

# 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: 160-16698-1

Client Project/Site: HDP RFP-CBA-022 (7 DAY TAT)  
Revision: 1

For:

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

Attn: Mr. Martin Swanson



Authorized for release by:  
4/6/2016 1:36:27 PM

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

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



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## Case Narrative

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

TestAmerica Job ID: 160-16698-1

**Job ID: 160-16698-1**

**Laboratory: TestAmerica St. Louis**

### Narrative

## CASE NARRATIVE

**Client: Westinghouse Electric Company LLC**

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

**Report Number: 160-16698-1 - Revision 1**

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. This revision places comments for gamma spec analysis in the correct section of the narrative.

### RECEIPT

The samples were received on 3/28/2016 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.

### TECHNETIUM-99 (ICPMS)

Samples L08-13-13-T-E-B-00 (160-16698-1), L08-13-14-T-E-B-00 (160-16698-2), L08-13-15-T-E-B-00 (160-16698-3), L08-13-16-T-E-B-00 (160-16698-4) and L08-13-17-T-E-B-00 (160-16698-5) were analyzed for Technetium-99 (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 03/29/2016 and analyzed on 03/30/2016.

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

### PERCENT SOLIDS

Samples L08-13-13-T-E-B-00 (160-16698-1), L08-13-14-T-E-B-00 (160-16698-2), L08-13-15-T-E-B-00 (160-16698-3), L08-13-16-T-E-B-00 (160-16698-4) and L08-13-17-T-E-B-00 (160-16698-5) were analyzed for percent solids in accordance with EPA

## Case Narrative

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

TestAmerica Job ID: 160-16698-1

### Job ID: 160-16698-1 (Continued)

#### Laboratory: TestAmerica St. Louis (Continued)

Method 160.3 MOD. The samples were analyzed on 03/29/2016.

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

#### CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Samples L08-13-13-T-E-B-00 (160-16698-1), L08-13-14-T-E-B-00 (160-16698-2), L08-13-15-T-E-B-00 (160-16698-3), L08-13-16-T-E-B-00 (160-16698-4) and L08-13-17-T-E-B-00 (160-16698-5) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 03/28/2016, and prepared and analyzed on 03/31/2016.

Preparation Batch 160-243052:

Radium-226 is reported in these samples at the client's request. Radium-226 is reported from the 609.31 keV line of bismuth-214. Because the samples have not had a 21-day ingrowth, the activity for radium-226 is an estimated value and may be biased low. This bias is caused by the disruption of secular equilibrium between radium-226 and bismuth-214 by the loss of radon-222 during sample preparation. L08-13-13-T-E-B-00 (160-16698-1), L08-13-14-T-E-B-00 (160-16698-2), L08-13-15-T-E-B-00 (160-16698-3), L08-13-16-T-E-B-00 (160-16698-4), L08-13-17-T-E-B-00 (160-16698-5), (LCS 160-243052/2-A), (MB 160-243052/1-A) and (160-16698-A-1-G DU)

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.

[illegible]

160-16698 Chain of Custody

## Login Sample Receipt Checklist

Client: Westinghouse Electric Company LLC

Job Number: 160-16698-1

**Login Number: 16698**

**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: 160-16698-1

### 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: 160-16698-1

Method	Method Description	Protocol	Laboratory
6020A	Metals (ICP/MS), Tc-99	SW846	TAL SL
Moisture	Percent Moisture	EPA	TAL SL
6020A	Metals (ICP/MS), Tc-99 in Activity	SW846	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### 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: 160-16698-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-16698-1	L08-13-13-T-E-B-00	Solid	03/24/16 10:20	03/28/16 11:11
160-16698-2	L08-13-14-T-E-B-00	Solid	03/24/16 10:30	03/28/16 11:11
160-16698-3	L08-13-15-T-E-B-00	Solid	03/24/16 10:25	03/28/16 11:11
160-16698-4	L08-13-16-T-E-B-00	Solid	03/24/16 10:35	03/28/16 11:11
160-16698-5	L08-13-17-T-E-B-00	Solid	03/24/16 15:00	03/28/16 11:11

# Client Sample Results

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

TestAmerica Job ID: 160-16698-1

**Client Sample ID: L08-13-13-T-E-B-00**

**Date Collected: 03/24/16 10:20**

**Date Received: 03/28/16 11:11**

**Lab Sample ID: 160-16698-1**

**Matrix: Solid**

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.27		0.206	0.244		0.0983	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Americium 241	0.0345	U	0.0735	0.0736		0.123	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Bismuth 212	1.44		0.414	0.440		0.308	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Bismuth 214	0.883		0.141	0.169		0.0958	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Lead 212	1.06		0.0956	0.167		0.0787	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Lead 214	0.985		0.115	0.154		0.0962	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Potassium 40	17.9		1.48	2.35		0.459	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Protactinium 231	-0.609	U	0.863	0.865		1.43	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Radium 226	0.883		0.141	0.169	1.00	0.0958	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Thorium 234	0.998		0.336	0.351	1.00	0.972	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Uranium 235	0.152	U	0.159	0.160		0.253	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Protactinium 234m	4.47	U	4.11	4.14		5.63	pCi/g	03/31/16 12:41	03/31/16 21:46	1
Thorium 232	1.27		0.206	0.244		0.0983	pCi/g	03/31/16 12:41	03/31/16 21:46	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>
Ti-208	0.362		0.0683	0.0779		0.0531	pCi/g	03/31/16 12:41	03/31/16 21:46	1

**Client Sample ID: L08-13-13-T-E-B-00**

**Date Collected: 03/24/16 10:20**

**Date Received: 03/28/16 11:11**

**Lab Sample ID: 160-16698-1**

**Matrix: Solid**

**Percent Solids: 83.2**

## Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000083		0.000068	0.000021	mg/Kg	☼	03/29/16 06:15	03/30/16 11:14	1

## Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	1.43		0.0743	0.151	1.37	0.235	pCi/g	03/29/16 06:15	03/30/16 11:14	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	87		30 - 110					03/29/16 06:15	03/30/16 11:14	1

**Client Sample ID: L08-13-14-T-E-B-00**

**Date Collected: 03/24/16 10:30**

**Date Received: 03/28/16 11:11**

**Lab Sample ID: 160-16698-2**

**Matrix: Solid**

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.05		0.115	0.157		0.0852	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Americium 241	-0.0157	U	0.0719	0.0719		0.120	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Bismuth 212	1.35		0.401	0.425		0.348	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Bismuth 214	0.778		0.0840	0.117		0.0587	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Lead 212	1.09		0.0777	0.161		0.0637	pCi/g	03/31/16 12:41	03/31/16 21:47	1

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# Client Sample Results

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

TestAmerica Job ID: 160-16698-1

**Client Sample ID: L08-13-14-T-E-B-00**

**Lab Sample ID: 160-16698-2**

**Date Collected: 03/24/16 10:30**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Lead 214	0.952		0.0824	0.129		0.0625	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Potassium 40	19.2		1.06	2.23		0.258	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Protactinium 231	0.319	U	0.207	0.210		1.01	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Radium 226	0.778		0.0840	0.117	1.00	0.0587	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Thorium 234	2.62		0.575	0.637	1.00	0.853	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Uranium 235	2.70		0.260	0.378		0.250	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Protactinium 234m	4.50	U	2.56	2.60		4.53	pCi/g	03/31/16 12:41	03/31/16 21:47	1
Thorium 232	1.05		0.115	0.157		0.0852	pCi/g	03/31/16 12:41	03/31/16 21:47	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.330		0.0406	0.0531		0.0295	pCi/g	03/31/16 12:41	03/31/16 21:47	1

**Client Sample ID: L08-13-14-T-E-B-00**

**Lab Sample ID: 160-16698-2**

**Date Collected: 03/24/16 10:30**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

**Percent Solids: 81.9**

## Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.00020		0.000070	0.000021	mg/Kg	☼	03/29/16 06:15	03/30/16 11:26	1

## Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	3.48		0.0617	0.326	1.40	0.239	pCi/g	03/29/16 06:15	03/30/16 11:26	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	87		30 - 110					03/29/16 06:15	03/30/16 11:26	1

**Client Sample ID: L08-13-15-T-E-B-00**

**Lab Sample ID: 160-16698-3**

**Date Collected: 03/24/16 10:25**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.950		0.161	0.188		0.112	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Americium 241	0.0236	U	0.0566	0.0567		0.0945	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Bismuth 212	1.55		0.387	0.419		0.312	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Bismuth 214	0.825		0.0968	0.129		0.0653	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Lead 212	1.01		0.0778	0.153		0.0632	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Lead 214	0.882		0.0788	0.121		0.0663	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Potassium 40	18.0		1.16	2.18		0.237	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Protactinium 231	0.844	U	0.380	0.391		0.898	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Radium 226	0.825		0.0968	0.129	1.00	0.0653	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Thorium 234	1.39		0.480	0.502	1.00	0.739	pCi/g	03/31/16 12:41	03/31/16 21:48	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-16698-1

**Client Sample ID: L08-13-15-T-E-B-00**

**Lab Sample ID: 160-16698-3**

**Date Collected: 03/24/16 10:25**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium 235	0.193	U	0.146	0.147		0.205	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Protactinium 234m	3.24	U	3.53	3.55		5.80	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Thorium 232</b>	<b>0.950</b>		0.161	0.188		0.112	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Other Detected Radionuclides			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.388		0.0539	0.0673		0.0371	pCi/g	03/31/16 12:41	03/31/16 21:48	1

**Client Sample ID: L08-13-15-T-E-B-00**

**Lab Sample ID: 160-16698-3**

**Date Collected: 03/24/16 10:25**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

**Percent Solids: 79.9**

## Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
<b>Technetium 99</b>	<b>0.00036</b>		0.000069	0.000021	mg/Kg	☼	03/29/16 06:15	03/30/16 11:30	1

## Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
<b>Technetium 99</b>	<b>6.23</b>		0.448	0.728	1.38	0.236	pCi/g	03/29/16 06:15	03/30/16 11:30	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	91		30 - 110					03/29/16 06:15	03/30/16 11:30	1

**Client Sample ID: L08-13-16-T-E-B-00**

**Lab Sample ID: 160-16698-4**

**Date Collected: 03/24/16 10:35**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
<b>Actinium 228</b>	<b>1.21</b>		0.137	0.184		0.110	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Americium 241	-0.00951	U	6.02	6.02		0.107	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Bismuth 212</b>	<b>1.39</b>		0.458	0.480		0.412	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Bismuth 214</b>	<b>0.964</b>		0.0981	0.140		0.0641	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Lead 212</b>	<b>1.19</b>		0.0819	0.174		0.0661	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Lead 214</b>	<b>0.968</b>		0.0949	0.139		0.0733	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Potassium 40</b>	<b>21.4</b>		1.17	2.45		0.287	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Protactinium 231	0.363	U	0.202	0.206		1.29	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Radium 226</b>	<b>0.964</b>		0.0981	0.140	1.00	0.0641	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Thorium 234</b>	<b>1.20</b>		0.518	0.533	1.00	0.823	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Uranium 235</b>	<b>0.226</b>		0.130	0.132		0.201	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Protactinium 234m	3.07	U	2.97	2.98		4.76	pCi/g	03/31/16 12:41	03/31/16 21:48	1
<b>Thorium 232</b>	<b>1.21</b>		0.137	0.184		0.110	pCi/g	03/31/16 12:41	03/31/16 21:48	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-16698-1

**Client Sample ID: L08-13-16-T-E-B-00**

**Lab Sample ID: 160-16698-4**

**Date Collected: 03/24/16 10:35**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.77		0.707	0.737		0.827	pCi/g	03/31/16 12:41	03/31/16 21:48	1
Tl-208	0.437		0.0561	0.0719		0.0430	pCi/g	03/31/16 12:41	03/31/16 21:48	1

**Client Sample ID: L08-13-16-T-E-B-00**

**Lab Sample ID: 160-16698-4**

**Date Collected: 03/24/16 10:35**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

**Percent Solids: 78.6**

**Method: 6020A - Metals (ICP/MS), Tc-99**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.00047		0.000074	0.000022	mg/Kg	☼	03/29/16 06:15	03/30/16 11:34	1

**Method: 6020A - Metals (ICP/MS), Tc-99 in Activity**

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	8.11		0.178	0.767	1.48	0.254	pCi/g	03/29/16 06:15	03/30/16 11:34	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	86		30 - 110					03/29/16 06:15	03/30/16 11:34	1

**Client Sample ID: L08-13-17-T-E-B-00**

**Lab Sample ID: 160-16698-5**

**Date Collected: 03/24/16 15:00**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

**Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.03		0.108	0.151		0.0908	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Americium 241	0.0181	U	0.0528	0.0528		0.0883	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Bismuth 212	1.08		0.402	0.417		0.380	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Bismuth 214	0.780		0.0932	0.124		0.0704	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Lead 212	1.04		0.0733	0.153		0.0600	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Lead 214	0.969		0.0794	0.128		0.0592	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Potassium 40	17.7		1.03	2.08		0.265	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Protactinium 231	-0.574	U	0.687	0.690		1.13	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Radium 226	0.780		0.0932	0.124	1.00	0.0704	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Thorium 234	1.07		0.461	0.475	1.00	0.732	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Uranium 235	0.103	U	0.140	0.141		0.206	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Protactinium 234m	-0.0204	U	2.14	2.14		3.89	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Thorium 232	1.03		0.108	0.151		0.0908	pCi/g	03/31/16 12:41	03/31/16 21:50	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.312		0.0422	0.0532		0.0344	pCi/g	03/31/16 12:41	03/31/16 21:50	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-16698-1

**Client Sample ID: L08-13-17-T-E-B-00**

**Lab Sample ID: 160-16698-5**

**Date Collected: 03/24/16 15:00**

**Matrix: Solid**

**Date Received: 03/28/16 11:11**

**Percent Solids: 81.2**

## Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.0015		0.000069	0.000021	mg/Kg	☼	03/29/16 06:15	03/30/16 11:38	1

## Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	24.9		0.576	2.36	1.39	0.237	pCi/g	03/29/16 06:15	03/30/16 11:38	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Re	89		30 - 110	03/29/16 06:15	03/30/16 11:38	1

# QC Sample Results

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

TestAmerica Job ID: 160-16698-1

## Method: 6020A - Metals (ICP/MS), Tc-99

Lab Sample ID: MB 160-242513/1-A  
Matrix: Solid  
Analysis Batch: 242946

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 242513

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000053	0.000016	mg/Kg		03/29/16 06:15	03/30/16 11:07	1

Lab Sample ID: LCS 160-242513/2-A  
Matrix: Solid  
Analysis Batch: 242946

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 242513

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.00119	0.00124		mg/Kg		104	80 - 120

Lab Sample ID: 160-16698-1 MS  
Matrix: Solid  
Analysis Batch: 242946

Client Sample ID: L08-13-13-T-E-B-00  
Prep Type: Total/NA  
Prep Batch: 242513

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.000083		0.00143	0.00160		mg/Kg	☼	106	75 - 125

Lab Sample ID: 160-16698-1 MSD  
Matrix: Solid  
Analysis Batch: 242946

Client Sample ID: L08-13-13-T-E-B-00  
Prep Type: Total/NA  
Prep Batch: 242513

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	Limit
Technetium 99	0.000083		0.00143	0.00160		mg/Kg	☼	106	75 - 125	0	30

## Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Lab Sample ID: MB 160-242513/1-A  
Matrix: Solid  
Analysis Batch: 242947

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 242513

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	0.01873	U	0.0185	0.0186	1.06	0.182	pCi/g	03/29/16 06:15	03/30/16 11:07	1
Carrier	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	94		30 - 110					03/29/16 06:15	03/30/16 11:07	1

Lab Sample ID: LCS 160-242513/2-A  
Matrix: Solid  
Analysis Batch: 242947

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 242513

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	20.3	21.22		2.28	1.06	0.182	pCi/g	104	80 - 120
Carrier	LCS %Yield	LCS Qualifier	Limits						
Re	94		30 - 110						

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# QC Sample Results

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

TestAmerica Job ID: 160-16698-1

## Method: 6020A - Metals (ICP/MS), Tc-99 in Activity (Continued)

Lab Sample ID: 160-16698-1 MS

Matrix: Solid

Analysis Batch: 242947

Client Sample ID: L08-13-13-T-E-B-00

Prep Type: Total/NA

Prep Batch: 242513

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	1.43		24.4	27.42		2.74	1.37	0.234	pCi/g	106	75 - 125
<b>Carrier</b>											
	<b>MS %Yield</b>	<b>MS Qualifier</b>	<b>Limits</b>								
Re	88		30 - 110								

Lab Sample ID: 160-16698-1 MSD

Matrix: Solid

Analysis Batch: 242947

Client Sample ID: L08-13-13-T-E-B-00

Prep Type: Total/NA

Prep Batch: 242513

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Technetium 99	1.43		24.4	27.40		2.54	1.36	0.233	pCi/g	106	75 - 125	0.01	1
<b>Carrier</b>													
	<b>MSD %Yield</b>	<b>MSD Qualifier</b>	<b>Limits</b>										
Re	88		30 - 110										

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-243052/1-A

Matrix: Solid

Analysis Batch: 243068

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 243052

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.01033	U	0.0162	0.0163		0.0414	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Americium 241	0.005009	U	0.0121	0.0121		0.0213	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Bismuth 212	0.0000	U	0.0352	0.0352		0.130	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Bismuth 214	-0.01474	U	0.0711	0.0712		0.0552	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Lead 212	-0.005071	U	0.0420	0.0420		0.0272	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Lead 214	-0.01008	U	0.417	0.417		0.0400	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Potassium 40	-0.06207	U	2.48	2.48		0.723	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Protactinium 231	0.05800	U	0.186	0.186		0.341	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Radium 226	-0.01474	U	0.0711	0.0712	1.00	0.0552	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Thorium 234	-0.003878	U	0.00532	0.00533	1.00	0.286	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Uranium 235	-0.003477	U	0.0640	0.0640		0.0743	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Protactinium 234m	-0.03520	U	0.122	0.122		3.40	pCi/g	03/31/16 12:41	03/31/16 20:41	1
Thorium 232	0.01033	U	0.0162	0.0163		0.0414	pCi/g	03/31/16 12:41	03/31/16 20:41	1
<b>Other Detected Radionuclides</b>										
	<b>MB Result</b>	<b>MB Qualifier</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>
Other Detected Radionuclide	None						pCi/g	03/31/16 12:41	03/31/16 20:41	1

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# QC Sample Results

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

TestAmerica Job ID: 160-16698-1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: LCS 160-243052/2-A  
Matrix: Solid  
Analysis Batch: 243069

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 243052

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium 241	101	98.32		10.2		0.516	pCi/g	98	87 - 116
Cesium 137	34.1	32.73		3.42	0.200	0.152	pCi/g	96	87 - 120
Cobalt 60	31.7	29.99		3.03		0.122	pCi/g	95	87 - 115

Lab Sample ID: 160-16698-1 DU  
Matrix: Solid  
Analysis Batch: 243069

Client Sample ID: L08-13-13-T-E-B-00  
Prep Type: Total/NA  
Prep Batch: 243052

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium 228	1.27		1.061		0.165		0.0688	pCi/g	0.52	1
Americium 241	0.0345	U	0.01823	U	0.0636		0.106	pCi/g	0.12	1
Bismuth 212	1.44		1.506		0.505		0.404	pCi/g	0.07	1
Bismuth 214	0.883		0.8419		0.130		0.0640	pCi/g	0.14	1
Lead 212	1.06		1.073		0.164		0.0730	pCi/g	0.03	1
Lead 214	0.985		0.9756		0.133		0.0691	pCi/g	0.03	1
Potassium 40	17.9		17.07		2.04		0.210	pCi/g	0.19	1
Protactinium 231	-0.609	U	0.5087	U	0.265		1.13	pCi/g	0.99	1
Radium 226	0.883		0.8419		0.130	1.00	0.0640	pCi/g	0.14	1
Thorium 234	0.998		1.271		0.512	1.00	0.771	pCi/g	0.32	1
Uranium 235	0.152	U	0.07467	U	0.156		0.252	pCi/g	0.24	1
Protactinium 234m	4.47	U	2.144	U	3.06		5.14	pCi/g	0.32	1
Thorium 232	1.27		1.061		0.165		0.0688	pCi/g	0.52	1
<b>Total</b>										
<b>Other Detected Radionuclides</b>	<b>Sample Result</b>	<b>Sample Qual</b>	<b>DU Result</b>	<b>DU Qual</b>	<b>Total Uncert. (2σ+/-)</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>RER</b>	<b>RER Limit</b>
Tl-208	0.362		0.3339		0.0593		0.0352	pCi/g	0.20	1

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# QC Association Summary

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

TestAmerica Job ID: 160-16698-1

## Metals

### Prep Batch: 242513

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16698-1	L08-13-13-T-E-B-00	Total/NA	Solid	None	
160-16698-1 MS	L08-13-13-T-E-B-00	Total/NA	Solid	None	
160-16698-1 MSD	L08-13-13-T-E-B-00	Total/NA	Solid	None	
160-16698-2	L08-13-14-T-E-B-00	Total/NA	Solid	None	
160-16698-3	L08-13-15-T-E-B-00	Total/NA	Solid	None	
160-16698-4	L08-13-16-T-E-B-00	Total/NA	Solid	None	
160-16698-5	L08-13-17-T-E-B-00	Total/NA	Solid	None	
LCS 160-242513/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-242513/1-A	Method Blank	Total/NA	Solid	None	

### Analysis Batch: 242946

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16698-1	L08-13-13-T-E-B-00	Total/NA	Solid	6020A	242513
160-16698-1 MS	L08-13-13-T-E-B-00	Total/NA	Solid	6020A	242513
160-16698-1 MSD	L08-13-13-T-E-B-00	Total/NA	Solid	6020A	242513
160-16698-2	L08-13-14-T-E-B-00	Total/NA	Solid	6020A	242513
160-16698-3	L08-13-15-T-E-B-00	Total/NA	Solid	6020A	242513
160-16698-4	L08-13-16-T-E-B-00	Total/NA	Solid	6020A	242513
160-16698-5	L08-13-17-T-E-B-00	Total/NA	Solid	6020A	242513
LCS 160-242513/2-A	Lab Control Sample	Total/NA	Solid	6020A	242513
MB 160-242513/1-A	Method Blank	Total/NA	Solid	6020A	242513

## General Chemistry

### Analysis Batch: 242510

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16698-1	L08-13-13-T-E-B-00	Total/NA	Solid	Moisture	
160-16698-1 DU	L08-13-13-T-E-B-00	Total/NA	Solid	Moisture	
160-16698-2	L08-13-14-T-E-B-00	Total/NA	Solid	Moisture	
160-16698-3	L08-13-15-T-E-B-00	Total/NA	Solid	Moisture	
160-16698-4	L08-13-16-T-E-B-00	Total/NA	Solid	Moisture	
160-16698-5	L08-13-17-T-E-B-00	Total/NA	Solid	Moisture	

## Rad

### Leach Batch: 242446

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16698-1	L08-13-13-T-E-B-00	Total/NA	Solid	Dry and Grind	
160-16698-1 DU	L08-13-13-T-E-B-00	Total/NA	Solid	Dry and Grind	
160-16698-2	L08-13-14-T-E-B-00	Total/NA	Solid	Dry and Grind	
160-16698-3	L08-13-15-T-E-B-00	Total/NA	Solid	Dry and Grind	
160-16698-4	L08-13-16-T-E-B-00	Total/NA	Solid	Dry and Grind	
160-16698-5	L08-13-17-T-E-B-00	Total/NA	Solid	Dry and Grind	

### Prep Batch: 242513

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16698-1	L08-13-13-T-E-B-00	Total/NA	Solid	None	
160-16698-1 MS	L08-13-13-T-E-B-00	Total/NA	Solid	None	
160-16698-1 MSD	L08-13-13-T-E-B-00	Total/NA	Solid	None	
160-16698-2	L08-13-14-T-E-B-00	Total/NA	Solid	None	

TestAmerica St. Louis

## QC Association Summary

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

TestAmerica Job ID: 160-16698-1

### Rad (Continued)

#### Prep Batch: 242513 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16698-3	L08-13-15-T-E-B-00	Total/NA	Solid	None	
160-16698-4	L08-13-16-T-E-B-00	Total/NA	Solid	None	
160-16698-5	L08-13-17-T-E-B-00	Total/NA	Solid	None	
LCS 160-242513/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-242513/1-A	Method Blank	Total/NA	Solid	None	

#### Prep Batch: 243052

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-16698-1	L08-13-13-T-E-B-00	Total/NA	Solid	Fill_Geo-0	242446
160-16698-1 DU	L08-13-13-T-E-B-00	Total/NA	Solid	Fill_Geo-0	242446
160-16698-2	L08-13-14-T-E-B-00	Total/NA	Solid	Fill_Geo-0	242446
160-16698-3	L08-13-15-T-E-B-00	Total/NA	Solid	Fill_Geo-0	242446
160-16698-4	L08-13-16-T-E-B-00	Total/NA	Solid	Fill_Geo-0	242446
160-16698-5	L08-13-17-T-E-B-00	Total/NA	Solid	Fill_Geo-0	242446
LCS 160-243052/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-243052/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

## Tracer/Carrier Summary

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

TestAmerica Job ID: 160-16698-1

**Method: 6020A - Metals (ICP/MS), Tc-99 in Activity**

**Matrix: Solid**

**Prep Type: Total/NA**

### Percent Yield (Acceptance Limits)

Lab Sample ID	Client Sample ID	Re (30-110)
160-16698-1	L08-13-13-T-E-B-00	87
160-16698-1 MS	L08-13-13-T-E-B-00	88
160-16698-1 MSD	L08-13-13-T-E-B-00	88
160-16698-2	L08-13-14-T-E-B-00	87
160-16698-3	L08-13-15-T-E-B-00	91
160-16698-4	L08-13-16-T-E-B-00	86
160-16698-5	L08-13-17-T-E-B-00	89
LCS 160-242513/2-A	Lab Control Sample	94
MB 160-242513/1-A	Method Blank	94

### Tracer/Carrier Legend

Re = Re