM
493624008	S3-012-109B-FJGS-063-SM
493624009	S3-012-109B-FJGS-064-SM
493624010	L2-011-101-FSGS-013-SS
493624011	L2-011-104-FSGS-001-SS
493624012	L2-011-104-FSGS-010-SS
493624013	L3-012-101-FSGS-004-SS
493624014	L3-012-109-FSGS-005-SS
493624015	L3-012-109-FSGS-006-SS
493624016	L3-012-109-FSGS-011-SS
493624017	L1-010-107-FSGS-008-SS
493624018	L1-010-101-FSGS-015-SS
493624019	L1-010-102-FSGS-007-SS
493624020	L1-010-103-FSGS-005-SS

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:** Dry Weight

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929603

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624021	L1-010-104-FSGS-016-SS
493624022	L1-010-105-FSGS-007-SS
493624023	L2-011-101-FSGS-005-SS
493624024	L2-011-104-FSGS-011-SS
493624025	L3-012-101-FSGS-005-SS
493624026	L3-012-109-FSGS-014-SS
493624027	L3-012-109-FSGS-017-SS
493624028	L1-PAD-GR5-AJGS-006-SS
493624029	L1-PAD-GR10-AJGS-007-SS

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:** 1929624

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204410974	Method Blank (MB)
1204410975	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204410976	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****Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

Sample	Value
1204410975 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

**Product: Gamma Ni59, Solid**

**Analytical Method:** DOE RESL Ni-1

**Analytical Procedure:** GL-RAD-A-022 REV# 19

**Analytical Batch:** 1931847

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204415726	Method Blank (MB)
1204415727	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204415728	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****Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

Sample	Value
1204415727 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

**Product: GFPC, Sr90, Solid**

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

**Analytical Procedure:** GL-RAD-A-004 REV# 21

**Analytical Batch:** 1933651

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
493624007	S3-012-109B-FJGS-062-SM
493624008	S3-012-109B-FJGS-063-SM
493624009	S3-012-109B-FJGS-064-SM
493624010	L2-011-101-FSGS-013-SS
493624011	L2-011-104-FSGS-001-SS
493624012	L2-011-104-FSGS-010-SS
493624013	L3-012-101-FSGS-004-SS

493624014	L3-012-109-FSGS-005-SS
493624015	L3-012-109-FSGS-006-SS
1204420254	Method Blank (MB)
1204420255	493624005(L4-OFF-SOL-IJGS-A01-SS NE) Sample Duplicate (DUP)
1204420256	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**

##### **Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

Sample	Value
1204420255 (L4-OFF-SOL-IJGS-A01-SS NEDUP)	Received 21-OCT-19, out of holding 31-OCT-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

##### **Recounts**

Samples 493624002 (L3-012-101-RAGS-004-SS) and 493624012 (L2-011-104-FSGS-010-SS) were recounted due to results more negative than the three sigma TPU. The second counts are reported.

##### **Product:** GFPC, Sr90, Solid

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

**Analytical Procedure:** GL-RAD-A-004 REV# 21

**Analytical Batch:** 1933654

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batches:** 1929602 and 1929603

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624016	L3-012-109-FSGS-011-SS
493624017	L1-010-107-FSGS-008-SS

493624018	L1-010-101-FSGS-015-SS
493624019	L1-010-102-FSGS-007-SS
493624020	L1-010-103-FSGS-005-SS
493624021	L1-010-104-FSGS-016-SS
493624022	L1-010-105-FSGS-007-SS
493624023	L2-011-101-FSGS-005-SS
493624024	L2-011-104-FSGS-011-SS
493624025	L3-012-101-FSGS-005-SS
493624026	L3-012-109-FSGS-014-SS
493624027	L3-012-109-FSGS-017-SS
493624028	L1-PAD-GR5-AJGS-006-SS
493624029	L1-PAD-GR10-AJGS-007-SS
1204420262	Method Blank (MB)
1204420263	493624025(L3-012-101-FSGS-005-SS) Sample Duplicate (DUP)
1204420264	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 1204420264 (LCS) was recounted due to high recovery. The recount is reported.

##### **Product: Liquid Scint Pu241, Solid**

**Analytical Method:** DOE EML HASL-300, Pu-11-RC Modified

**Analytical Procedure:** GL-RAD-A-035 REV# 21

**Analytical Batch:** 1929696

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204411100	Method Blank (MB)
1204411101	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204411102	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**

Sample (see below) did not meet the detection limit due to a lower sample yield. The client yield requirement was met. The sample was counted the maximum count time in order to achieve the lowest possible MDAs.

Sample	Analyte	Value
493624003 (L3-012-101-RBGS-004-SS)	Plutonium-241	Result -2.96 < MDA 5.69 > RDL 5 pCi/g

#### **Technical Information**

##### **Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

Sample	Value
1204411101 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

#### **Miscellaneous Information**

##### **Additional Comments**

The tracer peak centroid for sample 493624005 (L4-OFF-SOL-IJGS-A01-SS NE) is greater than 50 keV from the expected library energy value for the tracer; however, the tracer yield requirement was met and the tracer peak is within the tracer region of interest.

**Product:** LSC, Tritium Distillation, Solid

**Analytical Method:** EPA 906.0 Modified

**Analytical Procedure:** GL-RAD-A-002 REV# 23

**Analytical Batch:** 1929721

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

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204411178	Method Blank (MB)
1204411179	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204411180	493624001(L3-012-101-RAGS-002-SS) Matrix Spike (MS)
1204411181	Laboratory Control Sample (LCS)

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.

#### **Technical Information**

##### **Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

<b>Sample</b>	<b>Value</b>
1204411179 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
1204411180 (L3-012-101-RAGS-002-SSMS)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

##### **Recounts**

Samples 1204411179 (L3-012-101-RAGS-002-SSDUP) and 493624004 (L3-012-101-RBGS-007-SS) were recounted due to high MDCs. The recounts are reported.

##### **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:** 1929739

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204411222	Method Blank (MB)
1204411223	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204411224	Laboratory Control Sample (LCS)

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.

**Technical Information**

**Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

<b>Sample</b>	<b>Value</b>
1204411223 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

**Product:** Liquid Scint Fe55, Solid

**Analytical Method:** DOE RESL Fe-1, Modified

**Analytical Procedure:** GL-RAD-A-040 REV# 13

**Analytical Batch:** 1931683

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602



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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204415379	Method Blank (MB)
1204415380	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204415381	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**

Samples (see below) did not meet the detection limits. Samples were counted the maximum count time in order to achieve the lowest MDAs possible.

<b>Sample</b>	<b>Analyte</b>	<b>Value</b>
1204415380 (L3-012-101-RAGS-002-SSDUP)	Iron-55	Result -9.54 < MDA 12.4 > RDL 10 pCi/g
493624001 (L3-012-101-RAGS-002-SS)	Iron-55	Result -1.57 < MDA 18.7 > RDL 10 pCi/g
493624002 (L3-012-101-RAGS-004-SS)	Iron-55	Result -8.13 < MDA 16.8 > RDL 10 pCi/g
493624003 (L3-012-101-RBGS-004-SS)	Iron-55	Result -3.06 < MDA 16.7 > RDL 10 pCi/g
493624004 (L3-012-101-RBGS-007-SS)	Iron-55	Result -2.34 < MDA 14.1 > RDL 10 pCi/g
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Iron-55	Result -2.65 < MDA 12.7 > RDL 10 pCi/g

#### **Technical Information**

##### **Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

<b>Sample</b>	<b>Value</b>
1204415380 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

**Recounts**

Samples 1204415380 (L3-012-101-RAGS-002-SSDUP), 493624001 (L3-012-101-RAGS-002-SS), 493624002 (L3-012-101-RAGS-004-SS), 493624003 (L3-012-101-RBGS-004-SS), 493624004 (L3-012-101-RBGS-007-SS), 493624005 (L4-OFF-SOL-IJGS-A01-SS NE) and 493624006 (L4-OFF-SOL-IJGS-A03-SS SW) were recounted due to high MDCs. The recounts are reported.

**Product: Liquid Scint Ni63, Solid**

**Analytical Method:** DOE RESL Ni-1, Modified

**Analytical Procedure:** GL-RAD-A-022 REV# 19

**Analytical Batch:** 1931689

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 23

**Preparation Batch:** 1929602

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204415394	Method Blank (MB)
1204415395	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204415396	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****Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

<b>Sample</b>	<b>Value</b>
1204415395 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17

493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

**Product:** Liquid Scint C14, Solid

**Analytical Method:** EPA EERF C-01 Modified

**Analytical Procedure:** GL-RAD-A-003 REV# 16

**Analytical Batch:** 1934551

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

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
493624001	L3-012-101-RAGS-002-SS
493624002	L3-012-101-RAGS-004-SS
493624003	L3-012-101-RBGS-004-SS
493624004	L3-012-101-RBGS-007-SS
493624005	L4-OFF-SOL-IJGS-A01-SS NE
493624006	L4-OFF-SOL-IJGS-A03-SS SW
1204422491	Method Blank (MB)
1204422492	493624001(L3-012-101-RAGS-002-SS) Sample Duplicate (DUP)
1204422493	493624001(L3-012-101-RAGS-002-SS) Matrix Spike (MS)
1204422494	Laboratory Control Sample (LCS)

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.

#### **Technical Information**

##### **Holding Time**

Samples (See Below) were received and analyzed outside the hold time.

<b>Sample</b>	<b>Value</b>
1204422492 (L3-012-101-RAGS-002-SSDUP)	Received 21-OCT-19, out of holding 07-MAR-17
1204422493 (L3-012-101-RAGS-002-SSMS)	Received 21-OCT-19, out of holding 07-MAR-17
493624001 (L3-012-101-RAGS-002-SS)	Received 21-OCT-19, out of holding 07-MAR-17
493624002 (L3-012-101-RAGS-004-SS)	Received 21-OCT-19, out of holding 12-MAR-17
493624003 (L3-012-101-RBGS-004-SS)	Received 21-OCT-19, out of holding 12-APR-17
493624004 (L3-012-101-RBGS-007-SS)	Received 21-OCT-19, out of holding 22-APR-17
493624005 (L4-OFF-SOL-IJGS-A01-SS NE)	Received 21-OCT-19, out of holding 31-OCT-17
493624006 (L4-OFF-SOL-IJGS-A03-SS SW)	Received 21-OCT-19, out of holding 31-OCT-17

**Recounts**


Samples 493624002 (L3-012-101-RAGS-004-SS) and 493624006 (L4-OFF-SOL-IJGS-A03-SS SW) were recounted to verify sample results. Recounts are reported.

**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.

[illegible]

493624

Page: <u>2</u> of <u>4</u>		 <b>Laboratories LLC</b> <small>Chemistry   Radiochemistry   Radiobioassay   Specialty Analytics</small> <b>Chain of Custody and Analytical Request</b>		GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 Phone: (843) 556-8171 Fax: (843) 766-1178															
Project # <u>LACBWR</u> Site																			
GEL Quote #:																			
COC Number <sup>(1)</sup> :																			
PO Number: 672583		GEL Work Order Number:		GEL Project Manager:															
Client Name: La Crosse Solutions		Phone # 608-689-4259		Sample Analysis Requested <sup>(5)</sup> (Fill in the number of containers for each test)															
Project/Site Name: LACBWR-Genoa W1		Fax #		Should this sample be considered:															
Address: 54601 State Road 35				Preservative Type (6)															
Collected By: Kevin L Murray		Send Results To: Scott Zoller sgzoller@energysolutions.com		Comments Note: extra sample is required for sample specific QC															
Sample ID <i>* For composites - indicate start and stop date/time</i>	*Date Collected (mm-dd-yy)	*Time Collected (Military) (hhmm)	QC Code (2)	Field Filtered (3)	Sample Matrix (4)	Radioactive (If yes, please supply isotopic info.)	(7) Known or possible hazards	Total number of containers	Sp90										
S3-012-109B-FJGS-062-SM	08/22/19	10:05	N	N	SO	N	N	1	1										
S3-012-109B-FJGS-063-SM	08/22/19	10:14	N	N	SO	N	N	1	1										
S3-012-109B-FJGS-064-SM	08/22/19	13:12	N	N	SO	N	N	1	1										
L2-011-101-FSGS-013-SS	09/20/19	10:43	N	N	SO	N	N	1	1										
L2-011-104-FSGS-001-SS	09/09/19	14:08	N	N	SO	N	N	1	1										
L2-011-104-FSGS-010-SS	09/09/19	14:46	N	N	SO	N	N	1	1										
L3-012-101-FSGS-004-SS	09/05/19	8:58	N	N	SO	N	N	1	1										
L3-012-109-FSGS-005-SS	09/24/19	8:05	N	N	SO	N	N	1	1										
L3-012-109-FSGS-006-SS	09/24/19	10:36	N	N	SO	N	N	1	1										
L3-012-109-FSGS-011-SS	09/23/19	14:09	N	N	SO	N	N	1	1										
Chain of Custody Signatures						TAT Requested: Normal: <u>X</u> Rush: <u>    </u> Specify: <u>    </u> (Subject to Surcharge)													
Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time	Fax Results: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No													
1. Kevin L Murray <i>[Signature]</i>	10/16/2019	1315	1. A. Almen <i>[Signature]</i>	10/21/19	8:40	Select Deliverable: <input type="checkbox"/> C of A <input type="checkbox"/> QC Summary <input type="checkbox"/> Level 1 <input checked="" type="checkbox"/> Level 2 <input type="checkbox"/> Level 3 <input type="checkbox"/> Level 4													
2			2			Additional Remarks: <u>None</u>													
3			3			For Lab Receiving Use Only: Custody Seal Intact? <input type="checkbox"/> Yes <input type="checkbox"/> No Cooler Temp: <u>    </u> °C													
> For sample shipping and delivery details, see Sample Receipt & Review form (SRR.)						Sample Collection Time Zone: <input type="checkbox"/> Eastern <input type="checkbox"/> Pacific <input checked="" type="checkbox"/> Central <input type="checkbox"/> Mountain <input type="checkbox"/> Other:													
1.) Chain of Custody Number = Client Determined 2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite 3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered. 4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal 5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1). 6.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank																			
7.) <b>KNOWN OR POSSIBLE HAZARDS</b>		<b>Characteristic Hazards</b>		<b>Listed Waste</b>		<b>Other</b>		Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)											
RCRA Metals		FL = Flammable/Ignitable		LW = Listed Waste		OT = Other / Unknown													
As = Arsenic Hg = Mercury		CO = Corrosive		(F, K, P and U-listed wastes.)		(i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.)													
Ba = Barium Se = Selenium		RE = Reactive		Waste code(s):		Description:													
Cd = Cadmium Ag = Silver		TSCA Regulated																	
Cr = Chromium MR = Misc. RCRA metals		PCB = Polychlorinated biphenyls																	
Pb = Lead																			

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Page: <u>3</u> of <u>4</u>		<b>Laboratories LLC</b> <small>Chemistry   Radiochemistry   Radioassay   Specialty Analytics</small> <b>Chain of Custody and Analytical Request</b>		GEL Laboratories, LLC																	
Project # <u>LACBWR</u> Site				2040 Savage Road																	
GEL Quote #:				Charleston, SC 29407																	
COC Number <sup>(1)</sup> :				Phone: (843) 556-8171																	
PO Number: 672583		<b>GEL Work Order Number:</b>		<b>GEL Project Manager:</b>																	
Client Name: La Crosse Solutions		Phone # 608-689-4259		<b>Sample Analysis Requested <sup>(5)</sup></b> (Fill in the number of containers for each test)																	
Project/Site Name: LACBWR-Genoa WI		Fax #																			
Address: 54601 State Road 35		Should this sample be considered: (if yes, please supply isotopic info.) (7) Known or possible Hazards		Total number of containers Sr90																	
Collected By: Kevin L Murray						Send Results To: Scott Zoller sgzoller@energysolutions.com															
<b>Sample ID</b> <i>* For composites - indicate start and stop date/time</i>		*Date Collected (mm-dd-yy)	*Time Collected (Military) (hhmm)	QC Code <sup>(2)</sup>	Field Filtered <sup>(3)</sup>	Sample Matrix <sup>(4)</sup>	Radioactive (if yes, please supply isotopic info.)	(7) Known or possible Hazards	Total number of containers	Sr90											<b>Comments</b> Note: extra sample is required for sample specific QC
L1-010-107-FSGS-008-SS	08/08/19	15:00	N	N	SO	N	N	1	1												
L1-010-101-FJGS-015-SS	08/08/19	15:12	N	N	SO	N	N	1	1												
L1-010-102-FSGS-007-SS	08/14/19	15:18	N	N	SO	N	N	1	1												
L1-010-103-FSGS-005-SS	08/14/19	10:13	N	N	SO	N	N	1	1												
L1-010-104-FJGS-016-SS	08/23/19	9:57	N	N	SO	N	N	1	1												
L1-010-105-FSGS-007-SS	08/23/19	13:29	N	N	SO	N	N	1	1												
L2-011-101-FSGS-005-SS	09/20/19	14:01	N	N	SO	N	N	1	1												
L2-011-104-FSGS-011-SS	09/09/19	14:52	N	N	SO	N	N	1	1												
L3-012-101-FSGS-005-SS	09/05/19	13:00	N	N	SO	N	N	1	1												
L3-012-109-FSGS-014-SS	09/23/19	14:21	N	N	SO	N	N	1	1												
<b>Chain of Custody Signatures</b>						<b>TAT Requested:</b> Normal: <u>X</u> Rush: _____ Specify: _____ (Subject to Surcharge)															
Relinquished By (Signed)		Date	Time	Received by (signed)		Date	Time	Fax Results: [ ] Yes [X] No													
1. Kevin L Murray		10/16/2019	1315	1. [Signature]		10/20/19	8:40	Select Deliverable: [ ] C of A [ ] QC Summary [ ] level 1 [X] Level 2 [ ] Level 3 [ ] Level 4													
2				2				Additional Remarks: <u>None</u>													
3				3				For Lab Receiving Use Only: Custody Seal Intact? [ ] Yes [ ] No Cooler Temp: _____ °C													
> For sample shipping and delivery details, see Sample Receipt & Review form (SRR.)								Sample Collection Time Zone: [ ] Eastern [ ] Pacific [X] Central [ ] Mountain [ ] Other:													
1.) Chain of Custody Number = Client Determined 2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite 3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered. 4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal 5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1). 6.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate. If no preservative is added = leave field blank																					
<b>7.) KNOWN OR POSSIBLE HAZARDS</b>				<b>Characteristic Hazards</b>				<b>Listed Waste</b>				<b>Other</b>				Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)					
RCRA Metals				FL = Flammable/Ignitable				LW= Listed Waste				OT= Other / Unknown									
As = Arsenic Hg= Mercury				CO = Corrosive				(F,K,P and U-listed wastes.)				(i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.)									
Ba = Barium Se= Selenium				RE = Reactive				Waste code(s):				Description:									
Cd = Cadmium Ag= Silver				<b>TSCA Regulated</b>																	
Cr = Chromium MR= Misc. RCRA metals				PCB = Polychlorinated biphenyls																	
Pb = Lead																					



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Page: <u>4</u> of <u>4</u>		<b>Laboratories LLC</b> <small>Chemistry   Radiochemistry   Radiobiology   Specialty Analytics</small> <b>Chain of Custody and Analytical Request</b>		GEL Laboratories, LLC		
Project # <u>LACBWR</u> Site				2040 Savage Road		
GEL Quote #:				Charleston, SC 29407		
COC Number <sup>(1)</sup> :				Phone: (843) 556-8171		
PO Number: 672583		GEL Work Order Number:		GEL Project Manager:		
Client Name: La Crosse Solutions		Phone # 608-689-4259		<b>Sample Analysis Requested <sup>(5)</sup></b> (Fill in the number of containers for each test)		
Project/Site Name: LACBWR-Genoa WI		Fax #				
Address: 54601 State Road 35		Should this sample be considered: (if yes, please supply isotopic info.)		Total number of containers S-90		
Collected By: Kevin L Murray						
Send Results To: Scott Zoller sgzoller@energysolutions.com		Radioactive (if yes, please supply isotopic info.) (7) Known or possible Hazards		<-- Preservative Type (6)		
Sample ID	*Date Collected	*Time Collected (Military) (hhmm)	QC Code <sup>(4)</sup>	Field Filtered <sup>(3)</sup>	Sample Matrix <sup>(4)</sup>	Comments Note: extra sample is required for sample specific QC
* For composites - indicate start and stop date/time						
L3-012-109-FJGS-017-SS	09/24/19	13:52	N	N	SO	
L1-PAD-GR5-AJGS-006-SS	07/12/19	12:22	N	N	SO	
L1-PAD-GR10-AJGS-007-SS	07/13/19	13:48	N	N	SO	
<b>Chain of Custody Signatures</b>						TAT Requested: Normal: <u>X</u> Rush: <u>  </u> Specify: <u>  </u> (Subject to Surcharge)
Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time	Fax Results: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
1. Kevin L Murray <i>[Signature]</i>	10/16/2019	1315	1. <i>[Signature]</i>	10/21/19	8:40	Select Deliverable: <input type="checkbox"/> C of A <input type="checkbox"/> QC Summary <input type="checkbox"/> level 1 <input checked="" type="checkbox"/> Level 2 <input type="checkbox"/> Level 3 <input type="checkbox"/> Level 4
2. <i>[Signature]</i>			2. <i>[Signature]</i>			Additional Remarks: <u>None</u>
3. <i>[Signature]</i>			3. <i>[Signature]</i>			For Lab Receiving Use Only: Custody Seal Intact? <input type="checkbox"/> Yes <input type="checkbox"/> No Cooler Temp: <u>  </u> °C
> For sample shipping and delivery details, see Sample Receipt & Review form (SRR.)						Sample Collection Time Zone: <input type="checkbox"/> Eastern <input type="checkbox"/> Pacific <input checked="" type="checkbox"/> Central <input type="checkbox"/> Mountain <input type="checkbox"/> Other:
1.) Chain of Custody Number = Client Determined 2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite 3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered. 4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Faecal, N=Nasal 5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1). 6.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank						
<b>7.) KNOWN OR POSSIBLE HAZARDS</b> RCRA Metals As = Arsenic Hg = Mercury Ba = Barium Se = Selenium Cd = Cadmium Ag = Silver Cr = Chromium MR = Misc. RCRA metals Pb = Lead		<b>Characteristic Hazards</b> FL = Flammable/Ignitable CO = Corrosive RE = Reactive <b>TSCA Regulated</b> PCB = Polychlorinated biphenyls		<b>Listed Waste</b> LW = Listed Waste (F, K, P and U-listed wastes.) Waste code(s):		<b>Other</b> OT = Other / Unknown (i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.) Description:
Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)						



EK

## SAMPLE RECEIPT &amp; REVIEW FORM

Client: <u>ENRAG</u>		SDG/AR/COC/Work Order: <u>493624</u>	
Received By: <u>AJA</u>		Date Received: <u>10/21/19</u>	
Carrier and Tracking Number		Circle Applicable: <input checked="" type="radio"/> FedEx Express <input type="radio"/> FedEx Ground <input type="radio"/> UPS <input type="radio"/> Field Services <input type="radio"/> Courier <input type="radio"/> Other <u>7767 3575 6970</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.	
A) Shipped as a DOT Hazardous?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Hazard Class Shipped: _____ UN#: _____ If UN2910, Is the Radioactive Shipment Survey Compliant? Yes ___ No ___	
B) Did the client designate the samples are to be received as radioactive?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	COC notation or radioactive stickers on containers equal client designation.	
C) Did the RSO classify the samples 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: Rad 1 Rad 2 Rad 3	
D) Did the client designate samples are hazardous?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	COC notation or hazard labels on containers equal client designation.	
E) Did the RSO identify possible hazards?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	If D or E is yes, select Hazards below. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other: _____	
Sample Receipt Criteria		Yes <input type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Circle Applicable: Client contacted and provided COC COC created upon receipt
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	Yes <input type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Preservation Method: Wet Ice Ice Packs Dry ice <input checked="" type="radio"/> None <input type="radio"/> Other: _____ *all temperatures are recorded in Celsius TEMP: <u>23°</u>
4	Daily check performed and passed on IR temperature gun?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Temperature Device Serial #: <u>784-16</u> Secondary Temperature Device Serial # (If Applicable): _____
5	Sample containers intact and sealed?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?	Yes <input type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Sample ID's and Containers Affected: _____ If Preservation added, Lot#: _____
7	Do any samples require Volatile Analysis?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	If Yes, are Encores or Soil Kits present for solids? Yes ___ No ___ NA ___ (If yes, take to VOA Freezer) Do liquid VOA vials contain acid preservation? Yes ___ No ___ NA ___ (If unknown, select No) Are liquid VOA vials free of headspace? Yes ___ No ___ NA ___ Sample ID's and containers affected: _____
8	Samples received within holding time?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	ID's and tests affected: _____
9	Sample ID's on COC match ID's on bottles?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	ID's and containers affected: _____
10	Date & time on COC match date & time on bottles?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
11	Number of containers received match number indicated on COC?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Circle Applicable: No container count on COC Other (describe)
12	Are sample containers identifiable as GEL provided?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	
13	COC form is properly signed in relinquished/received sections?	Yes <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/> No <input type="checkbox"/>	Circle Applicable: Not relinquished Other (describe)
Comments (Use Continuation Form if needed):			

PM (or PMA) review: Initials MB Date 10/22/19 Page 1 of 1

GL-CHL-SR-001 Rev 6

**List of current GEL Certifications as of 14 November 2019**

<b>State</b>	<b>Certification</b>
Alaska	17-018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
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	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019-165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-29
Vermont	VT87156
Virginia NELAP	460202
Washington	C780