

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: 160-16778-2

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:
4/28/2016 12:41:27 PM

Ivan Vania, Project Manager II
(314)298-8566
ivan.vania@testamericainc.com

LINKS

Review your project
results through

TotalAccess

Have a Question?



Visit us at:

www.testamericainc.com

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	4
Receipt Checklists	5
Definitions/Glossary	6
Method Summary	7
Sample Summary	8
Client Sample Results	9
QC Sample Results	14
QC Association Summary	16

Case Narrative

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

TestAmerica Job ID: 160-16778-2

Job ID: 160-16778-2

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Westinghouse Electric Company LLC

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

Report Number: 160-16778-2

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 4/4/2016 11:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 20.0° C.

RADIUM-226 BY GAMMA SPEC (21 DAY INGROWTH)

Samples L05-04-01-T-S-S-00 (160-16778-1), L05-04-02-T-R-S-00 (160-16778-2), L05-04-02-T-R-Q-00 (160-16778-3), L05-04-04-T-E-S-00 (160-16778-4), L05-04-05-T-S-S-00 (160-16778-5), L05-04-06-T-R-S-00 (160-16778-6), L05-04-08-T-S-S-00 (160-16778-7), L05-04-09-T-R-S-00 (160-16778-8), L05-04-11-T-S-S-00 (160-16778-9) and L05-04-12-T-R-S-00 (160-16778-10) were analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA_01_R. The samples were leached on 04/04/2016, prepared on 04/06/2016 and analyzed on 04/27/2016.

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

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-040116-01		Page	1/1	Requested Analysis										Laboratory Name:			
Project Name:						<div style="display: flex; justify-content: space-between;"> <div> Gamma Spec Isotopic Uranium Te-99 Gamma Spec (21 day ingrow for Ra-226) </div> <div> Total Containers </div> </div>										TA-MO			
Contact Person:																Laboratory Address:			
Phone Number:																Phone No.			
Sampler Name																Laboratory Contact Person:			
Westinghouse Electric Company						13715 Rider Trail North													
Clark Evers						314-298-8566													
Mike Dekeyser						708-870-8453													
Sample ID						Date						Time		Matrix		Comp (C) or Grab (G)		Turn Around Time	
L05-04-01-T-S-S-00						4/1/2016						8:30		S		G		Rush (7 days)	
L05-04-02-T-R-S-00						4/1/2016						12:40		S		C		Remarks	
L05-04-02-T-R-Q-00						4/1/2016						12:40		S		C			
L05-04-04-T-E-S-00						4/1/2016						8:40		S		G			
L05-04-05-T-S-S-00						4/1/2016						8:55		S		G			
L05-04-06-T-R-S-00						4/1/2016						12:55		S		C			
L05-04-08-T-S-S-00						4/1/2016						9:00		S		G			
L05-04-09-T-R-S-00						4/1/2016						10:45		S		C			
L05-04-11-T-S-S-00						4/1/2016						9:05		S		G			
L05-04-12-T-R-S-00						4/1/2016						13:25		S		C			
Relinquished by:						Date/Time						Received by:		Date/Time		Total		Cooler Temperature:	
M. Delays						4-4-16						R. Delays		4-4-16		10		Ambient	
Company Name:						0900						Company Name:		09100		Cooler ID:		Shipper and Number:	
WBC												CROSSROADS				0401-01			
Received by:						Date/Time						Relinquished by:		Date/Time		Comments: N/A			
Company Name:												Company Name:							
Relinquished by:						Date/Time						Received by:		Date/Time		Verified By:			
M. Delays						4-4-16						R. Delays		4-4-16		Thomas Yach			
Company Name:						1100						Company Name:		1100		4-3-16			
CROSSROADS												CROSSROADS							

Login Sample Receipt Checklist

Client: Westinghouse Electric Company LLC

Job Number: 160-16778-2

Login Number: 16778

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: 160-16778-2

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.
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: 160-16778-2

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: 160-16778-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-16778-1	L05-04-01-T-S-S-00	Solid	04/01/16 08:30	04/04/16 11:00
160-16778-2	L05-04-02-T-R-S-00	Solid	04/01/16 12:40	04/04/16 11:00
160-16778-3	L05-04-02-T-R-Q-00	Solid	04/01/16 12:40	04/04/16 11:00
160-16778-4	L05-04-04-T-E-S-00	Solid	04/01/16 08:40	04/04/16 11:00
160-16778-5	L05-04-05-T-S-S-00	Solid	04/01/16 08:55	04/04/16 11:00
160-16778-6	L05-04-06-T-R-S-00	Solid	04/01/16 12:55	04/04/16 11:00
160-16778-7	L05-04-08-T-S-S-00	Solid	04/01/16 09:00	04/04/16 11:00
160-16778-8	L05-04-09-T-R-S-00	Solid	04/01/16 10:45	04/04/16 11:00
160-16778-9	L05-04-11-T-S-S-00	Solid	04/01/16 09:05	04/04/16 11:00
160-16778-10	L05-04-12-T-R-S-00	Solid	04/01/16 13:25	04/04/16 11:00

Client Sample Results

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

TestAmerica Job ID: 160-16778-2

Client Sample ID: L05-04-01-T-S-S-00

Date Collected: 04/01/16 08:30

Date Received: 04/04/16 11:00

Lab Sample ID: 160-16778-1

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	1.07		0.117	0.160		0.116	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Bismuth 212	1.36		0.424	0.447		0.386	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Bismuth 214	1.27		0.109	0.171		0.0570	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Lead 212	1.07		0.0789	0.159		0.0636	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Lead 214	1.33		0.0939	0.167		0.0759	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Potassium 40	18.9		1.20	2.27		0.317	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Protactinium 231	0.606	U	0.258	0.266		1.10	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Radium 226	1.27		0.109	0.171	1.00	0.0570	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Thorium 232	1.07		0.117	0.160		0.116	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Thorium 234	1.05		0.289	0.310		0.782	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Uranium 235	0.307		0.154	0.157		0.193	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Americium 241	0.0181	U	0.0544	0.0545		0.0911	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Protactinium 234m	6.09		3.74	3.79		5.51	pCi/g	04/06/16 10:29	04/27/16 08:31	1
Other Detected Radionuclides			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.349		0.0480	0.0601		0.0367	pCi/g	04/06/16 10:29	04/27/16 08:31	1

Client Sample ID: L05-04-02-T-R-S-00

Date Collected: 04/01/16 12:40

Date Received: 04/04/16 11:00

Lab Sample ID: 160-16778-2

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	1.03		0.134	0.170		0.0922	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Bismuth 212	0.821		0.340	0.351		0.342	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Bismuth 214	0.909		0.0886	0.129		0.0596	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Lead 212	0.942		0.0750	0.143		0.0656	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Lead 214	1.06		0.0791	0.135		0.0593	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Potassium 40	17.0		1.02	2.02		0.346	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Protactinium 231	0.416	U	0.219	0.223		0.905	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Radium 226	0.909		0.0886	0.129	1.00	0.0596	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Thorium 232	1.03		0.134	0.170		0.0922	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Thorium 234	0.894		0.267	0.283		0.775	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Uranium 235	0.150	U	0.123	0.124		0.228	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Americium 241	-0.0356	U	0.0620	0.0621		0.103	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Protactinium 234m	3.52	U	2.04	2.07		4.10	pCi/g	04/06/16 10:29	04/27/16 08:28	1
Other Detected Radionuclides			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.278		0.0370	0.0469		0.0294	pCi/g	04/06/16 10:29	04/27/16 08:28	1

TestAmerica St. Louis

Client Sample Results

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

TestAmerica Job ID: 160-16778-2

Client Sample ID: L05-04-02-T-R-Q-00

Lab Sample ID: 160-16778-3

Date Collected: 04/01/16 12:40

Matrix: Solid

Date Received: 04/04/16 11:00

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	0.574		0.155	0.165		0.181	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Bismuth 212	1.32		0.447	0.468		0.392	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Bismuth 214	0.909		0.129	0.160		0.0905	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Lead 212	1.01		0.0922	0.160		0.0774	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Lead 214	0.941		0.101	0.140		0.0790	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Potassium 40	18.8		1.45	2.40		0.497	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Protactinium 231	0.383	U	0.246	0.250		1.37	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Radium 226	0.909		0.129	0.160	1.00	0.0905	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Thorium 232	0.574		0.155	0.165		0.181	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Thorium 234	1.81		0.887	0.907		1.05	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Uranium 235	0.113	U	0.187	0.187		0.269	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Americium 241	-0.00134	U	0.0681	0.0681		0.115	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Protactinium 234m	-0.678	U	3.91	3.91		6.93	pCi/g	04/06/16 10:29	04/27/16 08:22	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208			0.0611	0.0738		0.0401	pCi/g	04/06/16 10:29	04/27/16 08:22	1

Client Sample ID: L05-04-04-T-E-S-00

Lab Sample ID: 160-16778-4

Date Collected: 04/01/16 08:40

Matrix: Solid

Date Received: 04/04/16 11:00

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	1.14		0.169	0.205		0.0951	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Bismuth 212	1.26		0.488	0.505		0.443	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Bismuth 214	1.17		0.120	0.170		0.0764	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Lead 212	0.991		0.0791	0.151		0.0658	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Lead 214	1.33		0.0992	0.170		0.0719	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Potassium 40	18.2		1.18	2.21		0.223	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Protactinium 231	0.561	U	0.356	0.362		1.07	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Radium 226	1.17		0.120	0.170	1.00	0.0764	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Thorium 232	1.14		0.169	0.205		0.0951	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Thorium 234	0.745	U	0.261	0.272		0.761	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Uranium 235	0.0909	U	0.109	0.110		0.232	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Americium 241	-0.0189	U	0.0574	0.0574		0.0961	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Protactinium 234m	3.46	U	2.28	2.30		6.08	pCi/g	04/06/16 10:29	04/27/16 11:03	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208			0.0496	0.0608		0.0391	pCi/g	04/06/16 10:29	04/27/16 11:03	1

TestAmerica St. Louis

Client Sample Results

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

TestAmerica Job ID: 160-16778-2

Client Sample ID: L05-04-05-T-S-S-00

Lab Sample ID: 160-16778-5

Date Collected: 04/01/16 08:55

Matrix: Solid

Date Received: 04/04/16 11:00

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	0.754		0.0877	0.117		0.0740	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Bismuth 212	1.14		0.371	0.389		0.316	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Bismuth 214	0.758		0.0693	0.105		0.0354	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Lead 212	0.670		0.0627	0.107		0.0575	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Lead 214	0.801		0.0679	0.107		0.0613	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Potassium 40	13.8		0.891	1.67		0.297	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Protactinium 231	0.313	U	0.151	0.154		0.915	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Radium 226	0.758		0.0693	0.105	1.00	0.0354	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Thorium 232	0.754		0.0877	0.117		0.0740	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Thorium 234	1.09		0.370	0.387		0.568	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Uranium 235	0.147	U	0.0881	0.0894		0.156	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Americium 241	0.0155	U	0.0505	0.0506		0.0846	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Protactinium 234m	0.293	U	2.44	2.44		4.02	pCi/g	04/06/16 10:29	04/27/16 11:29	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208			0.0393	0.0479		0.0291	pCi/g	04/06/16 10:29	04/27/16 11:29	1

Client Sample ID: L05-04-06-T-R-S-00

Lab Sample ID: 160-16778-6

Date Collected: 04/01/16 12:55

Matrix: Solid

Date Received: 04/04/16 11:00

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	1.06		0.156	0.190		0.153	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Bismuth 212	0.703		0.377	0.384		0.542	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Bismuth 214	1.21		0.142	0.190		0.0887	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Lead 212	1.04		0.0976	0.166		0.0882	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Lead 214	1.26		0.114	0.174		0.0915	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Potassium 40	18.9		1.39	2.39		0.256	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Protactinium 231	0.605	U	0.429	0.434		1.35	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Radium 226	1.21		0.142	0.190	1.00	0.0887	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Thorium 232	1.06		0.156	0.190		0.153	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Thorium 234	1.00	U	0.356	0.371		1.21	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Uranium 235	0.109	U	0.112	0.113		0.289	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Americium 241	-0.00183	U	0.0693	0.0693		0.117	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Protactinium 234m	1.11	U	3.97	3.97		6.94	pCi/g	04/06/16 10:29	04/27/16 11:44	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208			0.0638	0.0746		0.0519	pCi/g	04/06/16 10:29	04/27/16 11:44	1

TestAmerica St. Louis

Client Sample Results

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

TestAmerica Job ID: 160-16778-2

Client Sample ID: L05-04-08-T-S-S-00

Lab Sample ID: 160-16778-7

Date Collected: 04/01/16 09:00

Matrix: Solid

Date Received: 04/04/16 11:00

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	0.908		0.137	0.165		0.132	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Bismuth 212	0.381	U	0.330	0.332		0.518	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Bismuth 214	0.886		0.106	0.140		0.0550	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Lead 212	0.831		0.0820	0.135		0.0722	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Lead 214	1.05		0.105	0.152		0.0822	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Potassium 40	14.6		1.26	1.95		0.458	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Protactinium 231	0.555	U	0.317	0.323		1.27	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Radium 226	0.886		0.106	0.140	1.00	0.0550	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Thorium 232	0.908		0.137	0.165		0.132	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Thorium 234	1.32		0.318	0.347		0.870	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Uranium 235	0.513		0.178	0.186		0.236	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Americium 241	-0.0125	U	0.0668	0.0668		0.112	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Protactinium 234m	4.83	U	4.09	4.12		5.99	pCi/g	04/06/16 10:29	04/27/16 12:18	1
Other Detected Radionuclides			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.297		0.0477	0.0568		0.0333	pCi/g	04/06/16 10:29	04/27/16 12:18	1

Client Sample ID: L05-04-09-T-R-S-00

Lab Sample ID: 160-16778-8

Date Collected: 04/01/16 10:45

Matrix: Solid

Date Received: 04/04/16 11:00

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	0.857		0.123	0.151		0.0927	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Bismuth 212	0.955		0.360	0.374		0.358	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Bismuth 214	1.01		0.102	0.146		0.0674	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Lead 212	0.810		0.0680	0.125		0.0571	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Lead 214	1.07		0.0844	0.140		0.0623	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Potassium 40	14.4		0.996	1.77		0.200	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Protactinium 231	0.230	U	0.188	0.190		1.01	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Radium 226	1.01		0.102	0.146	1.00	0.0674	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Thorium 232	0.857		0.123	0.151		0.0927	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Thorium 234	0.668	U	0.258	0.267		0.702	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Uranium 235	0.178		0.100	0.102		0.159	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Americium 241	-0.0141	U	0.0543	0.0543		0.0910	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Protactinium 234m	0.998	U	2.99	2.99		5.18	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Other Detected Radionuclides			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.39		0.494	0.521		0.621	pCi/g	04/06/16 10:29	04/27/16 11:39	1
Tl-208	0.293		0.0489	0.0576		0.0382	pCi/g	04/06/16 10:29	04/27/16 11:39	1

TestAmerica St. Louis

Client Sample Results

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

TestAmerica Job ID: 160-16778-2

Client Sample ID: L05-04-11-T-S-S-00

Lab Sample ID: 160-16778-9

Date Collected: 04/01/16 09:05

Matrix: Solid

Date Received: 04/04/16 11:00

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	0.525		0.0823	0.0982		0.0652	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Bismuth 212	0.254	U	0.196	0.197		0.306	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Bismuth 214	0.570		0.0575	0.0825		0.0383	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Lead 212	0.464		0.0465	0.0759		0.0409	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Lead 214	0.720		0.0594	0.0955		0.0418	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Potassium 40	9.83		0.690	1.22		0.197	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Protactinium 231	0.229	U	0.149	0.151		0.761	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Radium 226	0.570		0.0575	0.0825	1.00	0.0383	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Thorium 232	0.525		0.0823	0.0982		0.0652	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Thorium 234	1.63		0.298	0.343		0.702	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Uranium 235	0.488		0.104	0.115		0.136	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Americium 241	-0.0187	U	0.0507	0.0508		0.0846	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Protactinium 234m	2.72	U	1.88	1.90		3.38	pCi/g	04/06/16 10:29	04/27/16 12:09	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
Tl-208	0.141		0.0270	0.0307		0.0237	pCi/g	04/06/16 10:29	04/27/16 12:09	1

Client Sample ID: L05-04-12-T-R-S-00

Lab Sample ID: 160-16778-10

Date Collected: 04/01/16 13:25

Matrix: Solid

Date Received: 04/04/16 11:00

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	0.913		0.154	0.180		0.150	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Bismuth 212	1.26		0.420	0.440		0.421	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Bismuth 214	0.877		0.106	0.140		0.0753	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Lead 212	0.981		0.0794	0.150		0.0663	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Lead 214	1.06		0.0937	0.145		0.0729	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Potassium 40	17.2		1.18	2.12		0.329	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Protactinium 231	0.416	U	0.243	0.248		0.999	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Radium 226	0.877		0.106	0.140	1.00	0.0753	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Thorium 232	0.913		0.154	0.180		0.150	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Thorium 234	1.07		0.493	0.505		0.779	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Uranium 235	0.115	U	0.140	0.140		0.223	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Americium 241	0.0207	U	0.0515	0.0516		0.0863	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Protactinium 234m	-1.38	U	3.25	3.26		5.58	pCi/g	04/06/16 10:29	04/27/16 12:12	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
Tl-208	0.328		0.0444	0.0560		0.0315	pCi/g	04/06/16 10:29	04/27/16 12:12	1

TestAmerica St. Louis

QC Sample Results

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

TestAmerica Job ID: 160-16778-2

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

Lab Sample ID: MB 160-244684/1-A

Matrix: Solid

Analysis Batch: 248012

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 244684

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.01339	U	0.0253	0.0254		0.0444	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Bismuth 212	0.04229	U	0.0748	0.0749		0.130	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Bismuth 214	0.002566	U	0.0200	0.0200		0.0335	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Lead 212	-0.003714	U	0.0263	0.0263		0.0231	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Lead 214	-0.006331	U	0.0470	0.0470		0.0299	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Potassium 40	-0.05688	U	2.28	2.28		0.164	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Protactinium 231	-0.0009372	U	0.155	0.155		0.292	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Radium 226	0.002566	U	0.0200	0.0200	1.00	0.0335	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Thorium 232	0.01339	U	0.0253	0.0254		0.0444	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Thorium 234	0.01415	U	0.0209	0.0209		0.274	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Uranium 235	-0.0001865	U	0.000605	0.000605		0.0593	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Americium 241	0.002849	U	0.0125	0.0125		0.0221	pCi/g	04/06/16 10:29	04/27/16 15:56	1
Protactinium 234m	-0.3414	U	13.7	13.7		2.35	pCi/g	04/06/16 10:29	04/27/16 15:56	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	04/06/16 10:29	04/27/16 15:56	1

Lab Sample ID: LCS 160-244684/2-A

Matrix: Solid

Analysis Batch: 248014

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 244684

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium 241	101	101.9		10.6		0.502	pCi/g	101	87 - 116
Cesium 137	34.0	34.06		3.57		0.172	pCi/g	100	87 - 120
Cobalt 60	31.4	31.15		3.15		0.104	pCi/g	99	87 - 115

Lab Sample ID: 160-16778-1 DU

Matrix: Solid

Analysis Batch: 248009

Client Sample ID: L05-04-01-T-S-S-00

Prep Type: Total/NA

Prep Batch: 244684

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium 228	1.07		1.169		0.195		0.159	pCi/g	0.28	1
Bismuth 212	1.36		1.533		0.531		0.450	pCi/g	0.17	1
Bismuth 214	1.27		1.065		0.177		0.0932	pCi/g	0.58	1
Lead 212	1.07		1.040		0.170		0.0917	pCi/g	0.08	1
Lead 214	1.33		1.299		0.184		0.0866	pCi/g	0.09	1
Potassium 40	18.9		18.49		2.36		0.512	pCi/g	0.08	1
Protactinium 231	0.606	U	0.5927	U	0.254		1.33	pCi/g	0.03	1
Radium 226	1.27		1.065		0.177	1.00	0.0932	pCi/g	0.58	1
Thorium 232	1.07		1.169		0.195		0.159	pCi/g	0.28	1
Thorium 234	1.05		1.105		0.353		0.944	pCi/g	0.08	1
Uranium 235	0.307		0.2470		0.195		0.245	pCi/g	0.17	1
Americium 241	0.0181	U	-0.00127	U	0.0724		0.122	pCi/g	0.15	1

9

TestAmerica St. Louis

QC Sample Results

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

TestAmerica Job ID: 160-16778-2

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

Lab Sample ID: 160-16778-1 DU
Matrix: Solid
Analysis Batch: 248009

Client Sample ID: L05-04-01-T-S-S-00
Prep Type: Total/NA
Prep Batch: 244684

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Protactinium 234m	6.09		1.984	U	3.88		6.59	pCi/g	0.54	1
<hr/>										
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tl-208	0.349		0.3591		0.0683		0.0441	pCi/g	0.08	1

QC Association Summary

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

TestAmerica Job ID: 160-16778-2

Rad

Leach Batch: 244065

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16778-1	L05-04-01-T-S-S-00	Total/NA	Solid	Dry and Grind	
160-16778-1 DU	L05-04-01-T-S-S-00	Total/NA	Solid	Dry and Grind	
160-16778-2	L05-04-02-T-R-S-00	Total/NA	Solid	Dry and Grind	
160-16778-3	L05-04-02-T-R-Q-00	Total/NA	Solid	Dry and Grind	
160-16778-4	L05-04-04-T-E-S-00	Total/NA	Solid	Dry and Grind	
160-16778-5	L05-04-05-T-S-S-00	Total/NA	Solid	Dry and Grind	
160-16778-6	L05-04-06-T-R-S-00	Total/NA	Solid	Dry and Grind	
160-16778-7	L05-04-08-T-S-S-00	Total/NA	Solid	Dry and Grind	
160-16778-8	L05-04-09-T-R-S-00	Total/NA	Solid	Dry and Grind	
160-16778-9	L05-04-11-T-S-S-00	Total/NA	Solid	Dry and Grind	
160-16778-10	L05-04-12-T-R-S-00	Total/NA	Solid	Dry and Grind	

Prep Batch: 244684

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16778-1	L05-04-01-T-S-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-1 DU	L05-04-01-T-S-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-2	L05-04-02-T-R-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-3	L05-04-02-T-R-Q-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-4	L05-04-04-T-E-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-5	L05-04-05-T-S-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-6	L05-04-06-T-R-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-7	L05-04-08-T-S-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-8	L05-04-09-T-R-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-9	L05-04-11-T-S-S-00	Total/NA	Solid	Fill_Geo-21	244065
160-16778-10	L05-04-12-T-R-S-00	Total/NA	Solid	Fill_Geo-21	244065
LCS 160-244684/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-244684/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	