

**Data Validation Report
Tennessee Valley Authority
Bull Run Fossil Plant
Environmental Investigation Plan
Background Soil Samples**

This data validation report was revised to report radium-226 and radium-228 results on a dry-weight basis.

This quality assurance (QA) review is based upon an examination of the data generated from the analyses of the six background soil samples and two aqueous blanks collected on October 30, 2018, at the Tennessee Valley Authority (TVA) Bull Run Fossil Plant facility. These samples were collectively analyzed by TestAmerica Laboratories, Inc. (TestAmerica), of St. Louis, Missouri, for radium-226 and for radium-228 by US EPA Method 901.1.

This review was performed in accordance with the Quality Assurance Project Plan for the Tennessee Valley Authority Bull Run Fossil Plant Environmental Investigation (TVA BRF QAPP, Revision 2, July 2018) and the Background Soil Sampling and Analysis Plan for TVA Bull Run Fossil Plant (TVA BRF SAP, Revision 3, July 2018). This review was performed with guidance from the National Functional Guidelines for Inorganic Data Review (US EPA, October 2004); the US EPA Region IV Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (November 2001); and the US EPA Region IV Data Validation Standard Operating Procedures. These validation guidance documents specifically address analyses performed in accordance with the Contract Laboratory Program (CLP) analytical methods and are not completely applicable to the type of analyses and analytical protocols performed for the US EPA method utilized by the laboratory for these samples. Environmental Standards, Inc. (Environmental Standards) used professional judgment to determine the usability of the analytical results and compliance relative to the US EPA method utilized by the laboratory.

Summary

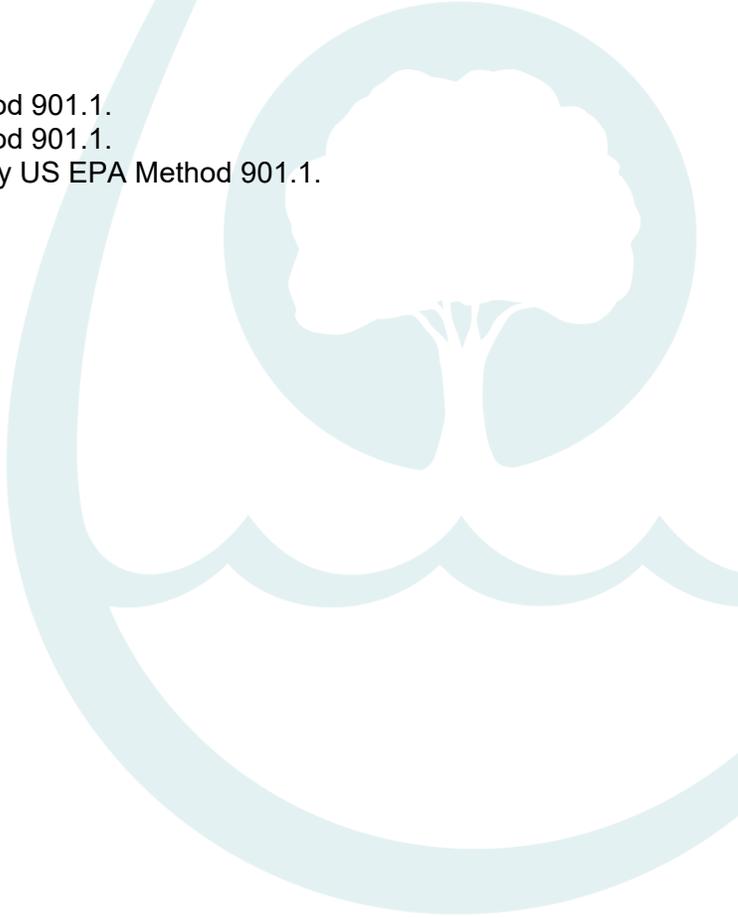
The analytical results and associated laboratory quality control (QC) samples were reviewed to determine the integrity of the reported analytical results and to ensure that the data met the established data quality objectives. This QA review includes all samples in TestAmerica Job Number 180-83550-1.

The samples that have undergone Stage 4 data validation are listed below:

| Sample Identification | Laboratory Sample Identification | Job Number | Matrix | Date Sample Collected | Parameter(s) Examined |
|---|----------------------------------|-------------|--------|-----------------------|----------------------------|
| BRF-BS-BG14-1.5/3.5-20181030 | 180-83550-1 | 180-83550-1 | Soil | 10/30/18 | Ra-226, Ra-228, Ra-226/228 |
| BRF-BS-BG14-6.0/8.0-20181030 | 180-83550-2 | 180-83550-1 | Soil | 10/30/18 | Ra-226, Ra-228, Ra-226/228 |
| BRF-BS-BG14-0.0/0.5-20181030 | 180-83550-3 | 180-83550-1 | Soil | 10/30/18 | Ra-226, Ra-228, Ra-226/228 |
| BRF-BS-FB01-20181030 (Field Blank) | 180-83550-4 | 180-83550-1 | Aq | 10/30/18 | Ra-226, Ra-228, Ra-226/228 |
| BRF-BS-BG01-0.0/0.5-20181030 | 180-83550-5 | 180-83550-1 | Soil | 10/30/18 | Ra-226, Ra-228, Ra-226/228 |
| BRF-BS-BG01-1.25/3.25-20181030 | 180-83550-6 | 180-83550-1 | Soil | 10/30/18 | Ra-226, Ra-228, Ra-226/228 |
| BRF-BS-BG01-6.5/8.5-20181030 | 180-83550-7 | 180-83550-1 | Soil | 10/30/18 | Ra-226, Ra-228, Ra-226/228 |
| BRF-BS-EB01-20181030 (Equipment Blank) | 180-83550-8 | 180-83550-1 | Aq | 10/30/18 | Ra-226, Ra-228, Ra-226/228 |

Parameters Examined

- Ra-226 - Radium-226 by US EPA Method 901.1.
- Ra-228 - Radium-228 by US EPA Method 901.1.
- Ra-226/228 - Radium-226/228 Calculation by US EPA Method 901.1.
- Aq - Aqueous.



| Items Reviewed | |
|--|------------------------------|
| Holding Times | Calibrations |
| Sample Preservation | Blank Results |
| Chain-of-Custody (COC) Records and Case Narratives | Sample Preparation |
| Laboratory Control Sample (LCS) Results | Laboratory Duplicate Results |
| Quantitation of Positive Results | |

Comments and Exceptions

- Radium-226+228 was reported as the summation of the calculated activities for radium-226 and radium-228. The reported results for radium-226+228 for the samples included in this report may have been adjusted and/or qualified in accordance with the TVA reporting protocols and assigned an “S” reason code.
- During a data inquiry associated with a TVA sediment SDG, it was discovered that soil and sediment radium samples were prepared and analyzed on a wet-weight basis. Per the associated QAPP, all radium soil and sediment data must be reported on a dry-weight basis. After several discussions, a decision was made that all radium analyses for soil and sediment samples must be performed using dried, ground material moving forward. In addition, TestAmerica was requested to revise all previously reported data to dry-weight correct the results using the moisture content determined by TestAmerica Pittsburgh (see Project Correspondence [Section 5]).

Qualifier Summary

| Analyte(s) | Job Number | Sample(s) | Validation Qualifier(s) | Reason(s) for Qualification |
|------------|-------------|--------------------------------|-------------------------|-----------------------------|
| Ra-228 | 180-83550-1 | BRF-BS-BG01-1.25/3.25-20181030 | U* | BL |

- Any radium-226+228 activity associated with a blank-qualified (“U*”) individual isotope activity should be considered estimated and has been flagged “J” (unless previously flagged “U*”) on the data tables.
- Any radium-226+228 results reported from the summation of one isotope activity less than the MDA (non-negative value) and one isotope activity greater than the MDA should be considered estimated and have been flagged “J” on the data tables.

Review performed by: Danielle Coles, Quality Assurance Chemist
Review reviewed by: Ammie L. Martin, Senior Quality Assurance Chemist
Review approved by: Andrew L. Piasecki, Senior Quality Assurance Chemist
Review approved by: Rock J. Vitale, CEAC, Technical Director of Chemistry/Principal
Date review completed: 5/21/19



SECTION 2

ANALYTICAL RESULTS

INORGANIC DATA QUALIFIERS

- U* This result should be considered “not-detected” because it was detected in a rinsate blank or laboratory blank at a similar level.
- UR Unreliable reporting limit; analyte may or may not be present in sample.
- R Unreliable positive result; analyte may or may not be present in sample.
- J Quantitation is approximate due to limitations identified during data validation.
- UJ This analyte was not detected, but the reporting limit may or may not be higher due to a bias identified during data validation.



REASON CODES AND EXPLANATIONS

| Reason Code | Explanation |
|-------------|--|
| BE | Equipment blank contamination. The result should be considered "not-detected." |
| BF | Field blank contamination. The result should be considered "not-detected." |
| BL | Laboratory blank contamination. The result should be considered "not-detected." |
| BN | Negative laboratory blank contamination. |
| C | Initial and/or Continuing Calibration issue, indeterminate bias. |
| C+ | Initial and/or Continuing Calibration issue. The result may be biased high. |
| C- | Initial and/or Continuing Calibration issue. The result may be biased low. |
| FD | Field duplicate imprecision. |
| FG | Total versus Dissolved Imprecision. |
| H | Holding time exceeded. |
| I | Internal standard recovery outside of acceptance limits. |
| L | LCS and LCSD recoveries outside of acceptance limits, indeterminate bias. |
| L+ | LCS and/or LCSD recoveries outside of acceptance limits. The result may be biased high. |
| L- | LCS and/or LCSD recoveries outside of acceptance limits. The result may be biased low. |
| LD | Laboratory duplicate imprecision. |
| LP | LCS/LCSD imprecision. |
| M | MS and MSD recoveries outside of acceptance limits, indeterminate bias. |
| M+ | MS and/or MSD recoveries outside of acceptance limits. The result may be biased high. |
| M- | MS and/or MSD recoveries outside of acceptance limits. The result may be biased low. |
| MP | MS/MSD imprecision. |
| P | Post-digestion spike recoveries outside of acceptance limits, indeterminate bias. |
| P+ | Post-digestion spike recovery outside of acceptance limits. The result may be biased high. |
| P- | Post-digestion spike recovery outside of acceptance limits. The result may be biased low. |
| Q | Chemical Preservation issue. |
| R | RL standards outside of acceptance limits, indeterminate bias. |
| R+ | RL standard(s) outside of acceptance limits. The result may be biased high. |
| R- | RL standard(s) outside of acceptance limits. The result may be biased low. |
| RL | Reported result between the MDL and the RL. |
| S | Radium-226+228 flagged due to reporting protocol for combined results. |
| T | Temperature preservation issue. |
| SD | Serial Dilution imprecision. |
| X | Percent solids < 50%. |
| Y+ | Chemical Yield outside of acceptance limits. The result may be biased high. |
| Y- | Chemical yield outside of acceptance limits. The result may be biased low. |
| Z | ICP or ICP/MS Interference. |
| ZZ | Other. |

| | |
|------------------------|------------------------------|
| Lab Sample ID | 180-83550-1 |
| Sys Sample Code | BRF-BS-BG14-1.5/3.5-20181030 |
| Sample Name | BRF-BS-BG14-1.5/3.5-20181030 |
| Sample Date | 10/30/2018 12:04:00 PM |
| Location | BRF-BG-14 |
| Sample Type | N |
| Parent Sample | |

| Analytic Method | Chemical Name | CAS Rn | Fraction | Result Unit | Final Result | Final Qual | Reason code | Uncertainty | Final MDL | Final RL | Final QL | Final Detect | Final Report | DF | Basis |
|-----------------|-------------------------|------------|----------|-------------|--------------|------------|-------------|-------------|-----------|----------|----------|--------------|--------------|----|-------|
| EPA 901.1 | Radium 226 + radium 228 | RA226/228 | T | PCI/G | 2.66 | | | 0.420 | | | | Y | Yes | 1 | DRY |
| | Radium 228 | 15262-20-1 | T | PCI/G | 1.59 | | | 0.335 | 0.133 | 0.133 | 1.00 | Y | Yes | 1 | DRY |
| | Radium-226 | 13982-63-3 | T | PCI/G | 1.07 | | | 0.254 | 0.174 | 0.174 | 1.00 | Y | Yes | 1 | DRY |

| | |
|-----------------|------------------------------|
| Lab Sample ID | 180-83550-2 |
| Sys Sample Code | BRF-BS-BG14-6.0/8.0-20181030 |
| Sample Name | BRF-BS-BG14-6.0/8.0-20181030 |
| Sample Date | 10/30/2018 12:25:00 PM |
| Location | BRF-BG-14 |
| Sample Type | N |
| Parent Sample | |

| Analytic Method | Chemical Name | CAS Rn | Fraction | Result Unit | Final Result | Final Qual | Reason code | Uncertainty | Final MDL | Final RL | Final QL | Final Detect | Final Report | DF | Basis |
|-----------------|-------------------------|------------|----------|-------------|--------------|------------|-------------|-------------|-----------|----------|----------|--------------|--------------|----|-------|
| EPA 901.1 | Radium 226 + radium 228 | RA226/228 | T | PCI/G | 2.01 | | | 0.489 | | | | Y | Yes | 1 | DRY |
| | Radium 228 | 15262-20-1 | T | PCI/G | 1.38 | | | 0.382 | 0.187 | 0.187 | 1.00 | Y | Yes | 1 | DRY |
| | Radium-226 | 13982-63-3 | T | PCI/G | 0.628 | | | 0.305 | 0.279 | 0.279 | 1.00 | Y | Yes | 1 | DRY |

| | |
|-----------------|------------------------------|
| Lab Sample ID | 180-83550-3 |
| Sys Sample Code | BRF-BS-BG14-0.0/0.5-20181030 |
| Sample Name | BRF-BS-BG14-0.0/0.5-20181030 |
| Sample Date | 10/30/2018 12:31:00 PM |
| Location | BRF-BG-14 |
| Sample Type | N |
| Parent Sample | |

| Analytic Method | Chemical Name | CAS Rn | Fraction | Result Unit | Final Result | Final Qual | Reason code | Uncertainty | Final MDL | Final RL | Final QL | Final Detect | Final Report | DF | Basis |
|-----------------|-------------------------|------------|----------|-------------|--------------|------------|-------------|-------------|-----------|----------|----------|--------------|--------------|----|-------|
| EPA 901.1 | Radium 226 + radium 228 | RA226/228 | T | PCI/G | 2.26 | | | 0.630 | | | | Y | Yes | 1 | DRY |
| | Radium 228 | 15262-20-1 | T | PCI/G | 1.16 | | | 0.557 | 0.536 | 0.536 | 1.00 | Y | Yes | 1 | DRY |
| | Radium-226 | 13982-63-3 | T | PCI/G | 1.11 | | | 0.294 | 0.247 | 0.247 | 1.00 | Y | Yes | 1 | DRY |

| | |
|-----------------|-----------------------|
| Lab Sample ID | 180-83550-4 |
| Sys Sample Code | BRF-BS-FB01-20181030 |
| Sample Name | BRF-BS-FB01-20181030 |
| Sample Date | 10/30/2018 2:15:00 PM |
| Location | |
| Sample Type | FB |
| Parent Sample | |

| Analytic Method | Chemical Name | CAS Rn | Fraction | Result Unit | Final Result | Final Qual | Reason code | Uncertainty | Final MDL | Final RL | Final QL | Final Detect | Final Report | DF | Basis |
|-----------------|-------------------------|------------|----------|-------------|--------------|------------|-------------|-------------|-----------|----------|----------|--------------|--------------|----|-------|
| EPA 901.1 | Radium 226 + radium 228 | RA226/228 | T | PCI/L | -23.5 | U | | 17.8 | | | | N | Yes | 1 | NA |
| | Radium 228 | 15262-20-1 | T | PCI/L | -20.9 | U | | 17.2 | 40.7 | 40.7 | 50.0 | N | Yes | 1 | NA |
| | Radium-226 | 13982-63-3 | T | PCI/L | -2.52 | U | | 4.64 | 34.7 | 34.7 | 50.0 | N | Yes | 1 | NA |

| | |
|-----------------|------------------------------|
| Lab Sample ID | 180-83550-5 |
| Sys Sample Code | BRF-BS-BG01-0.0/0.5-20181030 |
| Sample Name | BRF-BS-BG01-0.0/0.5-20181030 |
| Sample Date | 10/30/2018 3:42:00 PM |
| Location | BRF-BG-01 |
| Sample Type | N |
| Parent Sample | |

| Analytic Method | Chemical Name | CAS Rn | Fraction | Result Unit | Final Result | Final Qual | Reason code | Uncertainty | Final MDL | Final RL | Final QL | Final Detect | Final Report | DF | Basis |
|-----------------|-------------------------|------------|----------|-------------|--------------|------------|-------------|-------------|-----------|----------|----------|--------------|--------------|----|-------|
| EPA 901.1 | Radium 226 + radium 228 | RA226/228 | T | PCI/G | 2.19 | | | 0.412 | | | | Y | Yes | 1 | DRY |
| | Radium 228 | 15262-20-1 | T | PCI/G | 1.34 | | | 0.330 | 0.139 | 0.139 | 1.00 | Y | Yes | 1 | DRY |
| | Radium-226 | 13982-63-3 | T | PCI/G | 0.846 | | | 0.247 | 0.201 | 0.201 | 1.00 | Y | Yes | 1 | DRY |

| | |
|-----------------|--------------------------------|
| Lab Sample ID | 180-83550-6 |
| Sys Sample Code | BRF-BS-BG01-1.25/3.25-20181030 |
| Sample Name | BRF-BS-BG01-1.25/3.25-20181030 |
| Sample Date | 10/30/2018 3:40:00 PM |
| Location | BRF-BG-01 |
| Sample Type | N |
| Parent Sample | |

| Analytic Method | Chemical Name | CAS Rn | Fraction | Result Unit | Final Result | Final Qual | Reason code | Uncertainty | Final MDL | Final RL | Final QL | Final Detect | Final Report | DF | Basis |
|-----------------|-------------------------|------------|----------|-------------|--------------|------------|-------------|-------------|-----------|----------|----------|--------------|--------------|----|-------|
| EPA 901.1 | Radium 226 + radium 228 | RA226/228 | T | PCI/G | 1.36 | J | BL | 0.628 | | | | Y | Yes | 1 | DRY |
| | Radium 228 | 15262-20-1 | T | PCI/G | 0.826 | U* | BL | 0.591 | 0.826 | 0.826 | 1.00 | N | Yes | 1 | DRY |
| | Radium-226 | 13982-63-3 | T | PCI/G | 0.536 | | | 0.213 | 0.223 | 0.223 | 1.00 | Y | Yes | 1 | DRY |

| | |
|-----------------|------------------------------|
| Lab Sample ID | 180-83550-7 |
| Sys Sample Code | BRF-BS-BG01-6.5/8.5-20181030 |
| Sample Name | BRF-BS-BG01-6.5/8.5-20181030 |
| Sample Date | 10/30/2018 3:26:00 PM |
| Location | BRF-BG-01 |
| Sample Type | N |
| Parent Sample | |

| Analytic Method | Chemical Name | CAS Rn | Fraction | Result Unit | Final Result | Final Qual | Reason code | Uncertainty | Final MDL | Final RL | Final QL | Final Detect | Final Report | DF | Basis |
|-----------------|-------------------------|------------|----------|-------------|--------------|------------|-------------|-------------|-----------|----------|----------|--------------|--------------|----|-------|
| EPA 901.1 | Radium 226 + radium 228 | RA226/228 | T | PCI/G | 1.59 | | | 0.506 | | | | Y | Yes | 1 | DRY |
| | Radium 228 | 15262-20-1 | T | PCI/G | 0.955 | | | 0.433 | 0.366 | 0.366 | 1.00 | Y | Yes | 1 | DRY |
| | Radium-226 | 13982-63-3 | T | PCI/G | 0.638 | | | 0.261 | 0.263 | 0.263 | 1.00 | Y | Yes | 1 | DRY |

| | |
|-----------------|-----------------------|
| Lab Sample ID | 180-83550-8 |
| Sys Sample Code | BRF-BS-EB01-20181030 |
| Sample Name | BRF-BS-EB01-20181030 |
| Sample Date | 10/30/2018 4:10:00 PM |
| Location | |
| Sample Type | EB |
| Parent Sample | |

| Analytic Method | Chemical Name | CAS Rn | Fraction | Result Unit | Final Result | Final Qual | Reason code | Uncertainty | Final MDL | Final RL | Final QL | Final Detect | Final Report | DF | Basis |
|-----------------|-------------------------|------------|----------|-------------|--------------|------------|-------------|-------------|-----------|----------|----------|--------------|--------------|----|-------|
| EPA 901.1 | Radium 226 + radium 228 | RA226/228 | T | PCI/L | 35.0 | J | S | 22.8 | | | | Y | Yes | 1 | NA |
| | Radium 228 | 15262-20-1 | T | PCI/L | 14.9 | U | | 17.3 | 23.0 | 23.0 | 50.0 | N | Yes | 1 | NA |
| | Radium-226 | 13982-63-3 | T | PCI/L | 20.1 | | | 14.8 | 17.6 | 17.6 | 50.0 | Y | Yes | 1 | NA |

SECTION 3

SUPPORTING DOCUMENTATION FOR QUALIFIERS



RADIOLOGICAL ANALYSIS SUPPORT DOCUMENTATION

ESI project name: TVA-BRF EI
 Sample Collection Dates: 10/30/18
 Job Number: 20188395.A000
 Project Manager: AJC
 Laboratory: TestAmerica-St. Louis

Reviewed by: Danielle Coles
 Approved by: *AW*
 Completion Date: 12/20/18

Applicable Sample No's (X) Refer to Table 1 in the Quality Assurance Review

| Deliverable: | Level IV (Full) (X) | Sample No. | Lab Control No. |
|--------------|---------------------|-------------|-----------------|
| Limited () | | 180-83550-1 | |
| Other: | | | |

The following table indicates criteria that were examined, the identified problems, and support documentation attachments

| | Criteria Examined in Detail | | | | Problems Identified | | | | Support Documentation Attachments | | | |
|---|--|--|--|--|--|--|--|--|--|--|--|--|
| | Check (✓) if Yes or Footnote Letter for Comments Below | | | | Check (✓) if Yes or Footnote Letter for Comments Below | | | | Check (✓) if Yes or Footnote Letter for Comments Below | | | |
| | 901.1 | | | | 901.1 | | | | 901.1 | | | |
| Holding Times | X | | | | | | | | | | | |
| Blank Analysis Results | X | | | | X | | | | X | | | |
| Laboratory Control Standard (LCS) | X | | | | | | | | | | | |
| Tracer/Chemical Yield | | | | | | | | | | | | |
| Duplicate Analysis: (X) Field (X) Lab | X | | | | | | | | | | | |
| Matrix Spike Results | | | | | | | | | | | | |
| Quantitation of Results | X | | | | | | | | | | | |
| Detection Limit | | | | | | | | | | | | |
| Efficiency/Energy Calibrations | X | | | | | | | | | | | |
| Initial Calibration Verifications | X | | | | | | | | | | | |
| Annual Calibration Verifications | | | | | | | | | | | | |
| Continuing Calibration Checks | X | | | | | | | | | | | |
| Continuing Calibration Backgrounds | X | | | | | | | | | | | |
| Sample Preservation | X | | | | | | | | | | | |
| Condition on Receipt | X | | | | | | | | | | | |
| Others: insufficient sample size | X | | | | | | | | | | | |

Comments: All results are usable unless otherwise qualified.

Client Sample Results

Client: Environmental Standards Inc.
 Project/Site: BRF_BS_20181030_1B

Job ID: 180-83550-1

Client Sample ID: BRF-BS-BG01-1.25/3.25-20181030

Lab Sample ID: 180-83550-6

Date Collected: 10/30/18 15:40

Matrix: Solid

Date Received: 10/31/18 16:39

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

| Analyte | Result | Qualifier | Count | Total | RL | MDC | Unit | Prepared | Analyzed | Dil Fac |
|------------------------------|--------|-----------|--------------------|--------------------|------|-------|-------|----------------|----------------|---------|
| | | | Uncert. (2σ+/-) | Uncert. (2σ+/-) | | | | | | |
| Radium-226 | 0.536 | | 0.206 | 0.213 | 1.00 | 0.223 | pCi/g | 11/03/18 09:23 | 11/24/18 15:26 | 1 |
| Radium-228 <i>v-bl</i> | 0.826 | | 0.585 | 0.591 | | 0.608 | pCi/g | 11/03/18 09:23 | 11/24/18 15:26 | 1 |
| Combined Radium 226 + 228 | 1.36 | | 0.620 | 0.628 | | | pCi/g | 11/03/18 09:23 | 11/24/18 15:26 | 1 |



Client Sample Results

Client: Environmental Standards Inc.
 Project/Site: BRF_BS_20181030_1B

Job ID: 180-83550-1

Client Sample ID: BRF-BS-EB01-20181030

Lab Sample ID: 180-83550-8

Date Collected: 10/30/18 16:10

Matrix: Water

Date Received: 10/31/18 16:39

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

| Analyte | Result | Qualifier | Count | Total | RL | MDC | Unit | Prepared | Analyzed | Dil Fac |
|--------------------|--------|-----------|--------------------|--------------------|------|------|-------|----------------|----------------|---------|
| | | | Uncert. (2σ+/-) | Uncert. (2σ+/-) | | | | | | |
| Radium-226 | 20.1 | | 14.6 | 14.8 | 50.0 | 17.6 | pCi/L | 11/09/18 13:57 | 11/30/18 14:17 | 1 |
| Radium-228 | 14.9 | U | 17.2 | 17.3 | 50.0 | 23.0 | pCi/L | 11/09/18 13:57 | 11/30/18 14:17 | 1 |
| Radium 226 and 228 | 35.0 | J, S | 22.6 | 22.8 | | | pCi/L | 11/09/18 13:57 | 11/30/18 14:17 | 1 |



SECTION 4

CASE NARRATIVE AND CHAIN-OF-CUSTODY RECORD

Case Narrative

Client: Environmental Standards Inc.
Project/Site: BRF_BS_20181030_1B

Job ID: 180-83550-1

Job ID: 180-83550-1

Laboratory: Eurofins TestAmerica, Pittsburgh

Narrative

Job Narrative
180-83550-1

Revised Report

This report was revised to correct the solid sample results for dry weight using the dry weight results from TA-Pittsburgh. This replaces the previous final report. ✓

Receipt

The samples were received on 10/31/2018 4:39 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were 1.3° C and 1.5° C. ✓

Receipt Exceptions

The container label for the following samples did not match the information listed on the Chain-of-Custody (COC): BRF-BS-BG14-6.0/8.0-20181030 (180-83550-2) and BRF-BS-BG14-0.0/0.5-20181030 (180-83550-3). The container labels list opposite sample times with than the chain of custody. Sample 2 has the time of 1231 and sample 3 has a time of 1225 on the labels. The samples were logged per the chain.

RAD

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.



Sample Summary

Client: Environmental Standards Inc.
 Project/Site: BRF_BS_20181030_1B

TestAmerica Job ID: 180-83550-1

| Lab Sample ID | Client Sample ID | Matrix | Collected | Received |
|---------------|--------------------------------|--------|------------------|----------------|
| 180-83550-1 | BRF-BS-BG14-1.5/3.5-20181030 | Solid | 10/30/18 12:04 ✓ | 10/31/18 16:39 |
| 180-83550-2 | BRF-BS-BG14-6.0/8.0-20181030 | Solid | 10/30/18 12:25 ✓ | 10/31/18 16:39 |
| 180-83550-3 | BRF-BS-BG14-0.0/0.5-20181030 | Solid | 10/30/18 12:31 ✓ | 10/31/18 16:39 |
| 180-83550-4 | BRF-BS-FB01-20181030 | Water | 10/30/18 14:15 ✓ | 10/31/18 16:39 |
| 180-83550-5 | BRF-BS-BG01-0.0/0.5-20181030 | Solid | 10/30/18 15:42 ✓ | 10/31/18 16:39 |
| 180-83550-6 | BRF-BS-BG01-1.25/3.25-20181030 | Solid | 10/30/18 15:40 ✓ | 10/31/18 16:39 |
| 180-83550-7 | BRF-BS-BG01-6.5/8.5-20181030 | Solid | 10/30/18 15:26 ✓ | 10/31/18 16:39 |
| 180-83550-8 | BRF-BS-EB01-20181030 ✓ | Water | 10/30/18 16:10 ✓ | 10/31/18 16:39 |



Shipping and Receiving Documents

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

582918



180-83550 Waybill

ORIGIN ID: GKTA (865) 621-1653
DAVE MYERS
TEST AMERICA KNOXVILLE LAB
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN 37921
UNITED STATES US

SHIP DATE: 30OCT18
ACTWT: 58.00 LB
CAD: 006985425/SSFE1822
DIMS: 24x13x12 IN
BILL RECIPIENT

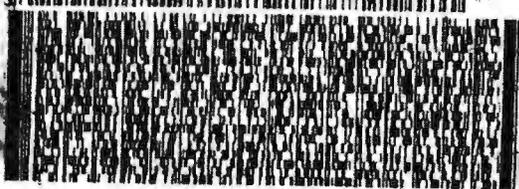
TO SAMPLE RECEIVING
TEST AMERICAN PITTSBURG
301 ALPHA DR RIDC, PK

PITTSBURGH PA 15238

(412) 963-7068

REF:

DEPT:



FedEx
EXP



Custody Seal

DATE
SIGNATURE

Align Open End of FedEx Pouch Here

SIGNATURE

DATE

Custody Seal

10/30/18

[Signature]

1 of 2

TRK# 8120 5915 0108
0215
MASTER

WED - 31 OCT 3:00
STANDARD OVERNIGHT

NA AGCA

1523

PA-48 P

Uncorrected temp 14.13 °C
Thermometer ID 10

CF 0.2 Initials TS

PT-WI-SR-001 effective 7/26/13

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
582918

582919

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

582917

ORIGIN ID: QKTA (885) 621-1653
DAVE MYERS
TEST AMERICA KNOXVILLE LAB
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN 37921
UNITED STATES US

SHIP DATE: 30OCT18
ACTWGT: 53.00 LB
CAD: 006995125/58FE192
DIMS: 24x13x12 IN

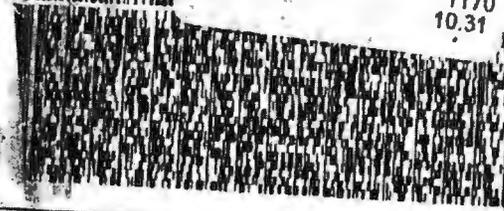
BILL RECIPIENT

TO SAMPLE RECEIVING
TEST AMERICAN PITTSBURG
301 ALPHA DR RIDG PK

PITTSBURG RE 97 52281

(412) 868-7068

15:00 A
1170
10.31



Custody Seal

DATE

10/30/18

SIGNATURE

[Signature]

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

582916

Custody Seal

DATE

10/30/18

SIGNATURE

[Signature]

2 of 2
MP# 7835 1907 1170
0691
Metrix 8120 5015 0108

WED - 31 OCT
STANDARD OVER

NA AGCA

0215

PA-US

Uncorrected temp 1.3/1.5 °C
Thermometer ID 10

CF 0.2 Initials JB

PT-M-SR-001 effective 1/26/13

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
582917

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
582916

TestAmerica Pittsburgh
 301 Alpha Drive RIDC Park
 Pittsburgh, PA 15238
 Phone (412) 963-7058 Fax (412) 963-2468

Chain of Custody Record



TestAmerica
THE LEADER IN LABORATORY TESTING

| | | | | | | |
|---|--|-------------------------------------|--|-------------------------------------|---|---|
| Client Information (Sub Contract Lab) | | Sampler: | Lab PM: | Carrier Tracking No(s): | COC No: | |
| Client Contact | | Phone: | Lage, Gail | | 180-345933.1 | |
| Shipping/Receiving | | E-Mail: | gail.lage@testamericainc.com | State of Origin: | Page: | |
| Company: | | Accreditations Required (See note): | | | Page 1 of 1 | |
| TestAmerica Laboratories, Inc. | | | | | Job #: | |
| Address: | | Due Date Requested: | Analysis Requested | | Preservation Codes: | |
| 13715 Rider Trail North, | | 11/7/2018 | | | | |
| City: | | TAT Requested (days): | Field Filtered Sample (Yes or No) | Perform MS/MSD (Yes or No) | Total Number of Containers | |
| Earth City | | | | | | |
| State, Zip: | | PO #: | 901.1_RaFill_Geo_21 (MOO) Radium-226/228 | | A - HCL B - NaOH C - Zn Acetate D - Nitric Acid E - NaHSO4 F - MeOH G - Amchlor H - Ascorbic Acid I - Ice J - DI Water K - EDTA L - EDA M - Hexane N - None O - AsNaO2 P - Na2O4S Q - Na2SO3 R - Na2S2O3 S - H2SO4 T - TSP Dodecanehydrate U - Acetone V - MCAA W - pH 4-5 Z - other (specify) | |
| MO, 63045 | | WC #: | 904.0PrcSep_0 Standard Target List | | | |
| Phone: | | Project #: | 903.0PrcSep_21 Standard Target List | | | |
| 314-298-8566(Tel) 314-298-8757(Fax) | | 18019624 | Ra226_228GFP_C_P | | | |
| Email: | | SSOW#: | | | | |
| Project Name: | | | | | | |
| BRF_BS_20181030_1B | | | | | | |
| Site: | | | | | | |
| | | | | | | |
| Sample Identification - Client ID (Lab ID) | | Sample Date | Sample Time | Sample Type (C=comp, G=grab) | Matrix (V=water, S=solid, O=other) | Special Instructions/Note: |
| | | | | | | |
| | | | | | | |
| BRF-BS-BG14-1.5/3.5-20181030 (180-83550-1) ✓ | | 10/30/18 | 12:04 Eastern | | Solid | 1 TVA |
| BRF-BS-BG14-6.0/8.0-20181030 (180-83550-2) ✓ | | 10/30/18 | 12:25 Eastern | | Solid | 1 TVA |
| BRF-BS-BG14-0.0/0.5-20181030 (180-83550-3) ✓ | | 10/30/18 | 12:31 Eastern | | Solid | 1 TVA |
| BRF-BS-FB01-20181030 (180-83550-4) ✓ | | 10/30/18 | 14:15 Eastern | | Water | 3 Analysis must follow TVA Protocol, Count after 7 days, recount if activity is above the TVA |
| BRF-BS-BG01-0.0/0.5-20181030 (180-83550-5) ✓ | | 10/30/18 | 15:42 Eastern | | Solid | 1 TVA |
| BRF-BS-BG01-1.25/3.25-20181030 (180-83550-6) ✓ | | 10/30/18 | 15:40 Eastern | | Solid | 1 TVA |
| BRF-BS-BG01-6.5/8.5-20181030 (180-83550-7) ✓ | | 10/30/18 | 15:26 Eastern | | Solid | 1 TVA |
| BRF-BS-EB01-20181030 (180-83550-8) ✓ | | 10/30/18 | 16:10 Eastern | | Water | 3 Analysis must follow TVA Protocol, Count after 7 days, recount if activity is above the |

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.

| | | | |
|--|-------------------|--|--------------|
| Possible Hazard Identification | | Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) | |
| Unconfirmed | | <input type="checkbox"/> Return To Client <input type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For Months | |
| Deliverable Requested: I, II, III, IV, Other (specify) | | Special Instructions/QC Requirements: | |
| Primary Deliverable Rank: 2 | | | |
| Empty Kit Relinquished by: | | Method of Shipment: | |
| Date: | | Time: | |
| Relinquished by: | Date/Time: | Received by: | Date/Time: |
| <i>[Signature]</i> | 11/7/18 1700 | <i>[Signature]</i> | 11/2/18 0700 |
| Relinquished by: | Date/Time: | Received by: | Date/Time: |
| | | | |
| Relinquished by: | Date/Time: | Received by: | Date/Time: |
| | | | |
| Custody Seals Intact: | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks: | |
| Δ Yes Δ No | | | |

Page 681 of 684

Login Sample Receipt Checklist

Client: Environmental Standards Inc.

Job Number: 180-83550-1

Login Number: 83550

List Source: TestAmerica Pittsburgh

List Number: 1

Creator: Say, Thomas C

| Question | Answer | Comment |
|---|--------|---------|
| Radioactivity wasn't checked or is \leq background as measured by a survey meter. | True | |
| The cooler's custody seal, if present, is intact. | True | |
| Sample custody seals, if present, are intact. | True | |
| The cooler or samples do not appear to have been compromised or tampered with. | True | |
| Samples were received on ice. | True | |
| Cooler Temperature is acceptable. | True | |
| Cooler Temperature is recorded. | True | |
| COC is present. | True | |
| COC is filled out in ink and legible. | True | |
| COC is filled out with all pertinent information. | True | |
| Is the Field Sampler's name present on COC? | True | |
| There are no discrepancies between the containers received and the COC. | True | |
| Samples are received within Holding Time (excluding tests with immediate HTs) | True | |
| Sample containers have legible labels. | True | |
| Containers are not broken or leaking. | True | |
| Sample collection date/times are provided. | True | |
| Appropriate sample containers are used. | True | |
| Sample bottles are completely filled. | True | |
| Sample Preservation Verified. | True | |
| There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs | True | |
| Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ ($1/4''$). | True | |
| Multiphasic samples are not present. | True | |
| Samples do not require splitting or compositing. | True | |
| Residual Chlorine Checked. | N/A | ✓ |

Login Sample Receipt Checklist

Client: Environmental Standards Inc.

Job Number: 180-83550-1

Login Number: 83550
List Number: 2
Creator: Hellm, Michael

List Source: TestAmerica St. Louis
List Creation: 11/02/18 02:47 PM

| Question | Answer | Comment |
|--|--------|---------|
| Radioactivity wasn't checked or is \leq background as measured by a survey meter. | True | |
| The cooler's custody seal, if present, is intact. | True | |
| Sample custody seals, if present, are intact. | N/A | |
| The cooler or samples do not appear to have been compromised or tampered with. | True | |
| Samples were received on ice. | True | |
| Cooler Temperature is acceptable. | True | |
| Cooler Temperature is recorded. | True | 0.3 |
| COC is present. | True | |
| COC is filled out in ink and legible. | True | |
| COC is filled out with all pertinent information. | True | |
| Is the Field Sampler's name present on COC? | N/A | |
| There are no discrepancies between the containers received and the COC. | True | |
| Samples are received within Holding Time (excluding tests with immediate HTs) | True | |
| Sample containers have legible labels. | True | |
| Containers are not broken or leaking. | True | |
| Sample collection date/times are provided. | True | |
| Appropriate sample containers are used. | True | |
| Sample bottles are completely filled. | True | |
| Sample Preservation Verified. | True | |
| There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs | True | |
| Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4"). | N/A | |
| Multiphasic samples are not present. | N/A | |
| Samples do not require splitting or compositing. | True | |
| Residual Chlorine Checked. | N/A | ✓ |

Login Sample Receipt Checklist

Client: Environmental Standards Inc.

Job Number: 180-83550-1

Login Number: 83550
List Number: 3
Creator: Hellm, Michael

List Source: TestAmerica St. Louis
List Creation: 11/02/18 02:48 PM

| Question | Answer | Comment |
|---|--------|---------|
| Radioactivity wasn't checked or is \leq background as measured by a survey meter. | True | |
| The cooler's custody seal, if present, is intact. | N/A | |
| Sample custody seals, if present, are intact. | True | |
| The cooler or samples do not appear to have been compromised or tampered with. | True | |
| Samples were received on ice. | True | |
| Cooler Temperature is acceptable. | True | |
| Cooler Temperature is recorded. | True | 0.3 |
| COC is present. | True | |
| COC is filled out in ink and legible. | True | |
| COC is filled out with all pertinent information. | True | |
| Is the Field Sampler's name present on COC? | N/A | |
| There are no discrepancies between the containers received and the COC. | True | |
| Samples are received within Holding Time (excluding tests with immediate HTs) | True | |
| Sample containers have legible labels. | True | |
| Containers are not broken or leaking. | True | |
| Sample collection date/times are provided. | True | |
| Appropriate sample containers are used. | True | |
| Sample bottles are completely filled. | True | |
| Sample Preservation Verified. | N/A | |
| There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs | True | |
| Containers requiring zero headspace have no headspace or bubble is <math><6\text{mm}</math> (1/4"). | N/A | |
| Multiphasic samples are not present. | N/A | |
| Samples do not require splitting or compositing. | True | |
| Residual Chlorine Checked. | N/A | ✓ |

SECTION 5

PROJECT CORRESPONDENCE

Danielle Coles

From: Andrew Piasecki
Sent: Tuesday, April 2, 2019 12:29 PM
To: Danielle Coles
Subject: FW: TVA background soil and CCR material samples
Attachments: solid radium re-reporting.xlsx

Importance: High

From: Jennifer Gable
Sent: Friday, March 29, 2019 4:27 PM
To: CSO – TVA Projects <TVAProjects@testamericainc.com>
Cc: Quinn, James Roy III <jrquinn@tva.gov>; Rock J. Vitale <rvitale@envstd.com>; Amanda Cover <ACover@envstd.com>; TVA_Deliverables <tva_deliverables@envstd.com>; Andrew Piasecki <apiasecki@envstd.com>; Romanko, Terry <Terry.Romanko@testamericainc.com>
Subject: TVA background soil and CCR material samples
Importance: High

1

After discussion with TDEC, we have confirmed that radium analyses for all **background soil** and **CCR material** samples must be conducted using dried, ground material moving forward. For any background soil or CCR material samples currently on hold for radium analyses, please proceed with drying the samples prior to analysis.

Additionally, we will need all previously reported radium data for **background soil** and **CCR material** samples to be dry-weight corrected using the moisture content determined by TestAmerica Pittsburgh and re-reported on a dry-weight basis. I have attached a list of SDGs impacted, please confirm that I haven't missed any.

We are continuing discussions regarding radium data for sediment samples and will advise early next week on the path forward for sediments.

Thanks
Jen

Jennifer N. Gable
Associate Principal Chemist
Environmental Standards, Inc.
1140 Valley Forge Road • PO Box 810 • Valley Forge, PA 19482
610.935.5577 ext. 414 • www.envstd.com • jgable@envstd.com

Emergency Response Quality Assurance Hotline: 855.374.7272



2