

ANALYTICAL REPORT

Job Number: 160-18552-1

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.
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Project Manager I
9/8/2016 5:43 PM

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09/08/2016

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: 160-18552-1

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: 160-18552-1

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. This is above the recommended temperature of 6.0°C or below. Thermal preservation is not required for the requested analyses; therefore, the laboratory will proceed with the requested analyses and corrective action was deemed unnecessary. The client was notified on 8/9/16.

RADIUM-226 & OTHER GAMMA EMITTERS (GS)

Samples SU01-EXB-076-SS-P-00 (160-18552-1), SU01-EXB-077-SS-P-00 (160-18552-2), SU02-EXB-078-SS-P-00 (160-18552-3), SU02-EXB-079-SS-P-00 (160-18552-4), SU03-S-080-SS-P-00 (160-18552-5), SU03-S-081-SS-P-00 (160-18552-6) and SU03-S-082-SS-P-00 (160-18552-7) were analyzed for Radium-226 & Other Gamma Emitters (GS) in accordance with EPA 901.1. The samples were leached on 08/09/2016, prepared on 08/11/2016 and analyzed on 09/01/2016.

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

ISOTOPIC THORIUM

Samples SU01-EXB-076-SS-P-00 (160-18552-1), SU01-EXB-077-SS-P-00 (160-18552-2), SU02-EXB-078-SS-P-00 (160-18552-3), SU02-EXB-079-SS-P-00 (160-18552-4), SU03-S-080-SS-P-00 (160-18552-5), SU03-S-081-SS-P-00 (160-18552-6) and SU03-S-082-SS-P-00 (160-18552-7) were analyzed for Isotopic Thorium accordance with A01R_Th. The samples were leached on 08/09/2016, prepared on 08/25/2016 and analyzed on 08/31/2016 and 09/07/2016.

Thorium-230 was detected in method blank MB 160-266485/1-A at a level exceeding the reporting limit. However, because the result concentration was less than 1/10 the amount measured in the associated samples, no corrective action was necessary.

The following samples could not be thoroughly homogenized before sub-sampling was performed due to sample matrix: SU01-EXB-076-SS-P-00 (160-18552-1), SU01-EXB-077-SS-P-00 (160-18552-2), SU02-EXB-078-SS-P-00 (160-18552-3), SU02-EXB-079-SS-P-00 (160-18552-4), SU03-S-080-SS-P-00 (160-18552-5), SU03-S-081-SS-P-00 (160-18552-6), SU03-S-082-SS-P-00 (160-18552-7) and (160-18552-A-1-A DU). The samples contained rocks.

The following samples have an RER (replicate error ratio) result outside of the acceptance criteria of 1 (1.99) for Th-230. SU01-EXB-076-SS-P-00 (160-18552-1), SU01-EXB-077-SS-P-00 (160-18552-2), SU02-EXB-078-SS-P-00 (160-18552-3), SU02-EXB-079-SS-P-00 (160-18552-4), SU03-S-080-SS-P-00 (160-18552-5), SU03-S-081-SS-P-00 (160-18552-6), SU03-S-082-SS-P-00 (160-18552-7), (LCS 160-266485/2-A), (MB 160-266485/1-A) and (160-18552-A-1-E DU). Non-homogeneity of the sample matrix is suspected. The data have been qualified and reported.

The resolution (FWHM) for the Thorium-229 tracer peak for the following samples is greater than the 100 keV limit (112.9 keV): SU01-EXB-076-SS-P-00 (160-18552-1). The resolution of the tracer peak in all other samples were well within the 100 keV limit indicating an anomaly isolated to this sample. The laboratory does not believe this excursion adversely affects the data.

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: 160-18552-1

Client Sample ID: SU01-EXB-076-SS-P-00

Lab Sample ID: 160-18552-1

☐ No Detections.

Client Sample ID: SU01-EXB-077-SS-P-00

Lab Sample ID: 160-18552-2

☐ No Detections.

Client Sample ID: SU02-EXB-078-SS-P-00

Lab Sample ID: 160-18552-3

☐ No Detections.

Client Sample ID: SU02-EXB-079-SS-P-00

Lab Sample ID: 160-18552-4

☐ No Detections.

Client Sample ID: SU03-S-080-SS-P-00

Lab Sample ID: 160-18552-5

☐ No Detections.

Client Sample ID: SU03-S-081-SS-P-00

Lab Sample ID: 160-18552-6

☐ No Detections.

Client Sample ID: SU03-S-082-SS-P-00

Lab Sample ID: 160-18552-7

☐ No Detections.

This Detection Summary does not include radiochemical test results.

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Client Sample Results

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

TestAmerica Job ID: 160-18552-1

Client Sample ID: SU01-EXB-076-SS-P-00

Date Collected: 08/08/16 14:07

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-1

Matrix: Solid

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.52		0.234	0.283	0.500	0.164	pCi/g	08/11/16 15:27	09/01/16 10:43	1

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	5.94		0.363	0.617	0.100	0.0306	pCi/g	08/25/16 09:34	09/07/16 14:28	1
Thorium-232	2.71		0.244	0.334	0.100	0.0165	pCi/g	08/25/16 09:34	09/07/16 14:28	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	78.3		30 - 110					08/25/16 09:34	09/07/16 14:28	1

Client Sample ID: SU01-EXB-077-SS-P-00

Date Collected: 08/08/16 14:15

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-2

Matrix: Solid

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.10		0.243	0.269	0.500	0.184	pCi/g	08/11/16 15:27	09/01/16 10:46	1

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	1.11		0.153	0.179	0.100	0.0289	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Thorium-232	1.87		0.197	0.252	0.100	0.0156	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110					08/25/16 09:34	08/31/16 19:41	1

Client Sample ID: SU02-EXB-078-SS-P-00

Date Collected: 08/08/16 13:37

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-3

Matrix: Solid

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.46		0.218	0.266	0.500	0.145	pCi/g	08/11/16 15:27	09/01/16 10:47	1

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	1.10		0.152	0.178	0.100	0.0158	pCi/g	08/25/16 09:34	09/07/16 14:28	1
Thorium-232	1.11		0.153	0.179	0.100	0.0290	pCi/g	08/25/16 09:34	09/07/16 14:28	1

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Client Sample Results

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

TestAmerica Job ID: 160-18552-1

Client Sample ID: SU02-EXB-078-SS-P-00

Date Collected: 08/08/16 13:37

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-3

Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	86.1		30 - 110	08/25/16 09:34	09/07/16 14:28	1

Client Sample ID: SU02-EXB-079-SS-P-00

Date Collected: 08/08/16 14:30

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-4

Matrix: Solid

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.22		0.286	0.313	0.500	0.247	pCi/g	08/11/16 15:27	09/01/16 10:49	1

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	1.66		0.185	0.231	0.100	0.0338	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Thorium-232	1.95		0.200	0.259	0.100	0.0283	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac				
Thorium-229	84.3		30 - 110	08/25/16 09:34	08/31/16 19:41	1				

Client Sample ID: SU03-S-080-SS-P-00

Date Collected: 08/08/16 13:56

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-5

Matrix: Solid

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.30		0.172	0.218	0.500	0.0983	pCi/g	08/11/16 15:27	09/01/16 11:38	1

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	1.62		0.184	0.229	0.100	0.0289	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Thorium-232	1.42		0.173	0.210	0.100	0.0384	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac				
Thorium-229	87.0		30 - 110	08/25/16 09:34	08/31/16 19:41	1				

Client Sample ID: SU03-S-081-SS-P-00

Date Collected: 08/08/16 13:44

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-6

Matrix: Solid

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.29		0.276	0.307	0.500	0.233	pCi/g	08/11/16 15:27	09/01/16 11:39	1

TestAmerica St. Louis

Client Sample Results

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

TestAmerica Job ID: 160-18552-1

Client Sample ID: SU03-S-081-SS-P-00

Date Collected: 08/08/16 13:44

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-6

Matrix: Solid

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	9.09		0.437	0.880	0.100	0.0345	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Thorium-232	2.74		0.239	0.332	0.100	0.0289	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	90.2		30 - 110					08/25/16 09:34	08/31/16 19:41	1

Client Sample ID: SU03-S-082-SS-P-00

Date Collected: 08/08/16 13:49

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-7

Matrix: Solid

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.55		0.256	0.302	0.500	0.156	pCi/g	08/11/16 15:27	09/01/16 11:40	1

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	3.67		0.277	0.414	0.100	0.0289	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Thorium-232	1.69		0.188	0.236	0.100	0.0478	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	90.1		30 - 110					08/25/16 09:34	08/31/16 19:41	1

Tracer/Carrier Summary

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

TestAmerica Job ID: 160-18552-1

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

Matrix: Solid

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Th-229 (30-110)					
160-18552-1	SU01-EXB-076-SS-P-00	78.3					
160-18552-1 DU	SU01-EXB-076-SS-P-00	84.3					
160-18552-2	SU01-EXB-077-SS-P-00	88.0					
160-18552-3	SU02-EXB-078-SS-P-00	86.1					
160-18552-4	SU02-EXB-079-SS-P-00	84.3					
160-18552-5	SU03-S-080-SS-P-00	87.0					
160-18552-6	SU03-S-081-SS-P-00	90.2					
160-18552-7	SU03-S-082-SS-P-00	90.1					
LCS 160-266485/2-A	Lab Control Sample	89.1					
MB 160-266485/1-A	Method Blank	89.8					

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: 160-18552-1

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-264537/1-A
Matrix: Solid
Analysis Batch: 267763

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 264537

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	-0.02125	U	0.0472	0.0472	0.500	0.338	pCi/g	08/11/16 15:27	09/01/16 10:41	1

Lab Sample ID: LCS 160-264537/2-A
Matrix: Solid
Analysis Batch: 267757

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 264537

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.1	97.82		10.3		1.20	pCi/g	101	87 - 116
Cesium-137	29.5	29.19		3.11		0.270	pCi/g	99	87 - 120
Cobalt-60	16.6	16.27		1.68		0.146	pCi/g	98	87 - 115

Lab Sample ID: 160-18552-1 DU
Matrix: Solid
Analysis Batch: 267757

Client Sample ID: SU01-EXB-076-SS-P-00
Prep Type: Total/NA
Prep Batch: 264537

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	RER	RER Limit
Radium-226	1.52		1.422		0.312	0.500	0.233	pCi/g	0.16	1

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

Lab Sample ID: MB 160-266485/1-A
Matrix: Solid
Analysis Batch: 267479

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 266485

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	0.1036		0.0442	0.0450	0.100	0.0141	pCi/g	08/25/16 09:34	08/31/16 19:41	1
Thorium-232	0.008202	U	0.0176	0.0176	0.100	0.0346	pCi/g	08/25/16 09:34	08/31/16 19:41	1

Tracer	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.8		30 - 110	08/25/16 09:34	08/31/16 19:41	1

Lab Sample ID: LCS 160-266485/2-A
Matrix: Solid
Analysis Batch: 267480

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 266485

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	27.65		2.56	0.100	0.0694	pCi/g	113	81 - 118

Tracer	LCS %Yield	LCS Qualifier	Limits
Thorium-229	89.1		30 - 110

QC Sample Results

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

TestAmerica Job ID: 160-18552-1

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

Lab Sample ID: 160-18552-1 DU

Matrix: Solid

Analysis Batch: 268505

Client Sample ID: SU01-EXB-076-SS-P-00

Prep Type: Total/NA

Prep Batch: 266485

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	RER	Limit
Thorium-230	5.94		3.855		0.433	0.100	0.0161	pCi/g	1.99	1
Thorium-232	2.71		2.264		0.291	0.100	0.0161	pCi/g	0.71	1
Tracer	DU %Yield	DU Qualifier	Limits							
Thorium-229	84.3		30 - 110							

QC Association Summary

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

TestAmerica Job ID: 160-18552-1

Rad

Leach Batch: 264089

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18552-1	SU01-EXB-076-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18552-2	SU01-EXB-077-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18552-3	SU02-EXB-078-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18552-4	SU02-EXB-079-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18552-5	SU03-S-080-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18552-6	SU03-S-081-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18552-7	SU03-S-082-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18552-1 DU	SU01-EXB-076-SS-P-00	Total/NA	Solid	Dry and Grind	

Prep Batch: 264537

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18552-1	SU01-EXB-076-SS-P-00	Total/NA	Solid	Fill_Geo-21	264089
160-18552-2	SU01-EXB-077-SS-P-00	Total/NA	Solid	Fill_Geo-21	264089
160-18552-3	SU02-EXB-078-SS-P-00	Total/NA	Solid	Fill_Geo-21	264089
160-18552-4	SU02-EXB-079-SS-P-00	Total/NA	Solid	Fill_Geo-21	264089
160-18552-5	SU03-S-080-SS-P-00	Total/NA	Solid	Fill_Geo-21	264089
160-18552-6	SU03-S-081-SS-P-00	Total/NA	Solid	Fill_Geo-21	264089
160-18552-7	SU03-S-082-SS-P-00	Total/NA	Solid	Fill_Geo-21	264089
MB 160-264537/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	
LCS 160-264537/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
160-18552-1 DU	SU01-EXB-076-SS-P-00	Total/NA	Solid	Fill_Geo-21	264089

Prep Batch: 266485

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18552-1	SU01-EXB-076-SS-P-00	Total/NA	Solid	ExtChrom	264089
160-18552-2	SU01-EXB-077-SS-P-00	Total/NA	Solid	ExtChrom	264089
160-18552-3	SU02-EXB-078-SS-P-00	Total/NA	Solid	ExtChrom	264089
160-18552-4	SU02-EXB-079-SS-P-00	Total/NA	Solid	ExtChrom	264089
160-18552-5	SU03-S-080-SS-P-00	Total/NA	Solid	ExtChrom	264089
160-18552-6	SU03-S-081-SS-P-00	Total/NA	Solid	ExtChrom	264089
160-18552-7	SU03-S-082-SS-P-00	Total/NA	Solid	ExtChrom	264089
MB 160-266485/1-A	Method Blank	Total/NA	Solid	ExtChrom	
LCS 160-266485/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
160-18552-1 DU	SU01-EXB-076-SS-P-00	Total/NA	Solid	ExtChrom	264089

Lab Chronicle

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

TestAmerica Job ID: 160-18552-1

Client Sample ID: SU01-EXB-076-SS-P-00

Date Collected: 08/08/16 14:07

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-1

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264537	08/11/16 15:27	R1S	TAL SL
Total/NA	Analysis	901.1		1	267758	09/01/16 10:43	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	ExtChrom			266485	08/25/16 09:34	ATS	TAL SL
Total/NA	Analysis	A-01-R		1	268506	09/07/16 14:28	ALD	TAL SL

Client Sample ID: SU01-EXB-077-SS-P-00

Date Collected: 08/08/16 14:15

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-2

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264537	08/11/16 15:27	R1S	TAL SL
Total/NA	Analysis	901.1		1	267756	09/01/16 10:46	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	ExtChrom			266485	08/25/16 09:34	ATS	TAL SL
Total/NA	Analysis	A-01-R		1	267483	08/31/16 19:41	ALD	TAL SL

Client Sample ID: SU02-EXB-078-SS-P-00

Date Collected: 08/08/16 13:37

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-3

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264537	08/11/16 15:27	R1S	TAL SL
Total/NA	Analysis	901.1		1	267755	09/01/16 10:47	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	ExtChrom			266485	08/25/16 09:34	ATS	TAL SL
Total/NA	Analysis	A-01-R		1	268504	09/07/16 14:28	ALD	TAL SL

Client Sample ID: SU02-EXB-079-SS-P-00

Date Collected: 08/08/16 14:30

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-4

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264537	08/11/16 15:27	R1S	TAL SL
Total/NA	Analysis	901.1		1	267754	09/01/16 10:49	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	ExtChrom			266485	08/25/16 09:34	ATS	TAL SL
Total/NA	Analysis	A-01-R		1	267485	08/31/16 19:41	ALD	TAL SL

Lab Chronicle

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

TestAmerica Job ID: 160-18552-1

Client Sample ID: SU03-S-080-SS-P-00

Date Collected: 08/08/16 13:56

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-5

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264537	08/11/16 15:27	R1S	TAL SL
Total/NA	Analysis	901.1		1	267758	09/01/16 11:38	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	ExtChrom			266485	08/25/16 09:34	ATS	TAL SL
Total/NA	Analysis	A-01-R		1	267486	08/31/16 19:41	ALD	TAL SL

Client Sample ID: SU03-S-081-SS-P-00

Date Collected: 08/08/16 13:44

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-6

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264537	08/11/16 15:27	R1S	TAL SL
Total/NA	Analysis	901.1		1	267760	09/01/16 11:39	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	ExtChrom			266485	08/25/16 09:34	ATS	TAL SL
Total/NA	Analysis	A-01-R		1	267487	08/31/16 19:41	ALD	TAL SL

Client Sample ID: SU03-S-082-SS-P-00

Date Collected: 08/08/16 13:49

Date Received: 08/09/16 09:20

Lab Sample ID: 160-18552-7

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264537	08/11/16 15:27	R1S	TAL SL
Total/NA	Analysis	901.1		1	267761	09/01/16 11:40	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264089	08/09/16 15:11	DRO	TAL SL
Total/NA	Prep	ExtChrom			266485	08/25/16 09:34	ATS	TAL SL
Total/NA	Analysis	A-01-R		1	267489	08/31/16 19:41	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: 160-18552-1

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: 160-18552-1

Method	Method Description	Protocol	Laboratory
901.1	Radium-226 & Other Gamma Emitters (GS)	EPA	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

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

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: 160-18552-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-18552-1	SU01-EXB-076-SS-P-00	Solid	08/08/16 14:07	08/09/16 09:20
160-18552-2	SU01-EXB-077-SS-P-00	Solid	08/08/16 14:15	08/09/16 09:20
160-18552-3	SU02-EXB-078-SS-P-00	Solid	08/08/16 13:37	08/09/16 09:20
160-18552-4	SU02-EXB-079-SS-P-00	Solid	08/08/16 14:30	08/09/16 09:20
160-18552-5	SU03-S-080-SS-P-00	Solid	08/08/16 13:56	08/09/16 09:20
160-18552-6	SU03-S-081-SS-P-00	Solid	08/08/16 13:44	08/09/16 09:20
160-18552-7	SU03-S-082-SS-P-00	Solid	08/08/16 13:49	08/09/16 09:20

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

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)		Americium-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)		Americium-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)		Americium-241	5.652 Bq
							Pu-239	5.936 Bq
							Thorium-230	5.685 Bq
82235-334_00001	06/04/60	Eckert & Ziegler, Lot 82235-334			(Purchased Reagent)		Americium-241	7.466 Bq
							Pu-239	6.897 Bq
							Thorium-230	7.167 Bq
82237-334_00003	06/01/60	Eckert & Ziegler, Lot 82237-334			(Purchased Reagent)		Americium-241	5.608 Bq
							Pu-239	6.424 Bq
							Thorium-230	5.856 Bq
82240-334_00001	06/08/60	Eckert & Ziegler, Lot 82240-334			(Purchased Reagent)		Americium-241	8.298 Bq
							Pu-239	7.163 Bq
							Thorium-230	6.304 Bq
82241-334_00001	06/08/60	Eckert & Ziegler, Lot 82241-334			(Purchased Reagent)		Americium-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)		Americium-241	7.145 Bq
							Pu-239	6.414 Bq
							Thorium-230	6.583 Bq
82243-334_00001	06/09/60	Eckert & Ziegler, Lot 82243-334			(Purchased Reagent)		Americium-241	6.39 Bq
							Pu-239	5.979 Bq
							Thorium-230	5.856 Bq
82244-334_00001	06/09/60	Eckert & Zigler, Lot 82244-334			(Purchased Reagent)		Americium-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)		Americium-241	5.528 Bq
							Pu-239	5.437 Bq
							Thorium-230	6.727 Bq
82247-334_00001	06/10/60	Eckert & Ziegler, Lot 82247-334			(Purchased Reagent)		Americium-241	6.291 Bq
							Pu-239	5.746 Bq
							Thorium-230	6.251 Bq
Marn Soil_00002	03/01/16	Eckert & Ziegler, Lot 83814-334			(Purchased Reagent)		Americium-241	2870 Bq
							Cd-109	39231 Bq
							Ce-139	1302 Bq
							Cesium-137	1087 Bq
							Co-57	849 Bq
							Cobalt-60	1788 Bq
							Hg-203	2820 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Pb-210	35040 Bq
							Sn-113	2306 Bq
							Y-88	3762 Bq
MarnSolid_00002	02/09/17	Eckert & Ziegler, Lot 90099			(Purchased Reagent)		Americium-241	2797 Bq
							Cd-109	39337 Bq
							Ce-139	1320 Bq
							Cesium-137	1122 Bq
							Co-57	870 Bq
							Hg-203	2814 Bq
							Pb-210	35883 Bq
							Sn-113	2322 Bq
							Y-88	3821 Bq
Source A_00001	04/01/59	02/23/11	water, Lot 79670-334	0.9986 Source	Gamma Ampuole_00001	0.9986 g	Americium-241	9.4429 Bq
							Cd-109	132.909 Bq
							Ce-139	4.4538 Bq
							Cesium-137	3.7296 Bq
							Co-57	2.9513 Bq
							Cobalt-60	6.2002 Bq
							Hg-203	9.6996 Bq
							Sn-113	7.6266 Bq
							Y-88	12.712 Bq
.Gamma Ampuole_00001	04/07/59	Analytcs, Lot 79670-334			(Purchased Reagent)		Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq
							Sn-113	7626.6 Bq
							Y-88	12712 Bq
Source C_00001	04/01/59	02/23/12	water, Lot 79670-334	1.0148 g	Gamma Ampuole_00001	1.0148 g	Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq
							Sn-113	7626.6 Bq
							Y-88	12712 Bq
.Gamma Ampuole_00001	04/07/59	Analytcs, Lot 79670-334			(Purchased Reagent)		Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Sn-113 Y-88	7626.6 Bq 12712 Bq
Source D_00001	04/01/59	02/23/11	water, Lot 79670-334	0.9781 g	Gamma Ampuole_00001	0.9781 g	Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq
							Sn-113 Y-88	7626.6 Bq 12712 Bq
.Gamma Ampuole_00001	04/07/59		Analytics, Lot 79670-334		(Purchased Reagent)		Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq
							Sn-113 Y-88	7626.6 Bq 12712 Bq
Source E_00001	04/01/59	02/23/11	water, Lot 79670-334	1.0205 g	Gamma Ampuole_00001	1.0205 g	Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq
							Sn-113 Y-88	7626.6 Bq 12712 Bq
.Gamma Ampuole_00001	04/07/59		Analytics, Lot 79670-334		(Purchased Reagent)		Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq
							Sn-113 Y-88	7626.6 Bq 12712 Bq
Source F_00001	01/01/61	02/23/11	water, Lot 83725-334	10 mL	Gamma Ampuole_00003	2.0327 mL	Americium-241	1846.42 Bq
							Cd-109	26819.3 Bq
							Ce-139	890.424 Bq
							Cesium-137	743.562 Bq
							Co-57	580.6 Bq
							Cobalt-60	1222.38 Bq
							Hg-203	1926.02 Bq
							Sn-113	1576.93 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
.Gamma Ampuole_00003	01/19/61		Analytics, Lot 83725-334		(Purchased Reagent)		Y-88	2572.87 Bq
							Americium-241	9083.6 Bq
							Cd-109	131939 Bq
							Ce-139	4380.5 Bq
							Cesium-137	3658 Bq
							Co-57	2856.3 Bq
							Cobalt-60	6013.6 Bq
							Hg-203	9475.2 Bq
							Sn-113	7757.8 Bq
Source H_00002	01/01/51	01/01/12	wataer, Lot 83725-334	10 mL	Gamma Ampuole_00003	2.1184 g	Y-88	12657.4 Bq
							Americium-241	1924.27 Bq
							Cd-109	27950 Bq
							Ce-139	927.965 Bq
							Cesium-137	774.911 Bq
							Co-57	605.079 Bq
							Cobalt-60	1273.92 Bq
							Hg-203	2007.23 Bq
							Sn-113	1643.41 Bq
.Gamma Ampuole_00003	01/19/61		Analytics, Lot 83725-334		(Purchased Reagent)		Y-88	2681.34 Bq
							Americium-241	9083.6 Bq
							Cd-109	131939 Bq
							Ce-139	4380.5 Bq
							Cesium-137	3658 Bq
							Co-57	2856.3 Bq
							Cobalt-60	6013.6 Bq
							Hg-203	9475.2 Bq
							Sn-113	7757.8 Bq
Source I_00001	01/01/61	01/01/12	wataer, Lot 83725-334	10 mL	Gamma Ampuole_00003	1.9559 g	Y-88	2475.66 Bq
							Americium-241	1776.66 Bq
							Cd-109	25806 Bq
							Ce-139	856.782 Bq
							Cesium-137	715.468 Bq
							Co-57	558.664 Bq
							Cobalt-60	1176.2 Bq
							Hg-203	1853.25 Bq
							Sn-113	1517.35 Bq
.Gamma Ampuole_00003	01/19/61		Analytics, Lot 83725-334		(Purchased Reagent)		Y-88	12657.4 Bq
							Americium-241	9083.6 Bq
							Cd-109	131939 Bq
							Ce-139	4380.5 Bq
							Cesium-137	3658 Bq
							Co-57	2856.3 Bq
							Cobalt-60	6013.6 Bq
							Hg-203	9475.2 Bq
							Sn-113	7757.8 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
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
TRM-2_00001	03/20/50	DOE, Lot TRM-2			(Purchased Reagent)		Pb-210	22.1 pCi/g
							Radium-226	25.4 pCi/g
							Thorium-230	24.5 pCi/g
							U-234	6.2 pCi/g
							U-238	6 pCi/g
Tuna Can LCS_00005	10/29/16	Analytics, Lot 74139-334			(Purchased Reagent)		Americium-241	219 dpm/g
							Cesium-137	82.3 dpm/g
							Cobalt-60	136 dpm/g
Tuna Can_00002	02/03/15	Eckert & Ziegler, Lot 81427-334			(Purchased Reagent)		Americium-241	1164 Bq
							Cd-109	16063 Bq
							Ce-139	546 Bq
							Cesium-137	465 Bq
							Co-57	357 Bq
							Cobalt-60	742 Bq
							Hg-203	1208 Bq
							Pb-210	15186 Bq
							Sn-113	943 Bq
Y-88	1571 Bq							
Tuna Can_00003	02/09/17	Eckert & Ziegler, Lot 90099			(Purchased Reagent)		Americium-241	1164 Bq
							Cd-109	16373 Bq
							Ce-139	549 Bq
							Cesium-137	467 Bq
							Co-57	362 Bq
							Cobalt-60	735 Bq
							Hg-203	1171 Bq
							Pb-210	14936 Bq
							Sn-113	967 Bq
Y-88	1590 Bq							
Tuna Can_00006	03/01/16	Eckert & Ziegler, Lot 83814-334			(Purchased Reagent)		Americium-241	1195 Bq
							Cd-109	16353 Bq
							Ce-139	543 Bq
							Cesium-137	453 Bq
							Co-57	354 Bq
							Cobalt-60	745 Bq
							Hg-203	1175 Bq
							Pb-210	14606 Bq
							Sn-113	961 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Y-88	1568 Bq

ALPHA SPECTROSCOPY

Method A-01-R Th

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

Prep Batch: 266485

Preparation, Extraction
Chromatography Resin Actinide
Separation

Alpha Spectroscopy Analysis Detail Report

Prep Batch: 266485

Lab ID: MB 160-266485/1-A
 Client ID:
 Sigma: 2

Analyzed: 08/31/16 19:41
 Detector: AV148
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	0.1036	0.0442	0.0450		pCi/g	0.100	0.0141	267479	
Thorium-232	0.008202	0.0176	0.0176	U	pCi/g	0.100	0.0346	267479	
Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.717	0.215	0.314		pCi/g	0.0389	3.03	89.8	30 - 110

Lab ID: LCS 160-266485/2-A
 Client ID:
 Sigma: 2

Analyzed: 08/31/16 19:41
 Detector: AV149
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	27.65	1.08	2.56		pCi/g	0.100	0.0694	267480	
Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	5.399	0.452	0.640		pCi/g	0.0694	6.06	89.1	30 - 110

Lab ID: 160-18552-1
 Client ID: SU01-EXB-076-SS-P-00
 Sigma: 2

Analyzed: 09/07/16 14:28
 Detector: AV217
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	5.94	0.363	0.617		pCi/g	0.100	0.0306	268506	
Thorium-232	2.71	0.244	0.334		pCi/g	0.100	0.0165	268506	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.37	0.203	0.284		pCi/g	0.0240	3.03	78.3	30 - 110

Lab ID: 160-18552-1 DU
 Client ID: SU01-EXB-076-SS-P-00
 Sigma: 2

Analyzed: 09/07/16 14:28
 Detector: AV216
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	DU Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	3.855	0.288	0.433		pCi/g	0.100	0.0161	268505	
Thorium-232	2.264	0.220	0.291		pCi/g	0.100	0.0161	268505	
Tracer	DU Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.553	0.215	0.304		pCi/g	0.0251	3.03	84.3	30 - 110

Alpha Spectroscopy Analysis Detail Report

Prep Batch: 266485

Lab ID: 160-18552-2
 Client ID: SU01-EXB-077-SS-P-00
 Sigma: 2

Analyzed: 08/31/16 19:41
 Detector: AV152
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	1.11	0.153	0.179		pCi/g	0.100	0.0289	267483	
Thorium-232	1.87	0.197	0.252		pCi/g	0.100	0.0156	267483	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.67	0.222	0.315		pCi/g	0.0340	3.03	88.0	30 - 110

Lab ID: 160-18552-3
 Client ID: SU02-EXB-078-SS-P-00
 Sigma: 2

Analyzed: 09/07/16 14:28
 Detector: AV213
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	1.10	0.152	0.178		pCi/g	0.100	0.0158	268504	
Thorium-232	1.11	0.153	0.179		pCi/g	0.100	0.0290	268504	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.61	0.218	0.309		pCi/g	0.0299	3.03	86.1	30 - 110

Lab ID: 160-18552-4
 Client ID: SU02-EXB-079-SS-P-00
 Sigma: 2

Analyzed: 08/31/16 19:41
 Detector: AV156
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	1.66	0.185	0.231		pCi/g	0.100	0.0338	267485	
Thorium-232	1.95	0.200	0.259		pCi/g	0.100	0.0283	267485	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.55	0.211	0.301		pCi/g	0.0320	3.03	84.3	30 - 110

Lab ID: 160-18552-5
 Client ID: SU03-S-080-SS-P-00
 Sigma: 2

Analyzed: 08/31/16 19:41
 Detector: AV157
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	1.62	0.184	0.229		pCi/g	0.100	0.0289	267486	
Thorium-232	1.42	0.173	0.210		pCi/g	0.100	0.0384	267486	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.63	0.219	0.311		pCi/g	0.0336	3.03	87.0	30 - 110

Alpha Spectroscopy Analysis Detail Report

Prep Batch: 266485

Lab ID: 160-18552-6
 Client ID: SU03-S-081-SS-P-00
 Sigma: 2

Analyzed: 08/31/16 19:41
 Detector: AV158
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	9.09	0.437	0.880		pCi/g	0.100	0.0345	267487	
Thorium-232	2.74	0.239	0.332		pCi/g	0.100	0.0289	267487	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.73	0.228	0.323		pCi/g	0.0350	3.03	90.2	30 - 110

Lab ID: 160-18552-7
 Client ID: SU03-S-082-SS-P-00
 Sigma: 2

Analyzed: 08/31/16 19:41
 Detector: AV160
 Dil Fac: 1

Decay Corrected: No
 Yield Truncated: No
 Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	3.67	0.277	0.414		pCi/g	0.100	0.0289	267489	
Thorium-232	1.69	0.188	0.236		pCi/g	0.100	0.0478	267489	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.73	0.227	0.323		pCi/g	0.0348	3.03	90.1	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 160-266485/1-A	Thorium-230			0.1036		pCi/g							4.60196909
MB 160-266485/1-A	Thorium-232			0.008202	U	pCi/g							.93192806
Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-266485/2-A	Thorium-230		24.5	27.65		pCi/g	113	81 - 118					1.8419972777
Duplicate ID:	Analyte	Parent Result	Spike Added	DU Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
160-18552-1	Thorium-230	5.94		3.855		pCi/g			43	1.99	5.53	1	
160-18552-1	Thorium-232	2.71		2.264		pCi/g			18	0.71	2.00	1	

Glossary:
 Ts = Count Duration, Sample

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

SDG No.: _____

Batch Number: 266485 Batch Start Date: 08/25/16 09:34 Batch Analyst: Sherman, Austin TBatch Method: ExtChrom Batch End Date: 08/31/16 15:04

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00021	TRM-2 00001			
MB 160-266485/1		ExtChrom, A-01-R		1.0 g	0.1 mL				
LCS 160-266485/2		ExtChrom, A-01-R		0.4998 g	0.1 mL	0.4998 g			
160-18552-A-1-A	SU01-EXB-076-SS-P-00	ExtChrom, A-01-R	T	1.0000 g	0.1 mL				
160-18552-A-1-A DU	SU01-EXB-076-SS-P-00	ExtChrom, A-01-R	T	1.0001 g	0.1 mL				
160-18552-A-2-A	SU01-EXB-077-SS-P-00	ExtChrom, A-01-R	T	0.9997 g	0.1 mL				
160-18552-A-3-A	SU02-EXB-078-SS-P-00	ExtChrom, A-01-R	T	1.0001 g	0.1 mL				
160-18552-A-4-A	SU02-EXB-079-SS-P-00	ExtChrom, A-01-R	T	0.9995 g	0.1 mL				
160-18552-A-5-A	SU03-S-080-SS-P-00	ExtChrom, A-01-R	T	1.0007 g	0.1 mL				
160-18552-A-6-A	SU03-S-081-SS-P-00	ExtChrom, A-01-R	T	1.0002 g	0.1 mL				
160-18552-A-7-A	SU03-S-082-SS-P-00	ExtChrom, A-01-R	T	1.0001 g	0.1 mL				

Batch Notes	
Balance ID	1123433897
Analyst ID - Column	nmn per scb
Column Date	8/31/16
Analyst ID - CoPrecipitation	scb
CoPrecipitation Date	8/31/16
Pipette ID	rad104
Analyst ID - Reagent Drop Witness	jdl
Analyst ID - Reagent Drop	ats
SOP Number	st-rc-0003, 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: AV148

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 16:27	140	IC 160-223445/1		223445			PS
10/26/15 19:10	60	ICV 160-223563/1		223563			PS
07/25/16 13:14	960	ICB 160-261998/1		261998			PS
07/26/16 09:12	60	CCV 160-262320/1		262320			PS
08/31/16 09:06	1	PULSER 160-267479/1		267479			ALD
08/31/16 19:41	400	MB 160-266485/1-A		267479	266485	A-01-R	ALD

Detector: AV149

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 15:51	140	IC 160-223446/1		223446			PS
10/26/15 19:10	60	ICV 160-223564/1		223564			PS
07/22/16 15:43	960	ICB 160-261903/1		261903			PS
07/27/16 07:26	60	CCV 160-262220/1		262220			PS
08/31/16 09:06	1	PULSER 160-267480/1		267480			ALD
08/31/16 19:41	400	LCS 160-266485/2-A		267480	266485	A-01-R	ALD

Detector: AV152

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 15:52	140	IC 160-223449/1		223449			PS
10/26/15 19:11	60	ICV 160-223567/1		223567			PS
07/22/16 15:43	960	ICB 160-261906/1		261906			PS
07/26/16 09:35	60	CCV 160-262324/1		262324			PS
08/31/16 09:06	1	PULSER 160-267483/1		267483			ALD
08/31/16 14:07	180	ZZZZZ		267483			
08/31/16 19:41	400	160-18552-2	SU01-EXB-077-SS-P-00	267483	266485	A-01-R	ALD

Detector: AV156

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 16:27	140	IC 160-223453/1		223453			PS
10/26/15 19:12	60	ICV 160-223571/1		223571			PS
07/22/16 15:43	960	ICB 160-261910/1		261910			PS
07/26/16 09:14	60	CCV 160-262326/1		262326			PS
08/31/16 09:06	1	PULSER 160-267485/1		267485			ALD
08/31/16 14:07	180	ZZZZZ		267485			
08/31/16 19:41	400	160-18552-4	SU02-EXB-079-SS-P-00	267485	266485	A-01-R	ALD

Detector: AV157

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 15:53	140	IC 160-223454/1		223454			PS
10/26/15 19:12	60	ICV 160-223572/1		223572			PS
07/22/16 15:43	960	ICB 160-261911/1		261911			PS
07/26/16 09:15	60	CCV 160-262327/1		262327			PS
08/31/16 09:06	1	PULSER 160-267486/1		267486			ALD
08/31/16 14:07	180	ZZZZZ		267486			
08/31/16 19:41	400	160-18552-5	SU03-S-080-SS-P-00	267486	266485	A-01-R	ALD

Alpha Spectroscopy Run Log

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
07/22/16 15:43	960	ICB 160-261912/1		261912			PS
07/26/16 09:15	60	CCV 160-262328/1		262328			PS
08/31/16 09:06	1	PULSER 160-267487/1		267487			ALD
08/31/16 14:07	180	ZZZZZ		267487			
08/31/16 19:41	400	160-18552-6	SU03-S-081-SS-P-00	267487	266485	A-01-R	ALD

Detector: AV160

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 16:27	140	IC 160-223457/1		223457			PS
10/26/15 19:13	60	ICV 160-223575/1		223575			PS
07/22/16 15:43	960	ICB 160-261914/1		261914			PS
07/26/16 09:34	60	CCV 160-262330/1		262330			PS
08/31/16 09:06	1	PULSER 160-267489/1		267489			ALD
08/31/16 14:07	180	ZZZZZ		267489			
08/31/16 19:41	400	160-18552-7	SU03-S-082-SS-P-00	267489	266485	A-01-R	ALD

Detector: AV213

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 16:12	140	IC 160-223878/1		223878			PS
11/01/15 16:04	60	ICV 160-223628/1		223628			PS
09/01/16 15:17	960	ICB 160-268076/1		268076			PS
09/06/16 11:24	60	CCV 160-268355/1		268355			PS
09/07/16 12:28	1	PULSER 160-268504/1		268504			ALD
09/07/16 14:28	400	160-18552-3	SU02-EXB-078-SS-P-00	268504	266485	A-01-R	ALD

Detector: AV216

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 16:13	140	IC 160-223512/1		223512			PS
11/01/15 16:12	60	ICV 160-223631/1		223631			PS
09/01/16 15:17	960	ICB 160-268079/1		268079			PS
09/07/16 08:38	60	CCV 160-268387/1		268387			PS
09/07/16 12:28	1	PULSER 160-268505/1		268505			ALD
09/07/16 14:28	400	160-18552-1 DU	SU01-EXB-076-SS-P-00 DU	268505	266485	A-01-R	ALD

Detector: AV217

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 18:57	140	IC 160-223513/1		223513			PS
11/01/15 19:16	60	ICV 160-223632/1		223632			PS
09/02/16 10:55	960	ICB 160-268140/1		268140			PS
09/06/16 11:25	60	CCV 160-268357/1		268357			PS
09/07/16 12:28	1	PULSER 160-268506/1		268506			ALD
09/07/16 14:28	400	160-18552-1	SU01-EXB-076-SS-P-00	268506	266485	A-01-R	ALD

GAMMA SPECTROSCOPY

Method 901.1

Ra-226

Radium-226 & Other Gamma Emitters
(GS) by Method 901.1

Prep Batch: 264537

Fill Geometry, 21-Day In-Growth

Gamma Spectroscopy Analysis Detail Report

Prep Batch: 264537

Lab ID: MB 160-264537/1-A Analyzed: 09/01/16 10:41 Ts: 30 Sigma: 2
 Client ID: Detector: GV17 Decay Corrected: No

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	-0.02125	0.0472	0.0472	U	pCi/g	0.500	0.338	267763

Lab ID: LCS 160-264537/2-A Analyzed: 09/01/16 10:42 Ts: 30 Sigma: 2
 Client ID: Detector: GV12 Decay Corrected: No

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Americium-241	97.82	1.62	10.3		pCi/g		1.20	267757
Cesium-137	29.19	0.682	3.11		pCi/g		0.270	267757
Cobalt-60	16.27	0.410	1.68		pCi/g		0.146	267757

Lab ID: 160-18552-1 Analyzed: 09/01/16 10:43 Ts: 30 Sigma: 2
 Client ID: SU01-EXB-076-SS-P-00 Detector: GV13 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.52	0.234	0.283		pCi/g	0.500	0.164	267758

Lab ID: 160-18552-1 DU Analyzed: 09/01/16 11:37 Ts: 30 Sigma: 2
 Client ID: SU01-EXB-076-SS-P-00 Detector: GV12 Decay Corrected: No

Analyte	DU Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.422	0.275	0.312		pCi/g	0.500	0.233	267757

Lab ID: 160-18552-2 Analyzed: 09/01/16 10:46 Ts: 30 Sigma: 2
 Client ID: SU01-EXB-077-SS-P-00 Detector: GV8 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.10	0.243	0.269		pCi/g	0.500	0.184	267756

Lab ID: 160-18552-3 Analyzed: 09/01/16 10:47 Ts: 30 Sigma: 2
 Client ID: SU02-EXB-078-SS-P-00 Detector: GV7 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.46	0.218	0.266		pCi/g	0.500	0.145	267755

Gamma Spectroscopy Analysis Detail Report

Prep Batch: 264537

Lab ID: 160-18552-4 Analyzed: 09/01/16 10:49 Ts: 30 Sigma: 2
 Client ID: SU02-EXB-079-SS-P-00 Detector: GV5 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.22	0.286	0.313		pCi/g	0.500	0.247	267754

Lab ID: 160-18552-5 Analyzed: 09/01/16 11:38 Ts: 30 Sigma: 2
 Client ID: SU03-S-080-SS-P-00 Detector: GV13 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.30	0.172	0.218		pCi/g	0.500	0.0983	267758

Lab ID: 160-18552-6 Analyzed: 09/01/16 11:39 Ts: 30 Sigma: 2
 Client ID: SU03-S-081-SS-P-00 Detector: GV14 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.29	0.276	0.307		pCi/g	0.500	0.233	267760

Lab ID: 160-18552-7 Analyzed: 09/01/16 11:40 Ts: 30 Sigma: 2
 Client ID: SU03-S-082-SS-P-00 Detector: GV15 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.55	0.256	0.302		pCi/g	0.500	0.156	267761

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 160-264537/1-A	Radium-226			-0.02125	U	pCi/g							-.90012896
Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-264537/2-A	Americium-241		97.1	97.82		pCi/g	101	87 - 116					.1004875708
LCS 160-264537/2-A	Cesium-137		29.5	29.19		pCi/g	99	87 - 120					-.1377630488
LCS 160-264537/2-A	Cobalt-60		16.6	16.27		pCi/g	98	87 - 115					-.2945392261
Duplicate ID:	Analyte	Parent Result	Spike Added	DU Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
160-18552-1	Radium-226	1.52		1.422		pCi/g			6	0.16	0.45	1	

Glossary:

Ts = Count Duration, Sample

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

SDG No.: _____

Batch Number: 264537 Batch Start Date: 08/11/16 15:27 Batch Analyst: Sloan, Robert 1Batch Method: Fill_Geo-21 Batch End Date: 08/11/16 17:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	TareWeight	GrossWeight	InitialAmount	IngDecDate1	IngDecDate3	Geometry
MB 160-264537/1		Fill_Geo-21, 901.1				291.18 g	8/11/2016	9/1/2016	Tuna Can
LCS 160-264537/2		Fill_Geo-21, 901.1				341.9 g	8/11/2016	9/1/2016	Tuna Can
160-18552-A-1-A	SU01-EXB-076-SS-P-00	Fill_Geo-21, 901.1	T	46.6 g	312.9 g	266.3 g	8/11/2016	9/1/2016	Tuna Can
160-18552-A-1-A DU	SU01-EXB-076-SS-P-00	Fill_Geo-21, 901.1	T	46.6 g	312.9 g	266.3 g	8/11/2016	9/1/2016	Tuna Can
160-18552-A-2-A	SU01-EXB-077-SS-P-00	Fill_Geo-21, 901.1	T	46.6 g	344.4 g	297.8 g	8/11/2016	9/1/2016	Tuna Can
160-18552-A-3-A	SU02-EXB-078-SS-P-00	Fill_Geo-21, 901.1	T	46.6 g	388.4 g	341.8 g	8/11/2016	9/1/2016	Tuna Can
160-18552-A-4-A	SU02-EXB-079-SS-P-00	Fill_Geo-21, 901.1	T	46.4 g	395.2 g	348.8 g	8/11/2016	9/1/2016	Tuna Can
160-18552-A-5-A	SU03-S-080-SS-P-00	Fill_Geo-21, 901.1	T	46.8 g	399.4 g	352.6 g	8/11/2016	9/1/2016	Tuna Can
160-18552-A-6-A	SU03-S-081-SS-P-00	Fill_Geo-21, 901.1	T	46.6 g	356.7 g	310.1 g	8/11/2016	9/1/2016	Tuna Can
160-18552-A-7-A	SU03-S-082-SS-P-00	Fill_Geo-21, 901.1	T	46.6 g	357.9 g	311.3 g	8/11/2016	9/1/2016	Tuna Can

Lab Sample ID	Client Sample ID	Method Chain	Basis	Tuna Can LCS 00005					
MB 160-264537/1		Fill_Geo-21, 901.1							
LCS 160-264537/2		Fill_Geo-21, 901.1		# g					
160-18552-A-1-A	SU01-EXB-076-SS-P-00	Fill_Geo-21, 901.1	T						
160-18552-A-1-A DU	SU01-EXB-076-SS-P-00	Fill_Geo-21, 901.1	T						
160-18552-A-2-A	SU01-EXB-077-SS-P-00	Fill_Geo-21, 901.1	T						
160-18552-A-3-A	SU02-EXB-078-SS-P-00	Fill_Geo-21, 901.1	T						
160-18552-A-4-A	SU02-EXB-079-SS-P-00	Fill_Geo-21, 901.1	T						
160-18552-A-5-A	SU03-S-080-SS-P-00	Fill_Geo-21, 901.1	T						
160-18552-A-6-A	SU03-S-081-SS-P-00	Fill_Geo-21, 901.1	T						

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.

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GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-18552-1

SDG No.: _____

Batch Number: 264537 Batch Start Date: 08/11/16 15:27 Batch Analyst: Sloan, Robert 1Batch Method: Fill_Geo-21 Batch End Date: 08/11/16 17:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	Tuna Can LCS 00005					
160-18552-A-7-A	SU03-S-082-SS-P- 00	Fill_Geo-21, 901.1	T						

Batch Notes	
Balance ID	1121432711
SOP Number	ST-RC-0003 ST-RC-0025

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.

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Run Logs

Gamma Spectroscopy Run Log

Detector: GV5

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/26/12 15:05		IC 160-12297/1		12297			JLW
03/27/12 10:12		ICV 160-12297/2		12297			JLW
01/28/16 10:21		ACVTOP 160-236240/1		236240			PS
07/30/16 17:50		ICB 160-262848/1		262848			RTM
09/01/16 00:22		CCB 160-267754/1		267754			RTM
09/01/16 05:32		CCV 160-267754/2		267754			
09/01/16 05:54		CCV 160-267754/3		267754			RTM
09/01/16 08:44	30	ZZZZZ		267754			
09/01/16 09:19	30	ZZZZZ		267754			
09/01/16 09:58	30	ZZZZZ		267754			
09/01/16 10:49	30	160-18552-4	SU02-EXB-079-SS-P-00	267754	264537	901.1	RTM
09/01/16 11:51	30	ZZZZZ		267754			
09/01/16 12:42	30	ZZZZZ		267754			
09/01/16 13:24	30	ZZZZZ		267754			
09/01/16 14:36	30	ZZZZZ		267754			
09/01/16 15:16	30	ZZZZZ		267754			
09/01/16 16:02	30	ZZZZZ		267754			
09/01/16 17:10		ZZZZZ		267754			
09/01/16 17:57		ZZZZZ		267754			
09/01/16 19:52	60	ZZZZZ		267754			
09/01/16 21:11	60	ZZZZZ		267754			

Detector: GV7

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/27/12 08:10		IC 160-12302/1		12302			JLW
03/27/12 15:25		ICV 160-12302/2		12302			JLW
01/23/16 19:25		ACVTOP 160-236241/1		236241			PS
07/30/16 18:29		ICB 160-262849/1		262849			RTM
09/01/16 00:23		CCB 160-267755/1		267755			RTM
09/01/16 05:35		CCV 160-267755/2		267755			
09/01/16 05:58		CCV 160-267755/3		267755			RTM
09/01/16 08:44	30	ZZZZZ		267755			
09/01/16 09:20	30	ZZZZZ		267755			
09/01/16 09:59	30	ZZZZZ		267755			
09/01/16 10:47	30	160-18552-3	SU02-EXB-078-SS-P-00	267755	264537	901.1	RTM
09/01/16 11:52	30	ZZZZZ		267755			
09/01/16 12:39	30	ZZZZZ		267755			
09/01/16 13:25	30	ZZZZZ		267755			
09/01/16 14:36	30	ZZZZZ		267755			
09/01/16 15:13	30	ZZZZZ		267755			
09/01/16 16:04	30	ZZZZZ		267755			
09/01/16 19:52	60	ZZZZZ		267755			
09/01/16 21:12	120	ZZZZZ		267755			

Detector: GV8

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/27/12 10:58		IC 160-12311/1		12311			JLW
03/29/12 01:58		ICV 160-12311/2		12311			JLW
01/28/16 18:34		ACVTOP 160-236248/1		236248			PS
08/07/16 22:06		ICB 160-263973/1		263973			ALS
09/01/16 00:24		CCB 160-267756/1		267756			RTM

Gamma Spectroscopy Run Log

Detector: GV8 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
09/01/16 05:38		CCV 160-267756/2		267756			
09/01/16 06:01		CCV 160-267756/3		267756			RTM
09/01/16 08:46	30	ZZZZZ		267756			
09/01/16 09:21	30	ZZZZZ		267756			
09/01/16 10:00	30	ZZZZZ		267756			
09/01/16 10:46	30	160-18552-2	SU01-EXB-077-SS-P-00	267756	264537	901.1	RTM
09/01/16 11:54	30	ZZZZZ		267756			
09/01/16 12:44	30	ZZZZZ		267756			
09/01/16 13:26	30	ZZZZZ		267756			
09/01/16 14:38	30	ZZZZZ		267756			
09/01/16 15:12	30	ZZZZZ		267756			
09/01/16 16:05	30	ZZZZZ		267756			
09/01/16 17:11		ZZZZZ		267756			
09/01/16 17:56		ZZZZZ		267756			
09/01/16 19:54	60	ZZZZZ		267756			
09/01/16 21:14	30	ZZZZZ		267756			
09/01/16 21:54	30	ZZZZZ		267756			

Detector: GV12

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/02/12 10:16		IC 160-13156/1		13156			JLW
10/04/12 09:10		ICV 160-13156/2		13156			JLW
01/28/16 13:28		ACVTOP 160-235885/1		235885			PS
08/06/16 17:43		ICB 160-263713/1		263713			ALS
09/01/16 00:25		CCV 160-267757/1		267757			
09/01/16 00:48		CCV 160-267757/2		267757			RTM
09/01/16 05:20		CCB 160-267757/3		267757			RTM
09/01/16 08:10	30	ZZZZZ		267757			
09/01/16 08:49	30	ZZZZZ		267757			
09/01/16 09:23	30	ZZZZZ		267757			
09/01/16 10:08	30	ZZZZZ		267757			
09/01/16 10:42	30	LCS 160-264537/2-A		267757	264537	901.1	RTM
09/01/16 11:37	30	160-18552-1 DU	SU01-EXB-076-SS-P-00 DU	267757	264537	901.1	RTM
09/01/16 12:31	30	ZZZZZ		267757			
09/01/16 13:09	30	ZZZZZ		267757			
09/01/16 14:40	30	ZZZZZ		267757			
09/01/16 15:14	30	ZZZZZ		267757			
09/01/16 16:06	30	ZZZZZ		267757			
09/01/16 16:45		ZZZZZ		267757			
09/01/16 19:55	60	ZZZZZ		267757			
09/01/16 21:14	60	ZZZZZ		267757			

Detector: GV13

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/27/12 15:23		IC 160-12348/1		12348			JLW
03/27/12 18:51		ICV 160-12348/2		12348			JLW
04/07/16 10:57		ACVTOP 160-244901/1		244901			PS
08/06/16 17:44		ICB 160-263714/1		263714			ALS
09/01/16 00:27		CCV 160-267758/1		267758			
09/01/16 00:50		CCV 160-267758/2		267758			RTM

Gamma Spectroscopy Run Log

Detector: GV13 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
09/01/16 05:21		CCB 160-267758/3		267758			RTM
09/01/16 08:11	30	ZZZZZ		267758			
09/01/16 08:48	30	ZZZZZ		267758			
09/01/16 09:25	30	ZZZZZ		267758			
09/01/16 10:09	30	ZZZZZ		267758			
09/01/16 10:43	30	160-18552-1	SU01-EXB-076-SS-P-00	267758	264537	901.1	RTM
09/01/16 11:38	30	160-18552-5	SU03-S-080-SS-P-00	267758	264537	901.1	RTM
09/01/16 12:32	30	ZZZZZ		267758			
09/01/16 13:10	30	ZZZZZ		267758			
09/01/16 14:42	30	ZZZZZ		267758			
09/01/16 15:15	30	ZZZZZ		267758			
09/01/16 16:09	30	ZZZZZ		267758			
09/01/16 16:44	30	ZZZZZ		267758			
09/01/16 19:55	60	ZZZZZ		267758			
09/01/16 21:15	60	ZZZZZ		267758			
09/01/16 22:17	60	ZZZZZ		267758			

Detector: GV14

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
04/23/12 09:56		IC 160-12359/1		12359			JLW
04/24/12 08:12		ICV 160-12359/2		12359			JLW
01/25/16 12:29		ACVTOP 160-235877/1		235877			PS
08/06/16 17:41		ICB 160-263717/1		263717			ALS
09/01/16 00:23		CCB 160-267760/1		267760			RTM
09/01/16 05:23		CCV 160-267760/2		267760			
09/01/16 05:48		CCV 160-267760/3		267760			RTM
09/01/16 08:11	30	ZZZZZ		267760			
09/01/16 09:10	30	ZZZZZ		267760			
09/01/16 09:47	30	ZZZZZ		267760			
09/01/16 10:37	30	ZZZZZ		267760			
09/01/16 11:39	30	160-18552-6	SU03-S-081-SS-P-00	267760	264537	901.1	RTM
09/01/16 12:33	30	ZZZZZ		267760			
09/01/16 13:11	30	ZZZZZ		267760			
09/01/16 14:35	30	ZZZZZ		267760			
09/01/16 15:10	30	ZZZZZ		267760			
09/01/16 16:07	30	ZZZZZ		267760			
09/01/16 16:51	30	ZZZZZ		267760			
09/01/16 19:56	120	ZZZZZ		267760			
09/01/16 22:09	120	ZZZZZ		267760			

Detector: GV15

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/22/12 11:06		IC 160-12362/1		12362			JLW
03/23/12 06:10		ICV 160-12362/2		12362			JLW
05/04/16 18:46		ACVTOP 160-249629/1		249629			PS
08/06/16 17:39		ICB 160-263718/1		263718			ALS
09/01/16 00:24		CCB 160-267761/1		267761			RTM
09/01/16 05:23		CCV 160-267761/2		267761			
09/01/16 05:48		CCV 160-267761/3		267761			RTM
09/01/16 08:34	30	ZZZZZ		267761			
09/01/16 09:14	30	ZZZZZ		267761			

Gamma Spectroscopy Run Log

Detector: GV15 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
09/01/16 09:48	30	ZZZZZ		267761			
09/01/16 10:38	30	ZZZZZ		267761			
09/01/16 11:40	30	160-18552-7	SU03-S-082-SS-P-00	267761	264537	901.1	RTM
09/01/16 12:33	30	ZZZZZ		267761			
09/01/16 13:12	30	ZZZZZ		267761			
09/01/16 14:33	30	ZZZZZ		267761			
09/01/16 15:08	30	ZZZZZ		267761			
09/01/16 16:08	30	ZZZZZ		267761			
09/01/16 16:48	30	ZZZZZ		267761			
09/01/16 19:57	60	ZZZZZ		267761			
09/01/16 21:16	30	ZZZZZ		267761			

Detector: GV17

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/26/12 06:29		IC 160-12390/1		12390			JLW
03/26/12 09:29		ICV 160-12390/2		12390			JLW
01/27/16 15:26		ACVTOP 160-235874/1		235874			PS
08/17/16 09:28		ICB 160-265384/1		265384			ALS
09/01/16 00:28		CCB 160-267763/1		267763			RTM
09/01/16 05:33		CCV 160-267763/2		267763			
09/01/16 05:57		CCV 160-267763/3		267763			RTM
09/01/16 08:17	30	ZZZZZ		267763			
09/01/16 08:51	30	ZZZZZ		267763			
09/01/16 09:51	30	ZZZZZ		267763			
09/01/16 10:41	30	MB 160-264537/1-A		267763	264537	901.1	RTM
09/01/16 11:51	30	ZZZZZ		267763			
09/01/16 12:36	30	ZZZZZ		267763			
09/01/16 13:14	30	ZZZZZ		267763			
09/01/16 14:31	30	ZZZZZ		267763			
09/01/16 15:05	30	ZZZZZ		267763			
09/01/16 16:11	30	ZZZZZ		267763			
09/01/16 16:46	30	ZZZZZ		267763			
09/01/16 19:59	120	ZZZZZ		267763			

Shipping and Receiving Documents

[illegible]

Login Sample Receipt Checklist

Client: EA Engineering, Science, and Technology

Job Number: 160-18552-1

Login Number: 18552

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	