

ANALYTICAL REPORT

Job Number: 160-18555-1

Job Description: EA and Cabrera - Hill AFB WR111

For:

EA Engineering, Science, and Technology
7995 E. Prentice Ave, Suite 206E
Greenwood Village, CO 80111
Attention: Pamela J Moss



Approved for release.
Jessica H DeHerrera
Project Manager I
9/9/2016 5:28 PM

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09/09/2016

The test results in this report relate only to the samples in this report and meet all requirements of NELAP, with any exceptions noted. Pursuant to NELAP, this report shall not be reproduced except in full, without the written approval of the laboratory. All questions regarding this report should be directed to the TestAmerica Denver Project Manager.

The Lab Certification ID# is 4025.

Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.

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Definitions/Glossary

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

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)

CASE NARRATIVE

Client: EA Engineering, Science, and Technology

Project: EA and Cabrera - Hill AFB WR111

Report Number: 160-18555-1

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.

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.

RECEIPT

The samples were received on 08/09/2016; the samples arrived in good condition. The temperature of the coolers at receipt was 18.0 C. Thermal preservation is not required for the requested analyses; therefore, corrective action is deemed unnecessary. The client was notified on 8/9/16.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples WR111-Composite Air Sample-BZ (160-18555-1), WR111-Composite Air Sample-Low Vol (160-18555-2) and WR111-Composite Air Sample-High Vol (160-18555-3) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A-01-R. The samples were prepared on 08/26/2016 and analyzed on 09/07/2016 and 09/09/2016.

The following samples are filters. Due to the matrix of the samples, a laboratory control sample and laboratory control sample duplicate were used for duplicity. WR111-Composite Air Sample-BZ (160-18555-1), WR111-Composite Air Sample-Low Vol (160-18555-2) and WR111-Composite Air Sample-High Vol (160-18555-3).

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

Detection Summary

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

Client Sample ID: WR111-Composite Air Sample-BZ

Lab Sample ID: 160-18555-1

☐ No Detections.

Client Sample ID: WR111-Composite Air Sample-Low Vol

Lab Sample ID: 160-18555-2

☐ No Detections.

Client Sample ID: WR111-Composite Air Sample-High Vol

Lab Sample ID: 160-18555-3

☐ No Detections.

This Detection Summary does not include radiochemical test results.

TestAmerica St. Louis

Client Sample Results

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

Client Sample ID: WR111-Composite Air Sample-BZ

Date Collected: 08/08/16 15:00

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18555-1

Matrix: Filter

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	0.563		0.192	0.198	1.00	0.0784	pCi/Sample	08/26/16 13:26	09/07/16 14:44	1
Thorium-232	0.155		0.102	0.103	1.00	0.0842	pCi/Sample	08/26/16 13:26	09/07/16 14:44	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	91.7		30 - 110					08/26/16 13:26	09/07/16 14:44	1

Client Sample ID: WR111-Composite Air Sample-Low Vol

Date Collected: 08/08/16 15:00

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18555-2

Matrix: Filter

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	1.73		0.338	0.367	1.00	0.109	pCi/Sample	08/26/16 13:26	09/07/16 14:44	1
Thorium-232	0.683		0.213	0.221	1.00	0.105	pCi/Sample	08/26/16 13:26	09/07/16 14:44	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	94.3		30 - 110					08/26/16 13:26	09/07/16 14:44	1

Client Sample ID: WR111-Composite Air Sample-High Vol

Date Collected: 08/08/16 15:00

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18555-3

Matrix: Filter

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	11.5		0.895	1.32	1.00	0.0977	pCi/Sample	08/26/16 13:26	09/09/16 10:34	1
Thorium-232	4.25		0.543	0.650	1.00	0.0840	pCi/Sample	08/26/16 13:26	09/09/16 10:34	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	82.4		30 - 110					08/26/16 13:26	09/09/16 10:34	1

Tracer/Carrier Summary

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

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

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Th-229 (30-110)					
160-18555-1	WR111-Composite Air Sample-E	91.7					
160-18555-2	WR111-Composite Air Sample-L	94.3					
160-18555-3	WR111-Composite Air Sample-t	82.4					
LCS 160-266788/2-A	Lab Control Sample	90.8					
LCSD 160-266788/3-A	Lab Control Sample Dup	95.3					
MB 160-266788/1-A	Method Blank	91.0					

Tracer/Carrier Legend

Th-229 = Thorium-229

QC Sample Results

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

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

Lab Sample ID: MB 160-266788/1-A

Matrix: Filter

Analysis Batch: 268472

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 266788

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	0.2572		0.133	0.135	1.00	0.107	pCi/Sample	08/26/16 13:26	09/07/16 14:44	1
Thorium-232	0.01193	U	0.0328	0.0328	1.00	0.0770	pCi/Sample	08/26/16 13:26	09/07/16 14:44	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	91.0		30 - 110					08/26/16 13:26	09/07/16 14:44	1

Lab Sample ID: LCS 160-266788/2-A

Matrix: Filter

Analysis Batch: 268654

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 266788

Analyte		Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits
Thorium-230		8.03	8.995		1.08	1.00	0.0881	pCi/Sam	112	81 - 118
Tracer	LCS %Yield	LCS Qualifier	Limits							
Thorium-229	90.8		30 - 110							

Lab Sample ID: LCSD 160-266788/3-A

Matrix: Filter

Analysis Batch: 268655

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 266788

Analyte		Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230		8.03	8.750		1.06	1.00	0.0929	pCi/Sam	109	81 - 118	0.11	1
Tracer	LCSD %Yield	LCSD Qualifier	Limits									
Thorium-229	95.3		30 - 110									

QC Association Summary

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

Rad

Prep Batch: 266788

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18555-1	WR111-Composite Air Sample-BZ	Total/NA	Filter	ExtChrom	
160-18555-2	WR111-Composite Air Sample-Low Vol	Total/NA	Filter	ExtChrom	
160-18555-3	WR111-Composite Air Sample-High Vol	Total/NA	Filter	ExtChrom	
MB 160-266788/1-A	Method Blank	Total/NA	Filter	ExtChrom	
LCS 160-266788/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-266788/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	

Lab Chronicle

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

Client Sample ID: WR111-Composite Air Sample-BZ

Date Collected: 08/08/16 15:00

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18555-1

Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	ExtChrom			266788	08/26/16 13:26	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268475	09/07/16 14:44	ALD	TAL SL

Client Sample ID: WR111-Composite Air Sample-Low Vol

Date Collected: 08/08/16 15:00

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18555-2

Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	ExtChrom			266788	08/26/16 13:26	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268476	09/07/16 14:44	ALD	TAL SL

Client Sample ID: WR111-Composite Air Sample-High Vol

Date Collected: 08/08/16 15:00

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18555-3

Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	ExtChrom			266788	08/26/16 13:26	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268746	09/09/16 10:34	ALD	TAL SL

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Certification Summary

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

Laboratory: TestAmerica St. Louis

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska	State Program	10	MO00054	06-30-17
California	State Program	9	2886	03-31-18
Connecticut	State Program	1	PH-0241	03-31-17
Florida	NELAP	4	E87689	06-30-17
Illinois	NELAP	5	003757	11-30-16 *
Iowa	State Program	7	373	12-01-16 *
Kansas	NELAP	7	E-10236	10-31-16 *
Kentucky (DW)	State Program	4	90125	12-31-16
L-A-B	DoD ELAP		L2305	04-06-19
Louisiana	NELAP	6	04080	06-30-17
Louisiana (DW)	NELAP	6	LA160008	12-31-16
Maryland	State Program	3	310	09-30-17
Missouri	State Program	7	780	06-30-17
Nevada	State Program	9	MO000542016-1	07-31-17
New Jersey	NELAP	2	MO002	06-30-17
New York	NELAP	2	11616	03-31-17
North Dakota	State Program	8	R207	06-30-17
NRC	NRC		24-24817-01	12-31-22
Oklahoma	State Program	6	9997	08-31-17
Pennsylvania	NELAP	3	68-00540	02-28-17 *
South Carolina	State Program	4	85002001	06-30-16 *
Texas	NELAP	6	T104704193-15-9	07-31-17
USDA	Federal		P330-07-00122	01-09-17
Utah	NELAP	8	MO000542016-8	07-31-17
Virginia	NELAP	3	460230	06-14-17
Washington	State Program	10	C592	08-30-17
West Virginia DEP	State Program	3	381	08-31-16 *

Laboratory: TestAmerica Denver

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-17
Utah	NELAP	8	CO00026	07-31-16 *

* Certification renewal pending - certification considered valid.

TestAmerica St. Louis

Method Summary

Client: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	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: EA Engineering, Science, and Technology
Project/Site: EA and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-18555-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-18555-1	WR111-Composite Air Sample-BZ	Filter	08/08/16 15:00	08/09/16 09:20
160-18555-2	WR111-Composite Air Sample-Low Vol	Filter	08/08/16 15:00	08/09/16 09:20
160-18555-3	WR111-Composite Air Sample-High Vol	Filter	08/08/16 15:00	08/09/16 09:20

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18555-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
82232-334_00001	06/03/60		Eckert & Ziegler, Lot 82232-334		(Purchased Reagent)		Am-241	7.281 Bq
							Pu-239	7.137 Bq
							Thorium-230	7.63 Bq
82233-334_00001	06/03/60		Eckert & Zigler, Lot 82233-334		(Purchased Reagent)		Am-241	5.114 Bq
							Pu-239	6.064 Bq
							Thorium-230	4.95 Bq
82234-334_00001	06/02/60		Eckert & Zigler, Lot 82234-334		(Purchased Reagent)		Am-241	5.652 Bq
							Pu-239	5.936 Bq
							Thorium-230	5.685 Bq
82236-334_00001	06/02/60		Eckert & Ziegler, Lot 82236-334		(Purchased Reagent)		Am-241	6.891 Bq
							Pu-239	6.664 Bq
							Thorium-230	7.107 Bq
82237-334_00003	06/01/60		Eckert & Ziegler, Lot 82237-334		(Purchased Reagent)		Am-241	5.608 Bq
							Pu-239	6.424 Bq
							Thorium-230	5.856 Bq
82241-334_00001	06/08/60		Eckert & Ziegler, Lot 82241-334		(Purchased Reagent)		Am-241	6.638 Bq
							Pu-239	6.797 Bq
							Thorium-230	6.629 Bq
82242-334_00001	06/08/60		Eckert & Ziegler, Lot 82242-334		(Purchased Reagent)		Am-241	7.145 Bq
							Pu-239	6.414 Bq
							Thorium-230	6.583 Bq
82244-334_00001	06/09/60		Eckert & Zigler, Lot 82244-334		(Purchased Reagent)		Am-241	6.897 Bq
							Pu-239	6.717 Bq
							Thorium-230	7.352 Bq
82245-334_00001	06/09/60		Eckert & Ziegler, Lot 82245-334		(Purchased Reagent)		Am-241	5.528 Bq
							Pu-239	5.437 Bq
							Thorium-230	6.727 Bq
82246-334_00001	06/09/60		Eckert & Ziegler, Lot 82246-334		(Purchased Reagent)		Am-241	6.002 Bq
							Pu-239	5.353 Bq
							Thorium-230	5.57 Bq
Th-229_00021	08/01/17	07/20/16	0.1M HNO3, Lot n/a	500 mL	Th-229_00017	15 mL	At-217	67.2296 dpm/mL
							Thorium-229	67.2296 dpm/mL
.Th-229_00017	08/01/17	08/20/14	0.1M HNO3, Lot n/a	100 mL	Th-229_00016	5.0464 g	At-217	2240.99 dpm/mL
							Thorium-229	2240.99 dpm/mL
..Th-229_00016	08/06/64		Analytics, Lot 97790		(Purchased Reagent)		At-217	740.127 Bq/g
							Thorium-229	740.127 Bq/g
Th-230_00029	10/06/16	09/22/14	1M HNO3, Lot 0	200 mL	Th-230_00019	4 mL	Gross Alpha	44.5646 dpm/mL
							Thorium-230	44.5646 dpm/mL

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18555-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration		
					Reagent ID	Volume Added				
.Th-230_00019	11/08/16	08/13/13	1M HNO3, Lot n/a	100 mL	Th-230_00018	5.0731 mL	Gross Alpha	2228.23 dpm/mL		
							Thorium-230	2228.23 dpm/mL		
..Th-230_00018	08/08/63	Eckert & Ziegler Analytics, Lot 92776			(Purchased Reagent)		Gross Alpha	43922.5 dpm/g		
							Thorium-230	43922.5 dpm/g		

ALPHA SPECTROSCOPY

Method A-01-R Th

Isotopic Thorium (Alpha
Spectrometry) by Method A-01-R

Prep Batch: 266788

Preparation, Extraction
Chromatography Resin Actinide
Separation

Alpha Spectroscopy Analysis Detail Report

Prep Batch: 266788

Lab ID: MB 160-266788/1-A
 Client ID:
 Sigma: 2

Analyzed: 09/07/16 14:44
 Detector: AV165
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 240

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	0.2572	0.133	0.135		pCi/Sample	1.00	0.107	268472	
Thorium-232	0.01193	0.0328	0.0328	U	pCi/Sample	1.00	0.0770	268472	
Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	11.02	0.801	1.22		pCi/Sample	0.0900	12.1	91.0	30 - 110

Lab ID: LCS 160-266788/2-A
 Client ID:
 Sigma: 2

Analyzed: 09/08/16 16:01
 Detector: AV154
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 240

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	8.995	0.765	1.08		pCi/Sample	1.00	0.0881	268654	
Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	10.99	0.806	1.23		pCi/Sample	0.0491	12.1	90.8	30 - 110

Lab ID: LCSD 160-266788/3-A
 Client ID:
 Sigma: 2

Analyzed: 09/08/16 16:01
 Detector: AV158
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 240

Analyte	LCSD Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	8.750	0.762	1.06		pCi/Sample	1.00	0.0929	268655	
Tracer	LCSD Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	11.54	0.855	1.29		pCi/Sample	0.112	12.1	95.3	30 - 110

Lab ID: 160-18555-1
 Client ID: WR111-Composite Air Sample-BZ
 Sigma: 2

Analyzed: 09/07/16 14:44
 Detector: AV168
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 240

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	0.563	0.192	0.198		pCi/Sample	1.00	0.0784	268475	
Thorium-232	0.155	0.102	0.103		pCi/Sample	1.00	0.0842	268475	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	11.1	0.813	1.24		pCi/Sample	0.0920	12.1	91.7	30 - 110

Alpha Spectroscopy Analysis Detail Report

Prep Batch: 266788

Lab ID: 160-18555-2
 Client ID: WR111-Composite Air Sample-Low Vol
 Sigma: 2

Analyzed: 09/07/16 14:44
 Detector: AV169
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 240

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	1.73	0.338	0.367		pCi/Sample	1.00	0.109	268476	
Thorium-232	0.683	0.213	0.221		pCi/Sample	1.00	0.105	268476	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	11.4	0.838	1.27		pCi/Sample	0.0744	12.1	94.3	30 - 110

Lab ID: 160-18555-3
 Client ID: WR111-Composite Air Sample-High Vol
 Sigma: 2

Analyzed: 09/09/16 10:34
 Detector: AV147
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 240

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	11.5	0.895	1.32		pCi/Sample	1.00	0.0977	268746	
Thorium-232	4.25	0.543	0.650		pCi/Sample	1.00	0.0840	268746	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	9.98	0.760	1.13		pCi/Sample	0.146	12.1	82.4	30 - 110

Quality Control Summary

Method Blank ID:	Analyte	Parent Result	Spike Added	MB Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
MB 160-266788/1-A	Thorium-230			0.2572		pCi/Sample							3.814408
MB 160-266788/1-A	Thorium-232			0.01193	U	pCi/Sample							65 .7272673 6
Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-266788/2-A	Thorium-230		8.03	8.995		pCi/Sample	112	81 - 118	3				1.339756 3475
Lab Control Sample Duplicate	Analyte	Parent Result	Spike Added	LCSD Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCSD 160-266788/3-A	Thorium-230		8.03	8.750		pCi/Sample	109	81 - 118	3	0.11	0.33	1	1.002475 0877

Glossary:

Ts = Count Duration, Sample

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-18555-1

SDG No.: _____

Batch Number: 266788 Batch Start Date: 08/26/16 13:26 Batch Analyst: Bernsen, Sarah CBatch Method: ExtChrom Batch End Date: 08/31/16 11:16

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00021	Th-230 00029			
MB 160-266788/1		ExtChrom, A-01-R		0.5 Sample	0.2 mL				
LCS 160-266788/2		ExtChrom, A-01-R		0.5 Sample	0.2 mL	0.2 mL			
LCSD 160-266788/3		ExtChrom, A-01-R		0.5 Sample	0.2 mL	0.2 mL			
160-18555-A-1	WR111-Composite Air Sample-BZ	ExtChrom, A-01-R	T	0.5 Sample	0.2 mL				
160-18555-A-2	WR111-Composite Air Sample-Low Vol	ExtChrom, A-01-R	T	0.5 Sample	0.2 mL				
160-18555-A-3	WR111-Composite Air Sample-High Vol	ExtChrom, A-01-R	T	0.5 Sample	0.2 mL				

Batch Notes	
Analyst ID - Column	nmn per scb
Column Date	8/30/16
Analyst ID - CoPrecipitation	scb
CoPrecipitation Date	8/31/16
Pipette ID	rad104
Analyst ID - Reagent Drop Witness	scb
Analyst ID - Reagent Drop	ats per scb
SOP Number	ST-RC-0004, ST-RC-0100, ST-RC-0242

Basis	Basis Description
T	Total/NA

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

A-01-R

Page 1 of 1

Run Logs

Alpha Spectroscopy Run Log

Detector: AV147

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 15:47	140	IC 160-223444/1		223444			PS
10/26/15 19:10	60	ICV 160-223562/1		223562			PS
09/01/16 15:17	960	ICB 160-268019/1		268019			PS
09/06/16 15:28	60	CCV 160-268312/1		268312			PS
09/09/16 09:10	1	PULSER 160-268746/1		268746			ALD
09/09/16 10:34	240	160-18555-3	WR111-Composite Air Sample-High Vol	268746	266788	A-01-R	ALD

Detector: AV154

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 15:52	140	IC 160-223451/1		223451			PS
10/26/15 19:11	60	ICV 160-223569/1		223569			PS
09/01/16 15:17	960	ICB 160-268026/1		268026			PS
09/06/16 12:40	60	CCV 160-268317/1		268317			PS
09/08/16 10:49	1	PULSER 160-268654/1		268654			ALD
09/08/16 16:01	240	LCS 160-266788/2-A		268654	266788	A-01-R	ALD

Detector: AV158

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 15:53	140	IC 160-223455/1		223455			PS
10/26/15 19:13	60	ICV 160-223573/1		223573			PS
09/02/16 10:55	960	ICB 160-268118/1		268118			PS
09/06/16 15:24	60	CCV 160-268318/1		268318			PS
09/08/16 10:49	1	PULSER 160-268655/1		268655			ALD
09/08/16 16:01	240	LCSD 160-266788/3-A		268655	266788	A-01-R	ALD

Detector: AV165

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 18:58	140	IC 160-223462/1		223462			PS
10/26/15 20:27	60	ICV 160-223580/1		223580			PS
09/01/16 15:17	960	ICB 160-268037/1		268037			PS
09/06/16 15:29	60	CCV 160-268323/1		268323			PS
09/07/16 12:23	1	PULSER 160-268472/1		268472			ALD
09/07/16 14:44	240	MB 160-266788/1-A		268472	266788	A-01-R	ALD

Detector: AV168

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 18:59	140	IC 160-223465/1		223465			PS
10/26/15 20:32	60	ICV 160-223583/1		223583			PS
09/02/16 10:55	960	ICB 160-268124/1		268124			PS
09/06/16 13:59	60	CCV 160-268326/1		268326			PS
09/07/16 12:23	1	PULSER 160-268475/1		268475			ALD
09/07/16 14:44	240	160-18555-1	WR111-Composite Air Sample-BZ	268475	266788	A-01-R	ALD

Alpha Spectroscopy Run Log

Detector: AV169

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 18:59	140	IC 160-223466/1		223466			PS
10/26/15 20:28	60	ICV 160-223584/1		223584			PS
09/01/16 15:17	960	ICB 160-268041/1		268041			PS
09/06/16 13:59	60	CCV 160-268327/1		268327			PS
09/07/16 12:23	1	PULSER 160-268476/1		268476			ALD
09/07/16 14:44	240	160-18555-2	WR111-Composite Air Sample-Low Vol	268476	266788	A-01-R	ALD

Shipping and Receiving Documents

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc.

[illegible]

Login Sample Receipt Checklist

Client: EA Engineering, Science, and Technology

Job Number: 160-18555-1

Login Number: 18555

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

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.	N/A	
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.	False	
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?	False	
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.	False	