

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: 160-17806-2

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:
7/11/2016 5:36:18 PM

Ivan Vania, Project Manager II
(314)298-8566
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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	4
Receipt Checklists	5
Definitions/Glossary	6
Method Summary	7
Sample Summary	8
Client Sample Results	9
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: 160-17806-2

Job ID: 160-17806-2

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Westinghouse Electric Company LLC

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

Report Number: 160-17806-2

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 6/15/2016 11:11 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 L12-01-25-P-S-B-00 (160-17806-1), L12-02-25-P-S-B-00 (160-17806-2), L12-03-25-P-S-B-00 (160-17806-3), L12-03-26-P-S-B-00 (160-17806-4), L12-04-25-P-S-B-00 (160-17806-5), L12-05-25-P-S-B-00 (160-17806-6), L12-06-25-P-S-B-00 (160-17806-7), L12-07-25-P-S-B-00 (160-17806-8), L12-08-25-P-S-B-00 (160-17806-9), L12-09-25-P-S-B-00 (160-17806-10) and L12-09-26-P-S-B-00 (160-17806-11) were analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA_01_R. The samples were leached on 06/15/2016, prepared on 06/17/2016 and analyzed on 07/08/2016.

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-061416-02 **Page** 1/1
Project Name: Westinghouse Electric Company
Contact Person: Clark Evers
Phone Number: 314-810-3336
Sampler Name: John Michel

Laboratory Name: TA-MO
Laboratory Address: 13715 Rider Trail North
Phone No.: 314-298-8566
Laboratory Contact Person: Ivan Vania
Phone No.: 708-870-8453
Turn Around Time: (7 days)
 Rush
 Remarks

Sample ID	Date	Time	Matrix	Comp (C) or Grab (G)	Gamma Spec	Isotopic Uranium	Tc-99	Gamma Spec (21 day Ingrow for Ra-226)	Requested Analysis	Total Containers	Remarks
L12-01-25-P-S-B-00	6/14/2016	16:05	S	G	X	X	X	X		1	LSA 12-01
L12-02-25-P-S-B-00	6/14/2016	15:13	S	G	X	X	X	X		1	LSA 12-02
L12-03-25-P-S-B-00	6/14/2016	15:20	S	G	X	X	X	X		1	LSA 12-03
L12-03-26-P-S-B-00	6/14/2016	15:25	S	G	X	X	X	X		1	LSA 12-03
L12-04-25-P-S-B-00	6/14/2016	15:30	S	G	X	X	X	X		1	LSA 12-04
L12-05-25-P-S-B-00	6/14/2016	15:35	S	G	X	X	X	X		1	LSA 12-05
L12-06-25-P-S-B-00	6/14/2016	15:33	S	G	X	X	X	X		1	LSA 12-06
L12-07-25-P-S-B-00	6/14/2016	16:00	S	G	X	X	X	X		1	LSA 12-07
L12-08-25-P-S-B-00	6/14/2016	15:55	S	G	X	X	X	X		1	LSA 12-08
L12-09-25-P-S-B-00	6/14/2016	15:45	S	G	X	X	X	X		1	LSA 12-09
L12-09-26-P-S-B-00	6/14/2016	15:50	S	G	X	X	X	X		1	LSA 12-09



Relinquished by: *C. Goeman*
Company Name: *WEC*
Received by:
Company Name:

Relinquished by: *KGH*
Company Name: *Cross Roads*
Received by: *C. Goeman*
Company Name: *TA-St. Louis*

Date/Time: 6-15-16 09:15
Date/Time: 6-15-16 09:15
Date/Time: 6-15-16
Date/Time: 11/11
Total: 11
Cooler ID: 0614-01
Shipper and Number:
Cooler Temperature: Ambient
Comments: N/A
Verified By: *C. Goeman*
Chief - 6-15-16

Login Sample Receipt Checklist

Client: Westinghouse Electric Company LLC

Job Number: 160-17806-2

Login Number: 17806

List Source: TestAmerica St. Louis

List Number: 1

Creator: Dedner, Connie L

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
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 <6mm (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: 160-17806-2

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: 160-17806-2

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



Sample Summary

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

TestAmerica Job ID: 160-17806-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-17806-1	L12-01-25-P-S-B-00	Solid	06/14/16 16:05	06/15/16 11:11
160-17806-2	L12-02-25-P-S-B-00	Solid	06/14/16 15:13	06/15/16 11:11
160-17806-3	L12-03-25-P-S-B-00	Solid	06/14/16 15:20	06/15/16 11:11
160-17806-4	L12-03-26-P-S-B-00	Solid	06/14/16 15:25	06/15/16 11:11
160-17806-5	L12-04-25-P-S-B-00	Solid	06/14/16 15:30	06/15/16 11:11
160-17806-6	L12-05-25-P-S-B-00	Solid	06/14/16 15:35	06/15/16 11:11
160-17806-7	L12-06-25-P-S-B-00	Solid	06/14/16 15:33	06/15/16 11:11
160-17806-8	L12-07-25-P-S-B-00	Solid	06/14/16 16:00	06/15/16 11:11
160-17806-9	L12-08-25-P-S-B-00	Solid	06/14/16 15:55	06/15/16 11:11
160-17806-10	L12-09-25-P-S-B-00	Solid	06/14/16 15:45	06/15/16 11:11
160-17806-11	L12-09-26-P-S-B-00	Solid	06/14/16 15:50	06/15/16 11:11

Client Sample Results

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

TestAmerica Job ID: 160-17806-2

Client Sample ID: L12-01-25-P-S-B-00

Lab Sample ID: 160-17806-1

Date Collected: 06/14/16 16:05

Matrix: Solid

Date Received: 06/15/16 11:11

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	0.782		0.121	0.145		0.135	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Bismuth 212	1.25		0.453	0.472		0.383	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Bismuth 214	0.970		0.105	0.145		0.0750	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Lead 212	0.852		0.0724	0.132		0.0648	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Lead 214	0.937		0.115	0.151		0.0932	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Potassium 40	16.6		1.27	2.12		0.419	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Protactinium 231	0.452	U	1.45	1.45		2.42	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Radium 226	0.970		0.105	0.145	1.00	0.0750	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Thorium 232	0.782		0.121	0.145		0.135	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Thorium 234	1.04		0.324	0.342		0.856	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Uranium 235	0.0518	U	0.0631	0.0633		0.627	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Americium 241	0.0610	U	0.0507	0.0511		0.0821	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Protactinium 234m	0.398	U	0.644	0.646		12.0	pCi/g	06/17/16 14:18	07/08/16 18:02	1
Other Detected Radionuclides			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.297		0.0532	0.0614		0.0394	pCi/g	06/17/16 14:18	07/08/16 18:02	1

Client Sample ID: L12-02-25-P-S-B-00

Lab Sample ID: 160-17806-2

Date Collected: 06/14/16 15:13

Matrix: Solid

Date Received: 06/15/16 11:11

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	1.05		0.123	0.162		0.0948	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Bismuth 212	1.35		0.499	0.518		0.425	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Bismuth 214	0.909		0.0939	0.132		0.0639	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Lead 212	0.942		0.0660	0.139		0.0547	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Lead 214	1.01		0.0864	0.136		0.0627	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Potassium 40	17.1		1.04	2.02		0.298	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Protactinium 231	-0.487	U	1.41	1.41		2.35	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Radium 226	0.909		0.0939	0.132	1.00	0.0639	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Thorium 232	1.05		0.123	0.162		0.0948	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Thorium 234	1.41		0.467	0.490		0.706	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Uranium 235	0.159	U	0.138	0.139		0.175	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Americium 241	-0.0352	U	0.0468	0.0470		0.146	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Protactinium 234m	2.20	U	3.29	3.30		7.12	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Other Detected Radionuclides			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.81		0.477	0.522		0.684	pCi/g	06/17/16 14:18	07/08/16 18:05	1
Tl-208	0.297		0.0413	0.0513		0.0331	pCi/g	06/17/16 14:18	07/08/16 18:05	1

Client Sample Results

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

TestAmerica Job ID: 160-17806-2

Client Sample ID: L12-03-25-P-S-B-00

Lab Sample ID: 160-17806-3

Date Collected: 06/14/16 15:20

Matrix: Solid

Date Received: 06/15/16 11:11

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	1.11		0.149	0.183		0.142	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Bismuth 212	1.52		0.481	0.503		0.386	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Bismuth 214	0.828		0.123	0.147		0.0840	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Lead 212	0.972		0.0842	0.134		0.0753	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Lead 214	0.982		0.101	0.139		0.0767	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Potassium 40	18.0		1.36	2.21		0.321	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Protactinium 231	0.000	U	0.420	0.420		2.22	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Radium 226	0.828		0.123	0.147	1.00	0.0840	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Thorium 232	1.11		0.149	0.183		0.142	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Thorium 234	1.07		0.330	0.346		0.867	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Uranium 235	0.168	U	0.160	0.161		0.213	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Americium 241	-0.00240	U	0.0810	0.0810		0.115	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Protactinium 234m	1.33	U	2.40	2.40		9.46	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Pb-210	1.80		0.692	0.730		0.848	pCi/g	06/17/16 14:18	07/08/16 20:12	1
Tl-208	0.362		0.0516	0.0624		0.0323	pCi/g	06/17/16 14:18	07/08/16 20:12	1

Client Sample ID: L12-03-26-P-S-B-00

Lab Sample ID: 160-17806-4

Date Collected: 06/14/16 15:25

Matrix: Solid

Date Received: 06/15/16 11:11

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	1.14		0.190	0.223		0.121	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Bismuth 212	1.23		0.413	0.432		0.383	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Bismuth 214	1.08		0.113	0.160		0.0672	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Lead 212	0.982		0.0795	0.150		0.0742	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Lead 214	1.15		0.0915	0.151		0.0869	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Potassium 40	18.4		1.26	2.26		0.272	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Protactinium 231	0.000	U	0.471	0.471		2.20	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Radium 226	1.08		0.113	0.160	1.00	0.0672	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Thorium 232	1.14		0.190	0.223		0.121	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Thorium 234	1.46		0.528	0.550		0.801	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Uranium 235	0.370		0.162	0.166		0.190	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Americium 241	-0.0194	U	0.0820	0.0821		0.116	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Protactinium 234m	4.34	U	5.38	5.40		9.42	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Pb-210	1.72		0.592	0.625		0.785	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Tl-208	0.282		0.0502	0.0581		0.0430	pCi/g	06/17/16 14:18	07/08/16 18:54	1

TestAmerica St. Louis

Client Sample Results

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

TestAmerica Job ID: 160-17806-2

Client Sample ID: L12-04-25-P-S-B-00

Lab Sample ID: 160-17806-5

Date Collected: 06/14/16 15:30

Matrix: Solid

Date Received: 06/15/16 11:11

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	0.848		0.121	0.149		0.113	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Bismuth 212	0.992		0.361	0.375		0.351	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Bismuth 214	0.869		0.110	0.142		0.0759	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Lead 212	0.859		0.0722	0.133		0.0659	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Lead 214	0.997		0.0911	0.138		0.0799	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Potassium 40	15.0		1.16	1.92		0.300	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Protactinium 231	0.470	U	1.07	1.07		2.40	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Radium 226	0.869		0.110	0.142	1.00	0.0759	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Thorium 232	0.848		0.121	0.149		0.113	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Thorium 234	1.20		0.560	0.574		0.878	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Uranium 235	0.0965	U	0.0967	0.0972		0.608	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Americium 241	-0.0228	U	0.0973	0.0973		0.162	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Protactinium 234m	1.81	U	2.67	2.67		9.19	pCi/g	06/17/16 14:18	07/08/16 18:54	1
Other Detected Radionuclides			Count	Total						
	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.302		0.0443	0.0543		0.0309	pCi/g	06/17/16 14:18	07/08/16 18:54	1

Client Sample ID: L12-05-25-P-S-B-00

Lab Sample ID: 160-17806-6

Date Collected: 06/14/16 15:35

Matrix: Solid

Date Received: 06/15/16 11:11

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	1.02		0.140	0.173		0.102	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Bismuth 212	1.46		0.457	0.481		0.383	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Bismuth 214	0.930		0.0977	0.137		0.0669	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Lead 212	1.08		0.0690	0.156		0.0542	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Lead 214	1.10		0.0977	0.151		0.0697	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Potassium 40	18.5		1.09	2.16		0.353	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Protactinium 231	0.000	U	0.181	0.181		2.10	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Radium 226	0.930		0.0977	0.137	1.00	0.0669	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Thorium 232	1.02		0.140	0.173		0.102	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Thorium 234	1.07		0.288	0.309		0.796	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Uranium 235	-0.0199	U	0.0447	0.0448		0.543	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Americium 241	-0.0489	U	0.0545	0.0548		0.156	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Protactinium 234m	1.96	U	2.86	2.87		8.23	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Other Detected Radionuclides			Count	Total						
	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.50		0.558	0.585		0.706	pCi/g	06/17/16 14:18	07/08/16 18:53	1
Tl-208	0.368		0.0505	0.0631		0.0375	pCi/g	06/17/16 14:18	07/08/16 18:53	1

Client Sample Results

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

TestAmerica Job ID: 160-17806-2

Client Sample ID: L12-06-25-P-S-B-00

Lab Sample ID: 160-17806-7

Date Collected: 06/14/16 15:33

Matrix: Solid

Date Received: 06/15/16 11:11

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	1.08		0.130	0.171		0.108	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Bismuth 212	0.994		0.441	0.453		0.445	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Bismuth 214	1.95		0.153	0.254		0.0922	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Lead 212	1.02		0.0769	0.152		0.0715	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Lead 214	2.22		0.135	0.267		0.0911	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Potassium 40	18.4		1.20	2.23		0.246	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Protactinium 231	0.201	U	0.707	0.707		2.24	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Radium 226	1.95		0.153	0.254	1.00	0.0922	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Thorium 232	1.08		0.130	0.171		0.108	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Thorium 234	1.49		0.548	0.570		0.842	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Uranium 235	0.280		0.141	0.144		0.194	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Americium 241	0.00877	U	0.0878	0.0878		0.124	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Protactinium 234m	3.45	U	6.37	6.38		9.41	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Pb-210	2.01		0.636	0.678		0.822	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Tl-208	0.324		0.0540	0.0636		0.0452	pCi/g	06/17/16 14:18	07/08/16 19:33	1

Client Sample ID: L12-07-25-P-S-B-00

Lab Sample ID: 160-17806-8

Date Collected: 06/14/16 16:00

Matrix: Solid

Date Received: 06/15/16 11:11

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	1.01		0.146	0.178		0.101	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Bismuth 212	0.0399	U	0.541	0.541		0.934	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Bismuth 214	0.884		0.115	0.147		0.0771	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Lead 212	0.815		0.0733	0.128		0.0684	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Lead 214	0.913		0.104	0.141		0.0766	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Potassium 40	15.9		1.24	2.04		0.325	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Protactinium 231	0.492	U	1.13	1.13		2.52	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Radium 226	0.884		0.115	0.147	1.00	0.0771	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Thorium 232	1.01		0.146	0.178		0.101	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Thorium 234	1.24		0.569	0.583		0.888	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Uranium 235	0.0227	U	0.123	0.123		0.598	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Americium 241	0.0404	U	0.0960	0.0961		0.160	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Protactinium 234m	2.24	U	3.84	3.85		9.99	pCi/g	06/17/16 14:18	07/08/16 19:33	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Tl-208	0.258		0.0462	0.0534		0.0365	pCi/g	06/17/16 14:18	07/08/16 19:33	1

TestAmerica St. Louis

Client Sample Results

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

TestAmerica Job ID: 160-17806-2

Client Sample ID: L12-08-25-P-S-B-00

Lab Sample ID: 160-17806-9

Date Collected: 06/14/16 15:55

Matrix: Solid

Date Received: 06/15/16 11:11

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	1.01		0.113	0.152		0.121	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Bismuth 212	0.320	U	0.541	0.542		0.900	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Bismuth 214	0.890		0.0949	0.132		0.0671	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Lead 212	0.964		0.0661	0.141		0.0563	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Lead 214	1.12		0.0897	0.147		0.0567	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Potassium 40	19.1		1.08	2.21		0.286	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Protactinium 231	0.401	U	0.897	0.898		2.00	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Radium 226	0.890		0.0949	0.132	1.00	0.0671	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Thorium 232	1.01		0.113	0.152		0.121	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Thorium 234	1.24		0.277	0.306		0.743	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Uranium 235	-0.125	U	0.558	0.559		0.511	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Americium 241	0.0313	U	0.0909	0.0910		0.151	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Protactinium 234m	3.33	U	3.87	3.89		6.83	pCi/g	06/17/16 14:18	07/08/16 19:34	1
Other Detected Radionuclides			Count	Total						
	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Tl-208	0.314		0.0527	0.0619		0.0404	pCi/g	06/17/16 14:18	07/08/16 19:34	1

Client Sample ID: L12-09-25-P-S-B-00

Lab Sample ID: 160-17806-10

Date Collected: 06/14/16 15:45

Matrix: Solid

Date Received: 06/15/16 11:11

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	1.04		0.137	0.173		0.0768	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Bismuth 212	0.326	U	0.515	0.517		0.859	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Bismuth 214	0.793		0.0957	0.126		0.0675	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Lead 212	0.924		0.0760	0.142		0.0664	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Lead 214	1.01		0.0978	0.144		0.0827	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Potassium 40	14.7		1.18	1.91		0.298	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Protactinium 231	0.313	U	0.984	0.985		2.41	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Radium 226	0.793		0.0957	0.126	1.00	0.0675	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Thorium 232	1.04		0.137	0.173		0.0768	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Thorium 234	1.24		0.346	0.370		0.843	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Uranium 235	0.294		0.166	0.169		0.235	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Americium 241	0.0446	U	0.0969	0.0970		0.161	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Protactinium 234m	2.91	U	4.92	4.93		7.80	pCi/g	06/17/16 14:18	07/08/16 20:11	1
Other Detected Radionuclides			Count	Total						
	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Tl-208	0.316		0.0566	0.0654		0.0439	pCi/g	06/17/16 14:18	07/08/16 20:11	1

Client Sample Results

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

TestAmerica Job ID: 160-17806-2

Client Sample ID: L12-09-26-P-S-B-00

Lab Sample ID: 160-17806-11

Date Collected: 06/14/16 15:50

Matrix: Solid

Date Received: 06/15/16 11:11

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	0.968		0.120	0.155		0.125	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Bismuth 212	1.08		0.330	0.349		0.425	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Bismuth 214	0.979		0.102	0.144		0.0666	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Lead 212	1.02		0.0691	0.149		0.0580	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Lead 214	1.14		0.0864	0.147		0.0700	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Potassium 40	18.3		1.11	2.15		0.398	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Protactinium 231	-0.467	U	1.37	1.37		2.29	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Radium 226	0.979		0.102	0.144	1.00	0.0666	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Thorium 232	0.968		0.120	0.155		0.125	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Thorium 234	1.33		0.519	0.537		0.806	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Uranium 235	0.231		0.179	0.181		0.193	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Americium 241	-0.0303	U	0.0595	0.0596		0.151	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Protactinium 234m	2.21	U	3.45	3.46		8.10	pCi/g	06/17/16 14:18	07/08/16 20:09	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.341		0.0498	0.0609		0.0380	pCi/g	06/17/16 14:18	07/08/16 20:09	1

QC Sample Results

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

TestAmerica Job ID: 160-17806-2

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

Lab Sample ID: MB 160-256926/1-A
Matrix: Solid
Analysis Batch: 259785

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 256926

Analyte	MB MB		Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
	Result	Qualifier	Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Actinium 228	-0.002269	U	0.00541	0.00542		0.0741	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Bismuth 212	-0.1042	U	0.125	0.125		0.431	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Bismuth 214	-0.03388	U	0.0203	0.0206		0.116	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Lead 212	-0.01401	U	0.0200	0.0200		0.0447	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Lead 214	0.02052	U	0.0222	0.0223		0.0350	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Potassium 40	0.007605	U	0.116	0.116		0.232	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Protactinium 231	0.03437	U	0.198	0.198		0.667	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Radium 226	-0.03388	U	0.0203	0.0206	1.00	0.116	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Thorium 232	-0.002269	U	0.00541	0.00542		0.0741	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Thorium 234	-0.1185	U	0.180	0.180		0.333	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Uranium 235	-0.003651	U	0.0623	0.0623		0.133	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Americium 241	-0.0009154	U	0.0201	0.0201		0.0301	pCi/g	06/17/16 14:18	07/08/16 17:30	1
Protactinium 234m	-0.3880	U	2.40	2.40		4.31	pCi/g	06/17/16 14:18	07/08/16 17:30	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	06/17/16 14:18	07/08/16 17:30	1

Lab Sample ID: LCS 160-256926/2-A
Matrix: Solid
Analysis Batch: 259735

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 256926

Analyte	Spike Added	LCS Result	LCS Qual	Total	RL	MDC	Unit	%Rec	%Rec.
				Uncert. (2σ+/-)					Limits
Americium 241	101	104.9		10.9		0.610	pCi/g	104	87 - 116
Cesium 137	33.9	34.01		3.57		0.200	pCi/g	100	87 - 120
Cobalt 60	30.6	30.96		3.13		0.115	pCi/g	101	87 - 115

Lab Sample ID: 160-17803-A-1-I DU
Matrix: Solid
Analysis Batch: 259841

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 256926

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total	RL	MDC	Unit	RER	RER
					Uncert. (2σ+/-)					Limit
Actinium 228	0.903		1.135		0.162		0.0668	pCi/g	0.67	1
Bismuth 212	1.10		1.196		0.333		0.367	pCi/g	0.14	1
Bismuth 214	0.926		1.021		0.147		0.0686	pCi/g	0.35	1
Lead 212	0.959		1.030		0.150		0.0596	pCi/g	0.24	1
Lead 214	1.02		1.091		0.146		0.0663	pCi/g	0.24	1
Potassium 40	19.2		21.96		2.50		0.343	pCi/g	0.58	1
Protactinium 231	0.189	U	-0.00000	U	1.25		2.11	pCi/g	0.10	1
Radium 226	0.926		1.021		0.147	1.00	0.0686	pCi/g	0.35	1
Thorium 232	0.903		1.135		0.162		0.0668	pCi/g	0.67	1
Thorium 234	1.52		1.459		0.340		0.813	pCi/g	0.07	1
Uranium 235	0.256		0.3328		0.130		0.169	pCi/g	0.30	1
Americium 241	0.0357	U	-0.05006	U	0.0546		0.166	pCi/g	0.60	1

TestAmerica St. Louis

QC Sample Results

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

TestAmerica Job ID: 160-17806-2

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

Lab Sample ID: 160-17803-A-1-I DU
 Matrix: Solid
 Analysis Batch: 259841

Client Sample ID: Duplicate
 Prep Type: Total/NA
 Prep Batch: 256926

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER
										Limit
Protactinium 234m	1.94	U	2.351	U	3.25		7.84	pCi/g	0.07	1
<i>Total</i>										
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Pb-210	1.65		1.406		0.582		0.727	pCi/g	0.19	1
Tl-208	0.295		0.3655		0.0611		0.0341	pCi/g	0.63	1

QC Association Summary

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

TestAmerica Job ID: 160-17806-2

Rad

Leach Batch: 256533

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17803-A-1-I DU	Duplicate	Total/NA	Solid	Dry and Grind	
160-17806-1	L12-01-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-2	L12-02-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-3	L12-03-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-4	L12-03-26-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-5	L12-04-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-6	L12-05-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-7	L12-06-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-8	L12-07-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-9	L12-08-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-10	L12-09-25-P-S-B-00	Total/NA	Solid	Dry and Grind	
160-17806-11	L12-09-26-P-S-B-00	Total/NA	Solid	Dry and Grind	

Prep Batch: 256926

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17803-A-1-I DU	Duplicate	Total/NA	Solid	Fill_Geo-21	256533
160-17806-1	L12-01-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-2	L12-02-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-3	L12-03-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-4	L12-03-26-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-5	L12-04-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-6	L12-05-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-7	L12-06-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-8	L12-07-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-9	L12-08-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-10	L12-09-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
160-17806-11	L12-09-26-P-S-B-00	Total/NA	Solid	Fill_Geo-21	256533
LCS 160-256926/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-256926/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	