

# 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: 160-17255-2

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:  
6/1/2016 11:32:59 AM

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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.*

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# Case Narrative

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

TestAmerica Job ID: 160-17255-2

**Job ID: 160-17255-2**

**Laboratory: TestAmerica St. Louis**

**Narrative**

## CASE NARRATIVE

**Client: Westinghouse Electric Company LLC**

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

**Report Number: 160-17255-2**

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 5/5/2016 11:15 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were 20.0° C and 20.0° C.

### **RADIUM-226 BY GAMMA SPEC (21 DAY INGROWTH)**

Samples L12-01-01-P-S-S-00 (160-17255-1), L12-01-01-P-S-Q-00 (160-17255-2), L12-01-02-P-R-S-00 (160-17255-3), L12-01-04-P-S-S-00 (160-17255-4), L12-01-05-P-R-S-00 (160-17255-5), L12-01-07-P-S-S-00 (160-17255-6), L12-01-08-P-R-S-00 (160-17255-7), L12-01-10-P-S-S-00 (160-17255-8), L12-01-11-P-R-S-00 (160-17255-9), L12-01-13-P-S-S-00 (160-17255-10), L12-01-13-P-S-Q-00 (160-17255-11), L12-01-14-P-R-S-00 (160-17255-12), L12-01-16-P-S-S-00 (160-17255-13), L12-01-17-P-R-S-00 (160-17255-14), L12-01-19-P-S-S-00 (160-17255-15), L12-01-20-P-R-S-00 (160-17255-16), L12-01-22-P-S-S-00 (160-17255-17) and L12-01-23-P-R-S-00 (160-17255-18) were analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA\_01\_R. The samples were leached on 05/05/2016, prepared on 05/06/2016 and analyzed on 05/30/2016.

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





# Login Sample Receipt Checklist

Client: Westinghouse Electric Company LLC

Job Number: 160-17255-2

**Login Number: 17255**

**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.	N/A	
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: 160-17255-2

## Qualifiers

### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

## Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
▫	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: 160-17255-2

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

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**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





# Sample Summary

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

TestAmerica Job ID: 160-17255-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-17255-1	L12-01-01-P-S-S-00	Solid	05/04/16 09:00	05/05/16 11:15
160-17255-2	L12-01-01-P-S-Q-00	Solid	05/04/16 09:00	05/05/16 11:15
160-17255-3	L12-01-02-P-R-S-00	Solid	05/04/16 09:15	05/05/16 11:15
160-17255-4	L12-01-04-P-S-S-00	Solid	05/03/16 15:40	05/05/16 11:15
160-17255-5	L12-01-05-P-R-S-00	Solid	05/03/16 15:50	05/05/16 11:15
160-17255-6	L12-01-07-P-S-S-00	Solid	05/03/16 15:15	05/05/16 11:15
160-17255-7	L12-01-08-P-R-S-00	Solid	05/03/16 15:30	05/05/16 11:15
160-17255-8	L12-01-10-P-S-S-00	Solid	05/03/16 13:50	05/05/16 11:15
160-17255-9	L12-01-11-P-R-S-00	Solid	05/03/16 14:00	05/05/16 11:15
160-17255-10	L12-01-13-P-S-S-00	Solid	05/03/16 14:10	05/05/16 11:15
160-17255-11	L12-01-13-P-S-Q-00	Solid	05/03/16 14:10	05/05/16 11:15
160-17255-12	L12-01-14-P-R-S-00	Solid	05/03/16 14:20	05/05/16 11:15
160-17255-13	L12-01-16-P-S-S-00	Solid	05/03/16 14:55	05/05/16 11:15
160-17255-14	L12-01-17-P-R-S-00	Solid	05/03/16 15:05	05/05/16 11:15
160-17255-15	L12-01-19-P-S-S-00	Solid	05/04/16 08:30	05/05/16 11:15
160-17255-16	L12-01-20-P-R-S-00	Solid	05/04/16 08:45	05/05/16 11:15
160-17255-17	L12-01-22-P-S-S-00	Solid	05/03/16 14:30	05/05/16 11:15
160-17255-18	L12-01-23-P-R-S-00	Solid	05/03/16 14:40	05/05/16 11:15

# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-01-P-S-S-00**

**Lab Sample ID: 160-17255-1**

Date Collected: 05/04/16 09:00

Matrix: Solid

Date Received: 05/05/16 11:15

**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	0.720		0.0892	0.116		0.0930	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Bismuth 212	0.813		0.225	0.240		0.192	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Bismuth 214	0.777		0.0770	0.112		0.0472	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Lead 212	0.706		0.0523	0.105		0.0468	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Lead 214	0.885		0.0727	0.117		0.0457	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Potassium 40	12.4		0.789	1.50		0.215	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Protactinium 231	-0.325	U	1.01	1.01		1.68	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Radium 226	0.777		0.0770	0.112	1.00	0.0472	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Thorium 232	0.720		0.0892	0.116		0.0930	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Thorium 234	0.856		0.381	0.391		0.594	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Uranium 235	0.00145	U	0.00299	0.00299		0.459	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Americium 241	-0.00472	U	0.0511	0.0512		0.124	pCi/g	05/06/16 09:31	05/30/16 18:10	1
Protactinium 234m	0.853	U	1.57	1.57		7.13	pCi/g	05/06/16 09:31	05/30/16 18:10	1
<b>Other Detected Radionuclides</b>			<b>Count Uncert. (2σ+/-)</b>	<b>Total Uncert. (2σ+/-)</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.233		0.0300	0.0385		0.0213	pCi/g	05/06/16 09:31	05/30/16 18:10	1

**Client Sample ID: L12-01-01-P-S-Q-00**

**Lab Sample ID: 160-17255-2**

Date Collected: 05/04/16 09:00

Matrix: Solid

Date Received: 05/05/16 11:15

**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	0.695		0.126	0.145		0.111	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Bismuth 212	0.183	U	0.446	0.447		0.757	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Bismuth 214	0.789		0.0975	0.127		0.0567	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Lead 212	0.573		0.0656	0.0990		0.0735	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Lead 214	0.927		0.0853	0.129		0.0640	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Potassium 40	11.4		1.01	1.54		0.272	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Protactinium 231	0.000	U	0.223	0.223		2.39	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Radium 226	0.789		0.0975	0.127	1.00	0.0567	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Thorium 232	0.695		0.126	0.145		0.111	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Thorium 234	0.420	U	0.252	0.256		0.713	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Uranium 235	-0.00666	U	0.00913	0.00916		0.494	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Americium 241	0.0345	U	0.0768	0.0768		0.102	pCi/g	05/06/16 09:31	05/30/16 17:34	1
Protactinium 234m	1.74	U	4.61	4.61		7.86	pCi/g	05/06/16 09:31	05/30/16 17:34	1
<b>Other Detected Radionuclides</b>			<b>Count Uncert. (2σ+/-)</b>	<b>Total Uncert. (2σ+/-)</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.223		0.0456	0.0512		0.0350	pCi/g	05/06/16 09:31	05/30/16 17:34	1

# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-02-P-R-S-00**

**Lab Sample ID: 160-17255-3**

Date Collected: 05/04/16 09:15

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
<b>Actinium 228</b>	<b>0.850</b>		0.101	0.133		0.0910	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Bismuth 212	0.231	U	0.417	0.417		0.697	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Bismuth 214</b>	<b>0.904</b>		0.0881	0.129		0.0504	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Lead 212</b>	<b>0.783</b>		0.0621	0.119		0.0562	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Lead 214</b>	<b>0.991</b>		0.0889	0.136		0.0610	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Potassium 40</b>	<b>13.9</b>		0.973	1.73		0.200	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Protactinium 231	0.336	U	1.01	1.01		1.68	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Radium 226</b>	<b>0.904</b>		0.0881	0.129	1.00	0.0504	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Thorium 232</b>	<b>0.850</b>		0.101	0.133		0.0910	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Thorium 234</b>	<b>0.719</b>		0.443	0.449		0.706	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Uranium 235	-0.000754	U	0.00475	0.00476		0.345	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Americium 241	-0.0169	U	0.0668	0.0668		0.0941	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Protactinium 234m	1.56	U	2.34	2.35		6.82	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
			(2σ+/-)	(2σ+/-)						
Tl-208	0.289		0.0372	0.0478		0.0226	pCi/g	05/06/16 09:31	05/30/16 18:11	1

**Client Sample ID: L12-01-04-P-S-S-00**

**Lab Sample ID: 160-17255-4**

Date Collected: 05/03/16 15:40

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
<b>Actinium 228</b>	<b>0.851</b>		0.121	0.149		0.138	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Bismuth 212	0.261	U	0.440	0.441		0.737	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Bismuth 214</b>	<b>0.905</b>		0.104	0.140		0.0657	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Lead 212</b>	<b>0.874</b>		0.0710	0.133		0.0625	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Lead 214</b>	<b>0.976</b>		0.0939	0.138		0.0660	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Potassium 40</b>	<b>14.6</b>		1.15	1.88		0.316	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Protactinium 231	-0.520	U	1.54	1.55		2.58	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Radium 226</b>	<b>0.905</b>		0.104	0.140	1.00	0.0657	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Thorium 232</b>	<b>0.851</b>		0.121	0.149		0.138	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Thorium 234</b>	<b>1.01</b>		0.530	0.541		0.838	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Uranium 235	0.167	U	0.139	0.140		0.185	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Americium 241	0.0266	U	0.0904	0.0904		0.151	pCi/g	05/06/16 09:31	05/30/16 18:11	1
Protactinium 234m	-1.47	U	5.52	5.52		10.9	pCi/g	05/06/16 09:31	05/30/16 18:11	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
			(2σ+/-)	(2σ+/-)						
Tl-208	0.293		0.0556	0.0634		0.0432	pCi/g	05/06/16 09:31	05/30/16 18:11	1

# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-05-P-R-S-00**

**Lab Sample ID: 160-17255-5**

Date Collected: 05/03/16 15:50

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.03		0.122	0.160		0.0969	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Bismuth 212	1.60		0.434	0.464		0.347	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Bismuth 214	0.993		0.103	0.145		0.0709	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Lead 212	1.02		0.0634	0.147		0.0513	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Lead 214	1.13		0.0831	0.144		0.0680	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Potassium 40	19.1		1.05	2.19		0.328	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Protactinium 231	-0.443	U	1.32	1.32		2.19	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Radium 226	0.993		0.103	0.145	1.00	0.0709	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Thorium 232	1.03		0.122	0.160		0.0969	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Thorium 234	0.771		0.265	0.277		0.756	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Uranium 235	0.0942	U	0.283	0.283		0.470	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Americium 241	0.0284	U	0.0806	0.0806		0.134	pCi/g	05/06/16 09:31	05/30/16 18:12	1
Protactinium 234m	1.81	U	2.98	2.98		8.04	pCi/g	05/06/16 09:31	05/30/16 18:12	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0467</i>	<i>0.0588</i>		<i>0.0346</i>	<i>pCi/g</i>	<i>05/06/16 09:31</i>	<i>05/30/16 18:12</i>	<i>1</i>

**Client Sample ID: L12-01-07-P-S-S-00**

**Lab Sample ID: 160-17255-6**

Date Collected: 05/03/16 15:15

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.773		0.139	0.159		0.0745	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Bismuth 212	0.759		0.341	0.350		0.345	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Bismuth 214	0.627		0.0988	0.118		0.0678	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Lead 212	0.511		0.0642	0.0921		0.0696	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Lead 214	0.638		0.0733	0.0989		0.0825	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Potassium 40	11.8		1.09	1.63		0.309	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Protactinium 231	0.382	U	0.885	0.886		2.00	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Radium 226	0.627		0.0988	0.118	1.00	0.0678	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Thorium 232	0.773		0.139	0.159		0.0745	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Thorium 234	1.11		0.578	0.590		0.742	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Uranium 235	-0.0993	U	0.145	0.146		0.505	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Americium 241	-0.00189	U	0.0566	0.0566		0.101	pCi/g	05/06/16 09:31	05/30/16 18:13	1
Protactinium 234m	3.46	U	4.30	4.31		7.29	pCi/g	05/06/16 09:31	05/30/16 18:13	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0468</i>	<i>0.0527</i>		<i>0.0346</i>	<i>pCi/g</i>	<i>05/06/16 09:31</i>	<i>05/30/16 18:13</i>	<i>1</i>

# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-08-P-R-S-00**

**Lab Sample ID: 160-17255-7**

Date Collected: 05/03/16 15:30

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.953		0.101	0.140		0.103	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Bismuth 212	1.28		0.305	0.332		0.239	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Bismuth 214	0.867		0.0853	0.124		0.0548	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Lead 212	0.979		0.0618	0.141		0.0481	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Lead 214	1.02		0.0743	0.130		0.0657	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Potassium 40	17.2		0.992	2.02		0.301	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Protactinium 231	0.356	U	0.824	0.825		1.84	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Radium 226	0.867		0.0853	0.124	1.00	0.0548	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Thorium 232	0.953		0.101	0.140		0.103	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Thorium 234	0.991		0.479	0.490		0.758	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Uranium 235	0.0550	U	0.123	0.123		0.469	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Americium 241	0.0324	U	0.0856	0.0856		0.142	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Protactinium 234m	1.35	U	2.23	2.23		6.87	pCi/g	05/06/16 09:31	05/30/16 18:47	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0470</i>	<i>0.0584</i>		<i>0.0354</i>	<i>pCi/g</i>	<i>05/06/16 09:31</i>	<i>05/30/16 18:47</i>	<i>1</i>

**Client Sample ID: L12-01-10-P-S-S-00**

**Lab Sample ID: 160-17255-8**

Date Collected: 05/03/16 13:50

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.747		0.156	0.174		0.109	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Bismuth 212	1.03		0.351	0.367		0.406	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Bismuth 214	0.799		0.104	0.133		0.0879	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Lead 212	0.920		0.0779	0.142		0.0647	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Lead 214	0.948		0.101	0.141		0.0876	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Potassium 40	17.1		1.30	2.18		0.183	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Protactinium 231	0.263	U	0.814	0.815		2.63	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Radium 226	0.799		0.104	0.133	1.00	0.0879	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Thorium 232	0.747		0.156	0.174		0.109	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Thorium 234	1.39		0.564	0.582		0.865	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Uranium 235	0.00873	U	0.0134	0.0134		0.683	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Americium 241	0.0425	U	0.0972	0.0973		0.162	pCi/g	05/06/16 09:31	05/30/16 18:47	1
Protactinium 234m	1.24	U	2.00	2.00		12.8	pCi/g	05/06/16 09:31	05/30/16 18:47	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0529</i>	<i>0.0632</i>		<i>0.0377</i>	<i>pCi/g</i>	<i>05/06/16 09:31</i>	<i>05/30/16 18:47</i>	<i>1</i>

# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-11-P-R-S-00**

**Lab Sample ID: 160-17255-9**

Date Collected: 05/03/16 14:00

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.27		0.144	0.193		0.0902	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Bismuth 212	1.15		0.325	0.346		0.416	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Bismuth 214	1.15		0.107	0.160		0.0688	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Lead 212	1.06		0.0696	0.154		0.0632	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Lead 214	1.27		0.0919	0.161		0.0637	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Potassium 40	21.6		1.16	2.47		0.369	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Protactinium 231	0.415	U	1.24	1.25		2.07	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Radium 226	1.15		0.107	0.160	1.00	0.0688	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Thorium 232	1.27		0.144	0.193		0.0902	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Thorium 234	0.850		0.334	0.346		0.830	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Uranium 235	-0.0437	U	0.105	0.105		0.541	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Americium 241	0.0292	U	0.0862	0.0863		0.143	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Protactinium 234m	3.57	U	4.33	4.34		6.35	pCi/g	05/06/16 09:31	05/30/16 18:49	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0488</i>	<i>0.0614</i>		<i>0.0364</i>	<i>pCi/g</i>	<i>05/06/16 09:31</i>	<i>05/30/16 18:49</i>	<i>1</i>

**Client Sample ID: L12-01-13-P-S-S-00**

**Lab Sample ID: 160-17255-10**

Date Collected: 05/03/16 14:10

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.900		0.141	0.169		0.114	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Bismuth 212	1.27		0.551	0.567		0.502	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Bismuth 214	0.881		0.111	0.144		0.0697	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Lead 212	0.676		0.0743	0.115		0.0815	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Lead 214	0.954		0.104	0.143		0.0717	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Potassium 40	20.4		1.42	2.53		0.306	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Protactinium 231	-0.526	U	1.67	1.67		2.79	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Radium 226	0.881		0.111	0.144	1.00	0.0697	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Thorium 232	0.900		0.141	0.169		0.114	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Thorium 234	1.10		0.732	0.741		0.931	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Uranium 235	0.204		0.147	0.148		0.202	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Americium 241	0.0361	U	0.0905	0.0906		0.120	pCi/g	05/06/16 09:31	05/30/16 18:49	1
Protactinium 234m	4.17	U	6.39	6.40		9.81	pCi/g	05/06/16 09:31	05/30/16 18:49	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0499</i>	<i>0.0581</i>		<i>0.0368</i>	<i>pCi/g</i>	<i>05/06/16 09:31</i>	<i>05/30/16 18:49</i>	<i>1</i>

# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-13-P-S-Q-00**

**Lab Sample ID: 160-17255-11**

Date Collected: 05/03/16 14:10

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.789		0.104	0.131		0.0868	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Bismuth 212	1.01		0.272	0.292		0.236	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Bismuth 214	0.926		0.0800	0.125		0.0484	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Lead 212	0.783		0.0585	0.117		0.0499	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Lead 214	0.961		0.0827	0.130		0.0623	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Potassium 40	19.3		1.07	2.25		0.302	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Protactinium 231	0.176	U	0.581	0.581		1.85	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Radium 226	0.926		0.0800	0.125	1.00	0.0484	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Thorium 232	0.789		0.104	0.131		0.0868	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Thorium 234	0.844		0.260	0.275		0.700	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Uranium 235	-0.00837	U	0.0158	0.0158		0.489	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Americium 241	0.0317	U	0.0864	0.0865		0.144	pCi/g	05/06/16 09:31	05/30/16 19:31	1
Protactinium 234m	1.10	U	1.89	1.90		7.18	pCi/g	05/06/16 09:31	05/30/16 19:31	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0358</i>	<i>0.0439</i>		<i>0.0274</i>	<i>pCi/g</i>	<i>05/06/16 09:31</i>	<i>05/30/16 19:31</i>	<i>1</i>

**Client Sample ID: L12-01-14-P-R-S-00**

**Lab Sample ID: 160-17255-12**

Date Collected: 05/03/16 14:20

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.07		0.135	0.174		0.122	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Bismuth 212	1.09		0.381	0.397		0.380	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Bismuth 214	1.03		0.109	0.153		0.0698	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Lead 212	0.866		0.0726	0.134		0.0717	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Lead 214	1.18		0.104	0.161		0.0728	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Potassium 40	21.3		1.28	2.53		0.228	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Protactinium 231	0.0393	U	0.513	0.513		2.08	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Radium 226	1.03		0.109	0.153	1.00	0.0698	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Thorium 232	1.07		0.135	0.174		0.122	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Thorium 234	0.963		0.474	0.485		0.741	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Uranium 235	0.0778	U	0.224	0.225		0.387	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Americium 241	-0.0106	U	0.0789	0.0789		0.111	pCi/g	05/06/16 09:31	05/30/16 19:32	1
Protactinium 234m	4.06	U	5.06	5.08		7.98	pCi/g	05/06/16 09:31	05/30/16 19:32	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0495</i>	<i>0.0595</i>		<i>0.0386</i>	<i>pCi/g</i>	<i>05/06/16 09:31</i>	<i>05/30/16 19:32</i>	<i>1</i>

# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-16-P-S-S-00**

**Lab Sample ID: 160-17255-13**

Date Collected: 05/03/16 14:55

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.762		0.119	0.142		0.102	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Bismuth 212	0.355	U	0.676	0.677		1.13	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Bismuth 214	0.647		0.100	0.121		0.0778	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Lead 212	0.704		0.0673	0.113		0.0600	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Lead 214	0.885		0.0920	0.130		0.0826	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Potassium 40	15.6		1.23	2.01		0.318	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Protactinium 231	0.235	U	0.731	0.732		2.36	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Radium 226	0.647		0.100	0.121	1.00	0.0778	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Thorium 232	0.762		0.119	0.142		0.102	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Thorium 234	0.421	U	0.232	0.236		1.51	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Uranium 235	-0.133	U	0.183	0.183		0.594	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Americium 241	-0.0451	U	0.102	0.102		0.170	pCi/g	05/06/16 09:31	05/30/16 19:33	1
Protactinium 234m	4.13	U	4.96	4.98		7.69	pCi/g	05/06/16 09:31	05/30/16 19:33	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.275		0.0486	0.0564		0.0361	pCi/g	05/06/16 09:31	05/30/16 19:33	1

**Client Sample ID: L12-01-17-P-R-S-00**

**Lab Sample ID: 160-17255-14**

Date Collected: 05/03/16 15:05

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.07		0.123	0.163		0.0721	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Bismuth 212	1.33		0.402	0.425		0.347	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Bismuth 214	1.13		0.0984	0.153		0.0641	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Lead 212	1.11		0.0677	0.160		0.0563	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Lead 214	1.28		0.0893	0.161		0.0615	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Potassium 40	20.2		1.08	2.30		0.328	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Protactinium 231	-0.444	U	1.34	1.34		2.22	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Radium 226	1.13		0.0984	0.153	1.00	0.0641	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Thorium 232	1.07		0.123	0.163		0.0721	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Thorium 234	0.748		0.282	0.292		0.748	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Uranium 235	-0.113	U	0.318	0.319		0.528	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Americium 241	0.0295	U	0.0837	0.0838		0.139	pCi/g	05/06/16 09:31	05/30/16 19:34	1
Protactinium 234m	4.22	U	4.92	4.94		7.19	pCi/g	05/06/16 09:31	05/30/16 19:34	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.390		0.0464	0.0614		0.0328	pCi/g	05/06/16 09:31	05/30/16 19:34	1



# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-19-P-S-S-00**

**Lab Sample ID: 160-17255-15**

Date Collected: 05/04/16 08:30

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.985		0.160	0.189		0.126	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Bismuth 212	-0.125	U	0.529	0.529		1.02	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Bismuth 214	0.962		0.139	0.171		0.0964	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Lead 212	0.748		0.0724	0.121		0.0775	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Lead 214	0.974		0.102	0.143		0.0715	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Potassium 40	18.9		1.28	2.32		0.269	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Protactinium 231	0.387	U	0.974	0.975		2.18	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Radium 226	0.962		0.139	0.171	1.00	0.0964	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Thorium 232	0.985		0.160	0.189		0.126	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Thorium 234	0.616	U	0.295	0.302		0.867	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Uranium 235	0.0954	U	0.326	0.326		0.541	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Americium 241	0.0213	U	0.0908	0.0908		0.121	pCi/g	05/06/16 09:31	05/30/16 19:35	1
Protactinium 234m	1.07	U	3.52	3.53		10.2	pCi/g	05/06/16 09:31	05/30/16 19:35	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.317		0.0583	0.0669		0.0451	pCi/g	05/06/16 09:31	05/30/16 19:35	1

**Client Sample ID: L12-01-20-P-R-S-00**

**Lab Sample ID: 160-17255-16**

Date Collected: 05/04/16 08:45

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.956		0.130	0.162		0.0955	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Bismuth 212	0.984		0.276	0.295		0.261	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Bismuth 214	0.947		0.0876	0.132		0.0516	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Lead 212	1.00		0.0648	0.145		0.0536	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Lead 214	1.13		0.0897	0.148		0.0667	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Potassium 40	17.2		1.02	2.04		0.327	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Protactinium 231	-0.402	U	1.25	1.25		2.09	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Radium 226	0.947		0.0876	0.132	1.00	0.0516	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Thorium 232	0.956		0.130	0.162		0.0955	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Thorium 234	1.02		0.543	0.554		0.738	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Uranium 235	0.0500	U	0.148	0.148		0.489	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Americium 241	0.0337	U	0.0823	0.0823		0.137	pCi/g	05/06/16 09:31	05/30/16 20:15	1
Protactinium 234m	1.63	U	2.72	2.73		6.86	pCi/g	05/06/16 09:31	05/30/16 20:15	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.315		0.0371	0.0494		0.0262	pCi/g	05/06/16 09:31	05/30/16 20:15	1

# Client Sample Results

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

TestAmerica Job ID: 160-17255-2

**Client Sample ID: L12-01-22-P-S-S-00**

**Lab Sample ID: 160-17255-17**

Date Collected: 05/03/16 14:30

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.03		0.151	0.184		0.115	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Bismuth 212	1.22		0.333	0.356		0.257	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Bismuth 214	0.873		0.0967	0.133		0.0593	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Lead 212	0.891		0.0683	0.134		0.0593	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Lead 214	0.943		0.0923	0.135		0.0727	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Potassium 40	17.3		1.18	2.12		0.385	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Protactinium 231	0.000	U	0.228	0.228		1.89	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Radium 226	0.873		0.0967	0.133	1.00	0.0593	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Thorium 232	1.03		0.151	0.184		0.115	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Thorium 234	0.891		0.272	0.287		0.744	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Uranium 235	-0.103	U	0.234	0.234		0.409	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Americium 241	-0.0277	U	0.0759	0.0760		0.107	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Protactinium 234m	-0.980	U	1.24	1.25		11.0	pCi/g	05/06/16 09:39	05/30/16 20:16	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
			(2σ+/-)	(2σ+/-)						
Tl-208	0.316		0.0420	0.0533		0.0283	pCi/g	05/06/16 09:39	05/30/16 20:16	1

**Client Sample ID: L12-01-23-P-R-S-00**

**Lab Sample ID: 160-17255-18**

Date Collected: 05/03/16 14:40

Matrix: Solid

Date Received: 05/05/16 11:15

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.05		0.148	0.182		0.104	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Bismuth 212	0.347	U	0.546	0.547		0.908	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Bismuth 214	0.944		0.117	0.152		0.0885	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Lead 212	1.07		0.0761	0.158		0.0582	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Lead 214	1.05		0.118	0.161		0.0906	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Potassium 40	16.0		1.20	2.03		0.299	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Protactinium 231	0.000	U	0.230	0.230		2.42	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Radium 226	0.944		0.117	0.152	1.00	0.0885	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Thorium 232	1.05		0.148	0.182		0.104	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Thorium 234	1.15		0.560	0.573		0.882	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Uranium 235	0.112	U	0.213	0.214		0.531	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Americium 241	0.0380	U	0.100	0.100		0.166	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Protactinium 234m	3.85	U	5.56	5.57		8.35	pCi/g	05/06/16 09:39	05/30/16 20:16	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
			(2σ+/-)	(2σ+/-)						
Pb-210	1.77		0.666	0.698		0.781	pCi/g	05/06/16 09:39	05/30/16 20:16	1
Tl-208	0.340		0.0535	0.0641		0.0411	pCi/g	05/06/16 09:39	05/30/16 20:16	1

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-17255-2

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

**Lab Sample ID: MB 160-250331/1-A**  
**Matrix: Solid**  
**Analysis Batch: 253813**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**  
**Prep Batch: 250331**

Analyte	MB MB		Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
	Result	Qualifier	Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Actinium 228	0.02497	U	0.0426	0.0427		0.0589	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Bismuth 212	0.07159	U	0.145	0.145		0.249	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Bismuth 214	0.004826	U	0.00518	0.00521		0.0770	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Lead 212	-0.003347	U	0.0208	0.0208		0.0363	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Lead 214	-0.02104	U	0.0262	0.0263		0.0458	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Potassium 40	-0.03758	U	0.204	0.204		0.299	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Protactinium 231	0.0000	U	0.0696	0.0696		0.870	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Radium 226	0.004826	U	0.00518	0.00521	1.00	0.0770	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Thorium 232	0.02497	U	0.0426	0.0427		0.0589	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Thorium 234	-0.1045	U	0.239	0.239		0.421	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Uranium 235	0.01836	U	0.0956	0.0956		0.162	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Americium 241	0.0006931	U	0.0244	0.0244		0.0420	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Protactinium 234m	0.8825	U	1.36	1.36		2.86	pCi/g	05/06/16 09:31	05/31/16 13:14	1
Other Detected Radionuclides	MB MB		Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
	Result	Qualifier	Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Other Detected Radionuclide	None						pCi/g	05/06/16 09:31	05/31/16 13:14	1

**Lab Sample ID: LCS 160-250331/2-A**  
**Matrix: Solid**  
**Analysis Batch: 253765**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**  
**Prep Batch: 250331**

Analyte	Spike Added	LCS Result	LCS Qual	Total	RL	MDC	Unit	%Rec	%Rec.
				Uncert. (2σ+/-)					Limits
Americium 241	101	105.9		11.0		0.505	pCi/g	105	87 - 116
Cesium 137	34.0	37.47		3.87		0.155	pCi/g	110	87 - 120
Cobalt 60	31.0	33.45		3.32		0.0834	pCi/g	108	87 - 115

**Lab Sample ID: 160-17255-1 DU**  
**Matrix: Solid**  
**Analysis Batch: 253763**

**Client Sample ID: L12-01-01-P-S-S-00**  
**Prep Type: Total/NA**  
**Prep Batch: 250331**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total	RL	MDC	Unit	RER	RER
					Uncert. (2σ+/-)					Limit
Actinium 228	0.720		0.7669		0.126		0.0935	pCi/g	0.19	1
Bismuth 212	0.813		0.8935		0.315		0.261	pCi/g	0.15	1
Bismuth 214	0.777		0.8749		0.127		0.0514	pCi/g	0.41	1
Lead 212	0.706		0.7213		0.111		0.0556	pCi/g	0.07	1
Lead 214	0.885		0.7986		0.112		0.0490	pCi/g	0.38	1
Potassium 40	12.4		12.37		1.56		0.197	pCi/g	0.01	1
Protactinium 231	-0.325	U	-0.07204	U	0.988		1.67	pCi/g	0.13	1
Radium 226	0.777		0.8749		0.127	1.00	0.0514	pCi/g	0.41	1
Thorium 232	0.720		0.7669		0.126		0.0935	pCi/g	0.19	1
Thorium 234	0.856		0.7285		0.410		0.635	pCi/g	0.16	1
Uranium 235	0.00145	U	0.04401	U	0.0967		0.278	pCi/g	0.43	1
Americium 241	-0.00472	U	-0.01573	U	0.0638		0.0899	pCi/g	0.1	1

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-17255-2

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

Lab Sample ID: 160-17255-1 DU  
 Matrix: Solid  
 Analysis Batch: 253763

Client Sample ID: L12-01-01-P-S-S-00  
 Prep Type: Total/NA  
 Prep Batch: 250331

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Protactinium 234m	0.853	U	3.350	U	4.26		7.29	pCi/g	0.43	1

Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tl-208	0.233		0.2558		0.0469		0.0285	pCi/g	0.27	1

# QC Association Summary

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

TestAmerica Job ID: 160-17255-2

## Rad

### Leach Batch: 249650

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17255-1	L12-01-01-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-1 DU	L12-01-01-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-2	L12-01-01-P-S-Q-00	Total/NA	Solid	Dry and Grind	
160-17255-3	L12-01-02-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-17255-4	L12-01-04-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-5	L12-01-05-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-17255-6	L12-01-07-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-7	L12-01-08-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-17255-8	L12-01-10-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-9	L12-01-11-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-17255-10	L12-01-13-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-11	L12-01-13-P-S-Q-00	Total/NA	Solid	Dry and Grind	
160-17255-12	L12-01-14-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-17255-13	L12-01-16-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-14	L12-01-17-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-17255-15	L12-01-19-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-16	L12-01-20-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-17255-17	L12-01-22-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-17255-18	L12-01-23-P-R-S-00	Total/NA	Solid	Dry and Grind	

### Prep Batch: 250331

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17255-1	L12-01-01-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-1 DU	L12-01-01-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-2	L12-01-01-P-S-Q-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-3	L12-01-02-P-R-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-4	L12-01-04-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-5	L12-01-05-P-R-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-6	L12-01-07-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-7	L12-01-08-P-R-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-8	L12-01-10-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-9	L12-01-11-P-R-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-10	L12-01-13-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-11	L12-01-13-P-S-Q-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-12	L12-01-14-P-R-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-13	L12-01-16-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-14	L12-01-17-P-R-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-15	L12-01-19-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-16	L12-01-20-P-R-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-17	L12-01-22-P-S-S-00	Total/NA	Solid	Fill_Geo-21	249650
160-17255-18	L12-01-23-P-R-S-00	Total/NA	Solid	Fill_Geo-21	249650
LCS 160-250331/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-250331/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	