

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-16732-2

Client Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

For:

Westinghouse Electric Company LLC
3300 State Road P
Festus, Missouri 63028

Attn: Mr. Martin Swanson



Authorized for release by:
4/25/2016 4:57:39 PM

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

1
2
3
4
5
6
7
8
9
10
11

Table of Contents

Cover Page	1
Table of Contents	2
Case Narrative	3
Chain of Custody	5
Receipt Checklists	6
Definitions/Glossary	7
Method Summary	8
Sample Summary	9
Client Sample Results	10
QC Sample Results	15
QC Association Summary	17



Case Narrative

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Job ID: 160-16732-2

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Westinghouse Electric Company LLC

Project: HDP RFP-CBA-022 (7 DAY TAT)

Report Number: 160-16732-2

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 3/31/2016 11:10 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were 1.5° C and 20.0° C.

RADIUM-226 BY GAMMA SPEC (21 DAY INGROWTH)

Samples L08-12-19-T-R-B-00 (160-16732-1), L08-12-20-T-R-B-00 (160-16732-2), L08-12-21-T-R-B-00 (160-16732-3), L08-12-21-T-R-Q-00 (160-16732-4), L08-12-22-T-R-B-00 (160-16732-5), L08-12-23-T-R-B-00 (160-16732-6), L08-12-24-T-E-B-00 (160-16732-7), L08-12-25-T-E-B-00 (160-16732-8), L08-12-26-T-R-B-00 (160-16732-9) and L08-12-27-T-R-B-00 (160-16732-10) were analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA_01_R. The samples were leached on 03/31/2016, prepared on 04/01/2016 and analyzed on 04/22/2016.

Preparation Batch 160-243343:

The samples, analyzed by gamma spectroscopy, resulted in an RPD/RER (relative percent difference/replicate error ratio) outside of the acceptance criteria of 40%/1 for protactinium-231. Both the sample and sample duplicates activity are less than the MDC. The data have been qualified and reported. L08-12-19-T-R-B-00 (160-16732-1), L08-12-20-T-R-B-00 (160-16732-2), L08-12-21-T-R-B-00 (160-16732-3),

Case Narrative

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Job ID: 160-16732-2 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

L08-12-21-T-R-Q-00 (160-16732-4), L08-12-22-T-R-B-00 (160-16732-5), L08-12-23-T-R-B-00 (160-16732-6), L08-12-24-T-E-B-00 (160-16732-7), L08-12-25-T-E-B-00 (160-16732-8), L08-12-26-T-R-B-00 (160-16732-9), L08-12-27-T-R-B-00 (160-16732-10), (LCS 160-243343/2-A), (MB 160-243343/1-A) and (160-16732-A-1-G DU)

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

Hematite Decommissioning Project

Procedure HDP-PR-QA-006, Chain of Custody

Revision: 4

Page 1 of 1

Westinghouse Non-Proprietary Class 3

FORM HDP-PR-QA-006-1
CHAIN OF CUSTODY

Instructions: Each time the container is transferred to another organization, a person from each organization should sign the CoC. The Laboratory/End User must verify that the sample is correctly identified before the sample is released for use or analysis and send the completed CoC to HDP.

Chain of Custody ID No. F-032916-02 Page 1/1				Requested Analysis										Laboratory Name:		
Project Name:				Comp (C) or Grab (G)	Gamma Spec	Isotopic Uranium	10-99	Gamma Spec (21 day ingrow for Ra-226)						Total Containers	TA-MO	
Contact Person:															Laboratory Address:	
Phone Number:															Phone No.	
Sampler Name															Laboratory Contact Person:	
															Phone No.	
				Turn Around Time												
				Rush (7 days)												
				Remarks												
Sample ID	Date	Time	Matrix													
L08-12-19-T-R-B-00	3/28/2016	16:00	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-20-T-R-B-00	3/28/2016	16:05	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-21-T-R-B-00	3/28/2016	16:10	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-21-T-R-Q-00	3/28/2016	16:10	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-22-T-R-B-00	3/28/2016	16:15	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-23-T-R-B-00	3/28/2016	16:20	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-24-T-E-B-00	3/28/2016	16:30	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-25-T-E-B-00	3/28/2016	16:35	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-26-T-R-B-00	3/29/2016	16:25	S	G	X		X	X						1	LSA 08-12 Bias	
L08-12-27-T-R-B-00	3/29/2016	16:30	S	G	X		X	X						1	LSA 08-12 Bias	
Relinquished by: <i>Gorsun</i>				Date/Time: 3/31/16		Received by: <i>R. G. 3815</i>		Date/Time: 3/31/16		Total: 10		Cooler Temperature: Ambient				
Company Name: <i>WEC</i>				Date/Time: 0910		Company Name: <i>CROSSROADS</i>		Date/Time: 0910		Cooler ID: 0329-01, 0330-01		Shipper and Number:				
Received by:				Date/Time:		Relinquished by:		Date/Time:		Comments: N/A						
Company Name:						Company Name:										
Relinquished by: <i>R. G. 3815</i>				Date/Time: 3/31/16		Received by: <i>Chapman</i>		Date/Time: 3/31/16		Verified By: <i>Gorsun</i>						
Company Name: <i>CROSSROADS</i>				Date/Time: 1110		Company Name: <i>WEC</i>		Date/Time: 1110		Date: 3/31/16						



160-16732 Chain of Custody

Login Sample Receipt Checklist

Client: Westinghouse Electric Company LLC

Job Number: 160-16732-2

Login Number: 16732

List Source: TestAmerica St. Louis

List Number: 1

Creator: Dedner, Connie L

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	
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").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.
F	Duplicate RPD exceeds the control limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Method	Method Description	Protocol	Laboratory
GA-01-R	Radium-226 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:
DOE = U.S. Department of Energy

Laboratory References:
TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

1
2
3
4
5
6
7
8
9
10
11

Sample Summary

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-16732-1	L08-12-19-T-R-B-00	Solid	03/28/16 16:00	03/31/16 11:10
160-16732-2	L08-12-20-T-R-B-00	Solid	03/28/16 16:05	03/31/16 11:10
160-16732-3	L08-12-21-T-R-B-00	Solid	03/28/16 16:10	03/31/16 11:10
160-16732-4	L08-12-21-T-R-Q-00	Solid	03/28/16 16:10	03/31/16 11:10
160-16732-5	L08-12-22-T-R-B-00	Solid	03/28/16 16:15	03/31/16 11:10
160-16732-6	L08-12-23-T-R-B-00	Solid	03/28/16 16:20	03/31/16 11:10
160-16732-7	L08-12-24-T-E-B-00	Solid	03/28/16 16:30	03/31/16 11:10
160-16732-8	L08-12-25-T-E-B-00	Solid	03/28/16 16:35	03/31/16 11:10
160-16732-9	L08-12-26-T-R-B-00	Solid	03/29/16 16:25	03/31/16 11:10
160-16732-10	L08-12-27-T-R-B-00	Solid	03/29/16 16:30	03/31/16 11:10

Client Sample Results

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Client Sample ID: L08-12-19-T-R-B-00

Date Collected: 03/28/16 16:00

Date Received: 03/31/16 11:10

Lab Sample ID: 160-16732-1

Matrix: Solid

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.18		0.147	0.190		0.103	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Bismuth 212	1.27		0.404	0.425		0.374	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Bismuth 214	1.26		0.108	0.170		0.0616	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Lead 212	1.11		0.0789	0.163		0.0626	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Lead 214	1.37		0.0978	0.172		0.0751	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Potassium 40	20.4		1.19	2.40		0.316	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Protactinium 231	-0.648	U	0.684	0.687		1.12	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Radium 226	1.26		0.108	0.170	1.00	0.0616	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Thorium 232	1.18		0.147	0.190		0.103	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Thorium 234	1.38		0.563	0.582		0.893	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Uranium 235	1.07		0.212	0.239		0.246	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Americium 241	0.0331	U	0.0648	0.0649		0.108	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Protactinium 234m	6.68		3.20	3.27		5.22	pCi/g	04/01/16 14:08	04/22/16 08:47	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.391		0.0540	0.0675		0.0411	pCi/g	04/01/16 14:08	04/22/16 08:47	1

Client Sample ID: L08-12-20-T-R-B-00

Date Collected: 03/28/16 16:05

Date Received: 03/31/16 11:10

Lab Sample ID: 160-16732-2

Matrix: Solid

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.581		0.132	0.145		0.380	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Bismuth 212	0.978		0.447	0.459		0.646	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Bismuth 214	1.11		0.124	0.170		0.0745	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Lead 212	1.01		0.101	0.166		0.0911	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Lead 214	1.09		0.111	0.159		0.0831	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Potassium 40	19.5		1.35	2.41		0.234	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Protactinium 231	0.431	U	0.600	0.602		0.995	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Radium 226	1.11		0.124	0.170	1.00	0.0745	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Thorium 232	0.581		0.132	0.145		0.380	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Thorium 234	10.4		0.985	1.47		1.28	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Uranium 235	4.15		0.378	0.566		0.354	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Americium 241	0.108	U	0.0880	0.0888		0.144	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Protactinium 234m	18.3		4.84	5.18		3.44	pCi/g	04/01/16 14:08	04/22/16 08:37	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.351		0.0463	0.0589		0.0258	pCi/g	04/01/16 14:08	04/22/16 08:37	1

TestAmerica St. Louis

Client Sample Results

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Client Sample ID: L08-12-21-T-R-B-00

Lab Sample ID: 160-16732-3

Date Collected: 03/28/16 16:10

Matrix: Solid

Date Received: 03/31/16 11:10

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.452		0.0611	0.0766		0.0448	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Bismuth 212	0.502		0.206	0.212		0.205	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Bismuth 214	0.758		0.0667	0.103		0.0310	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Lead 212	0.365		0.0416	0.0629		0.0382	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Lead 214	0.782		0.0572	0.0994		0.0438	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Potassium 40	6.55		0.559	0.873		0.160	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Protactinium 231	0.375	U	0.193	0.197		0.585	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Radium 226	0.758		0.0667	0.103	1.00	0.0310	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Thorium 232	0.452		0.0611	0.0766		0.0448	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Thorium 234	3.03		0.438	0.541		0.593	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Uranium 235	0.962		0.146	0.175		0.149	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Americium 241	0.000149	U	0.0437	0.0437		0.0738	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Protactinium 234m	2.75	U	1.72	1.74		2.82	pCi/g	04/01/16 14:08	04/22/16 09:31	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
Tl-208	0.140		0.0258	0.0296		0.0206	pCi/g	04/01/16 14:08	04/22/16 09:31	1

Client Sample ID: L08-12-21-T-R-Q-00

Lab Sample ID: 160-16732-4

Date Collected: 03/28/16 16:10

Matrix: Solid

Date Received: 03/31/16 11:10

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.572		0.119	0.132		0.112	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Bismuth 212	0.366	U	0.290	0.293		0.451	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Bismuth 214	0.838		0.0955	0.129		0.0593	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Lead 212	0.483		0.0626	0.0885		0.0602	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Lead 214	0.909		0.0784	0.123		0.0561	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Potassium 40	8.30		0.832	1.19		0.208	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Protactinium 231	0.224	U	0.421	0.422		0.711	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Radium 226	0.838		0.0955	0.129	1.00	0.0593	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Thorium 232	0.572		0.119	0.132		0.112	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Thorium 234	3.05		0.539	0.626		0.745	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Uranium 235	1.01		0.182	0.209		0.204	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Americium 241	0.0315	U	0.0363	0.0364		0.0595	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Protactinium 234m	9.47		3.61	3.74		3.01	pCi/g	04/01/16 14:08	04/22/16 09:30	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
Tl-208	0.180		0.0373	0.0417		0.0296	pCi/g	04/01/16 14:08	04/22/16 09:30	1

TestAmerica St. Louis

Client Sample Results

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Client Sample ID: L08-12-22-T-R-B-00

Lab Sample ID: 160-16732-5

Date Collected: 03/28/16 16:15

Matrix: Solid

Date Received: 03/31/16 11:10

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.903		0.0967	0.134		0.0913	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Bismuth 212	1.45		0.389	0.417		0.319	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Bismuth 214	0.874		0.0879	0.126		0.0590	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Lead 212	0.923		0.0766	0.142		0.0662	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Lead 214	1.03		0.0841	0.136		0.0663	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Potassium 40	16.6		0.924	1.93		0.159	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Protactinium 231	0.256	U	0.351	0.353		0.582	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Radium 226	0.874		0.0879	0.126	1.00	0.0590	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Thorium 232	0.903		0.0967	0.134		0.0913	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Thorium 234	4.14		0.775	0.887		0.876	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Uranium 235	0.857		0.189	0.208		0.215	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Americium 241	0.000990	U	0.0628	0.0628		0.106	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Protactinium 234m	8.17		3.30	3.40		3.01	pCi/g	04/01/16 14:08	04/22/16 10:13	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
TI-208	0.307		(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			0.0472	0.0569		0.0366	pCi/g	04/01/16 14:08	04/22/16 10:13	1

Client Sample ID: L08-12-23-T-R-B-00

Lab Sample ID: 160-16732-6

Date Collected: 03/28/16 16:20

Matrix: Solid

Date Received: 03/31/16 11:10

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.25		0.111	0.169		0.112	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Bismuth 212	1.21		0.288	0.314		0.329	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Bismuth 214	0.918		0.0898	0.131		0.0629	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Lead 212	1.28		0.0765	0.182		0.0588	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Lead 214	1.04		0.0872	0.139		0.0642	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Potassium 40	18.2		1.03	2.13		0.356	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Protactinium 231	-0.730	U	0.710	0.714		1.16	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Radium 226	0.918		0.0898	0.131	1.00	0.0629	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Thorium 232	1.25		0.111	0.169		0.112	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Thorium 234	8.95		1.07	1.42		1.21	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Uranium 235	4.27		0.277	0.515		0.263	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Americium 241	-0.00340	U	0.0804	0.0804		0.134	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Protactinium 234m	14.8		4.54	4.78		3.94	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
TI-208	0.394		(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			0.0409	0.0579		0.0278	pCi/g	04/01/16 14:08	04/22/16 10:14	1

TestAmerica St. Louis

Client Sample Results

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Client Sample ID: L08-12-24-T-E-B-00

Lab Sample ID: 160-16732-7

Date Collected: 03/28/16 16:30

Matrix: Solid

Date Received: 03/31/16 11:10

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.11		0.133	0.174		0.121	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Bismuth 212	1.42		0.490	0.511		0.438	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Bismuth 214	1.26		0.114	0.172		0.0729	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Lead 212	1.09		0.0979	0.172		0.0880	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Lead 214	1.30		0.119	0.180		0.0917	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Potassium 40	19.9		1.15	2.31		0.349	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Protactinium 231	0.385	U	0.221	0.225		1.21	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Radium 226	1.26		0.114	0.172	1.00	0.0729	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Thorium 232	1.11		0.133	0.174		0.121	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Thorium 234	3.72		0.778	0.870		1.18	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Uranium 235	9.01		0.338	0.979		0.392	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Americium 241	0.109	U	0.0878	0.0885		0.144	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Protactinium 234m	9.61		4.21	4.32		3.86	pCi/g	04/01/16 14:08	04/22/16 10:14	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
TI-208	0.367		(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			0.0433	0.0574		0.0325	pCi/g	04/01/16 14:08	04/22/16 10:14	1

Client Sample ID: L08-12-25-T-E-B-00

Lab Sample ID: 160-16732-8

Date Collected: 03/28/16 16:35

Matrix: Solid

Date Received: 03/31/16 11:10

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.01		0.169	0.198		0.193	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Bismuth 212	1.39		0.559	0.577		0.541	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Bismuth 214	1.13		0.156	0.196		0.111	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Lead 212	1.09		0.0943	0.170		0.0800	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Lead 214	1.34		0.123	0.186		0.0799	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Potassium 40	18.6		1.43	2.38		0.420	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Protactinium 231	0.345	U	0.281	0.284		1.47	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Radium 226	1.13		0.156	0.196	1.00	0.111	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Thorium 232	1.01		0.169	0.198		0.193	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Thorium 234	2.21		0.523	0.572		1.29	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Uranium 235	5.63		0.346	0.670		0.335	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Americium 241	-0.00125	U	0.100	0.100		0.168	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Protactinium 234m	1.57	U	3.90	3.90		6.87	pCi/g	04/01/16 14:08	04/22/16 10:16	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
TI-208	0.422		(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			0.0620	0.0759		0.0435	pCi/g	04/01/16 14:08	04/22/16 10:16	1

TestAmerica St. Louis

Client Sample Results

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Client Sample ID: L08-12-26-T-R-B-00

Lab Sample ID: 160-16732-9

Date Collected: 03/29/16 16:25

Matrix: Solid

Date Received: 03/31/16 11:10

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.901		0.106	0.140		0.0748	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Bismuth 212	0.799		0.295	0.307		0.415	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Bismuth 214	0.941		0.0884	0.132		0.0603	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Lead 212	0.915		0.0719	0.138		0.0624	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Lead 214	1.07		0.0926	0.145		0.0682	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Potassium 40	20.2		1.10	2.34		0.403	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Protactinium 231	-0.583	U	0.611	0.614		1.00	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Radium 226	0.941		0.0884	0.132	1.00	0.0603	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Thorium 232	0.901		0.106	0.140		0.0748	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Thorium 234	1.16		0.294	0.318		0.776	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Uranium 235	0.247		0.137	0.139		0.170	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Americium 241	0.0337	U	0.0571	0.0572		0.0947	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Protactinium 234m	2.25	U	2.49	2.50		4.11	pCi/g	04/01/16 14:08	04/22/16 11:10	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.311		0.0427	0.0535		0.0305	pCi/g	04/01/16 14:08	04/22/16 11:10	1

Client Sample ID: L08-12-27-T-R-B-00

Lab Sample ID: 160-16732-10

Date Collected: 03/29/16 16:30

Matrix: Solid

Date Received: 03/31/16 11:10

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.15		0.136	0.179		0.114	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Bismuth 212	1.20		0.520	0.534		0.499	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Bismuth 214	1.11		0.0976	0.150		0.0861	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Lead 212	1.24		0.0830	0.181		0.0686	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Lead 214	1.33		0.105	0.174		0.0752	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Potassium 40	23.7		1.19	2.66		0.265	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Protactinium 231	0.676	U	0.362	0.370		1.22	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Radium 226	1.11		0.0976	0.150	1.00	0.0861	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Thorium 232	1.15		0.136	0.179		0.114	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Thorium 234	5.01		0.718	0.890		1.03	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Uranium 235	2.18		0.238	0.326		0.247	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Americium 241	-0.0134	U	0.450	0.450		0.129	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Protactinium 234m	8.70		3.51	3.62		3.52	pCi/g	04/01/16 14:08	04/22/16 11:12	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.403		0.0519	0.0664		0.0405	pCi/g	04/01/16 14:08	04/22/16 11:12	1

TestAmerica St. Louis

QC Sample Results

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-243343/1-A

Matrix: Solid

Analysis Batch: 247453

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 243343

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.007195	U	0.0133	0.0133		0.0255	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Bismuth 212	0.0001185	U	0.0941	0.0941		0.185	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Bismuth 214	0.001417	U	0.0163	0.0163		0.0332	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Lead 212	0.001625	U	0.0105	0.0105		0.0207	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Lead 214	-0.001769	U	0.0150	0.0150		0.0301	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Potassium 40	-0.08523	U	2.45	2.45		0.304	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Protactinium 231	0.03406	U	0.160	0.161		0.293	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Radium 226	0.001417	U	0.0163	0.0163	1.00	0.0332	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Thorium 232	0.007195	U	0.0133	0.0133		0.0255	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Thorium 234	0.03040	U	0.0838	0.0839		0.272	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Uranium 235	0.01509	U	0.0325	0.0326		0.0595	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Americium 241	-0.002853	U	0.0132	0.0132		0.0234	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Protactinium 234m	0.1765	U	0.937	0.937		1.94	pCi/g	04/01/16 14:08	04/22/16 08:10	1
Other Detected Radionuclides	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/g	04/01/16 14:08	04/22/16 08:10	1

Lab Sample ID: LCS 160-243343/2-A

Matrix: Solid

Analysis Batch: 247452

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 243343

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium 241	101	97.63		10.2		0.492	pCi/g	97	87 - 116
Cesium 137	34.0	32.48		3.40		0.137	pCi/g	95	87 - 120
Cobalt 60	31.5	29.39		2.97		0.129	pCi/g	93	87 - 115

Lab Sample ID: 160-16732-1 DU

Matrix: Solid

Analysis Batch: 247452

Client Sample ID: L08-12-19-T-R-B-00

Prep Type: Total/NA

Prep Batch: 243343

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium 228	1.18		1.142		0.169		0.116	pCi/g	0.11	1
Bismuth 212	1.27		1.483		0.581		0.472	pCi/g	0.21	1
Bismuth 214	1.26		1.174		0.166		0.0734	pCi/g	0.25	1
Lead 212	1.11		1.138		0.167		0.0643	pCi/g	0.1	1
Lead 214	1.37		1.232		0.160		0.0708	pCi/g	0.40	1
Potassium 40	20.4		19.91		2.36		0.442	pCi/g	0.10	1
Protactinium 231	-0.648	U	0.4577	U F	0.223		1.17	pCi/g	1.21	1
Radium 226	1.26		1.174		0.166	1.00	0.0734	pCi/g	0.25	1
Thorium 232	1.18		1.142		0.169		0.116	pCi/g	0.11	1
Thorium 234	1.38		1.030		0.341		0.881	pCi/g	0.38	1
Uranium 235	1.07		0.9659		0.214		0.254	pCi/g	0.23	1
Americium 241	0.0331	U	0.01634	U	0.0697		0.117	pCi/g	0.12	1

TestAmerica St. Louis

QC Sample Results

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: 160-16732-1 DU
Matrix: Solid
Analysis Batch: 247452

Client Sample ID: L08-12-19-T-R-B-00
Prep Type: Total/NA
Prep Batch: 243343

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Protactinium 234m	6.68		2.096	U	2.98		5.01	pCi/g	0.73	1
<hr/>										
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tl-208	0.391		0.3689		0.0602		0.0356	pCi/g	0.17	1

QC Association Summary

Client: Westinghouse Electric Company LLC
Project/Site: HDP RFP-CBA-022 (7 DAY TAT)

TestAmerica Job ID: 160-16732-2

Rad

Leach Batch: 243044

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16732-1	L08-12-19-T-R-B-00	Total/NA	Solid	Dry and Grind	
160-16732-1 DU	L08-12-19-T-R-B-00	Total/NA	Solid	Dry and Grind	
160-16732-2	L08-12-20-T-R-B-00	Total/NA	Solid	Dry and Grind	
160-16732-3	L08-12-21-T-R-B-00	Total/NA	Solid	Dry and Grind	
160-16732-4	L08-12-21-T-R-Q-00	Total/NA	Solid	Dry and Grind	
160-16732-5	L08-12-22-T-R-B-00	Total/NA	Solid	Dry and Grind	
160-16732-6	L08-12-23-T-R-B-00	Total/NA	Solid	Dry and Grind	
160-16732-7	L08-12-24-T-E-B-00	Total/NA	Solid	Dry and Grind	
160-16732-8	L08-12-25-T-E-B-00	Total/NA	Solid	Dry and Grind	
160-16732-9	L08-12-26-T-R-B-00	Total/NA	Solid	Dry and Grind	
160-16732-10	L08-12-27-T-R-B-00	Total/NA	Solid	Dry and Grind	

Prep Batch: 243343

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16732-1	L08-12-19-T-R-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-1 DU	L08-12-19-T-R-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-2	L08-12-20-T-R-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-3	L08-12-21-T-R-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-4	L08-12-21-T-R-Q-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-5	L08-12-22-T-R-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-6	L08-12-23-T-R-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-7	L08-12-24-T-E-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-8	L08-12-25-T-E-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-9	L08-12-26-T-R-B-00	Total/NA	Solid	Fill_Geo-21	243044
160-16732-10	L08-12-27-T-R-B-00	Total/NA	Solid	Fill_Geo-21	243044
LCS 160-243343/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-243343/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	