

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: 160-17454-1 Client Project/Site: HDP RFP-CBA-022 (21 DAY TAT)

# For:

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

Attn: Mr. Martin Swanson

fan A. Van

Authorized for release by: 6/27/2016 11:56:43 AM

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



# **Table of Contents**

Cover Page	1
Table of Contents	2
Case Narrative	3
Chain of Custody	5
Receipt Checklists	6
Definitions/Glossary	7
Method Summary	8
Sample Summary	9
Client Sample Results	10
QC Sample Results	11
QC Association Summary	14
Tracer Carrier Summary	15

#### Job ID: 160-17454-1

#### Laboratory: TestAmerica St. Louis

#### Narrative

### **Client: Westinghouse Electric Company LLC**

**Case Narrative** 

#### Project: HDP RFP-CBA-022 (21 DAY TAT)

#### Report Number: 160-17454-1

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.

#### RECEIPT

The sample was received on 5/19/2016 11:30 AM; the sample arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 20.0° C.

#### RADIUM-226 (GFPC)-21 DAY INGROWTH

Sample 3970-EA-160519-00-01 (160-17454-1) was analyzed for Radium-226 (GFPC)-21 day ingrowth in accordance with EPA Method 903.0. The samples were prepared on 05/31/2016 and analyzed on 06/22/2016.

#### Preparation Batch 160-253972:

Insufficient sample volume was available to perform a sample duplicate (DUP) for sample 3970-EA-160519-00-01 (160-17454-1). A laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) were prepared instead. The sample was a filter that was dissolved and split between multiple analyses.

The method blank (MB) has radium-226 activity above the MDC and RL. The following associated samples are non-detect for the contaminant, therefore re-analysis is not required. The data have been qualified and reported. 3970-EA-160519-00-01 (160-17454-1), (LCS 160-253972/2-A), (LCSD 160-253972/3-A) and (MB 160-253972/1-A).

# Job ID: 160-17454-1 (Continued)

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

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

#### **ISOTOPIC THORIUM (ALPHA SPECTROMETRY)**

Sample 3970-EA-160519-00-01 (160-17454-1) was analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 06/01/2016 and analyzed on 06/13/2016.

Preparation Batch 160-254002:

This filter sample was split among several analyses; an LCSD was prepared in batch 254002 to meet QC requirements. 3970-EA-160519-00-01 (160-17454-1)

Thorium-230 was detected in method blank MB 160-254002/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate.

The Laboratory Control Sample (LCS) spike recovery (129%) associated with the following sample is outside the upper QC limit of (81-118%) indicating a potential positive bias for that analyte : 3970-EA-160519-00-01 (160-17454-1), (LCS 160-254002/2-A), (LCSD 160-254002/3-A) and (MB 160-254002/1-A). This analyte was not observed above the requested limit in the associated samples; therefore the sample data was not adversely affected by this excursion. The data have been qualified and reported.

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

#### ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Sample 3970-EA-160519-00-01 (160-17454-1) was analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 06/01/2016 and analyzed on 06/13/2016.

Preparation Batch 160-254004:

This filter sample was split among several analyses; an LCSD was prepared in batch 254004 to meet QC requirements. 3970-EA-160519-00-01 (160-17454-1)

Uranium 234 and Uranium 238 were detected in method blank MB 160-254004/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates.

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

#### TECHNETIUM-99 (LSC)

Sample 3970-EA-160519-00-01 (160-17454-1) was analyzed for Technetium-99 (LSC) in accordance with DOE Tc-02-RC. The samples were prepared on 06/01/2016 and analyzed on 06/06/2016.

Preparation Batch 160-254097:

This filter sample was split among several analyses; an LCSD was prepared in batch 254097 to meet QC requirements. 3970-EA-160519-00-01 (160-17454-1)

The detection goal of 1.00 pCi/Samples were not met for the following samples due to insufficient sample available for analysis. 3970-EA-160519-00-01 (160-17454-1) and (MB 160-254097/1-A). Analytical results are reported with the detection limit achieved.

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

Hematite		Procedu	re HDP-F	PR-Q4	4-006, (	Chain	of Cu	stody								
Decommissionin	ıg	Revision	on: 4								Page 1 of					
Project		Westing	house No	on-Pro	prietary	Class	s 3					-				
					FC	DRM CHA	1 HJ	DP-I OF	PR- CU	QA- STC	006 0DY	-1 r				
Instructions: Each time the container is	transferred to an	other orga	nization	a ners	on from	each	organ	izatio	n sho	uld ci	m tha	CoC	The	Loho	rotor	The dillog and the dealers in the second
the sample is released for use or analysi	s and send the co	mpleted C	oC to HI	DP.	on non	caen	0154	uzano	11 5110	ulu si	gn me		. The	Lauu	rator	by End User must verify that the sample is correctly identified befor
Chain of Cutody ID No.	051916-01	Page	1/1				R	eque	sted	Ana	lysis					Laboratory Name:
Project Name:																TA-MO
Westinghouse Electric Comp	any							ļ								
Contact Person: W. Clark Evers													ers	Laboratory Address: 13715 Rider Trail North Earth City, MO 63045		
Phone Number:				1											taine	Phone No.
314-810-3336			· ,	-	Iter										Con	314-298-8566
Sampler Name:				Ē	1 (fi	1									Cotal	Laboratory Contact Person:
C. GOISKI				) (C	iun										Ľ	Phone No
				G	Jran	llter	lter	ilter	(Le							708-870-8453
				°	L C	E	E	2 (f)	(EII							Turn Around Time
				))du	top	-23;	-21(	-22	66							Normal (21 days)
Sample ID	Date	Time	Matrix	Con	Iso	Ê	Pb	Ra.	T <sub>c</sub>							Remarks
3970-EA-160519-00-01	5/19/2016	7:30	F	С	X	X		X	X						1	BSA02-20 Comp
							ĺ									T TATALA KATA TAKIN KUTI DALA KUTI DALA JIKATI TAKIN KATA TAKIN KATA
							İ			·						
				Γ				<u> </u>								
								<u> </u>		İ						
				$\top$								-				160-17454 Chain of Custody
		1		+				-								
	1						-			t			$\square$	-		
	1		1	1		1	<b> </b>									
Relinquished by: Goesu	D	ate/Time	Re	geiv,	d by	Ý	1			Date/	Time	e	Tota	al Nư	mber	r of Containers: Cooler Temperature:
ciuj4	- 5	-19-16	, ∐	<u>\</u>	<u>5 אלת 5</u>	Į			5	- 19	-11	,				I Ambient
Company Name:	9	: 30	Cò	mpa	ny Nă ∠c≪≶(	me: ≀∽≏	กร		ĺ	٩.,	30		Conta	uner] 01	ID:	Shipper and Number:
Received by:	D	ate/Time	e Re	linqı	uished	by:			)	Date/	Time	e	Comn	nents	: PO	0 #4500404709
Company Name:			Co	mpa	ny Na	me:										
Relinquished by: 3815	D S	ate/Time	ic Ro	çeiv.	ed by:	(IL A)	$\mathbb{N}$	)()		Date/	Time	•	Verifi	ied B	v: C	Case
Company Name: CLOSS LOADS		30	- 60	mpa		me:			S	11	50					Curper S/19/12
Choss Korbs		-19- :30	- CO	hinpa Martin		00 me:		<u></u>	S	19.	50		Verifi	ied B	y: C	Curpt_ 5/19/14

Quality Record

# Login Sample Receipt Checklist

Client: Westinghouse Electric Company LLC

#### Login Number: 17454 List Number: 1 Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is = background as measured by a survey meter.</td <td>True</td> <td></td>	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	

#### Job Number: 160-17454-1

List Source: TestAmerica St. Louis

Client: Westinghouse Electric Company LLC Project/Site: HDP RFP-CBA-022 (21 DAY TAT)

#### Qualifiers

R	а	d	

Rad		
Qualifier	Qualifier Description	
U	Result is less than the sample detection limit.	
G	The Sample MDC is greater than the requested RL.	
*	LCS or LCSD is outside acceptance limits.	6

### 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 (21 DAY TAT)

**Method Description** 

Radium-226 (GFPC)

Technetium-99 (LSC)

DOE = U.S. Department of Energy EPA = US Environmental Protection Agency

Isotopic Thorium (Alpha Spectrometry)

Isotopic Uranium (Alpha Spectrometry)

TestAmerica Job ID: 160-17454-1						
EPA	TAL SL					
DOE DOE	TAL SL TAL SL	5				
DOE	TAL SL	6				
		7				

#### Laboratory References:

**Protocol References:** 

Method

903.0

A-01-R A-01-R

TC-02-RC

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 (21 DAY TAT)

TestAmerica Job ID: 160-17454-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-17454-1	3970-EA-160519-00-01	Filter	05/19/16 07:30	05/19/16 11:30

# **Client Sample Results**

Client: Westinghouse Electric Company LLC Project/Site: HDP RFP-CBA-022 (21 DAY TAT)

Project/Site: HDP	RFP-CBA-02	2 (21 DAY	TAT)								
Client Sample Date Collected: 0	ID: 3970-E 5/19/16 07:30	A-16051	9-00-01				I	_ab Sample	e ID: 160-17 Matrix	7454-1 c: Filter	
Date Received: 0	5/19/16 11:30										
	Radium-226	(GFPC)									
		. ,	Count	Total							5
			Uncert.	Uncert.							
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac	
Radium-226	0.274	U	0.361	0.362	1.00	0.603	pCi/Sample	05/31/16 19:09	06/22/16 07:45	1	
<b>a</b> .		o	,					_ /			
Carrier	%Yield	Qualifier						Prepared	Analyzed	Dil Fac	
Ba Carrier	88.6		40 - 110					05/31/16 19:09	06/22/16 07:45	1	8
Method: A-01-R	- Isotopic Th	orium (Al	pha <mark>Spectr</mark> Count Uncert	ometry) Total Uncert							9
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac	
Thorium-232	0.0266	U	0.0367	0.0368	1.00	0.0570	pCi/Sample	06/01/16 08:50	06/13/16 12:42	1	
Tracer	%Yield	Qualifier	Limits					Prepared	Analvzed	Dil Fac	
Thorium-229	85.8		30 - 110					06/01/16 08:50	06/13/16 12:42	1	
Method: A-01-R	- Isotopic Ur	anium (Al	pha Spectr Count Uncert.	o <mark>metry)</mark> Total Uncert.							
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac	
Uranium 234	0.491		0.166	0.171	1.00	0.0763	pCi/Sample	06/01/16 08:50	06/13/16 12:45	1	
Uranium 235	0.000	U	0.0143	0.0143	1.00	0.0515	pCi/Sample	06/01/16 08:50	06/13/16 12:45	1	
Uranium 238	0.193		0.103	0.104	1.00	0.0413	pCi/Sample	06/01/16 08:50	06/13/16 12:45	1	
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac	
Uranium 232	66.2		30 - 110					06/01/16 08:50	06/13/16 12:45	1	

Uranium 232

#### Method: TC-02-RC - Technetium-99 (LSC)

			Count Uncert.	Total Uncert.						
Analyte	Result	Qualifier	(2 <b>σ+/-</b> )	(2 <b>σ+/-</b> )	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	-6.00	UG	4.07	4.11	1.00	7.21	pCi/Sample	06/01/16 10:37	06/24/16 02:00	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Tc-99m	88.6		30 - 110					06/01/16 10:37	06/24/16 02:00	1

10

Method:	903.0 -	Radium-226	(GFPC)	)

Analysis Ba	icn: 25/5	02		Count	Total					Prep Bato	:n: 28	53972
		МВ	МВ	Uncert.	Uncert.							
Analyte		Result	Qualifier	(2 <b>σ+/-</b> )	(2 <b>σ+/-</b> )	RL	MDC	Unit	Prepared	Analyzed	d I	Dil Fa
Radium-226		1.022		0.432	0.441	1.00	0.495	pCi/Sample	05/31/16 19:09	06/22/16 07	':45	
		МВ	МВ									
Carrier		%Yield	Qualifier	Limits					Prepared	Analyzed	d l	Dil Fa
Ba Carrier		82.1		40 - 110					05/31/16 19:09	06/22/16 07	7:45	
Lab Sample	ID: LCS	160-253	972/2-A					Clien	t Sample ID:	Lab Contr	rol Sa	mpl
Matrix: Filte	r									Prep Type	: Tot	al/N
Analysis Ba	tch: 2575	02								Prep Bato	ch: 2{	5397
						Total				•		
			Spike	LCS	LCS	Uncert.				%Rec.		
Analyte			Added	Result	Qual	(2 <b>σ+/-</b> )	RL	MDC U	nit %Rec	Limits		
Radium-226			74.4	80.52		7.88	1.00	0.503 p	Ci/Sam 108	65 - 140		
	LCS	LCS										
Carrier	%Yield	Qualifier	Limits									
3a Carrier	86.9		40 - 110	_								
Lab Sample	ID: LCS	0 160-25	3972/3-A					Client Sar	nple ID: Lab	Control Sa	ample	e Du
Matrix: Filte	r									Prep Type	: Tot	al/N/
Analysis Ba	tch: 2575	02								Prep Bato	ch: 25	5397
						Total						
			Spike	LCSD	LCSD	Uncert.				%Rec.		RE
Analyte			Added	Result	Qual	(2σ+/-)	RL	MDC U	nit %Rec	Limits	RER	Lim
Radium-226			74.4	82.89		8.11	1.00	0.499 p	Ci/Sam 111	65 - 140	0.15	
	LCSD	LCSD										
Carrier	%Yield	Qualifier	Limits									
Ba Carrier	86.9		40 - 110	-								

Lab Sample ID: M Matrix: Filter			Client Samp	le ID: Method Prep Type: To	l Blank otal/NA					
Analysis Batch: 2	56227								Prep Batch:	2 <mark>5400</mark> 2
			Count	Total						
	MB	MB	Uncert.	Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-232	0.006574	U	0.0244	0.0244	1.00	0.0623	pCi/Sample	06/01/16 08:50	06/13/16 12:42	1
	MB	MB								
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	78.8		30 - 110					06/01/16 08:50	06/13/16 12:42	1

# Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

- Loh Comple		400 254	000/0 4					Clie			Lab Control	Comple
Lab Sample		160-254	002/2-A					CIIE	ent Sam	ipie iD:	Lab Control	Sample
	r tahi 9564	46									Prep Type:	01al/NA
Analysis Da	ICH: 2564	010				Total					Ргер Басси	254002
			Spike	1.09	1.00	lincort					% Boo	
Analuta			Spike	Decult			ы	MDC	11		%Rec.	
Analyte				Result		(20+/-)	RL			%Rec		
monum-230			8.03	10.55		1.10	1.00	0.0626	pci/sam	129	01-110	
	LCS	LCS										
Tracer	%Yield	Qualifier	· Limits									
Thorium-229	75.6		30 - 110	_								
Lab Sample Matrix: Filter	ID: LCSI r	0 160-25	54002/3-A					Client Sa	ample I	D: Lab	Control Sam Prep Type: 1	ple Dup fotal/NA
Analysis Bat	tch: 2564	18									Prep Batch	254002
						Total						
			Spike	LCSD	LCSD	Uncert.					%Rec.	RER
Analyte			Added	Result	Qual	(2σ+/-)	RL	MDC	Unit	%Rec	Limits RE	R Limit
Thorium-230			8.03	9.373		1.01	1.00	0.0599	pCi/Sam	117	81_118 0.4	45 1
	LCSD	LCSD										
Tracer	%Yield	Qualifier	Limits									
<b>Tracer</b> Thorium-229	%Yield 82.0	Qualifier	Limits	_								
Tracer Thorium-229	%Yield 82.0	Qualifier	<u>Limits</u> 30 - 110	_								
Tracer Thorium-229 Method: A- Lab Sample	%Yield 82.0 01-R - Is ID: MB 1	Qualifier Sotopi 60-2540	<u>Limits</u> 30-110 C Uranium	- ı (Alpha	a Spectr	ometry)			Clier	nt Samp	ole ID: Metho	d Blank
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter	<u>%Yield</u> 82.0 01-R - Is ID: MB 1	Qualifier	<u>Limits</u> 30 - 110 C Uranium	n (Alpha	a Spectr	ometry)			Clier	nt Samp	ole ID: Metho Prep Type: 1	d Blank otal/NA
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter Analysis Bat	%Yield 82.0 01-R - I ID: MB 1 r tch: 2562	Qualifier sotopi 60-2540	<u>Limits</u> 30 - 110 C Uranium	- ı (Alpha	a Spectr	ometry)			Clier	nt Samp	ole ID: Metho Prep Type: ⊺ Prep Batch:	d Blank Total/NA 254004
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter Analysis Bat	%Yield 82.0 01-R - I ID: MB 1 r tch: 2562	Qualifier SOTOPI 60-2540	<u>Limits</u> 30 - 110 <b>c Uranium</b> 004/1-A	Count	a Spectr	ometry)			Clier	nt Samp	ole ID: Metho Prep Type: 1 Prep Batch	d Blank otal/NA 254004
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter Analysis Bat	%Yield 82.0 01-R - I ID: MB 1 r tch: 2562	Qualifier Sotopi 60-2540 33 MB	<u>Limits</u> 30-110 c Uranium 004/1-A MB	Count Uncert.	Total Uncert.	ometry)			Clier	nt Samp	ole ID: Metho Prep Type: 1 Prep Batch	d Blank Total/NA 254004
Tracer Thorium-229 Vethod: A- Lab Sample Matrix: Filter Analysis Bat	%Yield 82.0 01-R - I: ID: MB 1 r tch: 2562	Qualifier sotopi 60-2540 33 MB Result	<u>Limits</u> 30-110 C Uranium 04/1-A MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	ometry) RL	MDC	Unit	Clier	nt Samp	Die ID: Metho Prep Type: 1 Prep Batch: Analyzed	d Blank Total/NA 254004 Dil Fac
Tracer Thorium-229 Vethod: A- Lab Sample Matrix: Filter Analysis Bat Analysis Bat	%Yield 82.0 01-R - I: ID: MB 1 r tch: 2562	Qualifier sotopi 60-2540 33 MB Result 0.05750	<u>Limits</u> 30-110 C Uranium 04/1-A MB Qualifier	Count Uncert. (2σ+/-) 0.0575	Total Uncert. (2σ+/-) 0.0577	ometry) 	<b>MDC</b> 0.0431	Unit pCi/Samp	Clier Pre le 06/01	pared 716 08:50	Die ID: Metho Prep Type: 1 Prep Batch: Analyzed 06/13/16 12:45	d Blank Total/NA 254004 Dil Fac
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter Analysis Bat Analysis Bat Uranium 234 Uranium 235	%Yield 82.0 01-R - Is ID: MB 1 r tch: 2562	Qualifier <b>Sotopi</b> <b>60-2540</b> <b>33</b> <b>MB</b> <b>Result</b> 0.05750 0.0000	<u>Limits</u> 30-110 C Uranium 04/1-A MB Qualifier	Count Uncert. (2σ+/-) 0.0575 0.0149	Total Uncert. (2σ+/-) 0.0577 0.0149	ometry) 	<b>MDC</b> 0.0431 0.0537	Unit pCi/Samp pCi/Samp	Clier Pre ile 06/01 ile 06/01	<b>pared</b> /16 08:50 /16 08:50	Die ID: Metho Prep Type: 1 Prep Batch: Mnalyzed 06/13/16 12:45 06/13/16 12:45	d Blank Total/NA 254004 Dil Fac
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter Analysis Bat Analysis Bat Uranium 234 Uranium 235 Uranium 238	<u>%Yield</u> 82.0 01-R - I ID: MB 1 r tch: 2562	Qualifier <b>SOTODI</b> <b>60-2540</b> <b>33</b> <b>MB</b> <b>Result</b> 0.05750 0.0000 0.04304	<u>Limits</u> 30 - 110 <b>C Uranium</b> 04/1-A MB Qualifier	Count Uncert. (2σ+/-) 0.0575 0.0149 0.0497	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	<b>RL</b> 1.00 1.00 1.00	<b>MDC</b> 0.0431 0.0537 0.0430	Unit pCi/Samp pCi/Samp pCi/Samp	Clier Clier le 06/01 le 06/01 le 06/01	pared /16 08:50 /16 08:50 /16 08:50	Die ID: Metho Prep Type: 7 Prep Batch Malyzed 06/13/16 12:45 06/13/16 12:45	<b>Dil Fac</b> <b>Dil Fac</b> 1 5 1
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter Analysis Bat Analysis Bat Uranium 234 Uranium 235 Uranium 238	<u>%Yield</u> 82.0 01-R - I ID: MB 1 r tch: 2562	Qualifier SOTOPI 60-2540 333 MB Result 0.05750 0.0000 0.04304 MB	<u>Limits</u> 30-110 C Uranium 004/1-A MB Qualifier U	Count Uncert. (20+/-) 0.0575 0.0149 0.0497	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	<b>RL</b> 1.00 1.00 1.00	<b>MDC</b> 0.0431 0.0537 0.0430	Unit pCi/Samp pCi/Samp pCi/Samp	Clier Pre le 06/01 le 06/01 le 06/01	pared /16 08:50 /16 08:50 /16 08:50	Die ID: Metho Prep Type: 7 Prep Batch Malyzed 06/13/16 12:45 06/13/16 12:45	<b>Dil Fac</b> <b>Dil Fac</b> 1 5 1
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter Analysis Bat Analysis Bat Uranium 234 Uranium 235 Uranium 238 Tracer	<u>%Yield</u> 82.0 01-R - Is ID: MB 1 r tch: 2562	Qualifier <b>Sotopi</b> <b>60-2540</b> <b>33</b> <b>MB</b> <b>Result</b> 0.05750 0.0000 0.04304 <b>MB</b> %Yield	<u>Limits</u> 30-110 C Uranium 04/1-A MB Qualifier U MB Qualifier	Count Uncert. (2σ+/-) 0.0575 0.0149 0.0497 Limits	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	<b>RL</b> 1.00 1.00	<b>MDC</b> 0.0431 0.0537 0.0430	Unit pCi/Samp pCi/Samp pCi/Samp	Clier Pre 06/01 06/01 06/01	pared /16 08:50 /16 08:50 /16 08:50	Die ID: Metho Prep Type: T Prep Batch 06/13/16 12:45 06/13/16 12:45 06/13/16 12:45	d Blank Fotal/NA 254004 Dil Fac 1 5 1 1 1 1 0 1
Tracer Thorium-229 Vethod: A- Lab Sample Matrix: Filter Analysis Bat Uranium 234 Uranium 235 Uranium 238 Tracer Uranium 232	<u>%Yield</u> 82.0 01-R - Is ID: MB 1 r tch: 2562	Qualifier <b>Sotopi</b> <b>60-2540</b> <b>33</b> <b>MB</b> <b>Result</b> 0.05750 0.0000 0.04304 <i>MB</i> %Yield 59.4	Limits 30-110 C Uranium 04/1-A MB Qualifier U MB Qualifier	Count Uncert. (2σ+/-) 0.0575 0.0149 0.0497 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	<b>ometry)</b> RL   1.00   1.00   1.00	<b>MDC</b> 0.0431 0.0537 0.0430	Unit pCi/Samp pCi/Samp pCi/Samp	Clier Pre 1e 06/01 1e 06/01 1e 06/01 Pre 06/01	epared /16 08:50 /16 08:50 /16 08:50 /16 08:50	Die ID: Metho Prep Type: 1 Prep Batch 06/13/16 12:45 06/13/16 12:45 06/13/16 12:45 Analyzed 06/13/16 12:45	<b>Dil Fac</b> <b>Dil Fac</b> <b>Dil Fac</b> <b>Dil Fac</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b>
Tracer Thorium-229 Wethod: A- Lab Sample Matrix: Filter Analysis Bat Analyte Uranium 234 Uranium 235 Uranium 238 Tracer Uranium 232 Lab Sample Matrix: Filter Analysis Bat	<u>%Yield</u> 82.0 01-R - I: ID: MB 1 r tch: 2562 ID: LCS r tch: 2564	Qualifier sotopi 60-2540 33 MB Result 0.05750 0.0000 0.04304 MB % Yield 59.4 160-254	Limits 30-110 C Uranium 04/1-A MB Qualifier U MB Qualifier 004/2-A	Count Uncert. (2σ+/-) 0.0575 0.0149 0.0497 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	ometry) 	<b>MDC</b> 0.0431 0.0537 0.0430	Unit pCi/Samp pCi/Samp pCi/Samp	Clier Ile 06/01 Ile 06/01 Ile 06/01 Pre 06/01 Present Sam	epared /16 08:50 /16 08:50 /16 08:50 /16 08:50 /16 08:50 /16 08:50	Analyzed         06/13/16       12:45         06/13/16       12:45         06/13/16       12:45         06/13/16       12:45         06/13/16       12:45         06/13/16       12:45         06/13/16       12:45         06/13/16       12:45         Lab Control       Prep Type: The patch         Prep Batch       10	d Blank Total/NA 254004 Dil Fac 1 1 1 1 1 5 1 1 1 1 1 1 1 1 5 5 7 5 5 7 5 5 7 5 5 7 7 5 5 7 7 7 5 7
Tracer Thorium-229 Vethod: A- Lab Sample Matrix: Filter Analysis Bat Uranium 234 Uranium 235 Uranium 235 Uranium 238 Tracer Uranium 232 Lab Sample Matrix: Filter Analysis Bat	<u>%Yield</u> 82.0 01-R - Is ID: MB 1 r tch: 2562 ID: LCS r tch: 2564	Qualifier sotopi 60-2540 33 MB Result 0.05750 0.0000 0.04304 <i>MB</i> %Yield 59.4 160-254	Limits 30-110 C Uranium 04/1-A MB Qualifier U MB Qualifier 004/2-A	Count Uncert. (2σ+/-) 0.0575 0.0149 0.0497 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	RL           1.00           1.00           1.00           1.00           1.00           1.00	<b>MDC</b> 0.0431 0.0537 0.0430	Unit pCi/Samp pCi/Samp pCi/Samp	Clier Ile 06/01 Ile 06/01 Ile 06/01 Pre 06/01 Present Sam	epared /16 08:50 /16 08:50 /16 08:50 /16 08:50 /16 08:50 pared /16 08:50	Die ID: Metho Prep Type: 1 Prep Batch: 06/13/16 12:45 06/13/16 12:45 06/13/16 12:45 Analyzed 06/13/16 12:45 Lab Control Prep Type: 1 Prep Batch: %Rec	d Blank Total/NA 254004 Dil Fac 1 1 1 1 5 <i>Dil Fac</i> 7 Sample Total/NA 254004
Tracer Thorium-229 Vethod: A- Lab Sample Matrix: Filter Analysis Bat Uranium 234 Uranium 235 Uranium 235 Uranium 238 Tracer Uranium 232 Lab Sample Matrix: Filter Analysis Bat	<u>%Yield</u> 82.0 01-R - Is ID: MB 1 r tch: 2562 ID: LCS r tch: 2564	Qualifier <b>Sotopi</b> <b>60-2540</b> <b>33</b> <b>MB</b> <b>Result</b> 0.05750 0.0000 0.04304 <i>MB</i> %Yield 59.4 <b>160-254</b> <b>15</b>	Limits 30-110 C Uranium 04/1-A MB Qualifier U MB Qualifier 004/2-A	Count Uncert. (2σ+/-) 0.0575 0.0149 0.0497 <i>Limits</i> 30 - 110	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	RL           1.00           1.00           1.00           1.00           1.00           1.00	MDC 0.0431 0.0537 0.0430	Unit pCi/Samp pCi/Samp pCi/Samp	Clier Pre 06/01 1e 06/01 Pre 06/01 Pre 06/01	epared /16 08:50 /16 08:50 /16 08:50 /16 08:50 /16 08:50 pared /16 08:50	Die ID: Metho Prep Type: 1 Prep Batch: 06/13/16 12:45 06/13/16 12:45 06/13/16 12:45 <i>Analyzed</i> 06/13/16 12:45 Lab Control Prep Type: 1 Prep Batch: %Rec.	d Blank Total/NA 254004 Dil Fac 1 1 1 <i>Dil Fac</i> 7 Sample Total/NA 254004
Tracer Thorium-229 Vethod: A- Lab Sample Matrix: Filter Analysis Bat Uranium 234 Uranium 235 Uranium 235 Uranium 238 Tracer Uranium 232 Lab Sample Matrix: Filter Analysis Bat	<u>%Yield</u> 82.0 01-R - Is ID: MB 1 r tch: 2562 ID: LCS r tch: 2564	Qualifier Sotopi 60-2540 33 MB Result 0.05750 0.0000 0.04304 MB %Yield 59.4 160-254 15	Limits 30-110 C Uranium 04/1-A MB Qualifier U MB Qualifier 004/2-A Spike Added	Count Uncert. (2σ+/-) 0.0575 0.0149 0.0497 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	RL         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00	MDC 0.0431 0.0537 0.0430 RL	Unit pCi/Samp pCi/Samp pCi/Samp Clie	Clier Ie 06/01 Ie 06/01 <i>Pre</i> 06/01 <b>Pre</b> 06/01 <b>Pre</b> 06/01	epared /16 08:50 /16 08:50 /16 08:50 /16 08:50 pared /16 08:50 pared /16 08:50 pared /16 08:50 pared /16 08:50 pared /16 08:50 /16 08:50 /	Die ID: Metho Prep Type: 1 Prep Batch: Analyzed 06/13/16 12:45 06/13/16 12:45 06/13/16 12:45 Analyzed 06/13/16 12:45 Lab Control Prep Type: 1 Prep Batch: %Rec. Limits 84 120	d Blank Total/NA 254004 Dil Fac 1 1 Dil Fac 7 Sample Total/NA 254004
Tracer Thorium-229 Vethod: A Lab Sample Matrix: Filter Analysis Bat Analyte Uranium 234 Uranium 235 Uranium 238 Tracer Uranium 232 Lab Sample Matrix: Filter Analysis Bat Analysis Bat	<u>%Yield</u> 82.0 01-R - Is ID: MB 1 r tch: 2562 ID: LCS r tch: 2564	Qualifier Sotopi 60-2540 33 MB Result 0.05750 0.0000 0.04304 MB %Yield 59.4 160-254 15	Limits 30-110 C Uranium 04/1-A MB Qualifier U MB Qualifier 004/2-A Spike Added 12.7	Count Uncert. (2σ+/-) 0.0575 0.0149 0.0497 Limits 30 - 110 LCS Result 13.14	Total Uncert. (2σ+/-) 0.0577 0.0149 0.0498	RL           1.00           1.00           1.00           1.00           1.00           1.00           1.00           1.00           1.00           1.00           1.00           1.00	MDC 0.0431 0.0537 0.0430 RL 1.00	Unit pCi/Samp pCi/Samp pCi/Samp Clie MDC 0.0664	Clier Ile 06/01 Ile 06/01 Pre 06/01 Pre 06/01 Pre 06/01	epared /16 08:50 /16 08:50 /16 08:50 /16 08:50 /16 08:50 /16 08:50 /16 08:50	Die ID: Metho Prep Type: 1 Prep Batch: Analyzed 06/13/16 12:45 06/13/16 12:45 06/13/16 12:45 Analyzed 06/13/16 12:45 Lab Control Prep Type: 1 Prep Batch: %Rec. Limits 84 - 120 92 122	d Blank Total/NA 254004 Dil Fac 1 5 1 1 1 1 1 5 1 1 1 1 1 5 1 1 1 1 5 2 5 4 004

	LCS	LCS	
Tracer	%Yield	Qualifier	Limits
Uranium 232	75.8		30 - 110

10

# Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample Matrix: Filter Analysis Bat	ID: LCSI .ch: 2562	D 160-25 235	4004/3-A					Client S	ample I	D: Lab	Control S Prep Typ Prep Ba	ample e: Tot tch: 2	e Dup al/NA 54004
						Total							
			Spike	LCSD	LCSD	Uncert.					%Rec.		RER
Analyte			Added	Result	Qual	(2σ+/-)	RL	MDC	Unit	%Rec	Limits	RER	Limit
Uranium 234			12.7	12.98		1.38	1.00	0.173	pCi/Sam	102	84 - 120	0.06	1
Uranium 238			13.0	13.52		1.42	1.00	0.0886	pCi/Sam	104	82 - 122	0.06	1
	1000	1000											
Tracer	%Vield	Qualifier	l imits										
Uranium 232	64.5	quamer		-									
Method: TC	-02-RC	- Tech	netium-99	) (LSC)									
Lab Sample	ID: MB 1	60-2540	97/1-A						Clier	nt Samp	ole ID: Me	thod	Blank
Matrix: Filter											Prep Typ	e: Tot	al/NA
Analysis Bat	ch: 2578	65		Count	Total						Ргер Ва	tch: 2	54097
		мв	MD	Count	IOCAL								
Ameliate		MB	MB	Uncert.	Uncert.		MDO	11	Due		Analum	1	
Analyte		2 125		(20+/-)	(20+1-)	1.00				pareu		eu	
rechnellum 99		-2.135	UG	3.30	3.30	1.00	0.02	pci/sam	JIE 00/01/	10 10.37	00/23/10 2	20.15	I
		MB	МВ										
Tracer		%Yield	Qualifier	Limits					Pre	pared	Analyz	ed	Dil Fac
Tc-99m		94.9		30 - 110					06/01/	/16 10:37	06/23/16 2	20:15	1
_ Г <b>.</b> .													
Lab Sample	ID: LCS	160-254	097/2-A					Cli	ent Sam	ple ID:	Lab Con	trol Sa	ample
Matrix: Filter		_									Prep Typ	e: lot	al/NA
Analysis Bat	ch: 2578	65				<b>T</b> . ( . )					Prep Ba	tch: 2	54097
						lotal					a/ <b>5</b>		
			Spike	LCS	LCS	Uncert.				~-	%Rec.		
Analyte			Added	Result	Qual	<u>(2σ+/-)</u>	RL	MDC	Unit	%Rec	Limits		
l echnetium 99			1030	1038		101	1.00	7.09	pCI/Sam	101	75 - 125		
	LCS	LCS											
Tracer	%Yield	Qualifier	Limits										
Tc-99m	97.2		30 - 110	-									
Lab Sample	ID: LCSI	0 160-25	4097/3-A					Client S	ample I	D: Lab	Control S	Sample	e Dup
Matrix: Filter	•										Prep Typ	e: Tot	al/NA
Analysis Bat	ch: 2578	65				<b>T</b> . 4 1					Prep Ba	tch: 2	54097
			<b>•</b> "		1.005	iotal					0/ <b>F</b>		
•			Spike	LCSD	LCSD	Uncert.			11	0/ F	%Rec.	<b>DC-</b>	RER
Analyte			Added	Result		<u>(2σ+/-)</u>		MDC		%Rec		RER	Limit
recnnetium 99			1030	1009		98.2	1.00	6.88	pCI/Sam	98	75 - 125	0.15	1
	LCSD	LCSD											
Tracer	%Yield	Qualifier	Limits										

Tc-99m 103 30 - 110

# **QC** Association Summary

Client: Westinghouse Electric Company LLC Project/Site: HDP RFP-CBA-022 (21 DAY TAT) TestAmerica Job ID: 160-17454-1

#### Rad

#### Prep Batch: 253972

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17454-1	3970-EA-160519-00-01	Total/NA	Filter	DPS-21	
LCS 160-253972/2-A	CS 160-253972/2-A Lab Control Sample		Filter	DPS-21	
LCSD 160-253972/3-A	Lab Control Sample Dup	Total/NA	Filter	DPS-21	
MB 160-253972/1-A	Method Blank	Total/NA	Filter	DPS-21	
Prep Batch: 254002					
Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17454-1	3970-EA-160519-00-01	Total/NA	Filter	ExtChrom	
LCS 160-254002/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-254002/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-254002/1-A	Method Blank	Total/NA	Filter	ExtChrom	
Prep Batch: 254004					
Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17454-1	3970-EA-160519-00-01	Total/NA	Filter	ExtChrom	
LCS 160-254004/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-254004/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-254004/1-A	Method Blank	Total/NA	Filter	ExtChrom	
Prep Batch: 254097					
Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17454-1	3970-EA-160519-00-01	Total/NA	Filter	Ext_Chrom_LSC	
LCS 160-254097/2-A	Lab Control Sample	Total/NA	Filter	Ext_Chrom_LSC	
LCSD 160-254097/3-A	Lab Control Sample Dup	Total/NA	Filter	Ext_Chrom_LSC	
MB 160-254097/1-A	Method Blank	Total/NA	Filter	Ext_Chrom_LSC	

# **Tracer/Carrier Summary**

Method: 903.0 - Radium-226 (GFPC)

# Prep Type: Total/NA

—			Percent Yield (Acceptance Limits)	
		Ba		
Lab Sample ID	Client Sample ID	(40-110)		
160-17454-1	3970-EA-160519-00-01	88.6		
LCS 160-253972/2-A	Lab Control Sample	86.9		
LCSD 160-253972/3-A	Lab Control Sample Dup	86.9		
MB 160-253972/1-A	Method Blank	82.1		
Tracer/Carrier Legend	I			

Ba = Ba Carrier

Matrix: Filter

#### Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) Matrix: Filter

			Percent Yield (Acceptance Limits)
		Th-229	
.ab Sample ID	Client Sample ID	(30-110)	
60-17454-1	3970-EA-160519-00-01	85.8	
CS 160-254002/2-A	Lab Control Sample	75.6	
CSD 160-254002/3-A	Lab Control Sample Dup	82.0	
IB 160-254002/1-A	Method Blank	78.8	

Th-229 = Thorium-229

#### Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) Matrix: Filtor

			Frep Type. Total/NA
_			Percent Yield (Acceptance Limits)
		U-232	
Lab Sample ID	Client Sample ID	(30-110)	
160-17454-1	3970-EA-160519-00-01	66.2	
LCS 160-254004/2-A	Lab Control Sample	75.8	
LCSD 160-254004/3-A	Lab Control Sample Dup	64.5	
MB 160-254004/1-A	Method Blank	59.4	
Tracer/Carrier Legend	d		

U-232 = Uranium 232

# Method: TC-02-RC - Technetium-99 (LSC) Matrix: Filter

#### Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
		Tc-99m					
Lab Sample ID	Client Sample ID	(30-110)					
160-17454-1	3970-EA-160519-00-01	88.6					
LCS 160-254097/2-A	Lab Control Sample	97.2					
LCSD 160-254097/3-A	Lab Control Sample Dup	103					
MB 160-254097/1-A	Method Blank	94.9					
Tracer/Carrier Legend	ł						

Tc-99m = Tc-99m

Pren Type: Total/NA

Prep Type: Total/NA