ENVIRONMENTAL STANDARDS

Setting the Standards for Innovative Environmental Solutions

Data Validation Report
Tennessee Valley Authority
Cumberland Fossil Plant
Environmental Investigation Plan
Background Soil Samples

This data validation report was revised to update the radium-226+228 uncertainty in the Analytical Results (Section 2) for samples where either the individual radium-226 or radium-228 activity results were negative.

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 13 background soil samples and three aqueous blanks collected on November 29 and 30, 2018, at the Tennessee Valley Authority (TVA) Cumberland 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 for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation (TVA CUF QAPP, Revision 2, January 2018) and the Background Soil Sampling and Analysis Plan for TVA Cumberland Fossil Plant (TVA CUF SAP, June 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 490-164123-1.

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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
CUF-BS-FB07-20181129 (Field Blank)	490-164123-1	490-164123-1	Aq	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG05-2.5/4.5-20181129	490-164123-2	490-164123-1	Soil	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG05-6.5/8.5-20181129	490-164123-3	490-164123-1	Soil	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG05-11.5/13.5-20181129	490-164123-4	490-164123-1	Soil	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG05-0.0/0.5-20181129	490-164123-5	490-164123-1	Soil	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG15-0.0/0.5-20181129	490-164123-6	490-164123-1	Soil	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-DUP01-20181129 (Field Duplicate of CUF-BS-BG15-1.9/3.9-20181129)	490-164123-7	490-164123-1	Soil	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG15-6.5/8.5-20181129	490-164123-8	490-164123-1	Soil	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG15-1.9/3.9-20181129	490-164123-9	490-164123-1	Soil	11/29/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-FB09-20181130 (Field Blank)	490-164123-10	490-164123-1	Aq	11/30/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG17-0.0/0.5-20181130	490-164123-11	490-164123-1	Soil	11/30/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG17-0.75/2.75-20181130	490-164123-12	490-164123-1	Soil	11/30/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG17-6.0/8.0-20181130	490-164123-13	490-164123-1	Soil	11/30/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG17-11.25/13.25-20181130	490-164123-14	490-164123-1	Soil	11/30/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-BG17-15.0/16.9-20181130	490-164123-15	490-164123-1	Soil	11/30/18	Ra-226, Ra-228, Ra-226/228
CUF-BS-EB03-20181130 (Equipment Blank)	490-164123-16	490-164123-1	Aq	11/30/18	Ra-226, Ra-228, Ra-226/228

<u>Parameters Examined</u>

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 and Field Duplicate Results
Chemical Yield	Quantitation of Positive Results

Comments and Exceptions

- 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 re-analyze and re-report radium results for all sediment samples using dried and ground material (see Project Correspondence [Section 5]).

- During data review associated with a TVA SDG, it was discovered that the combined radium-226+228 uncertainty for samples was not calculated correctly when either the individual radium-226 or radium-228 activity results were negative. In these instances, the uncertainty for the analyte with the negative activity was set to zero when the combined radium-226+228 uncertainty was calculated. Environmental Standards provided TestAmerica a spreadsheet with all impacted samples, and the corresponding corrected uncertainty. The corrected uncertainty values were validated by TestAmerica and a spreadsheet of validated corrected radium-226+228 uncertainty values was provided by Environmental Standards. The spreadsheet provided to Environmental Standards was used to update all impacted uncertainties in the database. Additionally, TestAmerica has confirmed they corrected the calculation for all future TVA SDGs (see Project Correspondence [Section 5]).

- 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.

Qualifier Summary

- Any radium-226+228 result 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:	Mital K. Patel, Quality Assurance Chemist
Review performed by:	Danielle Coles, Quality Assurance Chemist
Review reviewed by:	Amanda J. Cover, 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:	8/12/19

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.
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.

TVA CCR Program
Facility: Cumberland Fossil Plant
SDG: 4901641231

Lab Sample ID	490-164123-1
Sys Sample Code	CUF-BS-FB07-20181129
Sample Name	CUF-BS-FB07-20181129
Sample Date	11/29/2018 10:00:00 AM
Location	BG-05
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	6.59	U	S	25.3				N	Yes	1	NA
	Radium 228	15262-20-1	T	PCI/L	6.59	U		15.6	25.0	25.0	50.0	N	Yes	1	NA
	Radium-226	13982-63-3	T	PCI/L	-5.32	U		19.9	33.6	33.6	50.0	N	Yes	1	NA

TVA CCR Program
Facility: Cumberland Fossil Plant
SDG: 4901641231

Lab Sample ID	490-164123-10
Sys Sample Code	CUF-BS-FB09-20181130
Sample Name	CUF-BS-FB09-20181130
Sample Date	11/30/2018 8:40:00 AM
Location	BG-17
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	23.3	U		24.0				N	Yes	1	NA
	Radium 228	15262-20-1	T	PCI/L	12.6	U		19.8	23.1	23.1	50.0	N	Yes	1	NA
	Radium-226	13982-63-3	T	PCI/L	10.7	U		13.5	16.4	16.4	50.0	N	Yes	1	NA

TVA CCR Program
Facility: Cumberland Fossil Plant
SDG: 4901641231

Lab Sample ID	490-164123-11
Sys Sample Code	CUF-BS-BG17-0.0/0.5-20181130
Sample Name	CUF-BS-BG17-0.0/0.5-20181130
Sample Date	11/30/2018 10:02:00 AM
Location	BG-17
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	2.40			0.420				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	0.982			0.284	0.185	0.185	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	1.42			0.309	0.167	0.167	1.00	Y	Yes	1	DRY

TVA CCR Program
Facility: Cumberland Fossil Plant
SDG: 4901641231

Lab Sample ID	490-164123-12
Sys Sample Code	CUF-BS-BG17-0.75/2.75-20181130
Sample Name	CUF-BS-BG17-0.75/2.75-20181130
Sample Date	11/30/2018 9:08:00 AM
Location	BG-17
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	2.11			0.347				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.07			0.237	0.118	0.118	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	1.04			0.253	0.180	0.180	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-13
Sys Sample Code	CUF-BS-BG17-6.0/8.0-20181130
Sample Name	CUF-BS-BG17-6.0/8.0-20181130
Sample Date	11/30/2018 9:15:00 AM
Location	BG-17
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	1.91			0.421				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	0.837			0.345	0.305	0.305	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	1.07			0.242	0.162	0.162	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-14
Sys Sample Code	CUF-BS-BG17-11.25/13.25-20181130
Sample Name	CUF-BS-BG17-11.25/13.25-20181130
Sample Date	11/30/2018 9:34:00 AM
Location	BG-17
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	2.11			0.436				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.08			0.379	0.327	0.327	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	1.03			0.215	0.0650	0.0650	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-15
Sys Sample Code	CUF-BS-BG17-15.0/16.9-20181130
Sample Name	CUF-BS-BG17-15.0/16.9-20181130
Sample Date	11/30/2018 9:49:00 AM
Location	BG-17
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	1.73			0.347				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.02			0.282	0.145	0.145	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	0.712			0.203	0.195	0.195	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-16
Sys Sample Code	CUF-BS-EB03-20181130
Sample Name	CUF-BS-EB03-20181130
Sample Date	11/30/2018 10:21:00 AM
Location	BG-17
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	35.4	J	S	21.2				Y		1	NA
	Radium 228	15262-20-1	T	PCI/L	17.6	U		15.7	20.9	20.9	50.0	N	Yes	1	NA
	Radium-226	13982-63-3	T	PCI/L	17.8			14.2	14.6	14.6	50.0	Y	Yes	1	NA

Lab Sample ID	490-164123-2
Sys Sample Code	CUF-BS-BG05-2.5/4.5-20181129
Sample Name	CUF-BS-BG05-2.5/4.5-20181129
Sample Date	11/29/2018 10:41:00 AM
Location	BG-05
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	1.90			0.434				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.10			0.348	0.427	0.427	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	0.796			0.260	0.223	0.223	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-3
Sys Sample Code	CUF-BS-BG05-6.5/8.5-20181129
Sample Name	CUF-BS-BG05-6.5/8.5-20181129
Sample Date	11/29/2018 10:50:00 AM
Location	BG-05
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	1.62	J	S	0.424				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.42			0.384	0.198	0.198	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	0.201	U		0.180	0.519	0.519	1.00	N	Yes	1	DRY

Lab Sample ID	490-164123-4
Sys Sample Code	CUF-BS-BG05-11.5/13.5-20181129
Sample Name	CUF-BS-BG05-11.5/13.5-20181129
Sample Date	11/29/2018 10:55:00 AM
Location	BG-05
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	1.88			0.430				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.20			0.370	0.411	0.411	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	0.677			0.219	0.178	0.178	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-5
Sys Sample Code	CUF-BS-BG05-0.0/0.5-20181129
Sample Name	CUF-BS-BG05-0.0/0.5-20181129
Sample Date	11/29/2018 11:36:00 AM
Location	BG-05
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	2.18			0.518				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.03			0.389	0.430	0.430	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	1.15			0.342	0.228	0.228	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-6
Sys Sample Code	CUF-BS-BG15-0.0/0.5-20181129
Sample Name	CUF-BS-BG15-0.0/0.5-20181129
Sample Date	11/29/2018 3:41:00 PM
Location	BG-15
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	2.73			0.518				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.32			0.394	0.191	0.191	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	1.41			0.337	0.194	0.194	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-7
Sys Sample Code	CUF-BS-DUP01-20181129
Sample Name	CUF-BS-DUP01-20181129
Sample Date	11/29/2018 12:00:00 AM
Location	BG-15
Sample Type	FD
Parent Sample	CUF-BS-BG15-1.9/3.9-20181129

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	2.23			0.462				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.32			0.388	0.181	0.181	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	0.912			0.251	0.192	0.192	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-8
Sys Sample Code	CUF-BS-BG15-6.5/8.5-20181129
Sample Name	CUF-BS-BG15-6.5/8.5-20181129
Sample Date	11/29/2018 2:55:00 PM
Location	BG-15
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	2.37			0.432				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.72			0.378	0.175	0.175	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	0.646			0.209	0.133	0.133	1.00	Y	Yes	1	DRY

Lab Sample ID	490-164123-9
Sys Sample Code	CUF-BS-BG15-1.9/3.9-20181129
Sample Name	CUF-BS-BG15-1.9/3.9-20181129
Sample Date	11/29/2018 2:55:00 PM
Location	BG-15
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	2.35			0.541				Y	Yes	1	DRY
	Radium 228	15262-20-1	T	PCI/G	1.33			0.433	0.230	0.230	1.00	Y	Yes	1	DRY
	Radium-226	13982-63-3	T	PCI/G	1.02			0.324	0.276	0.276	1.00	Y	Yes	1	DRY

SECTION 3

SUPPORTING DOCUMENTATION FOR QUALIFIERS

ENVIRONMENTAL STANDARDS

RADIOLOGICAL ANALYSIS SUPPORT DOCUMENTATION

ESI project name:	TVA-CUF EI	Reviewed by:	Danielle Coles
Sample Collection Dates:	4/29-4/30/19	Approved by:	AJC
Job Number:	20188111.A000	Completion Date:	5/19
Project Manager:	AJC		
Laboratory:	TestAmerica-St. Louis		

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

			Sample No.	Lab Control No.
Deliverable:	Level IV (Full)	(X)	490-164123-1	
	Limited	( )		
	Other:			

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

	Criteria Examined in Detail Check (√) if Yes or Footnote Letter for Comments Below					Problems Identified Check (√) if Yes or Footnote Letter for Comments Below					Support Documentation Attachments Check (√) if Yes or Footnote Letter for Comments Below				
	901.1					901.1					901.1				
Holding Times	X														
Blank Analysis Results	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:															

Comments: All results are usable unless otherwise qualified.

Client Sample Results

Client: Environmental Standards Inc.
Project/Site: CUF_BS_20181129_2B

Job ID: 490-164123-1

Client Sample ID: CUF-BS-FB07-20181129

Date Collected: 11/29/18 10:00
Date Received: 11/30/18 15:10

Lab Sample ID: 490-164123-1

Matrix: Water

6

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	-5.32	U, S	19.9	19.9	50.0	33.6	pCi/L	12/06/18 11:00	12/27/18 02:52	1
Radium-228	6.59	U	15.6	15.6	50.0	25.0	pCi/L	12/06/18 11:00	12/27/18 02:52	1
Radium 226 and Radium 228	6.59	U	15.6	~~15.6~~ 25.3			pCi/L	12/06/18 11:00	12/27/18 02:52	1

Client Sample Results

Client: Environmental Standards Inc.
Project/Site: CUF_BS_20181129_2B

Job ID: 490-164123-1

Client Sample ID: CUF-BS-BG05-6.5/8.5-20181129

Lab Sample ID: 490-164123-3

Date Collected: 11/29/18 10:50
Date Received: 11/30/18 15:10

Matrix: Solid

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.201	U	0.178	0.180	1.00	0.519	pCi/g	12/05/18 17:49	12/26/18 07:49	1
Radium-228	1.42		0.355	0.384		0.198	pCi/g	12/05/18 17:49	12/26/18 07:49	1
Radium 226 and Radium 228	1.62	J, S	0.397	0.424		0.519	pCi/g	12/05/18 17:49	12/26/18 07:49	1

6

Client Sample Results

Client: Environmental Standards Inc.
Project/Site: CUF_BS_20181129_2B

Job ID: 490-164123-1

Client Sample ID: CUF-BS-FB09-20181130

Date Collected: 11/30/18 08:40
Date Received: 11/30/18 15:10

Lab Sample ID: 490-164123-10

Matrix: Water

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	10.7	U	13.5	13.5	50.0	16.4	pCi/L	12/06/18 11:00	12/27/18 05:51	1
Radium-228	12.6	U	19.8	19.8	50.0	23.1	pCi/L	12/06/18 11:00	12/27/18 05:51	1
Radium 226 and Radium 228	**23.3**	U	24.0	24.0			pCi/L	12/06/18 11:00	12/27/18 05:51	1

SECTION 4

CASE NARRATIVE AND CHAIN-OF-CUSTODY RECORD

Case Narrative

Client: Environmental Standards Inc.
Project/Site: CUF_BS_20181129_2B

Job ID: 490-164123-1

Job ID: 490-164123-1

Laboratory: Eurofins TestAmerica, Nashville

4

Narrative

Job Narrative
490-164123-1

Revised Report
This report was revised to adjust the solid sample results for dry weight using the dry weight results from TA-Nashville. This replaces the previous final report. No qual. flag due to this revision

Receipt
The samples were received on 11/30/2018 3:10 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 5 coolers at receipt time were 2.5° C, 3.0° C, 4.9° C, 5.2° C and 5.5° C.

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

TVA Environmental Investigations

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No: 1 of 5 29
COC No: CUF_BS_20181129_18
1 of 2 Pages
Task Desc: CUF_BS

Rev. 1
DC 12/19/18

Required Ship to Lab:
Lab Name: TestAmerica Nashville
Lab Address: 2960 Foster Creighton Drive, Nashville, TN 37204
Lab Manager Contact Information
Lab PM: Gali Lage
Phone/Fax: 615-301-5741/615-726-3404
Lab Email: Gali.Lage@testamericainc.com

Required Project Information:
Site ID #: CUMBERLAND FOSSIL PLANT
Project #: 49014071
Site Address: 815 Cumberland City Road
City: Cumberland City | State, Zip: TN, 37050
Site PM Name: Roy Quinn
Phone/Fax: 423-751-3753
Site PM Email:

Required Sampler Information:
Sampler: M Edmunds, S Boldon and W. Padgett
Sampling Company: Stantec
Address: Warehouse Row North 1110 Market Street, Suite
City/State: Chattanooga | Phone: 901-319-8787
Sampling Team Number: 1
Send EDD/Hard Copy to:

Analysis Turnaround Time
CALENDAR DAYS | WORKING DAYS
TAT if different from Below
24 Hours
3 Business Days
5 Business Days
10 Business Days (Standard)

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Start Depth (Depth Unit)	Sample Depth: End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/ Lab Sample I.D.	MS/MSD	Analysis: BACKGROUND_SOIL_RAD	Analysis: BACKGROUND_SOIL_SULFIDE_RAD
1	CUF-BS-FB07-20181129	BG-C5	NA	NA	W	G	FB	11/29/2018	1000	3		☐		X
2	CUF-BS-BG05-2.5/4.5-20181129	BG-05	2.5	4.5	S	G	N	11/29/2018	1041	2		☐	X	
3	CUF-BS-BG05-6.5/8.5-20181129	BG-05	6.5	8.5	S	G	N	11/29/2018	1050	2		☐	X	
4	CUF-BS-BG05-11.5/13.5-20181129	BG-05	11.5	13.5	S	G	N	11/29/2018	1055	2		☐	X	
5	CUF-BS-BG05-0.0/0.5-20181129	BG-05	0.0	0.5	S	G	N	11/29/2018	1136	2		☐	X	
6	CUF-BS-BG15-0.0/0.5-20181129	BG-15	0.0	0.5	S	G	N	11/29/2018	1541	2		☐	X	
7	CUF-BS-DUP01-20181129	-	-	-	S	G	N	11/29/2018	-	2		☐	X	
8	CUF-BS-BG15-5.5/8.5-20181129	BG-15	6.5	8.5	S	G	N	11/29/2018	1455	2		☐	X	
9	CUF-BS-BG15-1.0/3.9-20181129	BG-15	1.9	3.9	S	G	N	11/29/2018	1455	2		☐	X	

Additional Comments/Special Instructions:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Suama Boldon (Stantec)	11/30/2018	1235	Carolyn Stanton (Stantec)	11/30	1235

Sample Receipt Conditions: Temperature in °C | Sample on Ice? | Sample Intact? | Trip Blank?

SHIPPING METHOD:	SAMPLER NAME AND SIGNATURE
Hand delivery to TestAmerica (Nashville)	Suama Boldon
	Walker Padgett
	Matt Edmunds

Loc: 490
164123
#1
A

TA-NAS 11-30-2018 15:10 5.2, 3.0, 2.5, 4.5, 4.9, 5.5

Form TVA 10657A

TVA Environmental Investigations

Tennessee Valley Authority

COOLER No.:	1 of 5
COC No:	CUF_BS_20181129_1B
1 of 2 Pages	
Task Desc.	CUF_BS

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	TestAmerica Nashville	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	M. Edmunds, S. Bolden and W. Padgett
Lab Address:	2960 Foster Creighton Drive, Nashville, TN 37204	Project #:	49014071	Sampling Company:	Stantec
		Site Address	815 Cumberland City Road	Address	Warehouse Row North 1110 Market Street, Suite
		City	Cumberland City State, Zip: TN, 37763	City/State	Chattanooga Phone: 901-319-8787
Lab Manager Contact Information		Site PM Name:	Roy Quinn		
Lab PM:	Gail Lage	Phone/Fax:	423-751-3753	Sampling Team Number:	1
Phone/Fax:	615-301-5741/615-726-3404	Site PM Email:	[illegible]	Send EDD/Hard Copy to:	[illegible]
Lab Email:	Gail.Lage@testamericainc.com				

Analysis Turnaround Time: CALENDAR DAYS / WORKING DAYS

TAT Different from Below

- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☐ 10 Business Days (Standard)

Loc: 490
164123
#1
A

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Start Depth	Sample Depth: End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/ Lab Sample I.D.	MS/MSD	Analysis: BACKGROUND SOIL_RAD	Analysis: BACKGROUND SOIL_BLANKS_RAD	Filtered	Preserve Type
1	CUF-BS-FB07-20181129	BG-05	NA	NA	W	G	FB	11/29/2018	1000	3		☐		X	N	
2	CUF-BS-BG05-2.5/4.5-20181129	BG-05	2.5	4.5	S	G	N	11/29/2018	1041	2		☐	X		N	
3	CUF-BS-BG05-6.5/8.5-20181129	BG-05	6.5	8.5	S	G	N	11/29/2018	1050	2		☐	X		N	
4	CUF-BS-BG05-11.5/13.5-20181129	BG-05	11.5	13.5	S	G	N	11/29/2018	1055	2		☐	X		N	
5	CUF-BS-BG05-0.0/0.5-20181129	BG-05	0.0	0.5	S	G	N	11/29/2018	1136	2		☐	X		N	
6	CUF-BS-BG15-0.0/0.5-20181129	BG-15	0.0	0.5	S	G	N	11/29/2018	1541	2		☐	X		N	
7	CUF-BS-DUP01-20181129	-	-	-	S	G	N	11/29/2018	-	2		☐	X		N	
8	CUF-BS-BG15-6.5/8.5-20181129	BG-15	6.5	8.5	S	G	N	11/29/2018	1455	2		☐	X		N	
9	CUF-BS-BG15-1.9/3.9-20181129	BG-15	1.9	3.9	S	G	N	11/29/2018	1455	2		☐	X		N	

Additional Comments/Special Instructions:

SB 11/30/2018

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Shama Bolden (Stantec)	11/30/2018	1235	Carolyn Senton Stantec	11/30	1235
SB 11/30/2018			SB 11/30/18		
11/30/18					
SB 11/30/2018					

SHIPPING METHOD:	SAMPLER NAME AND SIGNATURE
hand delivery to Test America (Nashville)	Shama Bolden
	Walker Padgett
	Matt Edmunds

Sample Receipt Conditions: Temperature in °C; Sample on ice? Y/N; Sample intact? Y/N; Trip Blank? Y/N

Keith Jackson TA-NAS 11-30-2018 @ 15:10 5.2, 3.0, 2.5, 4.5, 4.9, 5.5

Form TVA 30057A

TVA Environmental Investigations

Tennessee Valley Authority

COOLER No.:	1	of	5
COC No:	CUF_BS_20181129_2B		
2 of 2 Pages			
Task Desc:	CUF_BS		

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	TestAmerica Nashville	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	M.Edmunds, S.Bolden and W. Padgett
Lab Address:	2960 Foster Creighton Drive	Project #:	49014071	Sampling Company:	Stantec
	Nashville, TN 37204	Site Address	815 Cumberland City Road	Address	Warehouse Row North 1110 Market Street, Suite
		City	Cumberland City State, Zip: TN, 37753	City/State	Chattanooga Phone: 901-319-8787
Lab Manager Contact Information		Site PM Name:	Roy Quinn		
Lab PM:	Gail Lace	Phone/Fax:	423-751-3753	Sampling Team Number:	-
Phone/Fax:	615-301-5741/615-726-3404	Site PM Email:	[illegible]	Send EDD/Hard Copy to:	[illegible]
Lab Email:	Gail.Lace@testamericainc.com				

Analysis Turnaround Time: CALENDAR DAYS / WORKING DAYS

TAT if different from Below _____

☐ 24 Hours ☐ 3 Business Days ☐ 5 Business Days ☐ 10 Business Days (Standard)

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Start Depth (Depth Unit)	Sample Depth: End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/ Lab Sample I.D.	MS/MSD	Analysis: BACKGROUNDSOIL_RAD	Analysis: BACKGROUNDSOIL_BLANKS_RAD
1	CUF-BS-FB09-20181130	BG-17	NA	NA	W	G	FB	11/30/2018	0840	3		☐		x
2	CUF-BS-BG17-0.0/0.5-20181130	BG-17	0.0	0.5	S	G	N	11/30/2018	1002	1		☐	x	
3	CUF-BS-BG17-0.75/2.75-20181130	BG-17	0.75	2.75	S	G	N	11/30/2018	0908	2		☐	x	
4	CUF-BS-BG17-6.0/8.0-20181130	BG-17	6.0	8.0	S	G	N	11/30/2018	0915	2		☐	x	
5	CUF-BS-BG17-11.25/13.25-20181130	BG-17	11.25	13.25	S	G	N	11/30/2018	0934	2		☑	x	
6	CUF-BS-BG17-15.0/16.9-20181130	BG-17	15.0	16.9	S	G	N	11/30/2018	0949	2		☐	x	
7	CUF-BS-EB03-20181130	BG-17	NA	NA	W	G	EB	11/30/2018	1021	3		☐		x

Preserved: Yes / No / (HCl)

Loc: 490
164123
#1
B

Additional Comments/Special Instructions:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Suama Bolden (Stantec)	11/30/2018	1235	Carolyn Sexton (Stantec)	11/30/18	1235
	11/30/2018			11/30/18	
	11/30/18				

SHIPPING METHOD:	SAMPLER NAME AND SIGNATURE
Hand delivery to Test America (Nashville)	Suama Bolden
	Walker Padgett
	Matt Edmunds

Sample Receipt Conditions: Temperature in °C / Sample on ice? / Sample intact? / Trip Blank?

Keith Dunn TA-NAS 11-30-2018 15:10 5.2, 3.0, 2.5, 4.5, 4.9, 5.5

Form TVA 30067A

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

490-164123 Chain of Custody

Cooler Received/Opened On 11/30/2018 @ 1510

Time Samples Removed From Cooler_____ Time Samples Placed In Storage_____ (2 Hour Window)

1. Tracking # N/A (last 4 digits, FedEx) Courier: Client

IR Gun ID 31470368 pH Strip Lot_____ Chlorine Strip Lot_____

2. Temperature of rep. sample or temp blank when opened: 5.2 Degrees Celsius

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

If yes, how many and where:_____

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) EA

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

Larger than this.

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) EA

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES...NO...NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) EA

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) EA

I certify that I attached a label with the unique LIMS number to each container (intial) EA

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...#_____

BIS = Broken in shipment

Cooler Receipt Form.doc LF-1 Revised 8/23/17

End of Form

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

Loc: 490

164123

COOLER RECEIPT FORM

Cooler Received/Opened On 11/30/2018 @ 1510

Time Samples Removed From Cooler ____ Time Samples Placed In Storage ____ (2 Hour Window)

1. Tracking # N/A (last 4 digits, FedEx) Courier: Client

IR Gun ID 31470368 pH Strip Lot ____ Chlorine Strip Lot ____

2. Temperature of rep. sample or temp blank when opened: 3.0 Degrees Celsius

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

If yes, how many and where: ____

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) EA

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

Larger than this.

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) EA

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES...NO...NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) EA

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) EA

I certify that I attached a label with the unique LIMS number to each container (intial) EA

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...#____

BIS – Broken in shipment

Cooler Receipt Form.doc

LF-1

Revised 8/23/17

End of Form

Log: 490
164123

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECEIPT FORM

Cooler Received/Opened On 11/30/2018 @ 1510

Time Samples Removed From Cooler_____ Time Samples Placed In Storage_____ (2 Hour Window)

1. Tracking # N/A (last 4 digits, FedEx) Courier: Client

IR Gun ID 31470368 pH Strip Lot_____ Chlorine Strip Lot_____

2. Temperature of rep. sample or temp blank when opened: 2.5 Degrees Celsius

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

If yes, how many and where:_____

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) EA

7. Were custody seals on containers: YES NO and intact YES...NO...NA

Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

Larger than this.

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # 1of4

I certify that I unloaded the cooler and answered questions 7-14 (intial) EA

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES...NO...NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) EA

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) EA

I certify that I attached a label with the unique LIMS number to each container (intial) EA

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...#_____

BIS = Broken in shipment

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

Loc: 490

164123

COOLER RECEIPT FORM

Cooler Received/Opened On 11/30/2018 @1510

Time Samples Removed From Cooler _____ Time Samples Placed In Storage_____ (2 Hour Window)

1. Tracking # NA (last 4 digits, FedEx) Courier: Client

IR Gun ID 31470368 pH Strip Lot_____ Chlorine Strip Lot_____

2. Temperature of rep. sample or temp blank when opened: 4.9 Degrees Celsius

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

If yes, how many and where:_____

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) EY

7. Were custody seals on containers: YES NO and intact YES...NO...NA

Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

Larger than this.

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) EY

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES...NO...NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) EY

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) EY

I certify that I attached a label with the unique LIMS number to each container (intial) EY

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...#_____

BIS - Broken in shipment

Cooler Receipt Form.doc

LF-1

Revised 8.23.17

End of Form

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

Loc: 490

164123

COOLER RECEIPT FORM

Cooler Received/Opened On 11/30/2018 @ 1510

Time Samples Removed From Cooler_____ Time Samples Placed In Storage_____ (2 Hour Window)

1. Tracking # N/A (last 4 digits, FedEx) Courier: Client

IR Gun ID 31470368 pH Strip Lot_____ Chlorine Strip Lot_____

2. Temperature of rep. sample or temp blank when opened: 5.5 Degrees Celsius

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO NA

4. Were custody seals on outside of cooler? YES...NO...NA

If yes, how many and where:_____

5. Were the seals Intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) EA

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry Ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

Larger than this.

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) EA

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES...NO...NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) EA

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) EA

I certify that I attached a label with the unique LIMS number to each container (intial) EA

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...#_____

BIS = Broken in shipment

Cooler Receipt Form.doc LF 1 Revised 8/23/17

End of Form

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Phone (615) 726-0177 Fax (615) 726-3404

Chain of Custody Record

TestAmerica

Client Information (Sub Contract Lab)	Sampler	Lab PM: Lage, Gail	Carrier Tracking No(s):	COC No: 490-83133.1
Client Contact: Shipping/Receiving	Phone	E-Mail: gail.lage@testamericainc.com	State of Origin: Tennessee	Page: Page 1 of 2
Company: TestAmerica Laboratories, Inc		Accreditations Required (See note):		Job #: 490-164123.1
Address: 13715 Rider Trail North	Due Date Requested: 1/3/2019			
City: Earth City	TAT Requested (days):			
State, Zip: MO, 63045				
Phone: 314-298-8566(Tel), 314-298-8757(Fax)	PO #:			
Email:	WO #:			
Project Name: CUF_BS_20181129_1B	Project #: 49014071			
Site:	SSOW#:			

Preservation Codes:
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 Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

Analysis Requested

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (Wastewater, Sewage, Sludge, Drinking Water, Tissue, Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	901.1_Ra/Fil_Geo_21 (MOD) Radium-226/228	Total Number of containers	Special Instructions/Note:
			Preservation Code						
CUF-BS-FB07-20181129 (490-164123-1)	11/29/18	10:00 Central		Water			X	3	TVA
CUF-BS-BG05-2.5/4.5-20181129 (490-164123-2)	11/29/18	10:41 Central		Solid			X	2	TVA
CUF-BS-BG05-6.5/8.5-20181129 (490-164123-3)	11/29/18	10:50 Central		Solid			X	2	TVA
CUF-BS-BG05-11.5/13.5-20181129 (490-164123-4)	11/29/18	10:55 Central		Solid			X	2	TVA
CUF-BS-BG05-0.0/0.5-20181129 (490-164123-5)	11/29/18	11:36 Central		Solid			X	2	TVA
CUF-BS-BG15-0.0/0.5-20181129 (490-164123-6)	11/29/18	15:41 Central		Solid			X	2	TVA
CUF-BS-DUP01-20181129 (490-164123-7)	11/29/18	00:01 Central		Solid			X	2	TVA
CUF-BS-BG15-5.5/8.5-20181129 (490-164123-8)	11/29/18	14:55 Central		Solid			X	2	TVA
CUF-BS-BG15-1.9/3.9-20181129 (490-164123-9)	11/29/18	14:55 Central		Solid			X	2	TVA

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon our 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/tests/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	☐ Return To Client ☐ Disposal By Lab ☐ Archive For ___ Months
Deliverable Requested: I, II, III, IV, Other (specify) — Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date	Time	Method of Shipment

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
[signature]	12/3/18 @ 1555	TANAS	[signature]	12/05/18 1000	TAS
Relinquished by	Date/Time	Company	Received by	Date/Time	Company
Relinquished by:	Date/Time	Company	Received by	Date/Time	Company

Custody Seals Intact: Yes No	Custody Seal No:	Cooler Temperature(s) °C and Other Remarks:

Ver: 09/20/2016

TestAmerica Nashville
4960 Eastern Creighton Drive
Nashville, TN 37204
Phone (615) 726-8177 Fax (615) 726-3404

Chain of Custody Record

TestAmerica

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Lage, Gail	Carrier Tracking No(s):	COC No: 490-831332
Client Contact: Shipping/Receiving	Phone:	E-Mail: gail.lage@testamericainc.com	State of Origin: Tennessee	Page: Page 2 of 2
Company: TestAmerica Laboratories, Inc.		Accred. Labs Required (See note):		Job #: 490-164123-1
Address: 13715 Rider Trail North	Due Date Requested: 1/3/2019			
City: Earth City	TAT Requested (days):			
State, Zip: MO, 63045				
Phone: 314-298-8566(Tel), 314-298-8757(Fax)	PO #:			
Email:	WO #:			
Project Name: CUF_BS_20181129_1B	Project #: 49014071			
Site:	SSOW#:			

Preservation Codes
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 Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

Analysis Requested

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (Wastewater, Sewage, Drinking Water, Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	901.1_Ra/Fill_Geo_21 (MOD) Radium-226/228	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
CUF-BS-FB09-20181130 (490-164123-10)	11/30/18	08:40 Central		Water			X	3	TVA
CUF-BS-BG17-0.0/0.5-20181130 (490-164123-11)	11/30/18	10:02 Central		Solid			X	1	TVA
CUF-BS-BG17-0.75/2.75-20181130 (490-164123-12)	11/30/18	09:08 Central		Solid			X	2	TVA
CUF-BS-BG17-6.5/8.0-20181130 (490-164123-13)	11/30/18	09:15 Central		Solid			X	2	TVA
CUF-BS-BG17-11.25/13.25-20181130 (490-164123-14)	11/30/18	09:34 Central		Solid			X	2	TVA
CUF-BS-BG17-15.0/16.9-201811360 (490-164123-15)	11/30/18	09:40 Central		Solid			X	2	TVA
CUF-BS-EB03-20181130 (490-164123-16)	11/30/18	10:21 Central		Water			X	3	TVA

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon our 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/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other sub-contract laboratory as may be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. 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	☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months
Deliverable Requested: I, II, III, IV, Other (specify) — Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by	Date	Time	Method of Shipment

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
[signature]	12-3-18@1555	TAWS	[signature]	12/05/18 1000	TAS
Relinquished by	Date/Time	Company	Received by	Date/Time	Company
Relinquished by	Date/Time	Company	Received by	Date/Time	Company

Custody Seals Intact: Yes No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 09/20/2016

Login Sample Receipt Checklist

Client: Environmental Standards Inc

Job Number: 490-164123-1

Login Number: 164123
List Number: 2
Creator: Hellm, Michael

List Source: TestAmerica St. Louis
List Creation: 12/05/18 03:33 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= 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.	False	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	17.0
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 <6mm (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: 490-164123-1

Login Number: 164123
List Number: 3
Creator: Hellm, Michael

List Source: TestAmerica St. Louis
List Creation: 12/05/18 03:37 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= 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.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	17.0
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 <6mm (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 12:31 PM
To: Danielle Coles
Subject: FW: TVA background soil and CCR material samples

From: Lage, Gail [mailto:Gail.Lage@testamericainc.com]
Sent: Friday, March 29, 2019 4:42 PM
To: Jennifer Gable <jgable@envstd.com>; 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>; Vicinie, Rusty <Rusty.Vicinie@testamericainc.com>
Subject: RE: TVA background soil and CCR material samples

Jen - thanks for the update. We will get the samples on hold start as soon as possible.

As for the revised reports that will take some IT input, so we will get that started as well.

Thanks

Gail Lage

Phone: 615-301-5741

E-mail: Gail.Lage@testamericainc.com

From: Jennifer Gable [mailto:jgable@envstd.com]
Sent: Friday, March 29, 2019 3:27 PM
To: CSO – TVA Projects
Cc: Quinn, James Roy III; Rock J. Vitale; Amanda Cover; TVA_Deliverables; Andrew Piasecki; Romanko, Terry
Subject: TVA background soil and CCR material samples
Importance: High

-External Email-

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

ENVIRONMENTAL®
STANDARDS

Amanda Cover

From: Lage, Gail <Gail.Lage@testamericainc.com>
Sent: Tuesday, July 30, 2019 1:09 PM
To: Jennifer Gable; Andrew Piasecki; CSO – TVA Projects
Cc: TVA_Deliverables; Amanda Cover; Danielle Coles; Ammie Martin; Rock J. Vitale; Vicinie, Rusty; Carnes, Jodie
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc
Attachments: CAR 901.1 Ra-226 + Ra-228 Uncertainty.pdf; 901.1_uncertainties_072619.pdf

Jen – I apologize for the delay. Attached is the letter and updated table. Please let me know if you need anything else.

Thanks

Gail Lage
Senior Project Manager

Eurofins TestAmerica
2960 Foster Creighton Drive
Nashville, TN 37204
USA

Phone: 615-301-5741

From: Jennifer Gable [mailto:jgable@envstd.com]
Sent: Friday, July 26, 2019 11:34 AM
To: Andrew Piasecki; Lage, Gail; CSO – TVA Projects
Cc: TVA_Deliverables; Amanda Cover; Danielle Coles; Ammie Martin; Rock J. Vitale; Vicinie, Rusty; Carnes, Jodie
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc
Importance: High

Can we please get an update on this issue? We are holding data finalization pending resolution.

Thanks
Jen

Jennifer N. Gable
Associate Principal Chemist
Environmental Standards, Inc.
(610) 935.5577 x 414

From: Andrew Piasecki <apiasecki@envstd.com>
Sent: Monday, July 22, 2019 5:02 PM
To: Lage, Gail <Gail.Lage@testamericainc.com>; Jennifer Gable <jgable@envstd.com>; CSO – TVA Projects <TVAProjects@testamericainc.com>
Cc: TVA_Deliverables <tva_deliverables@envstd.com>; Amanda Cover <ACover@envstd.com>; Danielle Coles <dcoles@envstd.com>; Ammie Martin <amartin@envstd.com>; Rock J. Vitale <rvitale@envstd.com>
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc

Hi Gail,

Attached are outstanding email requests for the "older" radium samples. We need to have these radium data requests resolved by the end of this week (or sooner). This includes the combined radium uncertainty calcuation issues. Do you have any updates?

Thanks,
Andrew

From: Andrew Piasecki
Sent: Wednesday, July 17, 2019 4:45 PM
To: 'Lage, Gail' <Gail.Lage@testamericainc.com>; Jennifer Gable <jgable@envstd.com>; CSO – TVA Projects <TVAProjects@testamericainc.com>
Cc: TVA_Deliverables <tva_deliverables@envstd.com>; Amanda Cover <ACover@envstd.com>; Danielle Coles <dcoles@envstd.com>; Ammie Martin <amartin@envstd.com>; Rock J. Vitale <rvitale@envstd.com>
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc

Hi Gail,

These samples were not included in the spreadsheet that I sent on July 5th. Please include them in your review:

Sample Name	analytic_method	lab_sdg	lab_sample_id	Reported Uncertainty for Radium 226+228
JOF-SED-BH02-CORRB-0.0/0.5-20190124	EPA 901.1	180861851	180-86185-60	0.200
JSF-CCR-FB16-20190423	EPA 901.1	180894481	180-89448-5	19.1
JSF-CCR-EB03-20190409	EPA 901.1	180888511	180-88851-4	15.2
JSF-CCR-EB05-20190501	EPA 901.1	180896681	180-89668-1	12.2
JSF-CCR-FB19-20190501	EPA 901.1	180896681	180-89668-5	0.00000
JSF-CCR-FB20-20190513	EPA 901.1	180901011	180-90101-1	19.7
JSF-CCR-FB21-20190514	EPA 901.1	180901041	180-90104-1	0.00000

Thanks,
Andrew

From: Lage, Gail <Gail.Lage@testamericainc.com>
Sent: Wednesday, July 10, 2019 6:39 PM
To: Jennifer Gable <jgable@envstd.com>; Andrew Piasecki <apiasecki@envstd.com>; CSO – TVA Projects <TVAProjects@testamericainc.com>
Cc: TVA_Deliverables <tva_deliverables@envstd.com>; Amanda Cover <ACover@envstd.com>; Danielle Coles <dcoles@envstd.com>; Ammie Martin <amartin@envstd.com>; Rock J. Vitale <rvitale@envstd.com>
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc

Jen – understood.

Thanks

Gail Lage

Senior Project Manager

Eurofins TestAmerica
2960 Foster Creighton Drive
Nashville, TN 37204
USA

Phone: 615-301-5741

From: Jennifer Gable [mailto:jgable@envstd.com]
Sent: Wednesday, July 10, 2019 5:25 PM
To: Andrew Piasecki; Lage, Gail; CSO – TVA Projects
Cc: TVA_Deliverables; Amanda Cover; Danielle Coles; Ammie Martin; Rock J. Vitale
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc

[redacted]

Hi Gail,

To proceed with our proposed plan below, we need Eurofins TestAmerica to provide confirmation, on your letterhead, of the corrected uncertainties for the samples impacted by this issue. You're welcome to use our calculation spreadsheet or perform your own calculations, but we won't be able to perform any updates until this information is provided formally by Eurofins TestAmerica.

Please let me know if you have any questions.

Thanks
Jen

Jennifer N. Gable
Associate Principal Chemist
Environmental Standards, Inc.
(610) 935.5577 x 414

From: Andrew Piasecki
Sent: Friday, July 5, 2019 1:31 PM
To: Lage, Gail <Gail.Lage@testamericainc.com>; CSO – TVA Projects <TVAProjects@testamericainc.com>
Cc: TVA_Deliverables <tva_deliverables@envstd.com>; Jennifer Gable <jgable@envstd.com>; Amanda Cover <ACover@envstd.com>; Danielle Coles <dcoles@envstd.com>; Ammie Martin <amartin@envstd.com>; Rock J. Vitale <rvitale@envstd.com>
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc

Hi Gail,

The uncertainties associated the negative results should be used to calculate the total uncertainty for combined radium 226+228 similar to the way it is being reported for methods 903.0 and 904.0. The reported uncertainty for combined radium-226+228 should be calculated as the combined uncertainty of the individual isotope results, calculated as the square root of the sum of the squared individual uncertainties (see the equation below).

Our plan is to write a memo and manually update the database with the correct uncertainties for combined radium 226+228. I've attached a spreadsheet comparing the currently reported uncertainties to the uncertainties calculated using the equation listed below. Please review the calculated uncertainties (column AG of the attachment), and confirm

that they are correct. Upon your confirmation, we will manually update the database. Also, please ensure that the uncertainties for combined rad 226+228 are calculated and reported correctly for all data going forward.

$$\text{Total uncertainty for combined Rad 226 and 228} = \sqrt{(\text{rad 226 uncertainty})^2 + (\text{rad 228 uncertainty})^2}$$

Thank you,

Andrew L. Piasecki
Quality Assurance Chemist
Environmental Standards, Inc.
1140 Valley Forge Road • PO Box 810 • Valley Forge, PA 19482
610.935.5577 ext. 433 • www.envstd.com • apiasecki@envstd.com

Emergency Response Quality Assurance Hotline: 855.374.7272

ENVIRONMENTAL® STANDARDS

From: Lage, Gail [mailto:Gail.Lage@testamericainc.com]
Sent: Wednesday, June 26, 2019 6:25 PM
To: Jennifer Gable <jgable@envstd.com>; Andrew Piasecki <apiasecki@envstd.com>; CSO – TVA Projects <TVAProjects@testamericainc.com>
Cc: TVA_Deliverables <tva_deliverables@envstd.com>; Amanda Cover <ACover@envstd.com>; Danielle Coles <dcoles@envstd.com>; Ammie Martin <amartin@envstd.com>; Rock J. Vitale <rvitale@envstd.com>
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc

I know why it is doing what it is doing. For the results, only the positive numbers are used to calculate the total for TVA. Therefore it is not using the uncertainty from the negative result to calculate the total uncertainty.

Gail Lage
Senior Project Manager

Eurofins TestAmerica
2960 Foster Creighton Drive
Nashville, TN 37204
USA

Phone: 615-301-5741

From: Jennifer Gable [mailto:jgable@envstd.com]
Sent: Wednesday, June 26, 2019 1:22 PM
To: Andrew Piasecki; CSO – TVA Projects
Cc: TVA_Deliverables; Amanda Cover; Danielle Coles; Ammie Martin; Rock J. Vitale
Subject: RE: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc
Importance: High

External Email

Gail - please hold on this request for now, we have some thoughts on resolution that I'd like to discuss internally. We'll get back to you shortly.

Jennifer N. Gable
Associate Principal Chemist
Environmental Standards, Inc.
(610) 935.5577 x 414

From: Andrew Piasecki
Sent: Wednesday, June 26, 2019 1:40 PM
To: CSO – TVA Projects <TVAProjects@testamericainc.com>
Cc: TVA_Deliverables <tva_deliverables@envstd.com>; Amanda Cover <ACover@envstd.com>; Jennifer Gable <jgable@envstd.com>; Danielle Coles <dcoles@envstd.com>; Ammie Martin <amartin@envstd.com>; Rock J. Vitale <rvitale@envstd.com>
Subject: TVA TDEC - Method 901.1 Combined Rad Uncertainty Calc

Hi Gail,

For the Method 901.1 rad data, it appears that the total uncertainties for combined radium 226+228 were not reported correctly when a negative value was reported for one (or both) of the isotopes. In these instances, it appears that the uncertainty for the isotope was treated as zero instead of being calculated as part of the root sum square. For example, in SDG 180-87481-1, the results for sample 180-87481-2 were reported as:

Method 901.1	Result (pCI/g)	Uncertainty
Rad-226	0.391	0.173
Rad-228	-0.221	0.528
Combined Rad 226+228	0.391	0.173

According to the reporting protocols, the combined rad 226+228 uncertainty should have been reported as ~0.556 in this example.

I've attached a list of samples where this issue has been identified. Please review the total uncertainty calculations and revise the data as appropriate.

Thank you,

Andrew L. Piasecki
Quality Assurance Chemist
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From: Ammie Martin
Sent: Friday, June 21, 2019 2:10 PM
To: Andrew Piasecki <apiasecki@envstd.com>
Subject: Total Uncertainty Calculation Discrepancy

During review of report 180-87481-1, it was noted that the total uncertainty (2σ) for combined radium-226/-228 in the US EPA Method 901.1 portion of sample 180-87481-2 did not take into account the result from the radium-228 analysis. The total uncertainty (2σ) reported was equal to that of radium-226. This is not consistent with the calculation of the total uncertainty (2σ) for combined radium-226/-228 in the other methods or samples reported. It appears that the system used zero for the radium-228 total uncertainty (2σ) in the calculation in the same manner it used zero for the negative radium-228 activity when calculating the combined radium-226/-228 activity. For all US EPA Method 901.1 samples where both components were positive (whether > MDC or < MDC) and for all GFPC samples, the total uncertainty was correctly calculated as the root sum square (RSS; the square root of the sum of the squared individual uncertainties).

Ammie Martin
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July 30, 2019

Environmental Standards, Inc.
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RE: EPA 901.1 Radium-226 + Radium-228, Incorrect Uncertainty Calculation

Dear Ms. Gable

It was recently discovered that sample uncertainty was being incorrectly calculated for the summation analyte Radium-226 + Radium-228 by EPA method 901.1. When either of the analyte results was negative, the uncertainty for that analyte was being set to zero.

Environmental Standards provided Eurofins TestAmerica with a spreadsheet of affected data that included the corrected uncertainty. This spreadsheet was then validated by the Quality Assurance Manager on July 26th, 2019. One error was found (sample JOF-SED-BH02-CORRB-0.0/0.5-20190124, lab ID 180-86185-60). This was corrected, and a PDF of the spreadsheet has been included (see attachment "901.1_uncertainties_072619").

The uncertainty calculation for Ra-226 + Ra-228 has been corrected by the Eurofins TestAmerica IT department, and has been verified by Terry Romanko, the Technical Director at the St. Louis facility.

Eurofins TestAmerica St. Louis prides itself on supplying its clients with reliable quality data. We deeply apologize for the calculation error and any difficulties this may have caused.

Regards,

Kristen Ely
Quality Assurance Manager
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