



**Addendum to the
Closeout Report
Waste Concentration Facility (Bldg. 811 – Area of Concern
10) and Surrounding Area**

June 14, 2019

Prepared by:

P.W. Grosser Consulting, Inc.
630 Johnson Avenue, Suite 7
Bohemia, New York 11716
and
DAQ, Inc.
3 Shadow Lane
Hopewell Junction, NY 12533

Prepared for:

Brookhaven National Laboratory
Environmental Protection Division
Upton, New York 11973

Executive Summary

Radiological contamination was identified in surface soil (i.e., three isolated areas of approximately 129 square-feet [ft²], 317 ft² and 751 ft²) along the fence line just north of the former Brookhaven National Laboratory (BNL) Waste Concentration Facility during radiological walkover surveys performed in 2016 as part of the Building 811 Project, as documented in the *Revised Closeout Report, Waste Concentration Facility (Bldg 811 – Area of Concern 10) and Surrounding Area*, (Building 811 Closeout Report) (BNL, January 2017). Analytical results for soil samples collected in these areas in 2016 indicate that the primary detected radionuclide was cesium-137 (Cs-137); however, one sample did contain detectable concentrations of cobalt-60 (Co-60). The following scope of work was completed in 2018 to address these three isolated areas of radiological contamination in surface soil:

- Excavation of soil contamination above site cleanup goals;
- Completion of a Final Status Survey (FSS) of a *Multi-Agency Radiological Survey and Site Investigation Manual* (MARSSIM) Class 1 survey unit (SU-3) to ensure site cleanup objectives were met;
- Characterization, transportation and disposal of excavated soil; and
- Site restoration.

Soil remediation and the subsequent FSS were performed in accordance with the *Record of Decision – Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6, 8, 10, 16, 17, and 18,)* (BNL, 1999) (OU I ROD) and the *Addendum to the Field Sampling Plan/Quality Assurance Project Plan, Waste Concentration Facility (AOC 10) and Surrounding Area* (PWGC, May 2018) (WCF FSP/QAPP Addendum).

Approximately 22 cubic yards of excavated soil were loaded into 7-cubic yard supersacks. A 3-foot long steel I-beam and concrete rubble associated with the removed fence were loaded into B-12 containers. Five supersacks and their associated overpacks, as well as two B-12 containers, were transported to BNL's Waste Management Facility for temporary storage, and subsequently shipped to Energy Solutions of Clive, Utah for disposal.

The following summarizes the as-left conditions for this project and how they satisfy the requirements of the OU I ROD:

- The results of the final status radiological walkover survey of SU-3 exhibited count rates below 21,500 counts per minute (cpm). As specified in Table 4-2 of the *Field Sampling Plan/Quality Assurance Project Plan, Waste Concentration Facility (AOC10) and Surrounding Area* (PWGC, August 2015), the 21,500 cpm count rate was determined to approximate a Cs-137 concentration of 15 picocuries per gram (pCi/g) (i.e., the screening

limit) in soil when using the uncollimated sodium iodide (NaI) gamma scintillation detector.

- The maximum Cs-137 and radium-226 (Ra-226) concentrations detected in surface soil and core samples collected after the completion of remediation are 15.5 pCi/g and 0.851 pCi/g, respectively. Strontium (Sr)-90 concentrations were below Minimum Detectable Concentrations (MDC). The as-left maximum concentrations are well below the site cleanup values (Cs-137 = 23 pCi/g, Sr-90 = 15 pCi/g and Ra-226 = 5 pCi/g).
- The maximum concentrations of additional radionuclides evaluated in surface soil composite samples, including tritium, gamma emitters (i.e., Co-60 and europium-152 [Eu-152]), and alpha emitters (isotopes of uranium and plutonium) are below the established site cleanup criteria specified in Table 3-1 of the *Field Sampling Plan/Quality Assurance Project Plan, Waste Concentration Facility (AOC10) and Surrounding Area* (PWGC, August 2015)
- As documented in the Building 811 Closeout Report, the results of the dose assessment performed during the Building 811 Project are well below the limits established in the OU I ROD, including the dose based soil cleanup objective of 15 millirem/year (mrem/yr) above background and the New York State Department of Environmental Conservation (NYSDEC) cleanup guideline of 10 mrem/yr from Technical and Administrative Guidance Memorandum (TAGM) 4003, which was adopted as an As-Low-As-Reasonably-Achievable (ALARA) goal. In accordance with the WCF FSP/QAPP Addendum, an additional dose assessment following the remediation documented in this addendum was not performed.
- Site restoration included backfilling excavated areas to original grade and the installation of temporary fencing to delineate the Waste Concentration Facility from the adjacent Collider Accelerator Department metal storage area.

The BNL Land Use Controls Fact Sheet was updated to reflect the as-left site conditions. No radiological soil contamination postings are required for this area. A Land Use and Institutional Controls (LUIC) point-of-contact sign is posted nearby. Brookhaven Science Associates (BSA) will perform surveillance and maintenance activities. In addition to maintaining institutional controls for the area, BSA will ensure that routine inspections are performed. The U.S. Department of Energy (DOE) will ensure enforcement of all institutional controls.

Table of Contents

Executive Summary	i
A. Purpose	1
B. Background	1
C. Remedial Activities	3
D. Final Status Survey (FSS) and Sampling Plan	4
D.1 Final Status Survey Design	5
D.2 Final Status Survey and Sampling Results	7
D.3 Final Status Survey Conclusion	8
E. Waste Management	8
F. Site Restoration	10
G. Performance Standards & Quality Control	11
H. Operation and Maintenance Activities	12
I. Summary of Project Costs	12
J. References	13

Figures

Figure B-1:	2016 Building 811 Project Fence Line Survey and ISOCs Soil Sample Results
Figure D-1:	Survey Unit 3
Figure D-2:	Survey Unit 3 Soil Sample Locations
Figure D-3:	Final Status Survey

Tables

Table D-1:	Survey Unit 3 – Surface Soil Grab Sample Results
Table D-2:	Survey Unit 3 – Surface Soil Composite Sample Results
Table D-3:	Survey Unit 3 – Modified Investigation Level for Soil Composite Samples
Table D-4:	Survey Unit 3 – Core Sample Results
Table E-1	Survey Unit 3 - Waste Characterization Metals Results
Table E-2	Survey Unit 3 – Waste Characterization Radiological Results
Table G-1	Survey Unit 3 – QA/QC Sample Results

Appendices

Appendix A:	Offsite Analytical Results
Appendix B:	Onsite ISOCS Results for Core Samples
Appendix C:	Waste Manifests
Appendix D:	Data Validation Checklists

A. Purpose

The purpose of this addendum to the *Revised Closeout Report, Waste Concentration Facility (Bldg 811 – Area of Concern 10) and Surrounding Area*, (Building 811 Closeout Report) (BNL, January 2017) is to document the actions completed to address radiological contamination in surface soil located along the fence line just north of the former Brookhaven National Laboratory (BNL) Building 811, which separates the Waste Concentration Facility (Area of Concern [AOC] 10) from the former Collider Accelerator Department metal storage area (**Figure B-1**). This addendum documents the following scope of work:

- Excavation of soil contaminated above site cleanup goals;
- Completion of a Final Status Survey (FSS);
- Characterization, transportation and disposal of excavated soil; and
- Site restoration.

This scope of work was completed by the BNL Environmental Protection Division (EPD), EPD task order subcontractors, the BNL Facilities and Operations Directorate (F&O) and the BNL Radiological Control Division (RCD). Soil remediation and the subsequent FSS were performed in accordance with the *Record of Decision – Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6, 8, 10, 16, 17, and 18)* (BNL, 1999) (OU I ROD) and the *Addendum to the Field Sampling Plan/Quality Assurance Project Plan, Waste Concentration Facility (AOC 10) and Surrounding Area* (PWGC, May 2018), referred to herein as the WCF FSP/QAPP Addendum.

B. Background

As documented in the Building 811 Closeout Report (BNL, January 2017), Decontamination and Dismantlement (D&D) of Building 810 (Waste Transfer Facility) and Building 811 (Waste Concentration Facility), the removal of the associated structures and piping, and the subsequent final status survey (FSS) and independent verification (IV) were completed between July 2014 and September 2016, referred to herein as the Building 811 Project. During the Building 811 Project, radiological contamination was identified in three isolated areas of approximately 129 square-feet (ft²), 317 ft² and 751 ft² along the fence line just north of the former Waste Concentration Facility. Count rates of greater than 21,500 counts per minute (cpm) were recorded in these areas using an uncollimated sodium iodide (NaI) gamma scintillation detector during the final status radiological walkover survey. Based on the radiological walkover survey and limited excavation activities along the fence line, the contaminated soil appeared to be shallow (i.e., less than 2 feet below ground surface [bgs]). Analytical results for soil samples collected in these

areas in 2016 indicate that the primary detected radionuclide was cesium-137 (Cs-137); however, one sample did contain detectable concentrations of cobalt-60 (Co-60). Due to insufficient funds for additional remediation activities at the time of the Building 811 Project, these areas with elevated levels of radiologically contaminated soil were placed under institutional controls and added to the Land Use and Institutional Controls (LUIC) contaminated soil map. These areas are illustrated on **Figure B-1**.

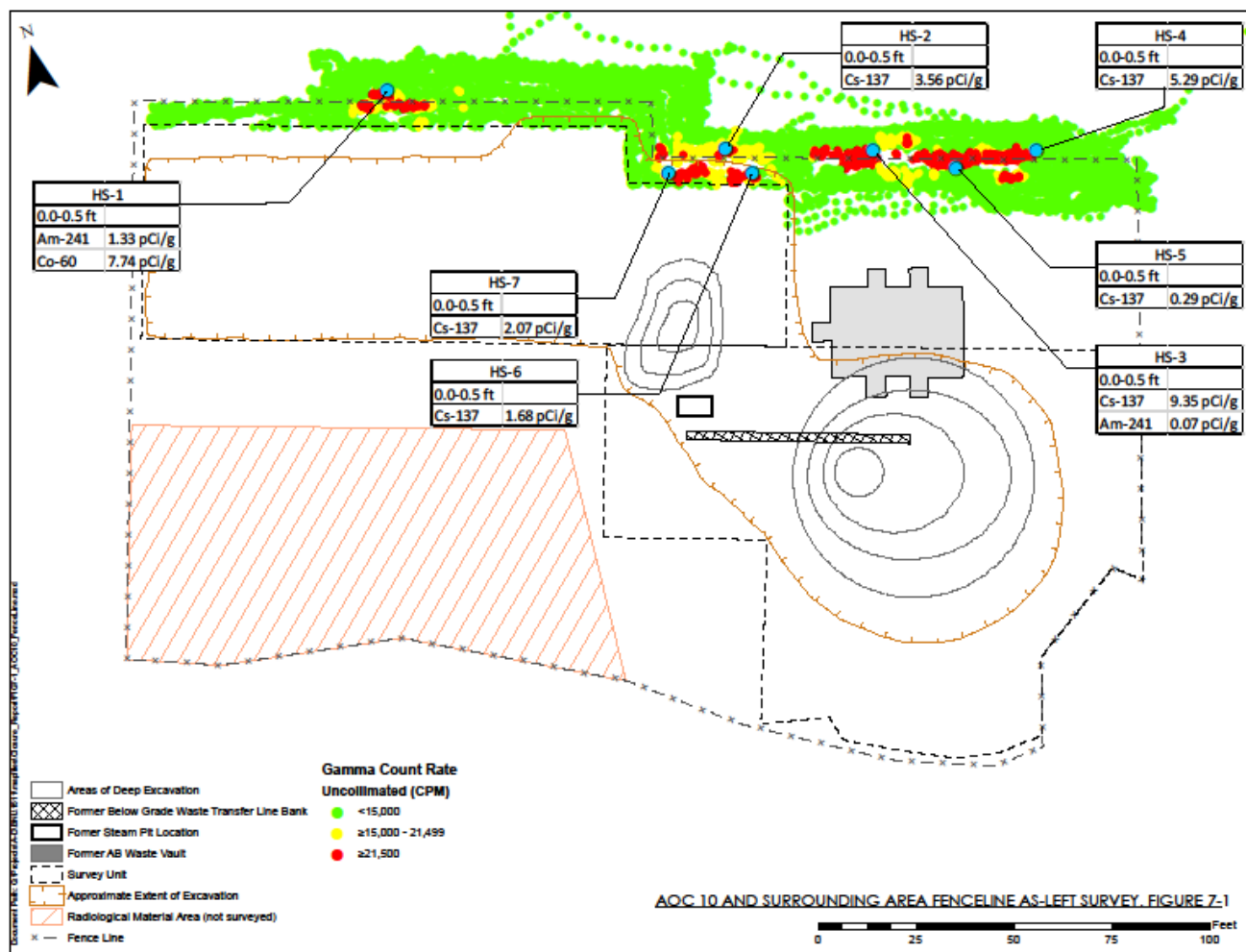


Figure B-1 – 2016 Building 811 Project Fence Line Survey and ISOCS Soil Sample Results



Photograph 1 – Project area, view to west

C. Remedial Activities

Mobilization and site preparation were initiated on July 16, 2018, which included removing fence posts and associated concrete, mowing/clearing vegetation, as well as staging excavation equipment and project waste containers. A general area that encompassed the three isolated areas of surface soil contamination (i.e., approximately 129 ft², 317 ft² and 751 ft²) was previously delineated with a radiological boundary. A BNL RCD Technician further delineated the three isolated areas of surface soil contamination by performing an initial radiological walkover survey with an uncollimated NaI detector and marking the areas measured above 21,500 cpm with spray paint. Excavation of the isolated areas of surface soil contamination was performed between July 17 and July 19, 2018. In accordance with the WCF FSP/QAPP Addendum, soil was removed in approximate one-foot lifts with a backhoe until radiological surveys using an uncollimated NaI showed that gamma radiation levels in remediated areas were less than 21,500 cpm. As further discussed in **Section D.2**, spot remediation was performed on August 27, 2018 to address a single surface soil sample location where elevated Cs-137 was detected in a surface soil grab sample. A total of 22 cubic yards of soil were excavated.



Photograph 2 – Remediation of isolated area of surface soil contamination

As further discussed in Section E., excavated soil was loaded into 7-cubic yard supersacks. A 3-foot long steel I-beam and concrete rubble associated with the removed fence were loaded into two B-12 containers.

D. Final Status Survey (FSS) and Sampling Plan

After completing remediation of the areas of surface soil contamination, walkover surveys were performed, and soil samples were collected and analyzed as specified below.

As discussed in Sections 2.1 and 3.2 of the Building 811 Closeout Report, the radionuclides of concern for Building 811 and the surrounding area, based on exposure potential, were Cs-137, radium-226 (Ra-226), and strontium-90 (Sr-90); and their respective site cleanup values are 23 picocuries per gram (pCi/g), 5 pCi/g and 15 pCi/g. Although less likely to be present, additional radionuclides were evaluated and include tritium, gamma emitters (i.e., Co-60 and europium-152 [Eu-152]), and alpha emitters (isotopes of uranium and plutonium).

D.1 Final Status Survey Design

In accordance with the WCF FSP/QAPP Addendum, a FSS was performed following the principles of the *Multi-Agency Radiological Survey and Site Investigation Manual* (MARSSIM). As illustrated on **Figure D-1**, a Class 1 survey unit (SU-3) was established, which contained the three distinct areas where surface soil contamination was remediated. These three areas comprise approximately 1,197 ft², or about 28% of the total survey unit (4,305 ft²).

On July 20 and July 28, 2018, a 100% gamma walkover scan of SU-3 was performed by a RCD Technician using an unshielded 2" x 2" NaI scintillation detector (Ludlum 44-10 probe) coupled to a count rate meter (Ludlum Model 2221) and an ERG 105G Real GPS Data Logger System. A 100% scan is defined as walking at 0.5 meters/second and moving the probe in a serpentine motion. The RCD Technician followed 1-meter-wide lanes over the entire survey unit.



Photograph 3 – Final status radiological walkover survey of remediated area

In accordance with the WCF FSP/QAPP Addendum, a random-start triangular grid pattern was established to determine 20 surface soil sample locations (0-6 inches bgs) within SU-3, as shown on **Figure D-2**. Surface samples were collected on July 31, 2018. A grab sample was collected from each of the 20 locations and analyzed for gamma emitters by gamma spectroscopy (including Cs-137 and Ra-226) and for Sr-90. Four surface soil composite samples were analyzed by alpha spectroscopy for alpha emitters (Uranium-235 [U-235], Uranium-238 [U-238], Plutonium-238 [Pu-238], Plutonium-239/240 [Pu-239/240]), and for tritium. In accordance with the WCF FSP/QAPP Addendum, each of the four composite samples were collected by combining soil from five of the surface soil sample locations (e.g., Composite 1 = SU-3-1 through SU-3-5, Composite 2 = SU-3-6 through SU-3-10, etc.). A fixed-point one-minute measurement with an unshielded 2" x 2" NaI scintillation detector was taken at each of the 20 surface soil sample locations. Grab and composite soil samples were analyzed at GEL Laboratories of Charleston, South Carolina (GEL).



Photograph 4 – Surface soil composite sample preparation

A Geoprobe was utilized to collect a core soil sample (0 – 8 feet bgs) in the approximate center of each of the three discrete areas of contamination within SU-3 on July 31, 2018, as shown on **Figure D-2**. In accordance with the WCF FSP/QAPP Addendum, the three core samples were analyzed in 2-foot sections (i.e., 4 samples per core location) for Cs-137 utilizing onsite gamma spectroscopy. Each core sample was also analyzed at GEL for gamma emitters by gamma spectroscopy (including Cs-137 and Ra-226) and for Sr-90. When Cs-137 was detected in a core soil sample at a concentration greater than 7 pCi/g (about 1/3 of the Derived Concentration Guideline Limit [DCGL]) utilizing onsite gamma spectroscopy, then the specific sample was also analyzed by GEL for alpha emitters (U-235/238, Pu-238, Pu-239/240) and tritium.

As specified in the WCF FSP/QAPP Addendum, soil samples were collected in accordance with BNL EPD standard operating procedures.

D.2 Final Status Survey and Sampling Results

The results of the final status radiological walkover survey of SU-3 performed on July 20 and 28, 2018 exhibited count rates below 21,500 cpm, as shown on **Figure D-3**. As specified in Table 4-2 of the *Field Sampling Plan/Quality Assurance Project Plan, Waste Concentration Facility (AOC10) and Surrounding Area* (BNL, August 2015), the 21,500 cpm count rate was determined to approximate a Cs-137 concentration of 15 pCi/G in soil when using the uncollimated NaI gamma scintillation detector.

Results of the fixed-point one-minute measurements taken with the NaI probe at each of the surface soil sample locations ranged from 5,371 cpm at SU-3-11 to 20,793 cpm at SU-3-1. Surface soil grab sample results for Cs-137 were all below the associated site cleanup criteria of 23 pCi/g (ranging from below detection limits to 10.4 pCi/g) with the exception of SU-3-1, which had a concentration of 50.5 pCi/g. Ra-226 concentrations ranged from 0.322 pCi/g to 0.851 pCi/g, well below the associated site cleanup criteria of 5 pCi/g. Sr-90 concentrations were below detection limits in all surface soil grab samples. As previously discussed in **Section C**, subsequent spot remediation was performed at SU-3-1 on August 27, 2018. Upon completion of the spot remediation, a second surface soil grab sample (SU-3-1-R) was collected at the location on August 28, 2018, which was analyzed for gamma emitters by gamma spectroscopy (including Cs-137 and Ra-226) and for Sr-90 at GEL. Analytical results for SU-3-1-R were reported as follows: Cs-137 was detected at a concentration of 8.01 pCi/g; Ra-226 was detected at a concentration of 0.514; and the Sr-90 result was below the detection limit. Since the final results indicate that radionuclides of concern were less than their associated site cleanup criteria in surface soil grab samples, per MARSSIM, the survey unit does not require analysis using the sign test or the elevated measurement comparison. The analytical results for surface soil grab samples are summarized in **Table D-1**, and the associated GEL data sheets are provided in **Appendix A**.

For the surface soil composite samples, alpha emitters (U-235, U-238, Pu-238, Pu-239/240) and tritium were reported at concentrations less than detection limits, with the exception of a U-238 detections of 0.444 pCi/g and 1.11 pCi/g in Composite 1 and Composite 4, respectively. These detections are below the established site cleanup criteria of 4.7 pCi/g specified in Table 3-1 of the *Field Sampling Plan/Quality Assurance Project Plan, Waste Concentration Facility (AOC10) and Surrounding Area* (PWGC, August 2015). The analytical results for composite soil samples are summarized in **Table D-2**, and the associated GEL data sheets are provided in **Appendix A**. In accordance with the WCF FSP/QAPP Addendum, there were five sub-samples (i.e., increments) for each of the surface soil composite samples. In accordance with MARSSIM, a modified

investigation level (MIL) was determined by dividing the derived concentration guidance level (DCGL) by the square root of the number of increments. The MIL is then compared to the minimum detectable concentration (MDC) for each radionuclide to ensure that the level of detection is acceptable. As shown in **Table D-3**, the MDC is less than the MIL for each analyzed contaminant in the composite samples.

Onsite ISOCS results for core samples were all below 7 pCi/g with the exception of the 0-2 feet bgs sample interval at Core 3, which indicated a Cs-137 result of 12 pCi/g. In accordance with the WCF FSP/QAPP Addendum, this specific sample was also analyzed by GEL for alpha emitters (U-235/238, Pu-238, Pu-239/240) and tritium, in addition to gamma emitters by gamma spectroscopy (including Cs-137 and Ra-226) and Sr-90. Offsite analysis by GEL indicated a Cs-137 concentration of 15.5 pCi/g in the Core 3, 0-2 feet bgs sample, which is below the established site cleanup goal of 23 pCi/g. The reported concentration of Ra-226 is 0.500, which is well below the established site cleanup goal of 5 pCi/g. The reported concentration of U-235/238 is 0.552 pCi/g, well below the associated site cleanup goal of 4.6 pCi/g. Sr-90, Pu-239, Pu-239/240 and tritium were reported below detection limits in the Core 3, 0-2 feet bgs sample. Cs-137, Ra-226 and Sr-90 were all reported by GEL at concentrations below their established cleanup goals in the remaining core samples. The offsite analytical results for core samples are summarized in **Table D-4**, and the associated data sheets are provided in **Appendix A**. Onsite ISOCS results for core samples are provided in **Appendix B**.

D.3 Final Status Survey Conclusion

As indicated above, the results of the FSS following the remediation of the three isolated areas of radiological contamination in surface soil demonstrates conformance to the site cleanup goals established for the project.

As documented in the *Revised Closeout Report, Waste Concentration Facility (Bldg 811 – Area of Concern 10) and Surrounding Area*, (Building 811 Closeout Report) (BNL, January 2017), the results of the dose assessment performed during the Building 811 Project are well below the limits established in the OU I ROD, including the dose based soil cleanup objective of 15 mrem/yr above background and the NYSDEC cleanup guideline of 10 millirem/year (mrem/yr) from TAGM 4003, which was adopted as an ALARA goal. In accordance with the WCF FSP/QAPP Addendum, an additional dose assessment following the remediation documented in this addendum was not performed.

E. Waste Management

Waste characterization, packaging, handling and storage were performed in accordance with BNL EPD's waste management procedures. A total of approximately 22 cubic yards of excavated soil

were placed into five 7-cubic yard supersacks provided by Strategic Packaging Systems, LLC (SPS Packaging Bags). Per Strategic Packaging Systems, LLC, the SPS Packaging Bags have a 20,000-pound capacity; and were manufactured with an 18-mil woven and coated polypropylene fabric outer shell and a 10-ounce geotextile, non-woven felt liner on the inner surface for puncture protection. In addition, an inner packaging bag was installed inside each 7-cubic yard supersack prior to loading. Per Strategic Packaging Systems, LLC., the inner packaging bags were manufactured with 12-mil woven and coated polypropylene. Although the SPS Packaging Bags inspected prior to use and were not loaded to capacity, two of the five bags failed along their zipper seams. As a result, each of the five SPS Packaging Bags was subsequently loaded into a designated 7-cubic yard polypropylene overpack provided by SPS.

A 3-foot long steel I-beam and concrete rubble associated with the fence that were removed, as well as used geotextile fabric, were loaded into two B-12 containers manufactured by Container Products Corporation (CPS).

Waste verification sampling was performed for disposal and the sample was analyzed by GEL for comparison to Energy Solutions' waste acceptance criteria (WAC). The waste verification sample was also analyzed for Sr-90, U-235/238, Pu-238/239/240/241, polychlorinated biphenyls, mercury, lead, gamma spectroscopy and full TCLP. According to the waste characterization results, the waste shipped met the WAC of Energy Solutions of Clive, Utah. Waste verification results, which are summarized in **Table E1** and **Table E2**, were submitted to BNL's Waste Management Division.

The five supersacks/overpacks and two B-12 containers were transported to BNL's Waste Management Facility for temporary storage on October 3, 2018, and were subsequently shipped via two trucks to Energy Solutions of Clive, Utah for disposal on November 15, 2018. Waste manifests are provided in **Appendix C**.



Photograph 5 – Excavated soil packaged in SPS Packaging Bags

Waste minimization and pollution prevention methods employed during remediation and characterization activities included excavation of soil in as small a lift as possible to minimize excavation of soil below cleanup goals, size reduction of fence concrete, and judicious use of consumables (e.g., PPE).

F. Site Restoration

Excavated areas were backfilled to original grade on October 4, 2018, using stockpiled soils generated during construction of the National Synchrotron Light Source II. This backfill source was evaluated and utilized during the Building 811 Project, as documented in Section 3.4 of the *Revised Closeout Report, Waste Concentration Facility (Bldg 811 – Area of Concern 10) and Surrounding Area*, (Building 811 Closeout Report) (BNL, January 2017). In addition, temporary fencing was installed on October 5, 2018 to delineate the Waste Concentration Facility from the former Collider Accelerator Department metal storage area.



Photograph 6 – Backfilled remediated areas

G. Performance Standards & Quality Control

Physical inspections were conducted on both incoming and outgoing waste containers. Radiological surveys were performed on outgoing containers. Inspections were also conducted on excavations and storm water control measures during excavation operations. Field sampling procedures were reviewed periodically.

Quality Assurance/Quality Control (QA/QC) samples were collected in accordance with the WCF FSP/QAPP Addendum. Field duplicates and equipment blanks were collected at a frequency of one per twenty soil samples and analyzed for the radiological contaminants of concern. QA/QC results are summarized in **Table G1**.

Data validation was performed for a minimum of 5% of the end-point sampling data. The data results obtained from the contract analytical laboratory (GEL Laboratories LLC) underwent a systematic data validation performed by BNL to provide assurance that the data is adequate for its intended use (i.e., in assessing the effectiveness of remedial activities). The validation was performed by personnel who have had appropriate training and/or experience in performing data validation for the radiological analyses.

Validation was performed in accordance with BNL EM-SOP-204, Radiochemical Data Verification, EM-SOP-209, Radiochemical Data Validation, and EM-SOP-210, Radiochemical

Data Usability. The validation checklists are provided in **Appendix D**.

The conclusion of the data validation was that the sample data is sufficient for the intended use.

H. Operation and Maintenance Activities

The BNL Land Use Controls Fact Sheet was updated to reflect the as-left site conditions. No radiological soil contamination postings are required for this area. An LUIC point-of-contact sign is posted nearby. Brookhaven Science Associates (BSA) will perform surveillance and maintenance activities. In addition to maintaining institutional controls for the area, BSA will ensure that routine inspections are performed. DOE will ensure enforcement of all institutional controls.

I. Summary of Project Costs

The remediation and characterization of SU-3, which included the three isolated areas of surface soil contamination located along the fence line just north of the former BNL Building 811 cost approximately \$225,000 to complete. The clean-up costs included the following details:

Engineering and Planning	\$15,000
Remediation and Characterization	\$160,000
Waste Transportation and Disposal	\$50,000
Total Cost	\$225,000

J. References

A comprehensive list of references is provided in the *Revised Closeout Report, Waste Concentration Facility (Bldg 811 – Area of Concern 10) and Surrounding Area*, (Building 811 Closeout Report) (BNL, January 2017). Additional references associated with this addendum are provided below:

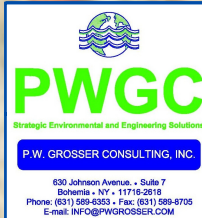
BNL, 2017. *Revised Closeout Report, Waste Concentration Facility (Bldg 811 – Area of Concern 10) and Surrounding Area*, (Building 811 Closeout Report), January 2017.

PWGC, 2018. *Addendum to the Field Sampling Plan/Quality Assurance Project Plan, Waste Concentration Facility (AOC 10) and Surrounding Area*, PWGC, May 2018.

FIGURES

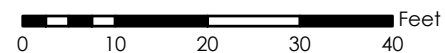


- Area of Contamination
- Survey Unit 3
- Footprint of Previous Building 810

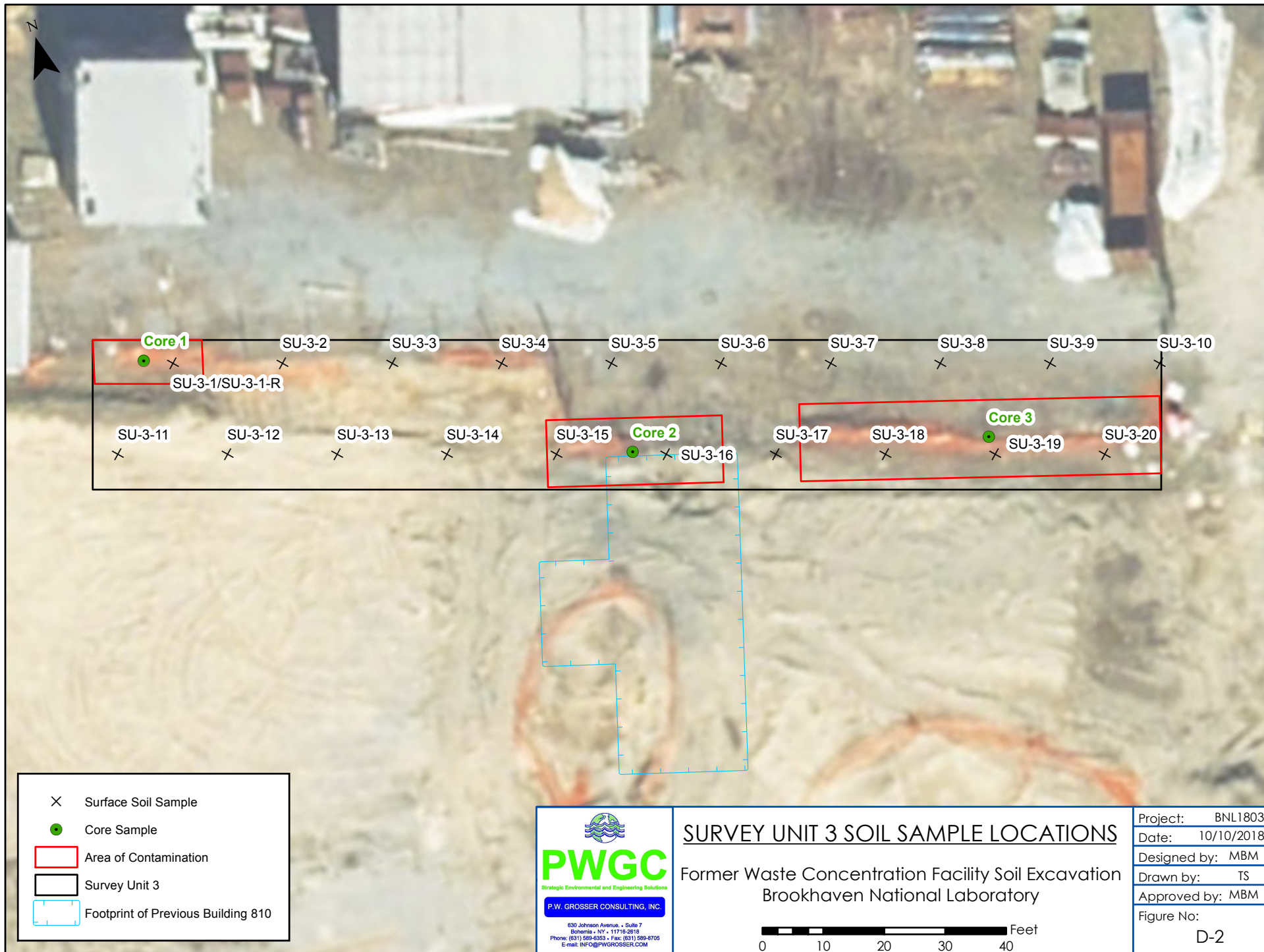


SURVEY UNIT 3

Former Waste Concentration Facility Soil Excavation
Brookhaven National Laboratory



Project:	BNL1803
Date:	8/31/2018
Designed by:	MBM
Drawn by:	TS
Approved by:	MBM
Figure No:	D-1





TABLES

Former Building 811 Soil Remediation																																
Table D-1: Survey Unit 3 - Surface Soil Grab Sample Results (COC# 39987/40141)																																
Sample Name	Sample ID	Sample Date	Sample Depth from Excavation Grade (ft)	One Minute Fixed Gamma Count Rate Uncollimated (CPM)	Americium-241 (pCi/g)		Beryllium-7 (pCi/g)		Cesium-134 (pCi/g)		Cesium-137 (pCi/g)		Cobalt-57 (pCi/g)		Cobalt-60 (pCi/g)		Europium-152 (pCi/g)		Europium-154 (pCi/g)		Europium-155 (pCi/g)		Manganese-54 (pCi/g)		Radium-226 (pCi/g)		Strontium-90 (pCi/g)		Sodium-22 (pCi/g)		Zinc-65 (pCi/g)	
					Result	Q	Result	Q	Result	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
811-SU-3-1	39987-001	7/31/2018	0.0-0.5	20,793	0.113	U	0.566	U-DL	0.0431	UI	50.5		0.00449	U-DL	0.170	J	0.0454	U	-0.023	U	0.0819	U	-0.00116	U	0.538	J	0.106	U	-0.00859	U	0.0122	U
811-SU-3-1R	40141-001	8/28/2018	0.0-0.5	NM	-0.0103	U	-0.091	U	0.0156	U	8.01		0.00977	U	0.0335	J-UI	-0.0176	U	0.00968	U	0.00933	U	0.0128	U	0.514	J	1.75	U	0.00358	U	-0.00789	U
811-SU-3-2	39987-002	7/31/2018	0.0-0.5	7,917	0.0766	U	-0.0179	U	0.0564	UI	0.0707	J	-0.00937	U	-0.00338	U	-0.0206	U	0.0163	U	0.0783	U	0.00697	U	0.597	J	-0.515	U	0.00337	U	0.000479	U
811-SU-3-3	39987-003	7/31/2018	0.0-0.5	8,041	-0.0367	U	0.0556	U	0.0817	UI	0.390	J	0.0115	U-DL	-0.0105	U	-0.0128	U	0.0284	U	0.128	J-UI	-0.0047	U	0.851	J	0.018	U	0.0116	U	-0.0169	U
811-SU-3-4	39987-004	7/31/2018	0.0-0.5	7,926	-0.0336	U	0.00169	U	0.0138	U	3.21		-0.00166	U	0.0167	U	-0.00831	U	-0.0152	U	0.0133	U	0.0137	U	0.505	J	-0.778	U	-0.00413	U	0.016	U
811-SU-3-5	39987-005	7/31/2018	0.0-0.5	6,534	0.176	J-UI	0.0679	U	0.040	UI	1.08	J	-0.00559	U	0.0115	U	-0.000755	U	0.0269	U	0.0899	J-UI	0.00561	U	0.535	J	0.154	U	0.00992	U	-0.015	U
811-SU-3-6	39987-007	7/31/2018	0.0-0.5	6,847	0.00547	U	-0.117	U-DL	0.0502	UI	2.95		-0.0123	U-DL	-0.00432	U	0.0217	U	0.00762	U	0.0185	U	0.0316	U	0.535	J	-0.507	U	-0.00341	U	-0.0186	U
811-SU-3-7	39987-008	7/31/2018	0.0-0.5	6,189	-0.0529	U	0.165	U	0.0485	UI	1.33	J	0.00491	U-DL	0.0221	U	-0.0457	U	0.011	U	0.0573	U	-0.00104	U	0.729	J	1.37	U	0.00428	U	0.0379	U
811-SU-3-8	39987-009	7/31/2018	0.0-0.5	6,016	0.218	U	0.0354	U	0.0146	U	1.68	J	0.0054	U	0.0149	U	-0.0331	U	0.000456	U	0.019	U	0.0136	U	0.422	J	0.0455	U	-0.000343	U	0.00408	U
811-SU-3-9	39987-010	7/31/2018	0.0-0.5	6,459	0.0155	U	-0.0941	U	0.0291	U	2.58		-0.00359	U	0.012	U	0.00096	U	0.0185	U	0.0257	U	0.00846	U	0.568	J	0.185	U	0.0067	U	-0.00391	U
811-SU-3-10	39987-011	7/31/2018	0.0-0.5	6,519	0.0105	U	0.0436	U	0.0146	U	1.10	J	0.00307	U	0.00209	U	0.0313	U	-0.0209	U	0.0615	U	0.0101	U	0.366	J	-0.515	U	-0.00696	U	-0.0183	U
811-SU-3-11	39987-013	7/31/2018	0.0-0.5	5,371	-0.00591	U	0.00978	U	0.0308	J-UI	0.180	J	-0.00342	U	-0.0055	U	0.00504	U	-0.00185	U	0.0117	U	0.0243	J-UI	0.322	J	0.710	U	-0.00113	U	0.0115	U
811-SU-3-12	39987-014	7/31/2018	0.0-0.5	5,612	-0.00611	U	0.0762	U	0.0451	UI	0.930	J	-0.000412	U	0.00456	U	0.00985	U	-0.00822	U	0.022	U	0.0244	J-UI	0.366	J	0.659	U	-0.00305	U	0.000666	U
811-SU-3-13	39987-015	7/31/2018	0.0-0.5	5,570	-0.00656	U	-0.0111	U	0.0069	U	0.303	J	-0.000236	U	-0.000785	U	-0.00446	U	-0.0115	U	0.0619	J-UI	0.0186	J-UI	0.461	J	-0.107	U	-0.00389	U	0.0061	U
811-SU-3-14	39987-016	7/31/2018	0.0-0.5	7,374	-0.0144	U	0.0367	U	0.0327	J-UI	0.856	J	0.00176	U	0.00705	U	0.00711	U	0.0176	U	0.0999	J-UI	0.0163	U	0.452	J	0.106	U	0.00661	U	0.0112	U
811-SU-3-15	39987-017	7/31/2018	0.0-0.5	9,631	-0.00869	U	0.252	U	0.0647	UI	3.80		0.00522	U	0.0366	J	-0.0231	U	-0.0103	U	0.144	J-UI	0.00758	U	0.722	J	0.442	U	-0.00348	U	0.0239	U
811-SU-3-16	39987-019	7/31/2018	0.0-0.5	13,890	0.113	J-UI	-0.0336	U-DL	0.0329	J-UI	10.4		0.0034	U	0.00575	U	-0.0153	U	-0.00112	U	0.0423	U	0.00408	U	0.590	J	-0.293	U	-0.000296	U	-0.00627	U
811-SU-3-17	39987-020	7/31/2018	0.0-0.5	7,890	-0.0167	U	-0.000365	U	0.032	J-UI	3.19		0.0015	U	0.00141	U	0.007	U	0.00642	U	0.0592	J-UI	0.0103	U	0.722	J	-0.0823	U	0.00201	U	0.0101	U
811-SU-3-18	39987-021	7/31/2018	0.0-0.5	6,743	0.0559	J-UI	-0.0403	U	0.0251	U-DL	0.717	J	0.024	UI	0.00652	U	-0.0161	U	-0.00506	U	0.151	J-UI	0.0243	U	0.492	J	-0.0602	U	-0.00178	U	-0.0292	U
811-SU-3-19	39987-022	7/31/2018	0.0-0.5	6,851	0.0293	U	0.361		0.0579	UI	0.822	J	-0.00358	U-DL	0.00339	U	-0.00457	U	-0.035	U	0.126	J-UI	0.0201	U	0.511	J	0.776	U	-0.0135	U	-0.00522	U
811-SU-3-20	39987-023	7/31/2018	0.0-0.5	7,233	0.131	U	0.0865	U	0.0268	U	0.398	J	-0.000594	U	-0.00269	U	0.0152	U	-0.0317	U	0.0246	U	0.00104	U	0.522	J	-0.0339	U	-0.0111	U	-0.00661	U

Notes:

DL - Failed required detection limit.

J - Value is estimated; the result was greater than the MDA but less than the required detection limit

NM-Not Measured

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

pCi/g - Picocuries per gram

Former Building 811 Soil Remediation														
Table D-2: Survey Unit 3 - Surface Soil Composite Sample Results (COC# 39987)														
Sample Name	Sample ID	Sample Date	Sample Depth from Excavation Grade (ft)	One Minute Fixed Gamma Count Rate Uncollimated (CPM)	Plutonium-238 (pCi/g)		Plutonium 239/240 (pCi/g)		Uranium-235/236 (pCi/g)		Uranium-238 (pCi/g)		Tritium (pCi/g)	
					Result	Q	Result	Q	Result	Q	Results	Q	Results	Q
Composite 1	39987-006	7/31/2018	0.0-0.5	NM	-0.0819	U	0.137	U	0.00	U	0.444	J	-30.1	U
Composite 2	39987-012	7/31/2018	0.0-0.5	NM	0.169	U	0.232	U	-0.0488	U	-0.0132	U	-42.3	U
Composite 3	39987-018	7/31/2018	0.0-0.5	NM	0.442	U	-0.0483	U	0.0765	U	0.498	U	-33.1	U
Composite 4	39987-024	7/31/2018	0.0-0.5	NM	0.552	U	0.376	U	0.044	U	1.11		-95.3	U

Notes:

DL - Failed required detection limit.

J - Value is estimated; the result was greater than the MDA but less than the required detection limit

NM - Not Measured

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

pCi/g - Picocuries per gram

Former Building 811 Soil Remediation				
Table D-3: Survey Unit 3 - Modified Investigation Level for Soil Composite Samples				
Contaminant	DCGLw (pCi/g)	MDC (pCi/g)	MIL (pCi/g)	Ratio of MDC to MIL
Tritium	1010	262	452	0.58
Uranium-235	4.6	0.56	2.1	0.27
Uranium-238	4.7	0.75	2.1	0.36
Plutonium-238	57	0.85	26	0.03
Plutonium-239/240	35	0.89	16	0.06

Notes:

DCGL - Derived Concentration Guidance Level

MDL - Minimum Detectable Concentration

MIL - Modified Investigation Level

NR-Not Reported

pCi/g - Picocuries per gram

Former Building 811 Soil Remediation																																									
Table D-4: Survey Unit 3 - Core Sample Results (COC# 39984)																																									
Sample Name	Sample ID	Sample Date	Sample Depth from Excavation Grade (ft)	Americium-241 (pCi/g)		Beryllium-7 (pCi/g)		Cesium-134 (pCi/g)		Cesium-137 (pCi/g)		Cobalt-57 (pCi/g)		Cobalt-60 (pCi/g)		Europium-152 (pCi/g)		Europium-154 (pCi/g)		Europium-155 (pCi/g)		Manganese-54 (pCi/g)		Plutonium-238 (pCi/g)		Plutonium-239/240 (pCi/g)		Radium-226 (pCi/g)		Strontium-90 (pCi/g)		Sodium-22 (pCi/g)		Tritium (pCi/g)		Uranium-235/236 (pCi/g)		Uranium-238 (pCi/g)		Zinc-65 (pCi/g)	
				Result	Q	Result	Q	Result	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
811-GP-01-2018	39984-001	7/31/2018	0.0-2.0	-0.00148	U	-0.0779	U	0.0594	UI	0.00376	U	0.00347	U	0.000262	U	0.0266	U	0.0194	U	0.00544	U	0.0138	U	NA		NA		0.634	J	0.019	U	0.00637	U	NA		NA		NA		-0.00434	U
811-GP-01-2018	39984-002	7/31/2018	2.0-4.0	0.0472	U	0.0495	U	0.022	U	0.00315	U	-0.00319	U	0.00502	U	-0.00167	U	-0.00145	U	0.0194	U	0.012	U	NA		NA		0.487	J	0.833	U	-0.00083	U	NA		NA		NA		-0.00155	U
811-GP-01-2018	39984-003	7/31/2018	4.0-6.0	0.000401	U	-0.00868	U	0.0167	U	-0.00504	U	-0.000623	U	0.00108	U	0.00233	U	0.017	U	0.0288	U	0.0185	J-UI	NA		NA		0.383	J	-0.115	U	0.00374	U	NA		NA		NA		0.0288	U
811-GP-01-2018	39984-004	7/31/2018	6.0-8.0	0.0584	U	-0.0574	U	0.033	J-UI	0.0241	J-UI	-0.00331	U	0.0425	J	0.00147	U	-0.0214	U	0.0255	U	0.0198	J-UI	NA		NA		0.321	J	-0.0625	U	-0.00735	U	NA		NA		NA		0.00836	U
811-GP-02-2018	39984-005	7/31/2018	0.0-2.0	0.171	J-UI	-0.00837	U	0.0662	UI	0.145	J	-0.00316	U	0.00579	U	-0.0143	U	-0.0527	U	0.0539	U	0.0266	J-UI	NA		NA		0.710	J	0.178	U	-0.0187	U	NA		NA		NA		-0.00481	U
811-GP-02-2018	39984-006	7/31/2018	2.0-4.0	0.000751	U	-0.0259	U	0.0478	UI	0.0131	U	-0.000369	U	-0.00515	U	-0.0311	U	0.0019	U	0.0732	J-UI	0.00581	U	NA		NA		0.468	J	-0.159	U	-0.002	U	NA		NA		NA		-0.0173	U
811-GP-02-2018	39984-007	7/31/2018	4.0-6.0	-0.0219	U	-0.0195	U	0.0349	J-UI	0.283	J	-0.00691	U	-0.00226	U	-0.0252	U	0.0186	U	0.0314	U	0.00787	U	NA		NA		0.478	J	-0.156	U	0.00627	U	NA		NA		NA		0.0128	U
811-GP-02-2018	39984-008	7/31/2018	6.0-8.0	-0.00677	U	0.129	U	0.0232	U	0.00636	U	0.00168	U	0.00453	U	-0.0053	U	0.0219	U	0.00627	U	-0.00647	U	NA		NA		0.353	J	0.612	U	0.00828	U	NA		NA		NA		0.011	U
811-GP-03-2018	39984-009	7/31/2018	0.0-2.0	-0.0281	U	-0.0767	U-DL	0.0563	UI	15.5		0.00153	U	-0.00173	U	0.00378	U	0.00426	U	0.0445	U	0.0108	U	-0.108	U	0.0206	U	0.500	J	0.428	U	0.00135	U	20.6	U	0.552	J	0.560	U	-0.0018	U
811-GP-03-2018	39984-010	7/31/2018	2.0-4.0	-0.0159	U	0.0144	U	0.0313	J-UI	0.00913	U	-0.000609	U	0.00459	U	-0.0047	U	0.00899	U	0.0238	U	0.0177	J-UI	NA		NA		0.379	J	-0.778	U	0.00316	U	NA		NA		NA		-0.0111	U
811-GP-03-2018	39984-011	7/31/2018	4.0-6.0	0.0171	U	0.0328	U	0.0232	J-UI	0.137	J	0.00126	U	0.00226	U	-0.00805	U	-0.0092	U	0.0576	U	0.000425	U	NA		NA		0.417	J	-0.201	U	-0.00538	U	NA		NA		NA		0.0165	U
811-GP-03-2018	39984-012	7/31/2018	6.0-8.0	-0.00938	U	0.0148	U	0.0117	U	-0.000652	U	0.00018	U	-0.00105	U	0.00208	U	0.00309	U	0.0198	U	0.00941	U	NA		NA		0.334	J	0.234	U	0.00075	U	NA		NA		NA		0.0116	U

Notes:

DL - Failed required detection limit.

J - Value is estimated; the result was greater than the MDA but less than the required detection limit

NA-Not Analyzed

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

pCi/g - Picocuries per gram

Former Building 811 Soil Remediation																		
Table E-1: Survey Unit 3 - Waste Characterization Metal Results (COC# 40085)																		
Sample ID	Sample Name	Sample Date	Mercury (ug/L)		Arsenic (ug/L)		Barium (ug/L)		Cadmium (ug/L)		Chromium (ug/L)		Lead (ug/L)		Selenium (ug/L)		Silver (ug/L)	
			Result	Q	Result	Q	Result	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
456413001	40085-001	7/25/18	2.00	U	300	U	272		50.0	U	50.0	U	100	U	115	J	250	U

Notes:

DL - Failed required detection limit.

J - Value is estimated; the result was greater than the MDA but less than the required detection limit

NA-Not Analyzed

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

Former Building 811 Soil Remediation																																								
Table E-2: Survey Unit 3 - Waste Characterization Radiological Results (COC# 40085)																																								
Sample ID	Sample Name	Sample Date	Americium-241 (pCi/g)		Beryllium-7 (pCi/g)		Cesium-134 (pCi/g)		Cesium-137 (pCi/g)		Cobalt-57 (pCi/g)		Cobalt-60 (pCi/g)		Europium-152 (pCi/g)		Europium-154 (pCi/g)		Europium-155 (pCi/g)		Manganese-54 (pCi/g)		Plutonium-238 (pCi/g)		Plutonium-239/240 (pCi/g)		Radium-226 (pCi/g)		Strontium-90 (pCi/g)		Sodium-22 (pCi/g)		Tritium (pCi/g)		Uranium-235/236 (pCi/g)		Uranium-238 (pCi/g)		Zinc-65 (pCi/g)	
			Result	Q	Result	Q	Result	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
456413001	40085-001	7/25/18	0.02	U	0.08	U-DL	0.0443	UI	8.320		-0.0082	U	0.0215	U	-0.00707	U	-0.0063	U	0.0675	U	0.000224	U	0.368	U	0.158	U	NA		0.0087	U	-0.00202	U	NA		0.428	U	0.949		0.0142	U

Notes:

DL - Failed required detection limit.

J - Value is estimated; the result was greater than the MDA but less than the required detection limit

NA-Not Analyzed

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

pCi/g - Picocuries per gram

Former Building 811 Soil Remediation																																									
Table G-1: Survey Unit 3 - QA/QC Sample Results (COC# 39984/39987)																																									
Sample ID	Sample Name	Sample Date	QA/QC Type	Americium-241 (pCi/g)		Beryllium-7 (pCi/g)		Cesium-134 (pCi/g)		Cesium-137 (pCi/g)		Cobalt-57 (pCi/g)		Cobalt-60 (pCi/g)		Europium-152 (pCi/g)		Europium-154 (pCi/g)		Europium-155 (pCi/g)		Manganese-54 (pCi/g)		Plutonium-238 (pCi/g)		Plutonium-239/240 (pCi/g)		Radium-226 (pCi/g)		Strontium-90 (pCi/g)		Sodium-22 (pCi/g)		Tritium (pCi/g)		Uranium-235/236 (pCi/g)		Uranium-238 (pCi/g)		Zinc-65 (pCi/g)	
				Result	Q	Result	Q	Result	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
39987-025	BD-1	7/31/18	Blind Duplicate	-0.011	U	-0.0438	U	0.274	U	0.103	J	-0.0027	U	-0.00802	U	-0.0134	U	0.0188	U	0.0105	U	0.0032	U	NA		NA		0.276	J	-0.276	U	0.0066	U	NA		NA		NA		-0.0027	U
39987-026	EB-1	7/31/18	Equipment Blank	-3.36	U	-2.93	U	-0.795	U	-0.492	U	0.113	U	0.511	U	0.287	U	-1.72	U	2.18	U	0.564	U	0.0161	U	-0.101	U	0.0798	U	0.207	U	-0.619	U	7.13	U	-0.0751	U	0.0439	U	-0.351	U
39984-013	BD-1	7/31/18	Blind Duplicate	0.0141	U	-0.019	U	0.019	J-UI	-0.0022	U	-0.0036	U	0.00493	U	-0.0058	U	0.0253	U	0.0392	U	0.0031	U	0.215	U	0.160	U	0.299	J	-0.0128	U	0.0088	U	NA		0.167	U	0.338	U	-0.0157	U
39984-014	EB-1	7/31/18	Equipment Blank	-8.72	U	1.35	U	1.27	U	0.177	U	-0.346	U	-1.45	U	-2.9	U	2.26	U	-1.45	U	-0.013	U	0.582	U	-0.0171	U	0.435	J	-0.268	U	0.795	U	146	U	0.110	U	0.0464	U	-2.2	U

Notes:

DL - Failed required detection limit.

J - Value is estimated; the result was greater than the MDA but less than the required detection limit

NA-Not Analyzed

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

Q- Qualifier

U - Analyte was analyzed for, but not detected above the MDA.

UI - Uncertain identification for gamma spectroscopy.

pCi/g - Picocuries per gram

APPENDIX A

Requires EDD

SAMPLING CHAIN OF CUSTODY

450280

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: W. Dorsch		Name: EPD Field Sampling Team		Name: GEL	
Life: No: 21133		Contact: R. Lagattolia		Address: 2040 Savage Rd.	
Ext: 5186		Phone: 631 344 7129		City: Charleston	
Dept: ES		Email/Fax: rlagattolia@bnl.gov		State: SC	
Email Reports To:		Sampler: R. Metz, J. Milligan		Zip: 29407	
iW. Dorsch		Project Manager: W. Dorsch		Contact: E. Kent	
2 B. Howe		811LYB		Phone: 843-556-8171	
Project Name:		Project Manager:		Email/Fax:	
811LYB		W. Dorsch		Field Engineer: R. Lagattolia	

Comments: SPDES TAT for EDD

Please provide all analysis possible 14 TAT R226 OK

Type	UID	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Unit	Name/Description	Cont. Vol./Units	Com. Type	Per Cont.	Preservative	Alpha/Beta	Tritium	Gamma	Remediation	Strontium 90	5242	624	Nuclide-specific Alpha	PCBs	Metals
E G	001	811-SU-3-1	0.0-0.5	7/31/18	0945	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	002	811-SU-3-2	0.0-0.5		0947	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	003	811-SU-3-3	0.0-0.5		0949	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	004	811-SU-3-4	0.0-0.5		0951	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	005	811-SU-3-5	0.0-0.5		0953	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E C	006	Composite 1	0.0-0.5		0955	S	Composite 1 (SU-3-1, 2, 3, 4, 5)	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	007	811-SU-3-6	0.0-0.5		1000	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	008	811-SU-3-7	0.0-0.5		1002	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	009	811-SU-3-8	0.0-0.5		1004	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	010	811-SU-3-9	0.0-0.5		1006	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	011	811-SU-3-10	0.0-0.5		1008	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E C	012	Composite 2	0.0-0.5		1010	S	Composite 2 (SU-3-6, 7, 8, 9, 10)	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	013	811-SU-3-11	0.0-0.5		1100	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---
E G	014	811-SU-3-12	0.0-0.5		1102	S	Bldg. 811 soil grab	16oz	P	1	---	---	---	---	---	---	---	---	---	---	---

1. Relinquished By/Date/Time		2. Relinquished By/Date/Time		3. Relinquished By/Date/Time	
Print	R. Metz	Print		Print	
Signature	Robert Metz	Signature		Signature	
1 Received By/Date/Time	8/1/18 1:30	2 Received By/Date/Time		3 Received By/Date/Time	
Print	C. Tarpelo	Print		Print	
Signature	C. Tarpelo	Signature		Signature	

Contractor Lab Sample Disposal:	
☐ Return To Client	☒ Disposal by Lab
☐ Archive For	Months

Data Package:	☒ Full	☐ Summary
---------------	--	----------------------------------

Turn-Around Time Required:

☐ Rush (1 Day)	☒ 14 Days	☐ 30 Days
☐ 7 Days	☐ Other ()	

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-001	Project:	BRKL00700
Sample ID:	456288001	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 09:45	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-1
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.538	+/-0.292	0.257	1.00	pCi/g			MXR1	08/24/18	0949	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.113	+/-0.210	0.395	4.00	pCi/g			RXF2	08/09/18	1058	1788713	2
Beryllium-7	U-DL	0.566	+/-0.607	0.977	0.300	pCi/g							
Cesium-134	UI	0.0431	+/-0.0358	0.0404	0.040	pCi/g							
Cesium-137		50.5	+/-0.411	0.0626	2.30	pCi/g							
Cobalt-57	U-DL	0.00449	+/-0.0262	0.0466	0.020	pCi/g							
Cobalt-60	J	0.170	+/-0.0358	0.0302	0.300	pCi/g							
Europium-152	U	0.0454	+/-0.135	0.246	4.80	pCi/g							
Europium-154	U	-0.023	+/-0.0518	0.0916	17.0	pCi/g							
Europium-155	U	0.0819	+/-0.103	0.187	0.300	pCi/g							
Manganese-54	U	-0.00116	+/-0.0172	0.0324	0.050	pCi/g							
Sodium-22	U	-0.00859	+/-0.0182	0.032	0.050	pCi/g							
Zinc-65	U	0.0122	+/-0.0473	0.0796	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.106	+/-0.637	1.17	2.00	pCi/g			KSD1	08/08/18	0910	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			95.5	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-001
Sample ID: 456288001

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-1
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-002	Project:	BRKL00700
Sample ID:	456288002	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 09:47	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-2
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.597	+/-0.154	0.101	1.00	pCi/g			MXR1	08/24/18	0949	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0766	+/-0.0871	0.155	4.00	pCi/g			RXF2	08/09/18	1102	1788713	2
Beryllium-7	U	-0.0179	+/-0.141	0.232	0.300	pCi/g							
Cesium-134	UI	0.0564	+/-0.0275	0.0376	0.040	pCi/g							
Cesium-137	J	0.0707	+/-0.0358	0.0328	2.30	pCi/g							
Cobalt-57	U	-0.00937	+/-0.0104	0.0199	0.020	pCi/g							
Cobalt-60	U	-0.00338	+/-0.0194	0.0317	0.300	pCi/g							
Europium-152	U	-0.0206	+/-0.0392	0.0717	4.80	pCi/g							
Europium-154	U	0.0163	+/-0.0473	0.094	17.0	pCi/g							
Europium-155	U	0.0783	+/-0.0534	0.0946	0.300	pCi/g							
Manganese-54	U	0.00697	+/-0.0147	0.028	0.050	pCi/g							
Sodium-22	U	0.00337	+/-0.0168	0.0329	0.050	pCi/g							
Zinc-65	U	0.000479	+/-0.0341	0.0586	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.515	+/-0.367	0.826	2.00	pCi/g			KSD1	08/08/18	0739	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			90.7	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-002
Sample ID: 456288002

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-2
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-003	Project:	BRKL00700
Sample ID:	456288003	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 09:49	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-3
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.851	+/-0.166	0.0931	1.00	pCi/g			MXR1	08/24/18	0950	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0367	+/-0.117	0.198	4.00	pCi/g			RXF2	08/09/18	1103	1788713	2
Beryllium-7	U	0.0556	+/-0.140	0.260	0.300	pCi/g							
Cesium-134	UI	0.0817	+/-0.0343	0.0444	0.040	pCi/g							
Cesium-137	J	0.390	+/-0.0534	0.0357	2.30	pCi/g							
Cobalt-57	U-DL	0.0115	+/-0.0118	0.0218	0.020	pCi/g							
Cobalt-60	U	-0.0105	+/-0.0162	0.0274	0.300	pCi/g							
Europium-152	U	-0.0128	+/-0.0443	0.0805	4.80	pCi/g							
Europium-154	U	0.0284	+/-0.0455	0.0904	17.0	pCi/g							
Europium-155	J-UI	0.128	+/-0.107	0.0881	0.300	pCi/g							
Manganese-54	U	-0.0047	+/-0.020	0.032	0.050	pCi/g							
Sodium-22	U	0.0116	+/-0.0156	0.0316	0.050	pCi/g							
Zinc-65	U	-0.0169	+/-0.0389	0.0591	0.500	pCi/g							

Rad Gas Flow Proportional Counting

GFPC, Sr90, solid "Dry Weight Corrected"

Strontium-90	U	0.018	+/-0.713	1.37	2.00	pCi/g			KSD1	08/07/18	1732	1788749	3
--------------	---	-------	----------	------	------	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			85.9	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-003
Sample ID: 456288003

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-3
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-004	Project:	BRKL00700
Sample ID:	456288004	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 09:51	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-4
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.505	+/-0.231	0.141	1.00	pCi/g			MXR1	08/24/18	0950	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0336	+/-0.0557	0.104	4.00	pCi/g			RXF2	08/09/18	1103	1788713	2
Beryllium-7	U	0.00169	+/-0.158	0.284	0.300	pCi/g							
Cesium-134	U	0.0138	+/-0.0256	0.031	0.040	pCi/g							
Cesium-137		3.21	+/-0.089	0.0277	2.30	pCi/g							
Cobalt-57	U	-0.00166	+/-0.00953	0.0159	0.020	pCi/g							
Cobalt-60	U	0.0167	+/-0.0188	0.0334	0.300	pCi/g							
Europium-152	U	-0.00831	+/-0.040	0.0735	4.80	pCi/g							
Europium-154	U	-0.0152	+/-0.0427	0.0757	17.0	pCi/g							
Europium-155	U	0.0133	+/-0.0359	0.0666	0.300	pCi/g							
Manganese-54	U	0.0137	+/-0.0203	0.0235	0.050	pCi/g							
Sodium-22	U	-0.00413	+/-0.0152	0.0271	0.050	pCi/g							
Zinc-65	U	0.016	+/-0.0283	0.0504	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.778	+/-0.750	1.50	2.00	pCi/g			KSD1	08/07/18	1732	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			83.5	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-004
Sample ID: 456288004

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-4
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-005	Project:	BRKL00700
Sample ID:	456288005	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 09:53	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-5
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.535	+/-0.165	0.133	1.00	pCi/g			MXR1	08/24/18	0955	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	J-UI	0.176	+/-0.120	0.0912	4.00	pCi/g			RXF2	08/09/18	1104	1788713	2
Beryllium-7	U	0.0679	+/-0.157	0.290	0.300	pCi/g							
Cesium-134	UI	0.040	+/-0.0329	0.0396	0.040	pCi/g							
Cesium-137	J	1.08	+/-0.0722	0.0319	2.30	pCi/g							
Cobalt-57	U	-0.00559	+/-0.0105	0.0182	0.020	pCi/g							
Cobalt-60	U	0.0115	+/-0.0184	0.0364	0.300	pCi/g							
Europium-152	U	-0.000755	+/-0.0428	0.0788	4.80	pCi/g							
Europium-154	U	0.0269	+/-0.0554	0.107	17.0	pCi/g							
Europium-155	J-UI	0.0899	+/-0.0784	0.0728	0.300	pCi/g							
Manganese-54	U	0.00561	+/-0.0149	0.0291	0.050	pCi/g							
Sodium-22	U	0.00992	+/-0.0196	0.0378	0.050	pCi/g							
Zinc-65	U	-0.015	+/-0.0394	0.0605	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.154	+/-0.461	0.856	2.00	pCi/g			KSD1	08/07/18	1732	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			93.1	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-005
Sample ID: 456288005

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-5
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-006	Project:	BRKL00700
Sample ID:	456288006	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 09:55	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	Composite 1
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

Rad Alpha Spec Analysis

Alphaspec Pu, Solid "Dry Weight Corrected"

Plutonium-238	U	-0.0819	+/-0.293	0.599	6.60	pCi/g			BXA4	08/06/18	2248	1788987	1
Plutonium-239/240	U	0.137	+/-0.200	0.325	4.00	pCi/g							

Alphaspec U-235, U-238 "Dry Weight Corrected"

Uranium-235/236	U	0.00	+/-0.192	0.286	0.900	pCi/g			BXA4	08/07/18	0856	1788988	2
Uranium-238	J	0.444	+/-0.403	0.370	0.900	pCi/g							

Rad Liquid Scintillation Analysis

LSC, Tritium Dist, Solid "As Received"

Tritium	U	-30.1	+/-105	196	500	pCi/g			MXH8	08/06/18	1124	1788846	3
---------	---	-------	--------	-----	-----	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 906.0 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Plutonium-236 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			89.9	(15%-125%)
Uranium-232 Tracer	Alphaspec U-235, U-238 "Dry Weight Corrected"			81.1	(15%-125%)

Notes:

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

Column headers are defined as follows:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-007	Project:	BRKL00700
Sample ID:	456288007	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 10:00	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-6
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.535	+/-0.168	0.154	1.00	pCi/g			MXR1	08/24/18	0956	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.00547	+/-0.134	0.252	4.00	pCi/g			RXF2	08/09/18	1104	1788713	2
Beryllium-7	U-DL	-0.117	+/-0.198	0.345	0.300	pCi/g							
Cesium-134	UI	0.0502	+/-0.0321	0.050	0.040	pCi/g							
Cesium-137		2.95	+/-0.108	0.038	2.30	pCi/g							
Cobalt-57	U-DL	-0.0123	+/-0.0135	0.0231	0.020	pCi/g							
Cobalt-60	U	-0.00432	+/-0.019	0.0347	0.300	pCi/g							
Europium-152	U	0.0217	+/-0.0568	0.107	4.80	pCi/g							
Europium-154	U	0.00762	+/-0.0595	0.112	17.0	pCi/g							
Europium-155	U	0.0185	+/-0.0574	0.105	0.300	pCi/g							
Manganese-54	U	0.0316	+/-0.0281	0.0347	0.050	pCi/g							
Sodium-22	U	-0.00341	+/-0.0219	0.0399	0.050	pCi/g							
Zinc-65	U	-0.0186	+/-0.0482	0.0747	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.507	+/-0.638	1.33	2.00	pCi/g			KSD1	08/10/18	0649	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			78.8	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-007
Sample ID: 456288007

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-6
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-008	Project:	BRKL00700
Sample ID:	456288008	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 10:02	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-7
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.729	+/-0.170	0.108	1.00	pCi/g			MXR1	08/24/18	1046	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0529	+/-0.0685	0.110	4.00	pCi/g			RXF2	08/09/18	1105	1788713	2
Beryllium-7	U	0.165	+/-0.154	0.292	0.300	pCi/g							
Cesium-134	UI	0.0485	+/-0.0216	0.0375	0.040	pCi/g							
Cesium-137	J	1.33	+/-0.0778	0.0288	2.30	pCi/g							
Cobalt-57	U-DL	0.00491	+/-0.0104	0.0204	0.020	pCi/g							
Cobalt-60	U	0.0221	+/-0.0161	0.0336	0.300	pCi/g							
Europium-152	U	-0.0457	+/-0.0489	0.0805	4.80	pCi/g							
Europium-154	U	0.011	+/-0.0518	0.0868	17.0	pCi/g							
Europium-155	U	0.0573	+/-0.0761	0.079	0.300	pCi/g							
Manganese-54	U	-0.00104	+/-0.0158	0.0294	0.050	pCi/g							
Sodium-22	U	0.00428	+/-0.0183	0.0307	0.050	pCi/g							
Zinc-65	U	0.0379	+/-0.0342	0.0643	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	1.37	+/-0.911	1.40	2.00	pCi/g			KSD1	08/07/18	1732	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			103	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-008
Sample ID: 456288008

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-7
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-009	Project:	BRKL00700
Sample ID:	456288009	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 10:04	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-8
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.422	+/-0.142	0.126	1.00	pCi/g			MXR1	08/24/18	1048	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0218	+/-0.071	0.135	4.00	pCi/g			RXF2	08/09/18	1105	1788713	2
Beryllium-7	U	0.0354	+/-0.155	0.290	0.300	pCi/g							
Cesium-134	U	0.0146	+/-0.0347	0.0321	0.040	pCi/g							
Cesium-137	J	1.68	+/-0.0814	0.0302	2.30	pCi/g							
Cobalt-57	U	0.0054	+/-0.00962	0.0186	0.020	pCi/g							
Cobalt-60	U	0.0149	+/-0.0178	0.0367	0.300	pCi/g							
Europium-152	U	-0.0331	+/-0.0421	0.0763	4.80	pCi/g							
Europium-154	U	0.000456	+/-0.0567	0.104	17.0	pCi/g							
Europium-155	U	0.019	+/-0.0374	0.0732	0.300	pCi/g							
Manganese-54	U	0.0136	+/-0.0149	0.0308	0.050	pCi/g							
Sodium-22	U	-0.000343	+/-0.0199	0.0362	0.050	pCi/g							
Zinc-65	U	0.00408	+/-0.0413	0.0686	0.500	pCi/g							

Rad Gas Flow Proportional Counting

GFPC, Sr90, solid "Dry Weight Corrected"

Strontium-90	U	0.0455	+/-0.669	1.27	2.00	pCi/g			KSD1	08/07/18	1732	1788749	3
--------------	---	--------	----------	------	------	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			95.5	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-009
Sample ID: 456288009

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-8
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000
Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-010	Project:	BRKL00700
Sample ID:	456288010	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 10:06	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-9
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.568	+/-0.136	0.109	1.00	pCi/g			MXR1	08/24/18	1048	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0155	+/-0.0401	0.0699	4.00	pCi/g			RXF2	08/09/18	1105	1788713	2
Beryllium-7	U	-0.0941	+/-0.145	0.250	0.300	pCi/g							
Cesium-134	U	0.0291	+/-0.0172	0.031	0.040	pCi/g							
Cesium-137		2.58	+/-0.0874	0.0281	2.30	pCi/g							
Cobalt-57	U	-0.00359	+/-0.00962	0.0168	0.020	pCi/g							
Cobalt-60	U	0.012	+/-0.0144	0.0267	0.300	pCi/g							
Europium-152	U	0.00096	+/-0.0416	0.0762	4.80	pCi/g							
Europium-154	U	0.0185	+/-0.0413	0.0793	17.0	pCi/g							
Europium-155	U	0.0257	+/-0.0393	0.0721	0.300	pCi/g							
Manganese-54	U	0.00846	+/-0.0138	0.0245	0.050	pCi/g							
Sodium-22	U	0.0067	+/-0.0145	0.028	0.050	pCi/g							
Zinc-65	U	-0.00391	+/-0.0322	0.0512	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.185	+/-0.595	1.09	2.00	pCi/g			KSD1	08/08/18	0739	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			97.9	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-010
Sample ID: 456288010

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-9
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-011	Project:	BRKL00700
Sample ID:	456288011	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 10:08	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-10
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.366	+/-0.191	0.0936	1.00	pCi/g			MXR1	08/24/18	1049	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0105	+/-0.0644	0.116	4.00	pCi/g			RXF2	08/09/18	1106	1788713	2
Beryllium-7	U	0.0436	+/-0.129	0.244	0.300	pCi/g							
Cesium-134	U	0.0146	+/-0.0166	0.032	0.040	pCi/g							
Cesium-137	J	1.10	+/-0.0661	0.0279	2.30	pCi/g							
Cobalt-57	U	0.00307	+/-0.00954	0.0178	0.020	pCi/g							
Cobalt-60	U	0.00209	+/-0.0154	0.0294	0.300	pCi/g							
Europium-152	U	0.0313	+/-0.0375	0.074	4.80	pCi/g							
Europium-154	U	-0.0209	+/-0.0371	0.0657	17.0	pCi/g							
Europium-155	U	0.0615	+/-0.0921	0.0665	0.300	pCi/g							
Manganese-54	U	0.0101	+/-0.0152	0.0287	0.050	pCi/g							
Sodium-22	U	-0.00696	+/-0.0131	0.0233	0.050	pCi/g							
Zinc-65	U	-0.0183	+/-0.0359	0.0555	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.515	+/-0.581	1.29	2.00	pCi/g			KSD1	08/07/18	1732	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			93.1	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-011
Sample ID: 456288011

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-10
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-012	Project:	BRKL00700
Sample ID:	456288012	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 10:10	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	Composite 2
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

Rad Alpha Spec Analysis

Alphaspec Pu, Solid "Dry Weight Corrected"

Plutonium-238	U	0.169	+/-0.216	0.299	6.60	pCi/g			BXA4	08/06/18	2248	1788987	1
Plutonium-239/240	U	0.232	+/-0.269	0.399	4.00	pCi/g							

Alphaspec U-235, U-238 "Dry Weight Corrected"

Uranium-235/236	U	-0.0488	+/-0.216	0.563	0.900	pCi/g			BXA4	08/07/18	0857	1788988	2
Uranium-238	U	-0.0132	+/-0.305	0.689	0.900	pCi/g							

Rad Liquid Scintillation Analysis

LSC, Tritium Dist, Solid "As Received"

Tritium	U	-42.3	+/-140	262	500	pCi/g			MXH8	08/06/18	1140	1788846	3
---------	---	-------	--------	-----	-----	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 906.0 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Plutonium-236 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			79	(15%-125%)
Uranium-232 Tracer	Alphaspec U-235, U-238 "Dry Weight Corrected"			86.1	(15%-125%)

Notes:

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

Column headers are defined as follows:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-013	Project:	BRKL00700
Sample ID:	456288013	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:00	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-11
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.322	+/-0.151	0.0847	1.00	pCi/g			MXR1	08/24/18	1051	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.00591	+/-0.0433	0.0781	4.00	pCi/g			RXF2	08/09/18	1106	1788713	2
Beryllium-7	U	0.00978	+/-0.0777	0.152	0.300	pCi/g							
Cesium-134	J-UI	0.0308	+/-0.0225	0.0234	0.040	pCi/g							
Cesium-137	J	0.180	+/-0.0294	0.022	2.30	pCi/g							
Cobalt-57	U	-0.00342	+/-0.00693	0.0128	0.020	pCi/g							
Cobalt-60	U	-0.0055	+/-0.00969	0.0163	0.300	pCi/g							
Europium-152	U	0.00504	+/-0.029	0.052	4.80	pCi/g							
Europium-154	U	-0.00185	+/-0.0361	0.058	17.0	pCi/g							
Europium-155	U	0.0117	+/-0.0299	0.0579	0.300	pCi/g							
Manganese-54	J-UI	0.0243	+/-0.0167	0.0171	0.050	pCi/g							
Sodium-22	U	-0.00113	+/-0.0126	0.0202	0.050	pCi/g							
Zinc-65	U	0.0115	+/-0.0252	0.0439	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.710	+/-0.853	1.44	2.00	pCi/g			KSD1	08/07/18	1732	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			85.9	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-013
Sample ID: 456288013

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-11
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-014	Project:	BRKL00700
Sample ID:	456288014	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:02	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-12
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.366	+/-0.154	0.0989	1.00	pCi/g			MXR1	08/24/18	1051	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.00611	+/-0.047	0.0914	4.00	pCi/g			RXF2	08/09/18	1107	1788713	2
Beryllium-7	U	0.0762	+/-0.0894	0.181	0.300	pCi/g							
Cesium-134	UI	0.0451	+/-0.0261	0.0286	0.040	pCi/g							
Cesium-137	J	0.930	+/-0.0488	0.0197	2.30	pCi/g							
Cobalt-57	U	-0.000412	+/-0.00705	0.0133	0.020	pCi/g							
Cobalt-60	U	0.00456	+/-0.0109	0.0222	0.300	pCi/g							
Europium-152	U	0.00985	+/-0.0317	0.0578	4.80	pCi/g							
Europium-154	U	-0.00822	+/-0.0288	0.0547	17.0	pCi/g							
Europium-155	U	0.022	+/-0.0284	0.0561	0.300	pCi/g							
Manganese-54	J-UI	0.0244	+/-0.0174	0.0167	0.050	pCi/g							
Sodium-22	U	-0.00305	+/-0.0101	0.0192	0.050	pCi/g							
Zinc-65	U	0.000666	+/-0.0274	0.0444	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.659	+/-1.10	1.92	2.00	pCi/g			KSD1	08/07/18	1733	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			62.1	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-014
Sample ID: 456288014

Project: BRKL00700
Client ID: BRKL007
39987

Samp Recv.:
Client Desc.: 811-SU-3-12
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-015	Project:	BRKL00700
Sample ID:	456288015	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:04	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-13
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.461	+/-0.113	0.101	1.00	pCi/g			MXR1	08/24/18	1057	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.00656	+/-0.0103	0.017	4.00	pCi/g			RXF2	08/09/18	1901	1788713	2
Beryllium-7	U	-0.0111	+/-0.0535	0.101	0.300	pCi/g							
Cesium-134	U	0.0069	+/-0.0115	0.0157	0.040	pCi/g							
Cesium-137	J	0.303	+/-0.0239	0.0146	2.30	pCi/g							
Cobalt-57	U	-0.000236	+/-0.0036	0.007	0.020	pCi/g							
Cobalt-60	U	-0.000785	+/-0.00645	0.012	0.300	pCi/g							
Europium-152	U	-0.00446	+/-0.0174	0.0303	4.80	pCi/g							
Europium-154	U	-0.0115	+/-0.0214	0.0381	17.0	pCi/g							
Europium-155	J-UI	0.0619	+/-0.0347	0.0255	0.300	pCi/g							
Manganese-54	J-UI	0.0186	+/-0.0114	0.0124	0.050	pCi/g							
Sodium-22	U	-0.00389	+/-0.00756	0.0135	0.050	pCi/g							
Zinc-65	U	0.0061	+/-0.0177	0.0302	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.107	+/-0.484	0.999	2.00	pCi/g			KSD1	08/07/18	1732	1788749	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			103	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-015
Sample ID: 456288015

Project: BRKL00700
Client ID: BRKL007
39987

Samp Recv.:
Client Desc.: 811-SU-3-13
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-016	Project:	BRKL00700
Sample ID:	456288016	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:06	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-14
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.452	+/-0.153	0.102	1.00	pCi/g			MXR1	08/24/18	1058	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0144	+/-0.0794	0.143	4.00	pCi/g			RXF2	08/09/18	1902	1788713	2
Beryllium-7	U	0.0367	+/-0.0964	0.180	0.300	pCi/g							
Cesium-134	J-UI	0.0327	+/-0.0166	0.0245	0.040	pCi/g							
Cesium-137	J	0.856	+/-0.0454	0.0193	2.30	pCi/g							
Cobalt-57	U	0.00176	+/-0.00706	0.0132	0.020	pCi/g							
Cobalt-60	U	0.00705	+/-0.0107	0.0208	0.300	pCi/g							
Europium-152	U	0.00711	+/-0.0285	0.0521	4.80	pCi/g							
Europium-154	U	0.0176	+/-0.0315	0.0604	17.0	pCi/g							
Europium-155	J-UI	0.0999	+/-0.0752	0.053	0.300	pCi/g							
Manganese-54	U	0.0163	+/-0.00872	0.0177	0.050	pCi/g							
Sodium-22	U	0.00661	+/-0.0111	0.0214	0.050	pCi/g							
Zinc-65	U	0.0112	+/-0.0241	0.0412	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.106	+/-0.399	0.746	2.00	pCi/g			KSD1	08/07/18	1615	1788750	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			100	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-016
Sample ID: 456288016

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-14
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-017	Project:	BRKL00700
Sample ID:	456288017	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:08	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-15
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.722	+/-0.143	0.0916	1.00	pCi/g			MXR1	08/24/18	1058	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.00869	+/-0.0238	0.0459	4.00	pCi/g			RXF2	08/09/18	1902	1788713	2
Beryllium-7	U	0.252	+/-0.244	0.285	0.300	pCi/g							
Cesium-134	UI	0.0647	+/-0.0356	0.0365	0.040	pCi/g							
Cesium-137		3.80	+/-0.0984	0.0304	2.30	pCi/g							
Cobalt-57	U	0.00522	+/-0.00873	0.0165	0.020	pCi/g							
Cobalt-60	J	0.0366	+/-0.0278	0.0242	0.300	pCi/g							
Europium-152	U	-0.0231	+/-0.0429	0.0796	4.80	pCi/g							
Europium-154	U	-0.0103	+/-0.0427	0.0774	17.0	pCi/g							
Europium-155	J-UI	0.144	+/-0.0734	0.061	0.300	pCi/g							
Manganese-54	U	0.00758	+/-0.0154	0.0282	0.050	pCi/g							
Sodium-22	U	-0.00348	+/-0.015	0.0273	0.050	pCi/g							
Zinc-65	U	0.0239	+/-0.0345	0.0607	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.442	+/-0.475	0.787	2.00	pCi/g			KSD1	08/08/18	0737	1788750	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			107	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-017
Sample ID: 456288017

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-15
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-018	Project:	BRKL00700
Sample ID:	456288018	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:10	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	Composite 3
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

Rad Alpha Spec Analysis

Alphaspec Pu, Solid "Dry Weight Corrected"

Plutonium-238	U	0.442	+/-0.432	0.662	6.60	pCi/g			BXA4	08/06/18	2248	1788987	1
Plutonium-239/240	U	-0.0483	+/-0.201	0.471	4.00	pCi/g							

Alphaspec U-235, U-238 "Dry Weight Corrected"

Uranium-235/236	U	0.0765	+/-0.287	0.482	0.900	pCi/g			BXA4	08/07/18	0857	1788988	2
Uranium-238	U	0.498	+/-0.523	0.750	0.900	pCi/g							

Rad Liquid Scintillation Analysis

LSC, Tritium Dist, Solid "As Received"

Tritium	U	-33.1	+/-127	238	500	pCi/g			MXH8	08/06/18	1156	1788846	3
---------	---	-------	--------	-----	-----	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 906.0 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Plutonium-236 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			65.7	(15%-125%)
Uranium-232 Tracer	Alphaspec U-235, U-238 "Dry Weight Corrected"			91.2	(15%-125%)

Notes:

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

Column headers are defined as follows:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-019	Project:	BRKL00700
Sample ID:	456288019	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:12	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-16
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.590	+/-0.204	0.133	1.00	pCi/g			MXR1	08/24/18	1059	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	J-UI	0.113	+/-0.0923	0.101	4.00	pCi/g			RXF2	08/09/18	1902	1788713	2
Beryllium-7	U-DL	-0.0336	+/-0.181	0.313	0.300	pCi/g							
Cesium-134	J-UI	0.0329	+/-0.0252	0.0266	0.040	pCi/g							
Cesium-137		10.4	+/-0.119	0.0251	2.30	pCi/g							
Cobalt-57	U	0.0034	+/-0.00979	0.0187	0.020	pCi/g							
Cobalt-60	U	0.00575	+/-0.0107	0.0201	0.300	pCi/g							
Europium-152	U	-0.0153	+/-0.0479	0.0848	4.80	pCi/g							
Europium-154	U	-0.00112	+/-0.0314	0.0563	17.0	pCi/g							
Europium-155	U	0.0423	+/-0.059	0.0714	0.300	pCi/g							
Manganese-54	U	0.00408	+/-0.0114	0.0212	0.050	pCi/g							
Sodium-22	U	-0.000296	+/-0.0111	0.0198	0.050	pCi/g							
Zinc-65	U	-0.00627	+/-0.0238	0.0368	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.293	+/-0.510	1.11	2.00	pCi/g			KSD1	08/07/18	1615	1788750	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			100	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-019
Sample ID: 456288019

Project: BRKL00700
Client ID: BRKL007
39987

Samp Recv.:
Client Desc.: 811-SU-3-16
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-020	Project:	BRKL00700
Sample ID:	456288020	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:14	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-17
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.722	+/-0.248	0.163	1.00	pCi/g			MXR1	08/24/18	1101	1790738	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0167	+/-0.0378	0.0571	4.00	pCi/g			RXF2	08/09/18	1903	1788713	2
Beryllium-7	U	-0.000365	+/-0.108	0.191	0.300	pCi/g							
Cesium-134	J-UI	0.032	+/-0.0201	0.0172	0.040	pCi/g							
Cesium-137		3.19	+/-0.0639	0.0187	2.30	pCi/g							
Cobalt-57	U	0.0015	+/-0.00664	0.0128	0.020	pCi/g							
Cobalt-60	U	0.00141	+/-0.00909	0.0168	0.300	pCi/g							
Europium-152	U	0.007	+/-0.0296	0.0541	4.80	pCi/g							
Europium-154	U	0.00642	+/-0.0271	0.0503	17.0	pCi/g							
Europium-155	J-UI	0.0592	+/-0.0483	0.0511	0.300	pCi/g							
Manganese-54	U	0.0103	+/-0.013	0.0144	0.050	pCi/g							
Sodium-22	U	0.00201	+/-0.00952	0.0176	0.050	pCi/g							
Zinc-65	U	0.0101	+/-0.021	0.0355	0.500	pCi/g							

Rad Gas Flow Proportional Counting

GFPC, Sr90, solid "Dry Weight Corrected"

Strontium-90	U	-0.0823	+/-0.501	1.00	2.00	pCi/g			KSD1	08/07/18	1615	1788750	3
--------------	---	---------	----------	------	------	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1530	1788645

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			103	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-020
Sample ID: 456288020

Project: BRKL00700
Client ID: BRKL007
39987

Samp Recv.:
Client Desc.: 811-SU-3-17
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-021	Project:	BRKL00700
Sample ID:	456288021	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:16	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-18
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.492	+/-0.148	0.101	1.00	pCi/g			MXR1	08/24/18	1119	1790740	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	J-UI	0.0559	+/-0.0522	0.0537	4.00	pCi/g			RXF2	08/09/18	1055	1788721	2
Beryllium-7	U	-0.0403	+/-0.154	0.280	0.300	pCi/g							
Cesium-134	U-DL	0.0251	+/-0.0362	0.0436	0.040	pCi/g							
Cesium-137	J	0.717	+/-0.058	0.0387	2.30	pCi/g							
Cobalt-57	UI	0.024	+/-0.017	0.0173	0.020	pCi/g							
Cobalt-60	U	0.00652	+/-0.0203	0.0391	0.300	pCi/g							
Europium-152	U	-0.0161	+/-0.0433	0.0768	4.80	pCi/g							
Europium-154	U	-0.00506	+/-0.0564	0.104	17.0	pCi/g							
Europium-155	J-UI	0.151	+/-0.120	0.0671	0.300	pCi/g							
Manganese-54	U	0.0243	+/-0.0213	0.0337	0.050	pCi/g							
Sodium-22	U	-0.00178	+/-0.0199	0.0367	0.050	pCi/g							
Zinc-65	U	-0.0292	+/-0.0468	0.071	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.0602	+/-0.671	1.30	2.00	pCi/g			KSD1	08/07/18	1615	1788750	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1526	1788646

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			107	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-021
Sample ID: 456288021

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-18
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000
Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-022	Project:	BRKL00700
Sample ID:	456288022	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:18	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-19
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.511	+/-0.162	0.118	1.00	pCi/g			MXR1	08/24/18	1139	1790740	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0293	+/-0.112	0.172	4.00	pCi/g			RXF2	08/09/18	1055	1788721	2
Beryllium-7		0.361	+/-0.216	0.235	0.300	pCi/g							
Cesium-134	UI	0.0579	+/-0.0295	0.039	0.040	pCi/g							
Cesium-137	J	0.822	+/-0.0544	0.0269	2.30	pCi/g							
Cobalt-57	U-DL	-0.00358	+/-0.0115	0.020	0.020	pCi/g							
Cobalt-60	U	0.00339	+/-0.0133	0.027	0.300	pCi/g							
Europium-152	U	-0.00457	+/-0.0469	0.0782	4.80	pCi/g							
Europium-154	U	-0.035	+/-0.0608	0.0893	17.0	pCi/g							
Europium-155	J-UI	0.126	+/-0.0914	0.0804	0.300	pCi/g							
Manganese-54	U	0.0201	+/-0.0233	0.0263	0.050	pCi/g							
Sodium-22	U	-0.0135	+/-0.0213	0.0309	0.050	pCi/g							
Zinc-65	U	-0.00522	+/-0.0369	0.061	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.776	+/-1.11	1.90	2.00	pCi/g			KSD1	08/07/18	1615	1788750	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1526	1788646

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			88.3	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-022
Sample ID: 456288022

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-19
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-023	Project:	BRKL00700
Sample ID:	456288023	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:20	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	811-SU-3-20
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.552	+/-0.101	0.0739	1.00	pCi/g			MXR1	08/24/18	1140	1790740	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.131	+/-0.151	0.137	4.00	pCi/g			RXF2	08/09/18	1056	1788721	2
Beryllium-7	U	0.0865	+/-0.111	0.220	0.300	pCi/g							
Cesium-134	U	0.0268	+/-0.0267	0.0344	0.040	pCi/g							
Cesium-137	J	0.398	+/-0.0419	0.0246	2.30	pCi/g							
Cobalt-57	U	-0.000594	+/-0.00977	0.0179	0.020	pCi/g							
Cobalt-60	U	-0.00269	+/-0.0119	0.0224	0.300	pCi/g							
Europium-152	U	0.0152	+/-0.0358	0.0675	4.80	pCi/g							
Europium-154	U	-0.0317	+/-0.0413	0.0717	17.0	pCi/g							
Europium-155	U	0.0246	+/-0.0388	0.0743	0.300	pCi/g							
Manganese-54	U	0.00104	+/-0.0143	0.026	0.050	pCi/g							
Sodium-22	U	-0.0111	+/-0.0145	0.0252	0.050	pCi/g							
Zinc-65	U	-0.00661	+/-0.0268	0.0442	0.500	pCi/g							

Rad Gas Flow Proportional Counting

GFPC, Sr90, solid "Dry Weight Corrected"

Strontium-90	U	-0.0339	+/-0.344	0.686	2.00	pCi/g			KSD1	08/07/18	1615	1788750	3
--------------	---	---------	----------	-------	------	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1526	1788646

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			105	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-023
Sample ID: 456288023

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: 811-SU-3-20
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-024	Project:	BRKL00700
Sample ID:	456288024	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 11:22	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	Composite 4
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

Rad Alpha Spec Analysis

Alphaspec Pu, Solid "Dry Weight Corrected"

Plutonium-238	U	0.552	+/-0.693	0.849	6.60	pCi/g			BXA4	08/08/18	0846	1788987	1
Plutonium-239/240	U	0.376	+/-0.622	0.894	4.00	pCi/g							

Alphaspec U-235, U-238 "Dry Weight Corrected"

Uranium-235/236	U	0.044	+/-0.244	0.469	0.900	pCi/g			BXA4	08/07/18	0857	1788988	2
Uranium-238		1.11	+/-0.573	0.418	0.900	pCi/g							

Rad Liquid Scintillation Analysis

LSC, Tritium Dist, Solid "As Received"

Tritium	U	-95.3	+/-128	251	500	pCi/g			MXH8	08/06/18	1213	1788846	3
---------	---	-------	--------	-----	-----	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1526	1788646

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 906.0 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Plutonium-236 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			99.8	(15%-125%)
Uranium-232 Tracer	Alphaspec U-235, U-238 "Dry Weight Corrected"			101	(15%-125%)

Notes:

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

Column headers are defined as follows:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39987-025	Project:	BRKL00700
Sample ID:	456288025	Client ID:	BRKL007
Matrix:	S	COC:	39987
Collect Date:	31-JUL-18 00:00	Samp Recv.:	
Receive Date:	02-AUG-18 08:55	Client Desc.:	BD-1
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.276	+/-0.083	0.145	1.00	pCi/g			MXR1	08/24/18	1140	1790740	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.011	+/-0.0634	0.127	4.00	pCi/g			RXF2	08/09/18	1056	1788721	2
Beryllium-7	U	-0.0438	+/-0.0847	0.157	0.300	pCi/g							
Cesium-134	U	0.0274	+/-0.0214	0.0275	0.040	pCi/g							
Cesium-137	J	0.103	+/-0.025	0.0204	2.30	pCi/g							
Cobalt-57	U	-0.00268	+/-0.00708	0.0133	0.020	pCi/g							
Cobalt-60	U	-0.00802	+/-0.0121	0.0214	0.300	pCi/g							
Europium-152	U	-0.0134	+/-0.0268	0.0486	4.80	pCi/g							
Europium-154	U	0.0188	+/-0.0307	0.0655	17.0	pCi/g							
Europium-155	U	0.0105	+/-0.0313	0.0615	0.300	pCi/g							
Manganese-54	U	0.00317	+/-0.0109	0.0209	0.050	pCi/g							
Sodium-22	U	0.00662	+/-0.0108	0.0231	0.050	pCi/g							
Zinc-65	U	-0.00268	+/-0.0258	0.0439	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.276	+/-0.346	0.808	2.00	pCi/g			KSD1	08/07/18	1615	1788750	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXB7	08/02/18	1526	1788646

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			105	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-025
Sample ID: 456288025

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: BD-1
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-026
Sample ID: 456288026
Matrix: W
Collect Date: 31-JUL-18 07:30
Receive Date: 02-AUG-18 08:55
Collector: Client

Project: BRKL00700
Client ID: BRKL007
COC: 39987
Samp Recv.:
Client Desc.: EB-1
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis													
Alphaspec Pu, Liquid "As Received"													
Plutonium-238	U	0.0161	+/-0.130	0.264	0.700	pCi/L			BXA4	08/06/18	2339	1788989	1
Plutonium-239/240	U	-0.101	+/-0.109	0.333	6.00	pCi/L							
Alphaspec U, Liquid "As Received"													
Uranium-235/236	U	-0.0751	+/-0.227	0.637	26.0	pCi/L			BXA4	08/07/18	0856	1788990	2
Uranium-238	U	0.0439	+/-0.244	0.468	26.0	pCi/L							
Rad Gamma Spec Analysis													
Gammascpec, Gamma, Liquid Remediation Standard "As Received"													
Americium-241	U	-3.36	+/-11.1	17.3	25.0	pCi/L			BSW1	08/08/18	1849	1789015	3
Beryllium-7	U	-2.93	+/-8.60	15.1	60.0	pCi/L							
Cesium-134	U	-0.795	+/-1.19	1.97	5.00	pCi/L							
Cesium-137	U	-0.492	+/-1.01	1.74	12.0	pCi/L							
Cobalt-57	U	0.113	+/-1.00	1.69	5.00	pCi/L							
Cobalt-60	U	0.511	+/-0.964	1.94	22.0	pCi/L							
Europium-152	U	0.287	+/-2.93	5.33	84.0	pCi/L							
Europium-154	U	-1.72	+/-5.32	4.82	57.0	pCi/L							
Europium-155	U	2.18	+/-4.20	7.27	359	pCi/L							
Manganese-54	U	0.564	+/-1.09	2.01	6.00	pCi/L							
Sodium-22	U	-0.619	+/-1.87	1.69	7.00	pCi/L							
Zinc-65	U	-0.351	+/-2.00	3.71	15.0	pCi/L							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, liquid "As Received"													
Strontium-90	U	0.207	+/-0.445	0.787	0.800	pCi/L			KSD1	08/06/18	1506	1788973	4
Rad Liquid Scintillation Analysis													
LSC, Tritium Dist, Liquid "As Received"													
Tritium	U	7.13	+/-148	284	500	pCi/L			MXH8	08/03/18	1015	1788843	5
Rad Radium-226													
Lucas Cell, Ra226, Liquid "As Received"													
Radium-226	U	0.0798	+/-0.156	0.305	1.00	pCi/L			PCW	08/09/18	0955	1788981	6

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: August 30, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000
Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39987-026
Sample ID: 456288026

Project: BRKL00700
Client ID: BRKL007
39987
Samp Recv.:
Client Desc.: EB-1
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 901.1	
4	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
5	EPA 906.0 Modified	
6	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Plutonium-236 Tracer	Alphaspec Pu, Liquid "As Received"			84.7	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			90	(15%-125%)
Strontium Carrier	GFPC, Sr90, liquid "As Received"			81.1	(25%-125%)

Notes:

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

Column headers are defined as follows:

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

BROOKHAVEN
NATIONAL LABORATORY

SAMPLING CHAIN OF CUSTODY

458430

 Requires EDD

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: W. Dorsch		Name: EPD Field Sampling Team		Name: GEI	
Life: No: 21133		Contact: R. Lagattolla		Address: 2040 Savage Rd	
Ext: 5186		Phone: 631 344 7429		City: Charleston St SC Zip: 29407	
Dept: ES		Email/Fax: rlagattolla@hml.gov		Contact: Edith Kent	
Email Reports To:		Sampler: <i>R. W. Dorsch</i>		Phone: 843-556-8171	
1 W Dorsch				Email/Fax:	
2 R. Howa		Project Manager:		Field Engineer:	
Project Name:		W. Dorsch		R. Lagattolla	
8111 YB					

Comments: Please send all available data with 7Day TAT, and Sr-90 14day TAT. **Ra226 when available**

Type		Sample Information				Additional Sample Information				Alpha		Gamma		Strontium		Cesium		Metals	
UID	Col	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Misc	Name/Description	Cont. Vol./Units	Con. Type	Is of Cont	Preservative	Tritium	Gamma	Strontium	Cesium	Metals	PCBs	Nuclides	624
001	E G	811-SU-3-1-R	0.0-0.5	8/28/18	1330	S	Building 811 Soil	160Z	P	1	---		X	X	X				

1 Relinquished By/Date/Time	2 Relinquished By/Date/Time	3 Relinquished By/Date/Time
Print 8/20/18	Print 8/1/18	Print
Signature [Signature]	Signature [Signature]	Signature [Signature]
1 Received By/Date/Time	2 Received By/Date/Time	3 Received By/Date/Time
Print SBODND	Print 8/29/18	Print
Signature [Signature]	Signature [Signature]	Signature [Signature]

Contractor Lab Sample Disposal:
☐ Return To Client ☒ Disposal by Lab
☐ Archive For _____ Months

Data Package: ☒ Full ☐ Summary

Turn-Around Time Required:
☐ Rush (1 Day) ☒ 14 Days ☐ 30 Days
☐ 7 Days ☐ Other (*30 days*)

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 21, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. Robert F. Howe
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	40141-001	Project:	BRKL00700
Sample ID:	458430001	Client ID:	BRKL007
Matrix:	S	COC:	40141
Collect Date:	28-AUG-18 13:30	Samp Recv.:	
Receive Date:	29-AUG-18 09:00	Client Desc.:	811-SU-3-1-R
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.514	+/-0.148	0.133	1.00	pCi/g			MXR1	09/21/18	0551	1798961	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0103	+/-0.0927	0.168	4.00	pCi/g			MXR1	08/31/18	1122	1798257	2
Beryllium-7	U	-0.091	+/-0.143	0.249	0.300	pCi/g							
Cesium-134	U	0.0156	+/-0.0119	0.0216	0.040	pCi/g							
Cesium-137		8.01	+/-0.106	0.0213	2.30	pCi/g							
Cobalt-57	U	0.00977	+/-0.0097	0.0191	0.020	pCi/g							
Cobalt-60	J-UI	0.0335	+/-0.0154	0.0169	0.300	pCi/g							
Europium-152	U	-0.0176	+/-0.0427	0.0766	4.80	pCi/g							
Europium-154	U	0.00968	+/-0.0303	0.0506	17.0	pCi/g							
Europium-155	U	0.00933	+/-0.0415	0.0814	0.300	pCi/g							
Manganese-54	U	0.0128	+/-0.00985	0.0179	0.050	pCi/g							
Sodium-22	U	0.00358	+/-0.0106	0.0178	0.050	pCi/g							
Zinc-65	U	-0.00789	+/-0.0215	0.0335	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	1.75	+/-1.19	1.85	2.00	pCi/g			LXB3	09/04/18	1415	1798282	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	08/30/18	1059	1798227

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			92.3	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 21, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. Robert F. Howe
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 40141-001
Sample ID: 458430001

Project: BRKL00700

Client ID: BRKL007
40141

Samp Recv.:

Client Desc.: 811-SU-3-1-R

Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

Lc/LC: Critical Level

PF: Prep Factor

RL: Reporting Limit

SQL: Sample Quantitation Limit

Geoprobe 811



Chain of Custody No.
39984

PO. #

Page 1 of 2

SAMPLING CHAIN OF CUSTODY 450300

Requires EDD

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: W. Dorsch	Name: EPD Field Sampling Team	Name: GEL			
Life: N21133	Contact: R. Lagattola	Address: 2040 Savage Rd			
Acct. No: 20802/23139	Phone: 631 344 7129	City: Charleston	St: SC	Zip: 29407	
	Email: Rplagattola@brl.gov	Contact: E. Kent			
W. Dorsch	Sampler: R. Metz, J. Milligan	Phone: 843-556-8171			
W. Howe		Email/Fax:			
	Project Name: 811LYB	Field Engineer: R. Lagattola			

Comments: SPDES TAT for EDD - 009 Additional Analysis per B. Howe. OK to test for PA 226

Type	UID	Smp	Coil	Sample Information		Date	Time	Hours	Additional Sample Information			Preservative
				Site ID/Bldg/Life #	Depth/RWP				Name/Description	Cont. Vol./Units	Con. Type	# of Cores
E	001	E	C	811-GP-01-2018	0.0-2.0	7/31/18	1320	S	Bldg. 811 Geoprobe soil cores (0.0ft-2.0ft) With MSM/MSD	16oz	P	1
E	002	E	C	811-GP-01-2018	2.0-4.0	7/31/18	1325	S	Bldg. 811 Geoprobe soil cores (2.0ft-4.0ft)	16oz	P	1
E	003	E	C	811-GP-01-2018	4.0-6.0	7/31/18	1355	S	Bldg. 811 Geoprobe soil cores (4.0ft-6.0ft)	16oz	P	1
E	004	E	C	811-GP-01-2018	6.0-8.0	7/31/18	1400	S	Bldg. 811 Geoprobe soil cores (6.0ft-8.0ft)	16oz	P	1
E	005	E	C	811-GP-02-2018	0.0-2.0	7/31/18	1405	S	Bldg. 811 Geoprobe soil cores (0.0ft-2.0ft)	16oz	P	1
E	006	E	C	811-GP-02-2018	2.0-4.0	7/31/18	1410	S	Bldg. 811 Geoprobe soil cores (2.0ft-4.0ft)	16oz	P	1
E	007	E	C	811-GP-02-2018	4.0-6.0	7/31/18	1415	S	Bldg. 811 Geoprobe soil cores (4.0ft-6.0ft)	16oz	P	1
E	008	E	C	811-GP-02-2018	6.0-8.0	7/31/18	1420	S	Bldg. 811 Geoprobe soil cores (6.0ft-8.0ft)	16oz	P	1
E	009	E	C	811-GP-03-2018	0.0-2.0	7/31/18	1425	S	Bldg. 811 Geoprobe soil cores (0.0ft-2.0ft)	16oz	P	1
E	010	E	C	811-GP-03-2018	2.0-4.0	7/31/18	1430	S	Bldg. 811 Geoprobe soil cores (2.0ft-4.0ft)	16oz	P	1
E	011	E	C	811-GP-03-2018	4.0-6.0	7/31/18	1435	S	Bldg. 811 Geoprobe soil cores (4.0ft-6.0ft)	16oz	P	1
E	012	E	C	811-GP-03-2018	6.0-8.0	7/31/18	1440	S	Bldg. 811 Geoprobe soil cores (6.0ft-8.0ft)	16oz	P	1
E	013	E	C	BD-1	0	7/31/18	0000	S	Blind Duplicate	16oz	P	1
E	014	E	C	EB-1	0	7/31/18	0730	W	Equipment Blank	4L	P	1

Analysis Requested									
Alpha/Beta									
Tritium									
Gamma Remediation, R226	X	X	X	X	X	X	X	X	X
Strontium 90	X	X	X	X	X	X	X	X	X
52+2									
624									
Nuclide-specific Alpha									
PCBs									
Metals									
U 235/238									
Pu 238/239/240									

1 Relinquished By/Date/Time		2 Relinquished By/Date/Time		3 Relinquished By/Date/Time	
Print	R. Metz 8/1/18 1512	Print	W. Dorsch 8/6/18 1515	Print	W. Dorsch 8/6/18 1515
Signature	R. Metz 8/1/18 1512	Signature	W. Dorsch 8/6/18 1515	Signature	W. Dorsch 8/6/18 1515
1 Received By/Date/Time		2 Received By/Date/Time		3 Received By/Date/Time	
Print	W. Dorsch 8/1/18 1515	Print	W. Dorsch 8/6/18 1420	Print	W. Dorsch 8/6/18 1420
Signature	W. Dorsch 8/1/18 1515	Signature	W. Dorsch 8/6/18 1420	Signature	W. Dorsch 8/6/18 1420

Contractor Lab Sample Disposal	
☐ Return To Client	☐ Disposal by Lab
☐ Archive For	Months
Data Package: ☒ Full ☐ Summary	
Turn-Around Time Required:	
☐ Rush (1 Day)	☐ 14 Days
☐ 7 Days	☐ Other ()

SAMPLING CHAIN OF CUSTODY

Comments: SPDES TAT for EDD

[illegible]

Contractor Lab Sample Disposals	
☐ Return To Client	☒ Disposal by Lab
☐ Archive For _____ Months	

Data Package:	
☒ Full	☐ Summary

Turn-Around Time Required:	
☒ Rush (1 Day)	☐ 14 Days
☐ 7 Days	☐ 30 Days
☐ Other ()	

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-001	Project:	BRKL00700
Sample ID:	456300002	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 13:20	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-01-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.634	+/-0.153	0.0902	1.00	pCi/g			RXF2	08/30/18	0552	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.00148	+/-0.0364	0.0647	4.00	pCi/g			RXF2	08/10/18	1116	1790490	2
Beryllium-7	U	-0.0779	+/-0.102	0.180	0.300	pCi/g							
Cesium-134	UI	0.0594	+/-0.0271	0.0354	0.040	pCi/g							
Cesium-137	U	0.00376	+/-0.0152	0.0252	2.30	pCi/g							
Cobalt-57	U	0.00347	+/-0.0092	0.0164	0.020	pCi/g							
Cobalt-60	U	0.000262	+/-0.0118	0.0225	0.300	pCi/g							
Europium-152	U	0.0266	+/-0.0328	0.0625	4.80	pCi/g							
Europium-154	U	0.0194	+/-0.0356	0.0708	17.0	pCi/g							
Europium-155	U	0.00544	+/-0.035	0.0652	0.300	pCi/g							
Manganese-54	U	0.0138	+/-0.0136	0.0261	0.050	pCi/g							
Sodium-22	U	0.00637	+/-0.0125	0.0247	0.050	pCi/g							
Zinc-65	U	-0.00434	+/-0.0293	0.0478	0.500	pCi/g							

Rad Gas Flow Proportional Counting

GFPC, Sr90, solid "Dry Weight Corrected"

Strontium-90	U	0.019	+/-0.490	0.943	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3
--------------	---	-------	----------	-------	------	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			103	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-001
Sample ID: 456300002

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-01-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-002	Project:	BRKL00700
Sample ID:	456300003	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 13:25	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-01-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.487	+/-0.105	0.084	1.00	pCi/g			RXF2	08/30/18	0552	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0472	+/-0.0487	0.102	4.00	pCi/g			RXF2	08/10/18	1117	1790490	2
Beryllium-7	U	0.0495	+/-0.0918	0.182	0.300	pCi/g							
Cesium-134	U	0.022	+/-0.0132	0.0276	0.040	pCi/g							
Cesium-137	U	0.00315	+/-0.0106	0.0203	2.30	pCi/g							
Cobalt-57	U	-0.00319	+/-0.00771	0.0144	0.020	pCi/g							
Cobalt-60	U	0.00502	+/-0.0111	0.0225	0.300	pCi/g							
Europium-152	U	-0.00167	+/-0.0281	0.0548	4.80	pCi/g							
Europium-154	U	-0.00145	+/-0.0324	0.0618	17.0	pCi/g							
Europium-155	U	0.0194	+/-0.033	0.0652	0.300	pCi/g							
Manganese-54	U	0.012	+/-0.0174	0.0171	0.050	pCi/g							
Sodium-22	U	-0.00083	+/-0.0113	0.0216	0.050	pCi/g							
Zinc-65	U	-0.00155	+/-0.0281	0.047	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.833	+/-0.916	1.53	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			100	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-002
Sample ID: 456300003

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-01-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-003	Project:	BRKL00700
Sample ID:	456300004	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 13:55	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-01-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.383	+/-0.128	0.0766	1.00	pCi/g			RXF2	08/30/18	0553	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.000401	+/-0.0431	0.0791	4.00	pCi/g			RXF2	08/10/18	1117	1790490	2
Beryllium-7	U	-0.00868	+/-0.0795	0.153	0.300	pCi/g							
Cesium-134	U	0.0167	+/-0.0118	0.0231	0.040	pCi/g							
Cesium-137	U	-0.00504	+/-0.0114	0.0189	2.30	pCi/g							
Cobalt-57	U	-0.000623	+/-0.00702	0.0133	0.020	pCi/g							
Cobalt-60	U	0.00108	+/-0.0106	0.0197	0.300	pCi/g							
Europium-152	U	0.00233	+/-0.0256	0.0507	4.80	pCi/g							
Europium-154	U	0.017	+/-0.0293	0.0581	17.0	pCi/g							
Europium-155	U	0.0288	+/-0.0289	0.0578	0.300	pCi/g							
Manganese-54	J-UI	0.0185	+/-0.0156	0.017	0.050	pCi/g							
Sodium-22	U	0.00374	+/-0.0107	0.0205	0.050	pCi/g							
Zinc-65	U	0.0288	+/-0.0296	0.0367	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.115	+/-0.339	0.725	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			105	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-003
Sample ID: 456300004

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-01-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-004	Project:	BRKL00700
Sample ID:	456300005	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:00	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-01-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.321	+/-0.120	0.0817	1.00	pCi/g			RXF2	08/30/18	0553	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0584	+/-0.0724	0.139	4.00	pCi/g			RXF2	08/10/18	1117	1790490	2
Beryllium-7	U	-0.0574	+/-0.0903	0.165	0.300	pCi/g							
Cesium-134	J-UI	0.033	+/-0.0232	0.0247	0.040	pCi/g							
Cesium-137	J-UI	0.0241	+/-0.0196	0.0194	2.30	pCi/g							
Cobalt-57	U	-0.00331	+/-0.0079	0.0146	0.020	pCi/g							
Cobalt-60	J	0.0425	+/-0.0225	0.0224	0.300	pCi/g							
Europium-152	U	0.00147	+/-0.0298	0.0527	4.80	pCi/g							
Europium-154	U	-0.0214	+/-0.0438	0.0655	17.0	pCi/g							
Europium-155	U	0.0255	+/-0.0321	0.0636	0.300	pCi/g							
Manganese-54	J-UI	0.0198	+/-0.0174	0.0195	0.050	pCi/g							
Sodium-22	U	-0.00735	+/-0.0154	0.0231	0.050	pCi/g							
Zinc-65	U	0.00836	+/-0.0248	0.0485	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.0625	+/-0.509	1.03	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			105	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-004
Sample ID: 456300005

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-01-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-005	Project:	BRKL00700
Sample ID:	456300006	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:05	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-02-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.710	+/-0.117	0.0787	1.00	pCi/g			RXF2	08/30/18	0553	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	J-UI	0.171	+/-0.134	0.159	4.00	pCi/g			RXF2	08/10/18	1118	1790490	2
Beryllium-7	U	-0.00837	+/-0.110	0.207	0.300	pCi/g							
Cesium-134	UI	0.0662	+/-0.0332	0.0343	0.040	pCi/g							
Cesium-137	J	0.145	+/-0.0435	0.0266	2.30	pCi/g							
Cobalt-57	U	-0.00316	+/-0.00956	0.0177	0.020	pCi/g							
Cobalt-60	U	0.00579	+/-0.0129	0.0264	0.300	pCi/g							
Europium-152	U	-0.0143	+/-0.0345	0.0654	4.80	pCi/g							
Europium-154	U	-0.0527	+/-0.0403	0.0649	17.0	pCi/g							
Europium-155	U	0.0539	+/-0.0395	0.0796	0.300	pCi/g							
Manganese-54	J-UI	0.0266	+/-0.0194	0.0225	0.050	pCi/g							
Sodium-22	U	-0.0187	+/-0.0141	0.0227	0.050	pCi/g							
Zinc-65	U	-0.00481	+/-0.0306	0.051	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.178	+/-0.526	0.967	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			97.9	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-005
Sample ID: 456300006

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-02-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-006	Project:	BRKL00700
Sample ID:	456300007	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:10	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-02-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.468	+/-0.113	0.0609	1.00	pCi/g			RXF2	08/30/18	0554	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.000751	+/-0.0188	0.0346	4.00	pCi/g			RXF2	08/10/18	1118	1790490	2
Beryllium-7	U	-0.0259	+/-0.102	0.189	0.300	pCi/g							
Cesium-134	UI	0.0478	+/-0.0224	0.0328	0.040	pCi/g							
Cesium-137	U	0.0131	+/-0.0249	0.0256	2.30	pCi/g							
Cobalt-57	U	-0.000369	+/-0.00729	0.0137	0.020	pCi/g							
Cobalt-60	U	-0.00515	+/-0.0151	0.0269	0.300	pCi/g							
Europium-152	U	-0.0311	+/-0.032	0.0578	4.80	pCi/g							
Europium-154	U	0.0019	+/-0.0403	0.0765	17.0	pCi/g							
Europium-155	J-UI	0.0732	+/-0.0698	0.0534	0.300	pCi/g							
Manganese-54	U	0.00581	+/-0.0142	0.0281	0.050	pCi/g							
Sodium-22	U	-0.002	+/-0.0145	0.0267	0.050	pCi/g							
Zinc-65	U	-0.0173	+/-0.0352	0.0535	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.159	+/-0.799	1.53	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			100	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-006
Sample ID: 456300007

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-02-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-007	Project:	BRKL00700
Sample ID:	456300008	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:15	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-02-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.478	+/-0.116	0.0899	1.00	pCi/g			RXF2	08/30/18	0554	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0219	+/-0.0709	0.147	4.00	pCi/g			RXF2	08/10/18	1118	1790490	2
Beryllium-7	U	-0.0195	+/-0.104	0.193	0.300	pCi/g							
Cesium-134	J-UI	0.0349	+/-0.0154	0.0338	0.040	pCi/g							
Cesium-137	J	0.283	+/-0.0323	0.0237	2.30	pCi/g							
Cobalt-57	U	-0.00691	+/-0.00784	0.0147	0.020	pCi/g							
Cobalt-60	U	-0.00226	+/-0.0144	0.0273	0.300	pCi/g							
Europium-152	U	-0.0252	+/-0.0367	0.0603	4.80	pCi/g							
Europium-154	U	0.0186	+/-0.0437	0.087	17.0	pCi/g							
Europium-155	U	0.0314	+/-0.0321	0.0665	0.300	pCi/g							
Manganese-54	U	0.00787	+/-0.0129	0.0257	0.050	pCi/g							
Sodium-22	U	0.00627	+/-0.0153	0.0305	0.050	pCi/g							
Zinc-65	U	0.0128	+/-0.0332	0.0565	0.500	pCi/g							

Rad Gas Flow Proportional Counting

GFPC, Sr90, solid "Dry Weight Corrected"

Strontium-90	U	-0.156	+/-0.364	0.781	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3
--------------	---	--------	----------	-------	------	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			100	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-007
Sample ID: 456300008

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-02-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-008	Project:	BRKL00700
Sample ID:	456300009	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:20	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-02-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.353	+/-0.112	0.0987	1.00	pCi/g			RXF2	08/30/18	0554	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.00677	+/-0.0629	0.128	4.00	pCi/g			RXF2	08/10/18	1119	1790490	2
Beryllium-7	U	0.129	+/-0.0896	0.192	0.300	pCi/g							
Cesium-134	U	0.0232	+/-0.0188	0.0288	0.040	pCi/g							
Cesium-137	U	0.00636	+/-0.0118	0.0214	2.30	pCi/g							
Cobalt-57	U	0.00168	+/-0.00763	0.0149	0.020	pCi/g							
Cobalt-60	U	0.00453	+/-0.013	0.026	0.300	pCi/g							
Europium-152	U	-0.0053	+/-0.0292	0.0542	4.80	pCi/g							
Europium-154	U	0.0219	+/-0.0367	0.0755	17.0	pCi/g							
Europium-155	U	0.00627	+/-0.0308	0.0609	0.300	pCi/g							
Manganese-54	U	-0.00647	+/-0.0111	0.0207	0.050	pCi/g							
Sodium-22	U	0.00828	+/-0.013	0.0268	0.050	pCi/g							
Zinc-65	U	0.011	+/-0.0312	0.055	0.500	pCi/g							

Rad Gas Flow Proportional Counting

GFPC, Sr90, solid "Dry Weight Corrected"

Strontium-90	U	0.612	+/-0.671	1.12	2.00	pCi/g			KSD1	08/14/18	0721	1791254	3
--------------	---	-------	----------	------	------	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			105	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-008
Sample ID: 456300009

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-02-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-009	Project:	BRKL00700
Sample ID:	456300010	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:25	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-03-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis													
Alphaspec Pu, Solid "Dry Weight Corrected"													
Plutonium-238	U	-0.108	+/-0.152	0.499	6.60	pCi/g			MXS2	09/01/18	1108	1796137	1
Plutonium-239/240	U	0.0206	+/-0.235	0.498	4.00	pCi/g							
Alphaspec U-235, U-238 "Dry Weight Corrected"													
Uranium-235/236	J	0.552	+/-0.494	0.537	0.900	pCi/g			MXS2	09/01/18	1510	1796140	2
Uranium-238	U	0.560	+/-0.499	0.674	0.900	pCi/g							
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.500	+/-0.231	0.157	1.00	pCi/g			RXF2	08/30/18	0555	1790737	3
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0281	+/-0.0524	0.0922	4.00	pCi/g			RXF2	08/10/18	1633	1790490	4
Beryllium-7	U-DL	-0.0767	+/-0.187	0.321	0.300	pCi/g							
Cesium-134	UI	0.0563	+/-0.026	0.0221	0.040	pCi/g							
Cesium-137		15.5	+/-0.125	0.022	2.30	pCi/g							
Cobalt-57	U	0.00153	+/-0.00914	0.0173	0.020	pCi/g							
Cobalt-60	U	-0.00173	+/-0.00831	0.0147	0.300	pCi/g							
Europium-152	U	0.00378	+/-0.0472	0.0839	4.80	pCi/g							
Europium-154	U	0.00426	+/-0.0262	0.0474	17.0	pCi/g							
Europium-155	U	0.0445	+/-0.0651	0.0678	0.300	pCi/g							
Manganese-54	U	0.0108	+/-0.0131	0.0164	0.050	pCi/g							
Sodium-22	U	0.00135	+/-0.0092	0.0166	0.050	pCi/g							
Zinc-65	U	-0.0018	+/-0.0209	0.0328	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	0.428	+/-0.718	1.25	2.00	pCi/g			KSD1	08/13/18	1526	1791254	5
Rad Liquid Scintillation Analysis													
LSC, Tritium Dist, Solid "As Received"													
Tritium	U	20.6	+/-28.4	48.6	500	pCi/g			MXH8	08/25/18	0145	1796008	6
The following Prep Methods were performed:													
Method	Description			Analyst		Date	Time	Prep Batch					
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021			MPK1		08/08/18	1143	1790436					

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000
Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-009
Sample ID: 456300010

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-03-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	DOE HASL 300, 4.5.2.3/Ga-01-R	
4	DOE HASL 300, 4.5.2.3/Ga-01-R	
5	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
6	EPA 906.0 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Plutonium-242 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			85.4	(15%-125%)
Uranium-232 Tracer	Alphaspec U-235, U-238 "Dry Weight Corrected"			91.6	(15%-125%)
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			95.5	(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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-010	Project:	BRKL00700
Sample ID:	456300011	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:30	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-03-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.379	+/-0.0988	0.0741	1.00	pCi/g			RXF2	08/30/18	0615	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.0159	+/-0.0256	0.0377	4.00	pCi/g			RXF2	08/10/18	1634	1790490	2
Beryllium-7	U	0.0144	+/-0.0523	0.0926	0.300	pCi/g							
Cesium-134	J-UI	0.0313	+/-0.0132	0.0149	0.040	pCi/g							
Cesium-137	U	0.00913	+/-0.0115	0.0111	2.30	pCi/g							
Cobalt-57	U	-0.000609	+/-0.00397	0.00786	0.020	pCi/g							
Cobalt-60	U	0.00459	+/-0.00658	0.0127	0.300	pCi/g							
Europium-152	U	-0.0047	+/-0.0159	0.0294	4.80	pCi/g							
Europium-154	U	0.00899	+/-0.020	0.0376	17.0	pCi/g							
Europium-155	U	0.0238	+/-0.0294	0.032	0.300	pCi/g							
Manganese-54	J-UI	0.0177	+/-0.00957	0.0109	0.050	pCi/g							
Sodium-22	U	0.00316	+/-0.00703	0.0132	0.050	pCi/g							
Zinc-65	U	-0.0111	+/-0.0156	0.0238	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.778	+/-0.645	1.40	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			103	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-010
Sample ID: 456300011

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-03-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-011	Project:	BRKL00700
Sample ID:	456300012	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:35	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-03-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.417	+/-0.146	0.0912	1.00	pCi/g			RXF2	08/30/18	0616	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0171	+/-0.0449	0.0812	4.00	pCi/g			RXF2	08/10/18	1705	1790490	2
Beryllium-7	U	0.0328	+/-0.0557	0.105	0.300	pCi/g							
Cesium-134	J-UI	0.0232	+/-0.0145	0.0158	0.040	pCi/g							
Cesium-137	J	0.137	+/-0.0209	0.0129	2.30	pCi/g							
Cobalt-57	U	0.00126	+/-0.00472	0.00871	0.020	pCi/g							
Cobalt-60	U	0.00226	+/-0.0089	0.0144	0.300	pCi/g							
Europium-152	U	-0.00805	+/-0.020	0.0328	4.80	pCi/g							
Europium-154	U	-0.0092	+/-0.0204	0.0356	17.0	pCi/g							
Europium-155	J-UI	0.0576	+/-0.0479	0.0376	0.300	pCi/g							
Manganese-54	U	0.000425	+/-0.00649	0.0122	0.050	pCi/g							
Sodium-22	U	-0.00538	+/-0.00737	0.0125	0.050	pCi/g							
Zinc-65	U	0.0165	+/-0.0234	0.0279	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.201	+/-0.713	1.42	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			100	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-011
Sample ID: 456300012

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-03-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-012	Project:	BRKL00700
Sample ID:	456300013	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 14:40	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	811-GP-03-2018
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.334	+/-0.103	0.088	1.00	pCi/g			RXF2	08/30/18	0617	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	-0.00938	+/-0.00902	0.014	4.00	pCi/g			RXF2	08/10/18	1705	1790490	2
Beryllium-7	U	0.0148	+/-0.0435	0.0841	0.300	pCi/g							
Cesium-134	U	0.0117	+/-0.012	0.0123	0.040	pCi/g							
Cesium-137	U	-0.000652	+/-0.0056	0.0103	2.30	pCi/g							
Cobalt-57	U	0.00018	+/-0.00299	0.00582	0.020	pCi/g							
Cobalt-60	U	-0.00105	+/-0.00591	0.0108	0.300	pCi/g							
Europium-152	U	0.00208	+/-0.014	0.025	4.80	pCi/g							
Europium-154	U	0.00309	+/-0.0174	0.0327	17.0	pCi/g							
Europium-155	U	0.0198	+/-0.0263	0.022	0.300	pCi/g							
Manganese-54	U	0.00941	+/-0.00824	0.00983	0.050	pCi/g							
Sodium-22	U	0.00075	+/-0.00609	0.0114	0.050	pCi/g							
Zinc-65	U	0.0116	+/-0.0133	0.0238	0.500	pCi/g							

Rad Gas Flow Proportional Counting

GFPC, Sr90, solid "Dry Weight Corrected"

Strontium-90	U	0.234	+/-0.635	1.14	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3
--------------	---	-------	----------	------	------	-------	--	--	------	----------	------	---------	---

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			107	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-012
Sample ID: 456300013

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: 811-GP-03-2018
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID:	39984-013	Project:	BRKL00700
Sample ID:	456300014	Client ID:	BRKL007
Matrix:	S	COC:	39984
Collect Date:	31-JUL-18 00:00	Samp Recv.:	
Receive Date:	08-AUG-18 09:20	Client Desc.:	BD-1
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis													
Gamma, Ra226, Solid "Dry Weight Corrected"													
Radium-226	J	0.299	+/-0.113	0.103	1.00	pCi/g			RXF2	08/30/18	0617	1790737	1
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"													
Americium-241	U	0.0141	+/-0.0407	0.0791	4.00	pCi/g			RXF2	08/10/18	1706	1790490	2
Beryllium-7	U	-0.019	+/-0.0661	0.118	0.300	pCi/g							
Cesium-134	J-UI	0.019	+/-0.0126	0.0171	0.040	pCi/g							
Cesium-137	U	-0.00222	+/-0.00729	0.0136	2.30	pCi/g							
Cobalt-57	U	-0.00362	+/-0.00645	0.00915	0.020	pCi/g							
Cobalt-60	U	0.00493	+/-0.00795	0.0151	0.300	pCi/g							
Europium-152	U	-0.00583	+/-0.0204	0.0374	4.80	pCi/g							
Europium-154	U	0.0253	+/-0.0247	0.048	17.0	pCi/g							
Europium-155	U	0.0392	+/-0.0411	0.0402	0.300	pCi/g							
Manganese-54	U	0.00311	+/-0.0119	0.015	0.050	pCi/g							
Sodium-22	U	0.00876	+/-0.00868	0.0169	0.050	pCi/g							
Zinc-65	U	-0.0157	+/-0.0184	0.0262	0.500	pCi/g							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, solid "Dry Weight Corrected"													
Strontium-90	U	-0.0128	+/-0.389	0.769	2.00	pCi/g			KSD1	08/13/18	1526	1791254	3

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MPK1	08/08/18	1143	1790436

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	DOE HASL 300, 4.5.2.3/Ga-01-R	
3	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"			100	(25%-125%)

Notes:

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

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-013
Sample ID: 456300014

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: BD-1
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

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: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-014
Sample ID: 456300001
Matrix: W
Collect Date: 31-JUL-18 07:30
Receive Date: 02-AUG-18 08:55
Collector: Client

Project: BRKL00700
Client ID: BRKL007
COC: 39984
Samp Recv.:
Client Desc.: EB-1
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis													
Alphaspec Pu, Liquid "As Received"													
Plutonium-238	U	0.582	+/-0.513	0.600	0.700	pCi/L			BXA4	08/16/18	1632	1790607	1
Plutonium-239/240	U	-0.0171	+/-0.257	0.600	6.00	pCi/L							
Alphaspec U, Liquid "As Received"													
Uranium-235/236	U	0.110	+/-0.310	0.331	26.0	pCi/L			BXA4	08/11/18	1248	1790610	2
Uranium-238	U	0.0464	+/-0.258	0.494	26.0	pCi/L							
Rad Gamma Spec Analysis													
Gammascpec, Gamma, Liquid Remediation Standard "As Received"													
Americium-241	U	-8.72	+/-10.7	17.1	25.0	pCi/L			MXR1	08/09/18	1904	1790652	3
Beryllium-7	U	1.35	+/-9.93	18.0	60.0	pCi/L							
Cesium-134	U	1.27	+/-1.37	2.64	5.00	pCi/L							
Cesium-137	U	0.177	+/-1.26	2.26	12.0	pCi/L							
Cobalt-57	U	-0.346	+/-1.12	2.01	5.00	pCi/L							
Cobalt-60	U	-1.45	+/-2.27	2.42	22.0	pCi/L							
Europium-152	U	-2.9	+/-3.76	6.41	84.0	pCi/L							
Europium-154	U	2.26	+/-3.60	6.75	57.0	pCi/L							
Europium-155	U	-1.45	+/-5.24	8.48	359	pCi/L							
Manganese-54	U	-0.013	+/-1.20	2.13	6.00	pCi/L							
Sodium-22	U	0.795	+/-1.27	2.38	7.00	pCi/L							
Zinc-65	U	-2.2	+/-2.55	4.41	15.0	pCi/L							
Rad Gas Flow Proportional Counting													
GFPC, Sr90, liquid "As Received"													
Strontium-90	U	-0.268	+/-0.376	0.786	0.800	pCi/L			LXB3	08/14/18	1417	1791253	4
Rad Liquid Scintillation Analysis													
LSC, Tritium Dist, Liquid "As Received"													
Tritium	U	146	+/-197	334	500	pCi/L			MXH8	08/10/18	2349	1791145	5
Rad Radium-226													
Lucas Cell, Ra226, Liquid "As Received"													
Radium-226	J	0.435	+/-0.270	0.320	1.00	pCi/L			PCW	08/13/18	0915	1789948	6

GEL LABORATORIES LLC

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

Certificate of Analysis

Report Date: September 6, 2018

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000
Contact: Mr. John Burke
Project: Hazardous & Radiochemical Analytical Services - Full

Client Sample ID: 39984-014
Sample ID: 456300001

Project: BRKL00700
Client ID: BRKL007
39984
Samp Recv.:
Client Desc.: EB-1
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
-----------	-----------	--------	-------------	-----	----	-------	----	----	---------	------	------	-------	--------

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	DOE EML HASL-300, Pu-11-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 901.1	
4	EPA 905.0 Modified/DOE RP501 Rev. 1 Modified	
5	EPA 906.0 Modified	
6	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Plutonium-236 Tracer	Alphaspec Pu, Liquid "As Received"			67.6	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			80.9	(15%-125%)
Strontium Carrier	GFPC, Sr90, liquid "As Received"			88.3	(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

APPENDIX B

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

Filename: 4502

Report Generated On : 8/4/2018 9:44:52 AM

Sample Title : 001 0' to 2'

Sample Description : 811 Soils 500ml Jar

Sample Identification : ISOCS

Sample Type :

Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00

Peak Locate Range (in channels) : 100 - 8000

Peak Area Range (in channels) : 100 - 8000

Identification Energy Tolerance : 1.000 keV

Sample Size : 8.200E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM

Acquisition Started : 8/4/2018 9:34:49 AM

Live Time : 600.0 seconds

Real Time : 601.0 seconds

Dead Time : 0.16 %

Energy Calibration Used Done On : 5/20/2014

Efficiency Calibration Used Done On : 4/23/2013

Efficiency ID : 500ML_BOTT

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

Detector Name: 4502
Sample Title: 001 0' to 2'
Peak Analysis Performed on: 8/4/2018 9:44:51 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	645-	655	648.45	185.81	0.43	6.35E+001	32.53	4.18E+002
2	2114-	2133	2122.43	608.42	1.60	1.58E+002	18.07	6.33E+001
3	3165-	3185	3174.07	910.11	2.17	9.16E+001	14.20	4.74E+001
4	3370-	3383	3376.19	968.11	1.15	4.09E+001	10.66	3.71E+001

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

Errors quoted at 1.000 sigma

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

Sample Title: 001 0' to 2'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide	Nuclide	Wt mean	Wt mean
Name	Id	Activity	Activity
	Confidence	(uCi/gram)	Uncertainty

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 9:44:51 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	185.81	1.0581E-001	51.25		
2	608.42	2.6285E-001	11.46	Tol.	BI-214
3	910.11	1.5271E-001	15.49		
4	968.11	6.8237E-002	26.05	Tol.	AC-228

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 10:56:01 AM

Sample Title : 002 2' to 4'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCs
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 7.940E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 10:45:58 AM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.16 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Detector Name: 4502
Sample Title: 002 2' to 4'
Peak Analysis Performed on: 8/4/2018 10:56:00 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	2023-	2042	2030.62	582.09	1.47	1.20E+002	16.82	6.06E+001
2	2114-	2132	2122.28	608.38	1.45	1.68E+002	17.09	4.77E+001
3	3370-	3384	3376.59	968.23	0.67	3.70E+001	10.54	3.80E+001

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

Errors quoted at 1.000 sigma

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

Sample Title: 002 2' to 4'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/gram)	Wt mean Activity Uncertainty
-----------------	-----------------------------	-----------------------------------	------------------------------------

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 10:56:00 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	582.09	2.0069E-001	13.97		
2	608.38	2.8048E-001	10.16	Tol.	BI-214
3	968.23	6.1592E-002	28.53	Tol.	AC-228

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 11:27:35 AM

Sample Title : 003 4' to 6'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 7.820E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 11:17:31 AM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Detector Name: 4502
Sample Title: 003 4' to 6'
Peak Analysis Performed on: 8/4/2018 11:27:33 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	258-	265	260.91	74.74	0.65	7.35E+001	38.78	4.72E+002
2	2024-	2039	2030.94	582.18	1.47	9.17E+001	14.66	5.23E+001
3	2115-	2133	2122.29	608.38	1.14	1.52E+002	17.00	5.25E+001
4	3168-	3181	3174.05	910.11	0.44	4.01E+001	10.28	3.49E+001
5	3369-	3382	3375.92	968.04	0.29	3.28E+001	9.79	3.32E+001

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

Errors quoted at 1.000 sigma

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

Sample Title: 003 4' to 6'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/gram)	Wt mean Activity Uncertainty
-----------------	-----------------------------	-----------------------------------	------------------------------------

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 11:27:33 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	74.74	1.2257E-001	52.74		
2	582.18	1.5282E-001	15.99		
3	608.38	2.5256E-001	11.22	Tol.	BI-214
4	910.11	6.6828E-002	25.63		
5	968.04	5.4659E-002	29.85	Tol.	AC-228

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 11:47:20 AM

Sample Title : 004 6' to 8'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 7.720E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 11:37:18 AM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Detector Name: 4502

Sample Title: 004 6' to 8'

Peak Analysis Performed on: 8/4/2018 11:47:19 AM

Peak Analysis From Channel: 100

Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	1220-	1235	1225.89	351.34	1.52	1.66E+002	22.43	1.27E+002
2	2022-	2042	2030.62	582.09	1.43	1.04E+002	17.67	7.54E+001
3	2112-	2131	2122.33	608.39	1.36	1.46E+002	17.66	6.16E+001

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

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

Sample Title: 004 6' to 8'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

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

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/gram)	Wt mean Activity Uncertainty
-----------------	-----------------------------	-----------------------------------	------------------------------------

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 11:47:19 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	351.34	2.7639E-001	13.52	Tol.	PB-214
2	582.09	1.7266E-001	17.06		
3	608.39	2.4395E-001	12.06	Tol.	BI-214

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 10:09:12 AM

Sample Title : 005 0' to 2'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 8.080E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 9:59:09 AM

Live Time : 600.0 seconds
Real Time : 601.0 seconds

Dead Time : 0.16 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Filename: 4502

Report Generated On : 8/4/2018 12:07:14 PM

Sample Title : 006 2' to 4'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCs
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 7.700E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 11:57:11 AM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Sample Title: 006 2' to 4'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCs Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide	Nuclide	Wt mean	Wt mean
Name	Id	Activity	Activity
	Confidence	(uCi/gram)	Uncertainty

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 12:07:12 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	77.06	1.3925E-001	46.22		
m 2	241.28	1.1011E-001	20.70		
3	351.28	2.9603E-001	12.76	Tol.	PB-214
4	582.24	1.8929E-001	15.38		
5	608.35	1.8541E-001	13.88	Tol.	BI-214
6	868.19	2.1190E-002	44.47		
7	909.93	1.4937E-001	14.15		

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

Errors quoted at 1.000 sigma

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

Sample Title: 005 0' to 2'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCs Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/gram)	Wt mean Activity Uncertainty
-----------------	-----------------------------	-----------------------------------	------------------------------------

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 10:09:11 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	77.13	2.5298E-001	28.32		
2	351.32	3.9580E-001	10.04	Tol.	PB-214
3	582.28	1.6849E-001	16.83		
4	608.38	2.8684E-001	10.79	Tol.	BI-214
5	910.08	1.5726E-001	14.02		

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 12:07:14 PM

Sample Title : 006 2' to 4'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCs
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 7.700E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 11:57:11 AM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Sample Title: 006 2' to 4'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCs Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide	Nuclide	Wt mean	Wt mean
Name	Id	Activity	Activity
	Confidence	(uCi/gram)	Uncertainty

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 12:07:12 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	77.06	1.3925E-001	46.22		
m 2	241.28	1.1011E-001	20.70		
3	351.28	2.9603E-001	12.76	Tol.	PB-214
4	582.24	1.8929E-001	15.38		
5	608.35	1.8541E-001	13.88	Tol.	BI-214
6	868.19	2.1190E-002	44.47		
7	909.93	1.4937E-001	14.15		

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 12:22:58 PM

Sample Title : 007 4' to 6'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 8.060E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 12:12:54 PM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Detector Name: 4502
Sample Title: 007 4' to 6'
Peak Analysis Performed on: 8/4/2018 12:22:56 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	318-	328	323.22	92.59	0.42	7.30E+001	45.12	6.91E+002
2	1024-	1034	1028.02	294.61	0.47	5.79E+001	21.44	1.68E+002
3	2115-	2134	2122.42	608.42	1.28	1.63E+002	17.77	5.70E+001
4	2299-	2313	2304.95	660.77	0.45	3.92E+001	12.13	5.18E+001
5	3165-	3184	3173.83	910.05	1.75	1.03E+002	14.20	4.37E+001

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

Errors quoted at 1.000 sigma

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

Sample Title: 007 4' to 6'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

IDENTIFIED NUCLIDES						
Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/gram)	Activity Uncertainty	Coinc Corr
GA-67	0.944	93.31*	39.20	3.48187E-008	2.18318E-008	err
		300.22	16.80			
CS-137	0.884	661.65*	85.12	3.53543E-008	1.11488E-008	err

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.
ISOCS/LabSOCS/Coinc. Corr. Warning/error code = 537199883
COIERR INTERNALISOCSERROR = Internal ISOCS error.
May be an invalid geometry or corrupt file.

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/gram)	Wt mean Activity Uncertainty
GA-67	0.944	3.481866E-008	2.183180E-008
CS-137	0.884	3.535429E-008	1.114877E-008

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 12:22:56 PM
 Peak Locate From Channel: 100
 Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
2	294.61	9.6453E-002	37.05	Tol.	PB-214
3	608.42	2.7162E-001	10.90	Tol.	BI-214
5	910.05	1.7224E-001	13.75		

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 10:28:44 AM

Sample Title : 008 6' to 8'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 6.420E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 10:18:42 AM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

*****PEAKANALYSISREPORT*****

Detector Name: 4502
Sample Title: 008 6' to 8'
Peak Analysis Performed on: 8/4/2018 10:28:43 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	2023-	2041	2030.85	582.16	0.61	1.24E+002	16.54	5.79E+001
2	2116-	2134	2122.39	608.41	1.95	1.29E+002	16.48	5.44E+001
3	4795-	4810	4802.07	1377.42	0.49	8.01E+000	5.03	8.99E+000

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

Errors quoted at 1.000 sigma

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

Sample Title: 008 6' to 8'

Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCs Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/gram)	Activity Uncertainty	Coinc Corr
-----------------	------------------	-----------------	--------------	------------------------	-------------------------	---------------

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

Coincidence correction performed.

free = No coincidence correction required.

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

err = Error in coincidence correction calculation.

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/gram)	Wt mean Activity Uncertainty
-----------------	-----------------------------	-----------------------------------	------------------------------------

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 10:28:43 AM
 Peak Locate From Channel: 100
 Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	582.16	2.0688E-001	13.33		
2	608.41	2.1431E-001	12.82	Tol.	BI-214
3	1377.42	1.3344E-002	62.88		

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 9:23:41 AM 12 pCi/g Cs¹³⁷
Sample Title : 009 0' to 2'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar
Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV
Sample Size : 7.480E+002 gram
Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 9:13:35 AM
Live Time : 600.0 seconds
Real Time : 602.0 seconds
Dead Time : 0.33 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Detector Name: 4502
Sample Title: 009 0' to 2'
Peak Analysis Performed on: 8/4/2018 9:23:38 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	108-	115	112.14	32.11	0.85	3.66E+002	44.64	5.41E+002
2	2114-	2133	2121.91	608.27	0.97	1.60E+002	24.39	1.61E+002
3	2292-	2318	2305.44	660.91	2.10	1.24E+004	113.22	1.56E+002
4	3896-	3909	3902.30	1119.11	0.53	1.79E+001	8.71	3.01E+001

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

Errors quoted at 1.000 sigma

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

Sample Title: 009 0' to 2'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/gram)	Activity Uncertainty	Coinc Corr
CS-137	0.917	661.65*	85.12	1.20164E-005	7.30865E-007	miss

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/gram)	Wt mean Activity Uncertainty
CS-137	0.917	1.201645E-005	7.308648E-007

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 9:23:38 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	32.11	6.1059E-001	12.18		
2	608.27	2.6611E-001	15.28		
4	1119.11	2.9896E-002	48.57		

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 7:36:58 AM

Sample Title : 010 2' to 4'

Sample Description : 811 Soils 500ml Jar

Sample Identification : ISOCS

Sample Type :

Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00

Peak Locate Range (in channels) : 100 - 8000

Peak Area Range (in channels) : 100 - 8000

Identification Energy Tolerance : 1.000 keV

Sample Size : 8.380E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM

Acquisition Started : 8/4/2018 7:26:55 AM

Live Time : 600.0 seconds

Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014

Efficiency Calibration Used Done On : 4/23/2013

Efficiency ID : 500ML_BOTT

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

Detector Name: 4502
Sample Title: 010 2' to 4'
Peak Analysis Performed on: 8/4/2018 7:36:57 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	265-	272	269.47	77.19	0.64	7.36E+001	39.75	5.00E+002

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

Errors quoted at 1.000 sigma

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

Sample Title: 010 2' to 4'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide	Nuclide	Wt mean	Wt mean
Nuclide	Id	Activity	Activity
Name	Confidence	(uCi/gram)	Uncertainty

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 7:36:57 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	77.19	1.2268E-001	54.01		

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 11:10:22 AM

Sample Title : 011 4' to 6'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 7.700E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 11:00:16 AM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Detector Name: 4502

Sample Title: 011 4' to 6'

Peak Analysis Performed on: 8/4/2018 11:10:18 AM

Peak Analysis From Channel: 100

Peak Analysis To Channel: 8000

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
m	1	825-	852	844.05	241.87	1.07	7.46E+001	23.26	2.23E+002
	2	1221-	1234	1225.33	351.18	1.35	1.38E+002	20.11	1.09E+002
	3	2114-	2133	2122.21	608.36	0.94	1.21E+002	17.64	7.12E+001
	4	2296-	2315	2305.41	660.91	1.25	9.11E+001	15.60	6.19E+001
	5	3165-	3185	3173.84	910.05	1.53	6.94E+001	11.95	3.16E+001
	6	3894-	3908	3901.29	1118.82	0.46	5.15E+001	9.96	2.45E+001

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

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

Sample Title: 011 4' to 6'
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

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

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/gram)	Activity Uncertainty	Coinc Corr
CS-137	0.915	661.65*	85.12	8.60822E-008	1.56181E-008	miss

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide Name	Nuclide		Wt mean	
	Id Confidence	Activity (uCi/gram)	Activity Uncertainty	
CS-137	0.915	8.608218E-008	1.561812E-008	

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 11:10:18 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m 1	241.87	1.2437E-001	31.17		
2	351.18	2.2933E-001	14.62	Tol.	PB-214
3	608.36	2.0131E-001	14.60	Tol.	BI-214
5	910.05	1.1568E-001	17.21		
6	1118.82	8.5899E-002	19.33		

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

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 12:41:32 PM

Sample Title : 012 6' to 8'
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 8.360E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 12:31:29 PM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Detector Name: 4502

Sample Title: 012 6' to 8'

Peak Analysis Performed on: 8/4/2018 12:41:31 PM

Peak Analysis From Channel: 100

Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	1774-	1784	1778.86	509.89	0.60	4.50E+001	13.37	6.80E+001
2	2113-	2131	2122.21	608.36	1.83	1.44E+002	16.70	5.22E+001

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

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

Sample Title: 012 6' to 8'

Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/gram)	Activity Uncertainty	Coinc Corr
-----------------	------------------	-----------------	--------------	------------------------	-------------------------	---------------

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

Coincidence correction performed.

free = No coincidence correction required.

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

err = Error in coincidence correction calculation.

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (uCi/gram)	Wt mean Activity Uncertainty
-----------------	-----------------------------	-----------------------------------	------------------------------------

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 12:41:31 PM
 Peak Locate From Channel: 100
 Peak Locate To Channel: 8000

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	509.89	7.4936E-002	29.73		
2	608.36	2.3962E-001	11.61	Tol.	BI-214

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

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

Filename: 4502

Report Generated On : 8/4/2018 7:49:24 AM

Sample Title : 013
Sample Description : 811 Soils 500ml Jar
Sample Identification : ISOCS
Sample Type :
Sample Geometry : 500ml Jar

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 8000
Peak Area Range (in channels) : 100 - 8000
Identification Energy Tolerance : 1.000 keV

Sample Size : 6.100E+002 gram

Sample Taken On : 8/4/2018 12:00:00 AM
Acquisition Started : 8/4/2018 7:39:21 AM

Live Time : 600.0 seconds
Real Time : 600.9 seconds

Dead Time : 0.15 %

Energy Calibration Used Done On : 5/20/2014
Efficiency Calibration Used Done On : 4/23/2013
Efficiency ID : 500ML_BOTT

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

Detector Name: 4502
Sample Title: 013
Peak Analysis Performed on: 8/4/2018 7:49:22 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8000

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M 1	3149-	3184	3155.22	904.70	1.79	1.40E+001	5.04	2.08E+001

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

Errors quoted at 1.000 sigma

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

Sample Title: 013
Nuclide Library Used: C:\GENIE2K\CAMFILES\Waste Mngt.NLB

ISOCS Geom. \GENIE2K\...\SIMPLE_CYLINDER\500mlsludgebottle.geo

..... IDENTIFIED NUCLIDES

Nuclide	Id	Energy	Yield	Activity	Activity	Coinc
Name	Confidence	(keV)	(%)	(uCi/gram)	Uncertainty	Corr

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000 sigma
Coincidence correction performed.
free = No coincidence correction required.
miss = Nuclide energy was not found in the coincidence library.
err = Error in coincidence correction calculation.

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

Nuclide	Nuclide	Wt mean	Wt mean
Name	Id	Activity	Activity
	Confidence	(uCi/gram)	Uncertainty

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

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 8/4/2018 7:49:22 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8000

Peak	Energy	Peak Size in	Peak CPS	Peak	Tol.
No.	(keV)	Counts per Second	% Uncertainty	Type	Nuclide
M 1	904.70	2.3330E-002	36.00		

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

Errors quoted at 1.000 sigma

APPENDIX C

FORM 540

EnergySolutions, LLC

UNIFORM LOW-LEVEL RADIOACTIVE
WASTE MANIFEST
SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER
(631) 344-2222

2. IS THIS AN "EXCLUSIVE USE" SHIPMENT?
☒ YES
☐ NO

3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST
3

4. DOES EPA REGULATED WASTE REQUIRING A MANIFEST ACCOMPANY THIS SHIPMENT?
If "Yes," provide Manifest Number =====
☒ YES
☐ NO

5. SHIPPER -- NAME AND FACILITY
Brookhaven National Laboratory
for the Department of Energy
Bldg. 860
Upton, NY 11973

5. SHIPPER I.D. NUMBER
7314-08-0020
☐ COLLECTOR
☐ PROCESSOR
☒ GENERATOR TYPE (Specify)

6. CARRIER -- Name and Address
RSB Logistics
2425 South 4th Street
Paducah, KY 42003
Truck # - 50216
Trailer # - 48214

7. FORM 540 AND 540A
FORM 541 AND 541A
FORM 542 AND 542A
ADDITIONAL INFORMATION
PAGE 1 OF 1 PAGE(S)
2 PAGE(S)
None PAGE(S)
None PAGE(S)

8. MANIFEST NUMBER
(Use this number on all continuation pages)
7314-08-0020

9. CONSIGNEE - Name and Facility
EnergySolutions, LLC
Clive Disposal Site (Bulk Waste Facility)
Interstate 80, Exit 49
Clive, UT 84029

10. CERTIFICATION
This is to certify that the herein-named materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. This also certifies that the materials are classified, packaged, marked, and labeled and are in proper condition for transportation and disposal as described in accordance with the requirements of 10 CFR Parts 20 and 61, or equivalent state regulations.

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION
(Including proper shipping name, hazard class, UN ID number, and any additional information)

12. DOT LABEL
"RADIOACTIVE"

13. TRANSPORT INDEX

14. PHYSICAL AND CHEMICAL FORM

15. INDIVIDUAL RADIONUCLIDES

16. TOTAL PACKAGE ACTIVITY
MBq mCi

17. LSA/SCO CLASS

18. TOTAL WEIGHT OR VOLUME
(Use appropriate units)

19. IDENTIFICATION NUMBER OF PACKAGE

20. TERMS AND CONDITIONS
A. HAZARDOUS MATERIALS: Generator represents & warrants that Waste Material ___ is (or) ☒ is not a hazardous waste as defined in 40 CFR 261. Where the material is a hazardous waste, this shipment is also accompanied by a separate and completed hazardous waste manifest, along with the appropriate land-disposal restriction notice and/or certification as required by 40 CFR 268.1.
B. TITLE: Upon acceptance at the disposal site by EnergySolutions, LLC, and all appropriate regulatory authorities, title to the Waste Material which conforms to Generator's representations herein shall thereupon transfer from Generator and be vested in EnergySolutions, LLC
C. WASTE MATERIAL: Generator represents and warrants that all data set forth in this (UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST) are true and correct in all respects and in accordance with all applicable governmental laws, rules, regulations and EnergySolutions LLC's facility license.
D. INDEMNIFICATION: Generator agrees to indemnify EnergySolutions, LLC, its officers, employees and agents against all losses and liability whatsoever if such losses or liability results from the failure of the Waste Material to conform in all material respects to the data supplied on the (UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST,) or if this shipment fails to meet the standards prescribed by the Department of Transportation or any governmental agency having jurisdiction over such matters.

ORGANIZATION
Brookhaven National Laboratory

CONTACT
Michael F. Clancy

CONTACT
Ronda Darnell

SIGNATURE -- Authorized carrier acknowledging waste receipt
William F. Reed

DATE
11-15-2018

AUTHORIZED SIGNATURE
[Signature]

TITLE
Shipper

DATE
11/15/18

FOR CONSIGNEE USE ONLY

Record Waste Description Inadequate

Contamination or Leakage Detected

Unexpected Exposure Rates Detected

Labels, Markings, etc. Inadequate

Container Integrity Inadequate

Other

No Violations Detected on this Shipment

FORM 540 (03-06)

Reviewed By [Signature]

(of Brookhaven Science Associates) 11/15/18 on behalf of the U.S. Department of Energy at Brookhaven National Laboratory

FORM 541

EnergySolutions, LLC

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION

Additional Nuclear Regulatory Commission (NRC) Requirements for Control, Transfer and Disposal of Radioactive Waste

1. MANIFEST TOTALS

NUMBER OF PACKAGES/ DISPOSAL CONTAINERS	NET WASTE VOLUME	NET WASTE WEIGHT	SPECIAL NUCLEAR MATERIAL (grams)				
			U-233	U-235	Pu	Total	
3	m3 11.2134	kg 17897.8489	NP	NP	NP	NP	
	ft3 396.0000	ton 19.7290					
ACTIVITY						SOURCE (kg)	
	ALL NUCLIDES	TRITIUM	C-14	Tc-99	I-129		
MBq	6.4757E+00	NP	NP	NP	NP	(kg)	5.0000E-02
mCi	1.7502E-01	NP	NP	NP	NP	(tons)	5.5116E-05

2. MANIFEST NUMBER

7314-08-0020

3. PAGE 1 OF 2 PAGE(S)

4. SHIPPER NAME

Brookhaven National Laboratory

SHIPMENT ID NUMBER

7314-08-0020

DISPOSAL CONTAINER DESCRIPTION

5. CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6. CONTAINER DESCRIPTION (See Note 1 & Note 1A)	7. VOLUME (m3) (ft3)	8. WASTE AND CONTAINER WEIGHT (kg) (ton)	9. SURFACE RADIATION LEVEL (mSv/hr) (mrem/hr)	10. SURFACE CONTAMINATION (MBq/100 cm2) (dpm/100cm2)	
					ALPHA	BETA-GAMMA
R57670/7314-08	19 STRONG-TIGHT POLYFIBER SACK	5.3519	5746.1085	1.0000E-03	<0.0000	<0.0000
		189.0000	6.3340	1.0000E-01	<20.0000	<1000.0000
R57671/7314-08	19 STRONG-TIGHT POLYFIBER SACK	5.3519	6558.9461	1.0000E-03	<0.0000	<0.0000
		189.0000	7.2300	1.0000E-01	<20.0000	<1000.0000
R57673/7314-08	19 STRONG-TIGHT POLYFIBER SACK	5.3519	5742.4798	1.0000E-03	<0.0000	<0.0000
		189.0000	6.3300	1.0000E-01	<20.0000	<1000.0000

WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER

11. PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION	15. RADIOLOGICAL DESCRIPTION				16. WASTE CLASSIFICATION AS-Class A Stable AU-Class A Unstable B-Class B C-Class C	
11. WASTE DESCRIPTOR (See Note 2 & Note 2A)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3) (FT3)	13. SOLIDIFICATION OR STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM/ CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL; OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT				
					RADIONUCLIDES	pCi/gm	MBq		mCi
22-H	3.5679	NA	NONE/NP	NP	Cs-137	8.26869E+00	1.7427E+00	4.7100E-02	AU
	126.0000				Ra-226	5.60024E-01	1.1803E-01	3.1900E-03	
					U-238 [1.5912E-02 kg]	9.49759E-01	2.0017E-01	5.4100E-03	
					Subtotal		2.0609E+00	5.5700E-02	
					Total		2.0609E+00	5.5700E-02	
					Source [1.5912E-02 kg]				
22-H	4.0776	NA	NONE/NP	NP	Cs-137	8.26546E+00	1.9906E+00	5.3800E-02	AU
	144.0000				Ra-226	5.59224E-01	1.3468E-01	3.6400E-03	
					U-238 [1.8177E-02 kg]	9.49452E-01	2.2866E-01	6.1800E-03	
					Subtotal		2.3539E+00	6.3620E-02	
					Total		2.3539E+00	6.3620E-02	
					Source [1.8177E-02 kg]				
22-H	3.5679	NA	NONE/NP	NP	Cs-137	8.27397E+00	1.7427E+00	4.7100E-02	AU
	126.0000				Ra-226	5.60381E-01	1.1803E-01	3.1900E-03	
					U-238 [1.5912E-02 kg]	9.50364E-01	2.0017E-01	5.4100E-03	
					Subtotal		2.0609E+00	5.5700E-02	
					Total		2.0609E+00	5.5700E-02	
					Source [1.5912E-02 kg]				

- Note 1: Container Description Codes. For containers/ waste requiring disposal in approved structural over-packs the numerical code must be followed by "-OP."

1. Wooden Box or Crate

2. Metal Box

3. Plastic Drum or Pail

4. Metal Drum or Pail

5. Metal Tank or Liner

6. Concrete Tank or Liner

7. Polyethylene Tank or Liner

8. Fiberglass Tank or Liner

9. Demineralizer

10. Gas Cylinder

11. Bulk, Unpackaged Waste

12. Unpackaged Components

13. High Integrity Container

19. Other. Describe in Item 6, or additional page
- Note 1A: Bulk Packaging Description Codes. (Choose one code as may be applicable.)

A Gondola

B Intermodal

C End-Dump

D Roll-off

E Seavan
- NOTE 2: Waste Descriptor Codes. (Choose up to three which predominate by volume.)

20. Charcoal

21. Incinerator Ash

22. Soil

23. Gas

24. Oil

25. Aqueous Liquid

26. Filter Media

27. Mechanical Filter

28. EPA or State Hazardous

29. Demolition Rubble

30. Cation Ion-exchange Media

31. Anion Ion-exchange Media

32. Mixed Bed Ion-exchange Media

33. Contaminated Equipment

34. Organic Liquid (except oil)

35. Glassware or Labware

36. Sealed Source/Device

37. Paint or Plating

38. Evaporator Bottoms/Sludges/ Concentrates

39. Compactible Trash

40. Noncompactible Trash

41. Animal Carcass

42. Biological Material (except animal carcass)

43. Activated Material

59. Other. Describe in item 11, or additional page
- NOTE 2A: Specific Waste Descriptions (Choose all applicable codes.)

G Dewatered

H Solid

I Combustible

J Non-combustible

K Air Filtration Filters

L Asbestos
- Note3: Solidification and Stabilization Media Codes. (Choose up to three which predominate by volume.) For media meeting disposal site structural stability requirements, the numerical code must be followed by "-S." and the media vendor and brand name must also be identified

in Item 13. Code 100=NONE REQUIRED.

Solidification

90. Cement

91. Concrete (encapsulation)

92. Bitumen

93. Vinyl Chloride

94. Vinyl Ester Styrene

99. Other. Describe in item 13, or additional page

100. None Required.
- FORM 541 (03-06)

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST
ISOTOPES REPORT

For Manifest # 7314-08-0020
EnergySolutions, LLC

<u>Isotope</u>	Total Activity		
	<u>(MBq)</u>	<u>(mCi)</u>	<u>(Ci)</u>
Cs-137	5.4760E+00	1.4800E-01	1.4800E-04
Ra-226	3.7074E-01	1.0020E-02	1.0020E-05
U-238	6.2900E-01	1.7000E-02	1.7000E-05

FORM 540

EnergySolutions, LLC

UNIFORM LOW-LEVEL RADIOACTIVE
WASTE MANIFEST
SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER
(631) 344-2222

ORGANIZATION
Brookhaven National Laboratory

2. IS THIS AN "EXCLUSIVE USE" SHIPMENT?

☐ YES
☒ NO

3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST
=====> 4

4. DOES EPA REGULATED WASTE REQUIRING A MANIFEST ACCOMPANY THIS SHIPMENT?
If "Yes," provide Manifest Number =====>

☐ YES
☒ NO

EPA MANIFEST NUMBER

5. SHIPPER -- NAME AND FACILITY
Brookhaven National Laboratory
for the Department of Energy
Bldg. 860
Upton, NY 11973

Utah Generator Site Access Permit No.
0112 001 215

SHIPMENT NUMBER
7314-08-0021

CONTACT
Glen Todzia

6. CARRIER -- Name and Address
RSB Logistics
2425 South 4th Street
Paducah, KY 42003

CONTACT
Ronda Darnell

SIGNATURE -- Authorized carrier acknowledging waste receipt

SHIPPER I.D. NUMBER
7314-08-0021

☐ COLLECTOR

☐ PROCESSOR

☒ GENERATOR TYPE
(Specify)

TELEPHONE NUMBER
(Include Area Code)
(631) 344-7488

EPA I.D. NUMBER
WAR000012005

SHIPPING DATE
11/15/2018

TELEPHONE
(Include Area Code)
(270) 444-6604

DATE

7. FORM 540 AND 540A
FORM 541 AND 541A
FORM 542 AND 542A
ADDITIONAL INFORMATION

PAGE 1 OF 1
PAGE(S)
2 PAGE(S)
None PAGE(S)
None PAGE(S)

8. MANIFEST NUMBER
(Use this number on all continuation pages)

7314-08-0021

9. CONSIGNEE - Name and Facility
EnergySolutions, LLC
Clive Disposal Site (Bulk Waste Facility)
Interstate 80, Exit 49
Clive, UT 84029

SIGNATURE -- Authorized consignee acknowledging waste receipt

DATE

10. CERTIFICATION
This is to certify that the herein-named materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. This also certifies that the materials are classified, packaged, marked, and labeled and are in proper condition for transportation and disposal as described in accordance with the requirements of 10 CFR Parts 20 and 61, or equivalent state regulations.

AUTHORIZED SIGNATURE

TITLE

DATE

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (Including proper shipping name, hazard class, UN ID number, and any additional information)	12. DOT LABEL "RADIOACTIVE"	13. TRANSPORT INDEX	14. PHYSICAL AND CHEMICAL FORM	15. INDIVIDUAL RADIONUCLIDES			16. TOTAL PACKAGE ACTIVITY MBq mCi		17. LSA/SCO CLASS	18. TOTAL WEIGHT OR VOLUME (Use appropriate units)	19. IDENTIFICATION NUMBER OF PACKAGE
DOT Non-Regulated Material STRONG-TIGHT POLYFIBER SACK	NA	NA	Solid Metal Oxide	Cs-137	Ra-226	U-238	1.9995E+00	5.4040E-02	NA	12300 LBS; 189 FT3	R57672
DOT Non-Regulated Material STRONG-TIGHT POLYFIBER SACK	NA	NA	Solid Metal Oxide	Cs-137	Ra-226	U-238	1.4219E+00	3.8430E-02	NA	8760 LBS; 189 FT3	R57674
DOT Non-Regulated Material Metal Box	NA	NA	Solid Metal Oxide	Cs-137	Ra-226	U-238	4.5480E-01	1.2292E-02	NA	3320 LBS; 48 FT3	R57675
DOT Non-Regulated Material Metal Box	NA	NA	Solid Metal Oxide	Cs-137	Ra-226	U-238	2.5419E-01	6.8700E-03	NA	2100 LBS; 48 FT3	R57676

FOR CONSIGNEE USE ONLY

Record Waste Description Inadequate

Contamination or Leakage Detected

Unexpected Exposure Rates Detected

Labels, Markings, etc. Inadequate

Container Integrity Inadequate

Other

No Violations Detected on this Shipment

20. TERMS AND CONDITIONS

A. HAZARDOUS MATERIALS: Generator represents & warrants that Waste Material __ is (or) ð is not a hazardous waste as defined in 40 CFR 261. Where the material is a hazardous waste, this shipment is also accompanied by a separate and completed hazardous waste manifest, along with the appropriate land-disposal restriction notice and/or certification as required by 40 CFR 268.1.

B. TITLE: Upon acceptance at the disposal site by EnergySolutions, LLC, and all appropriate regulatory authorities, title to the Waste Material which conforms to Generator's representations herein shall thereupon transfer from Generator and be vested in EnergySolutions, LLC

C. WASTE MATERIAL: Generator represents and warrants that all data set forth in this (UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST) are true and correct in all respects and in accordance with all applicable governmental laws, rules, regulations and EnergySolutions LLC's facility license.

D. INDEMNIFICATION: Generator agrees to indemnify EnergySolutions, LLC, its officers, employees and agents against all losses and liability whatsoever if such losses or liability results from the failure of the Waste Material to conform in all material respects to the data supplied on the (UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST,) or if this shipment fails to meet the standards prescribed by the Department of Transportation or any governmental agency having jurisdiction over such matters.

FORM 540 (03-06)

FORM 541 EnergySolutions, LLC UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST CONTAINER AND WASTE DESCRIPTION Additional Nuclear Regulatory Commission (NRC) Requirements for Control, Transfer and Disposal of Radioactive Waste						1. MANIFEST TOTALS								2. MANIFEST NUMBER 7314-08-0021								
						NUMBER OF PACKAGES/ DISPOSAL CONTAINERS	NET WASTE VOLUME		NET WASTE WEIGHT		SPECIAL NUCLEAR MATERIAL (grams)											
							U-233		U-235		Pu		Total									
						4	m3	6.4847	kg	11411.0241	NP		NP		NP		NP		3. PAGE 1 OF 2 PAGE(S)			
							ft3	229.0000	ton	12.5785												
								ACTIVITY				SOURCE (kg)				4. SHIPPER NAME Brookhaven National Laboratory						
								ALL NUCLIDES		TRITIUM		C-14		Tc-99						I-129		
MBq		4.1304E+00		NP		NP		NP		NP		(kg)	3.1874E-02		SHIPMENT ID NUMBER 7314-08-0021							
mCi		1.1163E-01		NP		NP		NP		NP		(tons)	3.5135E-05									
DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER											16. WASTE CLASSIFICATION AS-Class A Stable AU-Class A Unstable B-Class B C-Class C				
5. CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6. CONTAINER DESCRIPTION (See Note 1 & Note 1A)	7. VOLUME (m3) (ft3)	8. WASTE AND CONTAINER WEIGHT (kg) (ton)	9. SURFACE RADIATION LEVEL (mSv/hr) (mrem/hr)	10. SURFACE CONTAMINATION (MBq/100 cm2) (dpm/100cm2)		11. WASTE DESCRIPTOR (See Note 2 & Note 2A)			12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3) (FT3)	13. SOLIDIFICATION OR STABILIZATION MEDIA (See Note 3)	14. CHEMICAL DESCRIPTION CHEMICAL FORM/ CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	15. RADIOLOGICAL DESCRIPTION INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL; OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT								
					ALPHA	BETA-GAMMA								RADIONUCLIDES		pCi/gm	MBq		mCi			
R57672/7314-08	19 STRONG-TIGHT POLYFIBER SACK	5.3519	5579.1865	1.0000E-03	<0.0000	<0.0000	22-H		3.4547	89 - WASTE LOCK 770	NONE/NP	1	Cs-137	8.26512E+00	1.6909E+00	4.5700E-02	AU					
		189.0000	6.1500	1.0000E-01	<20.0000	<1000.0000							Ra-226	5.58845E-01	1.1433E-01	3.0900E-03						
									122.0000				U-238 [1.5441E-02 kg]	9.49494E-01	1.9425E-01	5.2500E-03						
													Subtotal	1.9995E+00	5.4040E-02							
													Total Source [1.5441E-02 kg]		1.9995E+00	5.4040E-02						
R57674/7314-08	19 STRONG-TIGHT POLYFIBER SACK	5.3519	3973.4694	1.0000E-03	<0.0000	<0.0000	22-H		2.4636	89 - WASTE LOCK 770	NONE/NP	1	Cs-137	8.28331E+00	1.2025E+00	3.2500E-02	AU					
		189.0000	4.3800	1.0000E-01	<20.0000	<1000.0000							Ra-226	5.60716E-01	8.1400E-02	2.2000E-03						
									87.0000				U-238 [1.0971E-02 kg]	9.50669E-01	1.3801E-01	3.7300E-03						
													Subtotal	1.4219E+00	3.8430E-02							
													Total Source [1.0971E-02 kg]		1.4219E+00	3.8430E-02						
R57675/7314-08	2	1.3592	1505.9268	1.0000E-03	<0.0000	<0.0000	59-Concrete-H		0.2832	NA	NONE/NP	NP	Cs-137	8.28331E+00	3.8480E-01	1.0400E-02	AU					
		48.0000	1.6600	1.0000E-01	<20.0000	<1000.0000							Ra-226	5.59123E-01	2.5974E-02	7.0200E-04						
									10.0000				U-238 [3.5000E-03 kg]	9.47802E-01	4.4030E-02	1.1900E-03						
													Subtotal	4.5480E-01	1.2292E-02							
													Total Source [3.5000E-03 kg]		4.5480E-01	1.2292E-02						

Note 1: Container Description Codes. For containers/ waste requiring disposal in approved structural over-packs the numerical code must be followed by "-OP."

1. Wooden Box or Crate

2. Metal Box

3. Plastic Drum or Pail

4. Metal Drum or Pail

5. Metal Tank or Liner

6. Concrete Tank or Liner

7. Polyethylene Tank or Liner

8. Fiberglass Tank or Liner

9. Demineralizer

10. Gas Cylinder

11. Bulk, Unpackaged Waste

12. Unpackaged Components

13. High Integrity Container

19. Other. Describe in Item 6, or additional page

Note 1A: Bulk Packaging Description Codes. (Choose one code as may be applicable.)

A Gondola

B Intermodal

C End-Dump

D Roll-off

E Seavan

NOTE 2: Waste Descriptor Codes. (Choose up to three which predominate by volume.)

20. Charcoal

21. Incinerator Ash

22. Soil

23. Gas

24. Oil

25. Aqueous Liquid

26. Filter Media

27. Mechanical Filter

28. EPA or State Hazardous

29. Demolition Rubble

30. Cation Ion-exchange Media

31. Anion Ion-exchange Media

32. Mixed Bed Ion-exchange Media

33. Contaminated Equipment

34. Organic Liquid (except oil)

35. Glassware or Labware

36. Sealed Source/Device

37. Paint or Plating

38. Evaporator Bottoms/Sludges/ Concentrates

39. Compactible Trash

40. Noncompactible Trash

41. Animal Carcass

42. Biological Material (except animal carcass)

43. Activated Material

59. Other. Describe in item 11, or additional page

NOTE 2A: Specific Waste Descriptions (Choose all applicable codes.)

G Dewatered

H Solid

I Combustible

J Non-combustible

K Air Filtration Filters

L Asbestos

Note3: Solidification and Stabilization Media Codes. (Choose up to three which predominate by volume.) For media meeting disposal site structural stability requirements, the numerical code must be followed by "-S." and the media vendor and brand name must also be identified

in Item 13. Code 100=NONE REQUIRED.

Solidification

90. Cement

91. Concrete (encapsulation)

92. Bitumen

93. Vinyl Chloride

94. Vinyl Ester Styrene

99. Other. Describe in item 13, or additional page

100. None Required.

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST ISOTOPES REPORT

For Manifest # 7314-08-0021
EnergySolutions, LLC

Isotope	Total Activity		
	(MBq)	(mCi)	(Ci)
Cs-137	3.4932E+00	9.4410E-02	9.4410E-05
Ra-226	2.3625E-01	6.3850E-03	6.3850E-06
U-238	4.0097E-01	1.0837E-02	1.0837E-05

APPENDIX D

Brookhaven National Laboratory
Radiochemical Analytical Data Package Verification Checklist

Project	Bldg 810/811 Soils			
Sampling Contractor	PWO Grosser / EPD Field Sampling			
Analytical Laboratory	General Engineering Labs			
Analytical Method	DOE HASL 300 / EPA 905/906			
Sample Delivery Group	456300001			
COC No./Sample IDs	39984 / 001-015			
Date Sampled	7/31/18			
Parameter(s)	Gamma Scan, Sr-90, U-235/236, Pu-239/240, H-3			
	Satisfactory	Unsatisfactory	NA	Comment
Sample IDs	X			Equipment Blank mis-labeled by BNL
Detection Limits (CRDL)	X			
Duplicates	X			
Matrix Spike (MS/MSD)	X			
MS/MSD Recoveries	X			
Field Blanks	X			
Equipment Blanks	X			
Method Blanks	X			Sample #9, U-235/236 MDA < MB < RL
Chain-of-Custody Forms	X			
Field Sampling Logs			X	
Holding Times	X			
Nonconformance			X	
Other			X	

Reviewed by _____ Date _____
 Project Manager

Attachment 1

BNL RADIOCHEMICAL VALIDATION REPORT

Project No. N/A Program Waste Management
 Site Brookhaven National Laboratory Project Name 810/811 Soils
 Contract Laboratory General Engineering Labs Project Manager Bob Howe
 Sample Delivery Group (SDG) 45630000 Sampling Date (Month/Year) 7/18

Type of Analyses/Special Request:

BNL Sample ID	Lab ID		BNL Sample ID	Lab ID
39984-009	456300010			

Laboratory QC Samples:

Number of Samples Analyzed 15 Total Number of Analyses 87
 (41 QC analyses)
 MS = Matrix Spike
 MSD = Matrix Spike Duplicate
 Dup = Matrix Duplicate (replicate)
 RE = Reanalysis

Data Reviewer C. Schaefer, CHP Date 10/2/18
 QA Review by C. Schaefer, CHP Date 10/2/18
 Data Validation Management (if applicable) N/A Date _____
 EM Manager Approval N/A Date _____
 Contractual violations found? Yes _____ No X Not Applicable _____

Attach, as necessary, the following Sample Delivery Group (SDF) information:

- I. Data Qualifier and Sub Qualifier Definitions
- II. Laboratory Case Narratives, Telephone Logs and Correspondence
- III. Qualified Sample Results (Form 1's)
- IV. Laboratory Matrix QC Summary Forms (Forms 5A and 6)
- V. Standardized Data Validation Comments

Deliverable:**Analyte:**

Case Narrative

Chain-of-Custody Records/Traffic Reports/Tracking Records

BNL Sample Identifiers and Unique Laboratory ID

Initial Calibration / Efficiency Determination

Daily Efficiency Check /Continuing Calibration Verification Results

Minimum Detectable Concentration Results and a Hand Calculation

Daily Background Results

Method Blank Results

Matrix Spike/Matrix Spike Duplicates Results

Gravimetric Standard / Chemical Tracer Results

Duplicate/Replicate Results

Laboratory Control Sample (LCS) Results

LCS Control Charts

Self Absorption Factors (Sr 90, alpha spec., gross alpha and gross beta)

Percent Completeness Report

Turn Around Time Documents (COC and Case Narrative)

Run Log

Sample Raw Data

Preparation Log Bench sheets

Percent Solids Calculations / Bench sheets

Legible Pages

Pages in Package Numbered and in Sequence

GS	Sr-90	Pu/U	H-3
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
N/A	X	X	N/A
X	X	X	X
X	X	X	X
X	X	X	X
N/A	X	N/A	N/A
0	0	0	0
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X

a/b = gross alpha/gross beta

GS = gamma scan

H3 = Tritium

Np-237 = neptunium-237

NR = Not Required

0 = Not included and/or Not Complete

Pu-240 = plutonium-240, Pu-242 = plutonium-242

Ra-228 = radium-228

RS = Provided as a Resubmission

Th-230 = thorium-230

U-233 = uranium-233, U-234 = uranium-234, U-235 = uranium-235, U-236 = uranium-236, U-238 = uranium-238

Tc-99 = technetium-99

Sr-89 = Strontium-89, Sr-89/90 = Strontium-89/90, Sr-90 = Strontium-90

X = Included in original data package

Questions:

1. Deliverables

All data deliverables, as expected, were found in the package and sent through resubmissions.

Yes X No _____ Comments:

- a. The following are expected deliverables that were not found in the data package:
- b. The following deliverables were found to have problems or contain errors, as provided in the data package:
- c. The following are expected deliverables that were initially not in the data package, but were provided as a resubmission:
- d. The following deliverables were initially found to have problems or contain errors; corrected information was provided in the laboratory resubmission:

2. Holding Times/Preservations

- a. Samples were prepared and analyzed within holding times specified by the project guidelines. The holding time is based on the date of sample collection to the date of analysis, with modifications for preservatives as necessary.

Yes X No _____ Comments:

3. Tentatively Identified Radionuclides

- a. All tentatively identified radionuclides have been identified and assigned a data qualifier.

Yes X No _____ Comments:

- b. Sample identification met all spectral line energy and percent of major peaks accounted for requirements.

Yes X No _____ Comments:

4. Contract Required Detection Limits

- a. The MDCs for all results that are at or near background levels were less than or equal to the contract required detection limits (CRDL).

Yes X No _____ Comments:

5. Background and Laboratory Quality Control Samples

- a. The required summary forms/information were provided and information was present to determine that initial calibration and geometry met guidelines (correlation, number of calibration standards, distribution range of standards, peak shape, spectral lines for gamma, etc.) or method criteria.

Yes X No _____ Comments:

- b. The continuing calibration standard (CCV) efficiency analyses were reported as required and had recoveries reported to be within the specified control limits.

Yes X No _____ Comments:

6. Contamination and Background Stability Quality Control

- a. Preparation/method blank was prepared and analyzed at the specified frequency. Background determinations were performed.

Yes X No _____ Comments:

- b. All analytes in the blank and background were below the minimum detectable concentration (i.e., detection limit).

Yes _____ No X Comments:

Result for U-235/236
method Blank > MDA
but < Reporting Limit.

- c. The package contained other types of blanks submitted to the laboratory with the field samples.

Yes X No _____ Comments:

Equipment Blanks submitted.

7. Gravimetric Standard / Chemical Tracer

- a. Gravimetric standards / chemical tracers were analyzed at the specified frequency and had measured recoveries within the required control limits.

Yes X No _____ Comments:

8. Accuracy Statements

- a. Spike/laboratory control samples (LCS) analyses were performed with each sample batch and for each matrix in the data package.

Yes X No _____ Comments:

- b. Laboratory control charts were provided in the package.

Yes ☒ No ☐ Comments:

- c. Spike/laboratory control sample (LCS) analyses were reported to be within control limits (75-125%).

Yes ☒ No ☐ Comments:

- f. The matrix (pre-digest) spike frequency requirement was met.

Yes ☒ No ☐ Comments:

- g. Matrix spike recoveries were within the specified control limits (75 - 125%).

Yes ☒ No ☐ Comments:

9. Precision Statement

- a. The matrix (pre-digest) duplicate frequency was met.

Yes ☒ No ☐ Comments:

- b. Matrix (pre-digest) duplicate differences were within specified control limits (aqueous: 20% RPD or the RER less than 2.0 for results less than five times the MDC; soil: 35% RPD or the RER less than 2.0 for results less than five times the MDC).

Yes ☒ No ☐ Comments:

26.7% RPD for Rg-226.
Okay.

- c. This package contained a field duplicate.

Yes ☒ No ☐ Comments:

Page 5 of 7

- d. All field duplicate results met criteria (aqueous: 20% RPD or the RER less than 2.0 for results less than five times the MDC; soil: 35% RPD or the RER less than 2.0 for results less than five times the MDC).

Yes ☒ No ☐ Comments:

10. Self-Absorption Factors

- a. Self-absorption factors were generated for alpha and beta determinations. Solids content in samples did not exceed 100 mg total.

Yes ☒ No ☐ Comments:

Self absorption factors
for Gas Flow (Sr-90)
reviewed. Okay.

11. Analytical Methods

- a. The analytical methods used were as specified on the chain-of-custody, the BNL QAPP.

Yes X No _____ Comments:

12. Turnaround Time

- a. The turnaround time specified on the chain-of-custody record of 14 days was met.

Yes X No _____ Comments:

Exception: Ra-226 due to Radon in-growth time required per procedure. Okay.

13. Completeness

- a. The percent of data completeness for all radionuclides and methods were greater than 90%.

Yes X No _____ Comments:

14. Calculations and Transcription

- a. Correct contract/method calculations (i.e. curve generation, sample quantitation, etc.) were performed.

Yes X No _____ Comments:

Verified ¹³⁷Cs result for sample 39984-009. Okay.

- b. Raw data was transcribed accurately to sample and QC summary sheets.

Yes X No _____ Comments:

Verified ⁹⁰Sr result for sample 39984-009. Okay.

Page 6 of 7

15. System Performance

- a. The instrumental and analytical systems used in the analysis of these samples maintained an acceptable level of performance throughout this case.

Yes X No _____ Comments:

16. Contract Requirements

- a. All contract requirements were met by the laboratory in the preparation and analysis of the samples in the package.

Yes X

No _____

Comments:

17. Additional Comments

All supporting QC data is satisfactory.

 Schaefer, CHP
10/2/18

BROOKHAVEN NATIONAL LABORATORY

Data Usability Summary Report

Project:	Bldg 810/811 Soils
Sampling Contractor:	PW Grasser / EPD Field Sampling
Analytical Laboratory:	General Engineering Labs
Analytical Method and/or Parameter:	DOE HASL 300 / EPA 905/906
Sample Delivery Group:	456300001
Chain-of-Custody (COC) No. / Sample IDs:	39984 / 001-015
Date Sampled:	7/31/18
Parameter(s):	Gamma Scan, Sr-90, U-235/236, Pu, H-3

SAMPLE ID	DATA USABILITY QUALIFIERS	EXPLANATION FOR QUALIFIERS
39984 001-015	No Qualifiers	N/A

Summary:

Data useable as reported by GEL.

Reviewed by: C. Schaefer, CHP
Subject Matter ExpertDate: 10/2/18Reviewed by: _____
Project Manager

Date: _____

Brookhaven National Laboratory
Radiochemical Analytical Data Package Verification Checklist

Project	Bldg 810/811 Soils			
Sampling Contractor	EPD Sampling			
Analytical Laboratory	General Engineering Labs			
Analytical Method	DOE HASL 300 / EPA 905/906			
Sample Delivery Group	45628800			
COC No./Sample IDs	39987 / 001 - 026			
Date Sampled	7/31/18			
Parameter(s)	Gamma Scan, Sr-90, Arsenic, Plutonium, H-3			
	Satisfactory	Unsatisfactory	NA	Comment
Sample IDs	X			
Detection Limits (CRDL)	X			Co-57 + Be-7 did not meet RDL due to limited volume
Duplicates	X			
Matrix Spike (MS/MSD)	X			
MS/MSD Recoveries	X			
Field Blanks	X			
Equipment Blanks	X			
Method Blanks	X			Zigard Sr90 > MDC; Sample results < MDC.
Chain-of-Custody Forms	X			
Field Sampling Logs			X	
Holding Times	X			
Nonconformance			X	
Other			X	

Reviewed by _____ Date _____
 Project Manager

Attachment 1

BNL RADIOCHEMICAL VALIDATION REPORT

Project No. N/A Program Waste Management
 Site Brookhaven National Laboratory Project Name 810/811 Sor/Is
 Contract Laboratory General Engineering Labs Project Manager Bob Howe
 Sample Delivery Group (SDG) 45628800 Sampling Date (Month/Year) 7/18

Type of Analyses/Special Request:

BNL Sample ID	Lab ID		BNL Sample ID	Lab ID
39987-001	456288001			
-019	456288019			

Laboratory QC Samples:

Number of Samples Analyzed 26 Total Number of Analyses 130
 (54 QC analyses)
 MS = Matrix Spike
 MSD = Matrix Spike Duplicate
 Dup = Matrix Duplicate (replicate)
 RE = Reanalysis

Data Reviewer C. Achter, CHP Date 10/3/18
 QA Review by C. Achter, CHP Date 10/3/18
 Data Validation Management (if applicable) N/A Date _____
 EM Manager Approval N/A Date _____
 Contractual violations found? Yes _____ No X Not Applicable _____

Attach, as necessary, the following Sample Delivery Group (SDF) information:

- I. Data Qualifier and Sub Qualifier Definitions
- II. Laboratory Case Narratives, Telephone Logs and Correspondence
- III. Qualified Sample Results (Form 1's)
- IV. Laboratory Matrix QC Summary Forms (Forms 5A and 6)
- V. Standardized Data Validation Comments

Deliverable:**Analyte:**

	GS	Sr-90	Pu/U	H-3
Case Narrative	X	X	X	X
Chain-of-Custody Records/Traffic Reports/Tracking Records	X	X	X	X
BNL Sample Identifiers and Unique Laboratory ID	X	X	X	X
Initial Calibration / Efficiency Determination	X	X	X	X
Daily Efficiency Check /Continuing Calibration Verification Results	X	X	X	X
Minimum Detectable Concentration Results and a Hand Calculation	X	X	X	X
Daily Background Results	X	X	X	X
Method Blank Results	X	X	X	X
Matrix Spike/Matrix Spike Duplicates Results	X	X	X	X
Gravimetric Standard / Chemical Tracer Results	N/A	X	X	N/A
Duplicate/Replicate Results	X	X	X	X
Laboratory Control Sample (LCS) Results	X	X	X	X
LCS Control Charts	X	X	X	X
Self Absorption Factors (Sr 90, alpha spec., gross alpha and gross beta)	X	X	X	X
Percent Completeness Report	0	0	0	0
Turn Around Time Documents (COC and Case Narrative)	X	X	X	X
Run Log	X	X	X	X
Sample Raw Data	X	X	X	X
Preparation Log Bench sheets	X	X	X	X
Percent Solids Calculations / Bench sheets	X	X	X	X
Legible Pages	X	X	X	X
Pages in Package Numbered and in Sequence	X	X	X	X

a/b = gross alpha/gross beta

GS = gamma scan

H3 = Tritium

Np-237 = neptunium-237

NR = Not Required

0 = Not included and/or Not Complete

Pu-240 = plutonium-240, Pu-242 = plutonium-242

Ra-228 = radium-228

RS = Provided as a Resubmission

Th-230 = thorium-230

U-233 = uranium-233, U-234 = uranium-234, U-235 = uranium-235, U-236 = uranium-236, U-238 = uranium-238

Tc-99 = technetium-99

Sr-89 = Strontium-89, Sr-89/90 = Strontium-89/90, Sr-90 = Strontium-90

X = Included in original data package

Questions:

1. Deliverables

All data deliverables, as expected, were found in the package and sent through resubmissions.

Yes ☒ No ☐ Comments:

- a. The following are expected deliverables that were not found in the data package:
- b. The following deliverables were found to have problems or contain errors, as provided in the data package:
- c. The following are expected deliverables that were initially not in the data package, but were provided as a resubmission:
- d. The following deliverables were initially found to have problems or contain errors; corrected information was provided in the laboratory resubmission:

2. Holding Times/Preservations

- a. Samples were prepared and analyzed within holding times specified by the project guidelines. The holding time is based on the date of sample collection to the date of analysis, with modifications for preservatives as necessary.

Yes ☒ No ☐ Comments:

3. Tentatively Identified Radionuclides

- a. All tentatively identified radionuclides have been identified and assigned a data qualifier.

Yes ☒ No ☐ Comments:

- b. Sample identification met all spectral line energy and percent of major peaks accounted for requirements.

Yes ☒ No ☐ Comments:

4. Contract Required Detection Limits

- a. The MDCs for all results that are at or near background levels were less than or equal to the contract required detection limits (CRDL).

Yes ☒ No ☐ Comments:

5. Background and Laboratory Quality Control Samples

- a. The required summary forms/information were provided and information was present to determine that initial calibration and geometry met guidelines (correlation, number of calibration standards, distribution range of standards, peak shape, spectral lines for gamma, etc.) or method criteria.

Yes X No _____ Comments:

- b. The continuing calibration standard (CCV) efficiency analyses were reported as required and had recoveries reported to be within the specified control limits.

Yes X No _____ Comments:

6. Contamination and Background Stability Quality Control

- a. Preparation/method blank was prepared and analyzed at the specified frequency. Background determinations were performed.

Yes X No _____ Comments:

- b. All analytes in the blank and background were below the minimum detectable concentration (i.e., detection limit).

Yes _____ No X Comments:

Sr-90 method Blank > MDC, but all (liquid) sample results < MDC. OKay.

- c. The package contained other types of blanks submitted to the laboratory with the field samples.

Yes X No _____ Comments:

Equipment Blanks submitted.

7. Gravimetric Standard / Chemical Tracer

- a. Gravimetric standards / chemical tracers were analyzed at the specified frequency and had measured recoveries within the required control limits.

Yes X No _____ Comments:

8. Accuracy Statements

- a. Spike/laboratory control samples (LCS) analyses were performed with each sample batch and for each matrix in the data package.

Yes X No _____ Comments:

- b. Laboratory control charts were provided in the package.

Yes X No _____ Comments:

- c. Spike/laboratory control sample (LCS) analyses were reported to be within control limits (75-125%).

Yes X No _____ Comments:

- f. The matrix (pre-digest) spike frequency requirement was met.

Yes X No _____ Comments:

- g. Matrix spike recoveries were within the specified control limits (75 - 125%).

Yes X No _____ Comments:

9. Precision Statement

- a. The matrix (pre-digest) duplicate frequency was met.

Yes X No _____ Comments:

- b. Matrix (pre-digest) duplicate differences were within specified control limits (aqueous: 20% RPD or the RER less than 2.0 for results less than five times the MDC; soil: 35% RPD or the RER less than 2.0 for results less than five times the MDC).

Yes X No _____ Comments:

- c. This package contained a field duplicate.

Yes X No _____ Comments:

Page 5 of 7

- d. All field duplicate results met criteria (aqueous: 20% RPD or the RER less than 2.0 for results less than five times the MDC; soil: 35% RPD or the RER less than 2.0 for results less than five times the MDC).

Yes X No _____ Comments:

10. Self-Absorption Factors

- a. Self-absorption factors were generated for alpha and beta determinations. Solids content in samples did not exceed 100 mg total.

Yes X No _____ Comments:

Self absorption reviewed.
Okay.

11. Analytical Methods

- a. The analytical methods used were as specified on the chain-of-custody, the BNL QAPP.

Yes X No _____ Comments:

12. Turnaround Time

- a. The turnaround time specified on the chain-of-custody record of _____ days was met.

Yes X No _____ Comments:

13. Completeness

- a. The percent of data completeness for all radionuclides and methods were greater than 90%.

Yes X No _____ Comments:

14. Calculations and Transcription

- a. Correct contract/method calculations (i.e. curve generation, sample quantitation, etc.) were performed.

Yes X No _____ Comments:

Verified ^{137}Cs and ^{90}Sr
results for samples 001
and 019. Okay.

- b. Raw data was transcribed accurately to sample and QC summary sheets.

Yes X No _____ Comments:

Page 6 of 7

15. System Performance

- a. The instrumental and analytical systems used in the analysis of these samples maintained an acceptable level of performance throughout this case.

Yes X No _____ Comments:

16. Contract Requirements

- a. All contract requirements were met by the laboratory in the preparation and analysis of the samples in the package.

Yes X No _____ Comments:

17. Additional Comments

Supporting QC data is satisfactory.

C. Schaefer, CHP
10/3/18

BROOKHAVEN NATIONAL LABORATORY

Data Usability Summary Report

Project:	Bldg 810/811 Soils
Sampling Contractor:	EPD Field Sampling
Analytical Laboratory:	General Engineering Labs
Analytical Method and/or Parameter:	DOE HASL 300 / EPA 905 / 906
Sample Delivery Group:	45628800
Chain-of-Custody (COC) No. / Sample IDs:	39987 / 001-026
Date Sampled:	7/31/18
Parameter(s):	Gamma Scan, Sr-90, Plutonium, Uranium, H-3

SAMPLE ID	DATA USABILITY QUALIFIERS	EXPLANATION FOR QUALIFIERS
39987 001-026	No Qualifiers	N/A

Summary:

Data useable as reported by GE.

Reviewed by: C. Schaefer, CAP
Subject Matter Expert

Date: 10/3/18

Reviewed by: _____
Project Manager

Date: _____