

## ANALYTICAL REPORT

Job Number: 160-18554-1

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 4:15 PM

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Jessica H DeHerrera, Project Manager I  
4955 Yarrow Street, Arvada, CO, 80002  
(303)736-0165  
jessica.deherrera@testamericainc.com  
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.

**TestAmerica Laboratories, Inc.**

TestAmerica St. Louis 13715 Rider Trail North, Earth City, MO 63045  
Tel (314) 298-8566 Fax (314) 298-8757 [www.testamericainc.com](http://www.testamericainc.com)



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## Definitions/Glossary

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

TestAmerica Job ID: 160-18554-1

### 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: 160-18554-1**

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.

### **RADIUM-226 & OTHER GAMMA EMITTERS (GS)**

Samples SU02-EXW-040-SS-P-00 (160-18554-1), SU02-EXN-041-SS-P-00 (160-18554-2), SU02-EXW-042-SS-P-00 (160-18554-3), SU02-EXB-043-SS-P-00 (160-18554-4), SU02-EXN-044-SS-P-00 (160-18554-5), SU02-EXB-045-SS-P-00 (160-18554-6), SU02-EXW-046-SS-P-00 (160-18554-7), SU02-EXW-047-SS-P-00 (160-18554-8), SU02-EXB-048-SS-P-00 (160-18554-9), SU02-EXB-049-SS-P-00 (160-18554-10), SU02-EXB-050-SS-P-00 (160-18554-11), SU02-EXW-051-SS-P-00 (160-18554-12), SU02-EXB-052-SS-P-00 (160-18554-13), SU02-EXB-053-SS-P-00 (160-18554-14), SU02-EXB-054-SS-P-00 (160-18554-15), SU02-EXS-055-SS-P-00 (160-18554-16), SU02-EXB-056-SS-P-00 (160-18554-17), SU02-EXB-057-SS-P-00 (160-18554-18), SU02-EXW-047-SS-DUP-P-00 (160-18554-19) and SU02-EXB-049-SS-DUP-P-00 (160-18554-20) 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 additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

### **ISOTOPIC THORIUM**

Samples SU02-EXW-040-SS-P-00 (160-18554-1), SU02-EXN-041-SS-P-00 (160-18554-2), SU02-EXW-042-SS-P-00 (160-18554-3), SU02-EXB-043-SS-P-00 (160-18554-4), SU02-EXN-044-SS-P-00 (160-18554-5), SU02-EXB-045-SS-P-00 (160-18554-6), SU02-EXW-046-SS-P-00 (160-18554-7), SU02-EXW-047-SS-P-00 (160-18554-8), SU02-EXB-048-SS-P-00 (160-18554-9), SU02-EXB-049-SS-P-00 (160-18554-10), SU02-EXB-050-SS-P-00 (160-18554-11), SU02-EXW-051-SS-P-00 (160-18554-12), SU02-EXB-052-SS-P-00 (160-18554-13), SU02-EXB-053-SS-P-00 (160-18554-14), SU02-EXB-054-SS-P-00 (160-18554-15), SU02-EXS-055-SS-P-00 (160-18554-16), SU02-EXB-056-SS-P-00 (160-18554-17), SU02-EXB-057-SS-P-00 (160-18554-18), SU02-EXW-047-SS-DUP-P-00 (160-18554-19) and SU02-EXB-049-SS-DUP-P-00 (160-18554-20) 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, 09/07/2016 and 09/08/2016.

The following sample could not be thoroughly homogenized before sub-sampling was performed due to sample matrix: SU02-EXB-054-SS-P-00 (160-18554-15). The samples contained rocks.

The following samples could not be thoroughly homogenized before sub-sampling was performed due to sample matrix:

SU02-EXW-040-SS-P-00 (160-18554-1), SU02-EXN-041-SS-P-00 (160-18554-2), SU02-EXW-042-SS-P-00 (160-18554-3), SU02-EXB-043-SS-P-00 (160-18554-4), SU02-EXN-044-SS-P-00 (160-18554-5), SU02-EXB-045-SS-P-00 (160-18554-6), SU02-EXW-046-SS-P-00 (160-18554-7), SU02-EXW-047-SS-P-00 (160-18554-8), SU02-EXB-048-SS-P-00 (160-18554-9), SU02-EXB-049-SS-P-00 (160-18554-10), SU02-EXB-050-SS-P-00 (160-18554-11), SU02-EXW-051-SS-P-00 (160-18554-12) and SU02-EXB-052-SS-P-00 (160-18554-13). The samples contained rocks.

The resolution (FWHM) for the Thorium-229 tracer peak for the following sample is greater than the 100 keV limit (108.4 keV): SU02-EXW-051-SS-P-00 (160-18554-12) The resolution of the tracer peak in all other samples associated with the batch are well within the 100 keV limit indicating an anomaly isolated to this sample. The laboratory does not believe this excursion adversely affects the data

The resolution (FWHM) for the Thorium-229 tracer peak for the following sample is greater than the 100 keV limit (117.4 keV): SU02-EXB-054-SS-P-00 (160-18554-15) The resolution of the tracer peak in all other samples associated with the batch are 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: 160-18554-1

**Client Sample ID: SU02-EXW-040-SS-P-00**

**Lab Sample ID: 160-18554-1**

☐ No Detections.

**Client Sample ID: SU02-EXN-041-SS-P-00**

**Lab Sample ID: 160-18554-2**

☐ No Detections.

**Client Sample ID: SU02-EXW-042-SS-P-00**

**Lab Sample ID: 160-18554-3**

☐ No Detections.

**Client Sample ID: SU02-EXB-043-SS-P-00**

**Lab Sample ID: 160-18554-4**

☐ No Detections.

**Client Sample ID: SU02-EXN-044-SS-P-00**

**Lab Sample ID: 160-18554-5**

☐ No Detections.

**Client Sample ID: SU02-EXB-045-SS-P-00**

**Lab Sample ID: 160-18554-6**

☐ No Detections.

**Client Sample ID: SU02-EXW-046-SS-P-00**

**Lab Sample ID: 160-18554-7**

☐ No Detections.

**Client Sample ID: SU02-EXW-047-SS-P-00**

**Lab Sample ID: 160-18554-8**

☐ No Detections.

**Client Sample ID: SU02-EXB-048-SS-P-00**

**Lab Sample ID: 160-18554-9**

☐ No Detections.

**Client Sample ID: SU02-EXB-049-SS-P-00**

**Lab Sample ID: 160-18554-10**

☐ No Detections.

**Client Sample ID: SU02-EXB-050-SS-P-00**

**Lab Sample ID: 160-18554-11**

☐ No Detections.

**Client Sample ID: SU02-EXW-051-SS-P-00**

**Lab Sample ID: 160-18554-12**

☐ No Detections.

**Client Sample ID: SU02-EXB-052-SS-P-00**

**Lab Sample ID: 160-18554-13**

☐ No Detections.

**Client Sample ID: SU02-EXB-053-SS-P-00**

**Lab Sample ID: 160-18554-14**

☐ No Detections.

This Detection Summary does not include radiochemical test results.

TestAmerica St. Louis

## Detection Summary

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXB-054-SS-P-00**

**Lab Sample ID: 160-18554-15**

☐ No Detections.

**Client Sample ID: SU02-EXS-055-SS-P-00**

**Lab Sample ID: 160-18554-16**

☐ No Detections.

**Client Sample ID: SU02-EXB-056-SS-P-00**

**Lab Sample ID: 160-18554-17**

☐ No Detections.

**Client Sample ID: SU02-EXB-057-SS-P-00**

**Lab Sample ID: 160-18554-18**

☐ No Detections.

**Client Sample ID: SU02-EXW-047-SS-DUP-P-00**

**Lab Sample ID: 160-18554-19**

☐ No Detections.

**Client Sample ID: SU02-EXB-049-SS-DUP-P-00**

**Lab Sample ID: 160-18554-20**

☐ 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: 160-18554-1

**Client Sample ID: SU02-EXW-040-SS-P-00**

**Date Collected: 08/08/16 11:41**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-1**

**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	1.28		0.241	0.276	0.500	0.146	pCi/g	08/11/16 15:20	09/01/16 11:54	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	1.15		0.153	0.181	0.100	0.0279	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Thorium-232	1.14		0.151	0.179	0.100	0.0151	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	91.0		30 - 110					08/25/16 15:51	09/07/16 14:24	1

**Client Sample ID: SU02-EXN-041-SS-P-00**

**Date Collected: 08/08/16 11:49**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-2**

**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	1.02		0.205	0.231	0.500	0.239	pCi/g	08/11/16 15:20	09/01/16 11:52	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	1.31		0.158	0.192	0.100	0.0263	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	1.15		0.148	0.176	0.100	0.0142	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110					08/25/16 15:51	08/31/16 19:45	1

**Client Sample ID: SU02-EXW-042-SS-P-00**

**Date Collected: 08/08/16 12:12**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-3**

**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	1.33		0.292	0.323	0.500	0.247	pCi/g	08/11/16 15:20	09/01/16 11:51	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	1.14		0.147	0.176	0.100	0.0143	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	0.934		0.133	0.154	0.100	0.0142	pCi/g	08/25/16 15:51	08/31/16 19:45	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: 160-18554-1

**Client Sample ID: SU02-EXW-042-SS-P-00**

**Date Collected: 08/08/16 12:12**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-3**

**Matrix: Solid**

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	95.3		30 - 110	08/25/16 15:51	08/31/16 19:45	1

**Client Sample ID: SU02-EXB-043-SS-P-00**

**Date Collected: 08/08/16 12:08**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-4**

**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	1.25		0.204	0.241	0.500	0.159	pCi/g	08/11/16 15:20	09/01/16 12:31	1

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

			Count Uncert.	Total Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	1.11		0.143	0.171	0.100	0.0255	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	0.972		0.134	0.157	0.100	0.0138	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	100		30 - 110					08/25/16 15:51	08/31/16 19:45	1

**Client Sample ID: SU02-EXN-044-SS-P-00**

**Date Collected: 08/08/16 12:03**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-5**

**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	0.994		0.204	0.228	0.500	0.152	pCi/g	08/11/16 15:20	09/01/16 12:32	1

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

			Count Uncert.	Total Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	2.07		0.201	0.266	0.100	0.0358	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	1.32		0.160	0.195	0.100	0.0267	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	89.1		30 - 110					08/25/16 15:51	08/31/16 19:45	1

**Client Sample ID: SU02-EXB-045-SS-P-00**

**Date Collected: 08/08/16 11:58**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-6**

**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	1.08		0.225	0.252	0.500	0.183	pCi/g	08/11/16 15:20	09/01/16 12:33	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: 160-18554-1

**Client Sample ID: SU02-EXB-045-SS-P-00**

**Date Collected: 08/08/16 11:58**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-6**

**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	1.63		0.180	0.226	0.100	0.0149	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	1.34		0.163	0.198	0.100	0.0274	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	87.1		30 - 110					08/25/16 15:51	08/31/16 19:45	1

**Client Sample ID: SU02-EXW-046-SS-P-00**

**Date Collected: 08/08/16 12:24**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-7**

**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	1.66		0.324	0.367	0.500	0.257	pCi/g	08/11/16 15:20	09/01/16 12:33	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	1.14		0.147	0.175	0.100	0.0262	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	1.24		0.153	0.185	0.100	0.0284	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	89.7		30 - 110					08/25/16 15:51	08/31/16 19:45	1

**Client Sample ID: SU02-EXW-047-SS-P-00**

**Date Collected: 08/08/16 12:18**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-8**

**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	1.68		0.230	0.289	0.500	0.152	pCi/g	08/11/16 15:20	09/01/16 12:35	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	1.30		0.156	0.191	0.100	0.0308	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	1.16		0.147	0.176	0.100	0.0140	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	100		30 - 110					08/25/16 15:51	08/31/16 19:45	1

# Client Sample Results

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXB-048-SS-P-00**

**Date Collected: 08/08/16 12:44**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-9**

**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	0.787		0.187	0.205	0.500	0.159	pCi/g	08/11/16 15:20	09/01/16 12:36	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	2.00		0.207	0.267	0.100	0.0162	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Thorium-232	1.25		0.164	0.194	0.100	0.0296	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	83.9		30 - 110					08/25/16 15:51	09/07/16 14:24	1

**Client Sample ID: SU02-EXB-049-SS-P-00**

**Date Collected: 08/08/16 13:22**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-10**

**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	1.06		0.243	0.267	0.500	0.183	pCi/g	08/11/16 15:20	09/01/16 12:44	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	2.04		0.211	0.272	0.100	0.0437	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	1.15		0.158	0.185	0.100	0.0299	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	83.3		30 - 110					08/25/16 15:51	08/31/16 19:45	1

**Client Sample ID: SU02-EXB-050-SS-P-00**

**Date Collected: 08/08/16 13:33**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-11**

**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	1.44		0.324	0.357	0.500	0.258	pCi/g	08/11/16 15:20	09/01/16 12:42	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	1.65		0.183	0.230	0.100	0.0331	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Thorium-232	1.11		0.150	0.177	0.100	0.0349	pCi/g	08/25/16 15:51	09/07/16 14:24	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXB-050-SS-P-00**

**Date Collected: 08/08/16 13:33**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-11**

**Matrix: Solid**

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.6		30 - 110	08/25/16 15:51	09/07/16 14:24	1

**Client Sample ID: SU02-EXW-051-SS-P-00**

**Date Collected: 08/08/16 12:28**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-12**

**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	2.11		0.266	0.345	0.500	0.175	pCi/g	08/11/16 15:20	09/01/16 13:09	1

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

			Count Uncert.	Total Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	1.31		0.168	0.201	0.100	0.0461	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Thorium-232	1.12		0.154	0.180	0.100	0.0159	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	88.1		30 - 110					08/25/16 15:51	09/07/16 14:24	1

**Client Sample ID: SU02-EXB-052-SS-P-00**

**Date Collected: 08/08/16 12:40**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-13**

**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	1.42		0.216	0.262	0.500	0.149	pCi/g	08/11/16 15:20	09/01/16 13:10	1

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

			Count Uncert.	Total Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	4.44		0.306	0.482	0.100	0.0291	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Thorium-232	1.66		0.186	0.233	0.100	0.0289	pCi/g	08/25/16 15:51	09/07/16 14:24	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	81.0		30 - 110					08/25/16 15:51	09/07/16 14:24	1

**Client Sample ID: SU02-EXB-053-SS-P-00**

**Date Collected: 08/08/16 13:28**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-14**

**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	1.07		0.211	0.238	0.500	0.164	pCi/g	08/11/16 15:20	09/01/16 13:11	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXB-053-SS-P-00**

**Lab Sample ID: 160-18554-14**

**Date Collected: 08/08/16 13:28**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

## 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	1.30		0.156	0.190	0.100	0.0306	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Thorium-232	1.23		0.151	0.183	0.100	0.0139	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	94.8		30 - 110					08/25/16 15:54	09/07/16 14:38	1

**Client Sample ID: SU02-EXB-054-SS-P-00**

**Lab Sample ID: 160-18554-15**

**Date Collected: 08/08/16 13:25**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

## 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	1.06		0.257	0.279	0.500	0.220	pCi/g	08/11/16 15:20	09/01/16 13:12	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	0.893		0.136	0.156	0.100	0.0340	pCi/g	08/25/16 15:54	09/08/16 15:56	1
Thorium-232	1.10		0.150	0.176	0.100	0.0285	pCi/g	08/25/16 15:54	09/08/16 15:56	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	83.3		30 - 110					08/25/16 15:54	09/08/16 15:56	1

**Client Sample ID: SU02-EXS-055-SS-P-00**

**Lab Sample ID: 160-18554-16**

**Date Collected: 08/08/16 12:33**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

## 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	1.57		0.255	0.302	0.500	0.190	pCi/g	08/11/16 15:20	09/01/16 13:13	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	1.15		0.155	0.182	0.100	0.0341	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Thorium-232	1.07		0.148	0.173	0.100	0.0155	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110					08/25/16 15:54	09/07/16 14:38	1

# Client Sample Results

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXB-056-SS-P-00**

**Lab Sample ID: 160-18554-17**

**Date Collected: 08/08/16 13:20**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

## 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	1.26		0.211	0.249	0.500	0.193	pCi/g	08/11/16 15:20	09/01/16 13:14	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	0.993		0.141	0.164	0.100	0.0399	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Thorium-232	1.24		0.157	0.188	0.100	0.0363	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	86.6		30 - 110					08/25/16 15:54	09/07/16 14:38	1

**Client Sample ID: SU02-EXB-057-SS-P-00**

**Lab Sample ID: 160-18554-18**

**Date Collected: 08/08/16 13:15**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

## 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	1.44		0.268	0.307	0.500	0.192	pCi/g	08/11/16 15:20	09/01/16 13:24	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	1.20		0.150	0.181	0.100	0.0141	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Thorium-232	1.23		0.152	0.184	0.100	0.0140	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	90.7		30 - 110					08/25/16 15:54	09/07/16 14:38	1

**Client Sample ID: SU02-EXW-047-SS-DUP-P-00**

**Lab Sample ID: 160-18554-19**

**Date Collected: 08/08/16 12:18**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

## 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	1.61		0.259	0.309	0.500	0.184	pCi/g	08/11/16 15:20	09/01/16 13:25	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	0.604		0.106	0.117	0.100	0.0336	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Thorium-232	0.694		0.113	0.127	0.100	0.0365	pCi/g	08/25/16 15:54	09/07/16 14:38	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXW-047-SS-DUP-P-00**

**Date Collected: 08/08/16 12:18**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-19**

**Matrix: Solid**

<i>Tracer</i>	<i>%Yield</i>	<i>Qualifier</i>	<i>Limits</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
Thorium-229	103		30 - 110	08/25/16 15:54	09/07/16 14:38	1

**Client Sample ID: SU02-EXB-049-SS-DUP-P-00**

**Date Collected: 08/08/16 13:22**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-20**

**Matrix: Solid**

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

<i>Analyte</i>	<i>Result</i>	<i>Qualifier</i>	<i>Count Uncert. (2σ+/-)</i>	<i>Total Uncert. (2σ+/-)</i>	<i>LOQ</i>	<i>MDC</i>	<i>Unit</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
Radium-226	1.19		0.230	0.261	0.500	0.152	pCi/g	08/11/16 15:20	09/01/16 13:26	1

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

			Count	Total						
			Uncert.	Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	0.671		0.115	0.128	0.100	0.0148	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Thorium-232	0.892		0.133	0.153	0.100	0.0323	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	89.9		30 - 110					08/25/16 15:54	09/07/16 14:38	1

## Tracer/Carrier Summary

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

TestAmerica Job ID: 160-18554-1

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

Matrix: Solid

Prep Type: Total/NA

Lab Sample ID	Client Sample ID	Percent Yield (Acceptance Limits)					
		Th-229 (30-110)					
160-18554-1	SU02-EXW-040-SS-P-00	91.0					
160-18554-2	SU02-EXN-041-SS-P-00	88.0					
160-18554-3	SU02-EXW-042-SS-P-00	95.3					
160-18554-4	SU02-EXB-043-SS-P-00	100					
160-18554-5	SU02-EXN-044-SS-P-00	89.1					
160-18554-6	SU02-EXB-045-SS-P-00	87.1					
160-18554-7	SU02-EXW-046-SS-P-00	89.7					
160-18554-8	SU02-EXW-047-SS-P-00	100					
160-18554-9	SU02-EXB-048-SS-P-00	83.9					
160-18554-10	SU02-EXB-049-SS-P-00	83.3					
160-18554-11	SU02-EXB-050-SS-P-00	91.6					
160-18554-12	SU02-EXW-051-SS-P-00	88.1					
160-18554-13	SU02-EXB-052-SS-P-00	81.0					
160-18554-14	SU02-EXB-053-SS-P-00	94.8					
160-18554-14 DU	SU02-EXB-053-SS-P-00	82.5					
160-18554-15	SU02-EXB-054-SS-P-00	83.3					
160-18554-16	SU02-EXS-055-SS-P-00	88.0					
160-18554-17	SU02-EXB-056-SS-P-00	86.6					
160-18554-18	SU02-EXB-057-SS-P-00	90.7					
160-18554-19	SU02-EXW-047-SS-DUP-P-00	103					
160-18554-20	SU02-EXB-049-SS-DUP-P-00	89.9					
LCS 160-266564/2-A	Lab Control Sample	92.5					
LCS 160-266565/2-A	Lab Control Sample	97.0					
MB 160-266564/1-A	Method Blank	101					
MB 160-266565/1-A	Method Blank	96.5					

#### 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: 160-18554-1

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

Lab Sample ID: MB 160-264535/1-A  
Matrix: Solid  
Analysis Batch: 267762

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 264535

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.02099	U	0.0211	0.0212	0.500	0.325	pCi/g	08/11/16 15:20	09/01/16 11:46	1

Lab Sample ID: LCS 160-264535/2-A  
Matrix: Solid  
Analysis Batch: 267763

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 264535

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.1	91.28		9.60		1.13	pCi/g	94	87 - 116
Cesium-137	29.5	28.58		3.05		0.245	pCi/g	97	87 - 120
Cobalt-60	16.6	16.11		1.67		0.0756	pCi/g	97	87 - 115

Lab Sample ID: 160-18554-1 DU  
Matrix: Solid  
Analysis Batch: 267755

Client Sample ID: SU02-EXW-040-SS-P-00  
Prep Type: Total/NA  
Prep Batch: 264535

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	RER	RER Limit
Radium-226	1.28		1.206		0.254	0.500	0.162	pCi/g	0.15	1

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

Lab Sample ID: MB 160-266564/1-A  
Matrix: Solid  
Analysis Batch: 267504

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 266564

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	0.05641		0.0338	0.0342	0.100	0.0304	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Thorium-232	0.01380		0.0159	0.0160	0.100	0.0138	pCi/g	08/25/16 15:51	08/31/16 19:45	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110					08/25/16 15:51	08/31/16 19:45	1

Lab Sample ID: LCS 160-266564/2-A  
Matrix: Solid  
Analysis Batch: 267505

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 266564

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	25.71		2.38	0.100	0.0647	pCi/g	105	81 - 118
Tracer	LCS %Yield	LCS Qualifier	Limits						
Thorium-229	92.5		30 - 110						

# QC Sample Results

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

TestAmerica Job ID: 160-18554-1

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

Lab Sample ID: MB 160-266565/1-A

Matrix: Solid

Analysis Batch: 268478

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 266565

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	0.09373		0.0422	0.0430	0.100	0.0143	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Thorium-232	0.004736	U	0.00947	0.00948	0.100	0.0142	pCi/g	08/25/16 15:54	09/07/16 14:38	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	96.5		30 - 110					08/25/16 15:54	09/07/16 14:38	1

Lab Sample ID: LCS 160-266565/2-A

Matrix: Solid

Analysis Batch: 268479

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 266565

Analyte		Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits
Thorium-230		24.5	25.18		2.33	0.100	0.0287	pCi/g	103	81 - 118
Tracer	LCS %Yield	LCS Qualifier	Limits							
Thorium-229	97.0		30 - 110							

Lab Sample ID: 160-18554-14 DU

Matrix: Solid

Analysis Batch: 268481

Client Sample ID: SU02-EXB-053-SS-P-00

Prep Type: Total/NA

Prep Batch: 266565

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit		RER	RER Limit
Thorium-230	1.30		1.307		0.198	0.100	0.0383	pCi/g		0.03	1
Thorium-232	1.23		1.056		0.172	0.100	0.0155	pCi/g		0.49	1
Tracer	DU %Yield	DU Qualifier	Limits								
Thorium-229	82.5		30 - 110								

# QC Association Summary

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

TestAmerica Job ID: 160-18554-1

## Rad

### Leach Batch: 264093

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18554-1	SU02-EXW-040-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-2	SU02-EXN-041-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-3	SU02-EXW-042-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-4	SU02-EXB-043-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-5	SU02-EXN-044-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-6	SU02-EXB-045-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-7	SU02-EXW-046-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-8	SU02-EXW-047-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-9	SU02-EXB-048-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-10	SU02-EXB-049-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-11	SU02-EXB-050-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-12	SU02-EXW-051-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-13	SU02-EXB-052-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-14	SU02-EXB-053-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-15	SU02-EXB-054-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-16	SU02-EXS-055-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-17	SU02-EXB-056-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-18	SU02-EXB-057-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-19	SU02-EXW-047-SS-DUP-P-00	Total/NA	Solid	Dry and Grind	
160-18554-20	SU02-EXB-049-SS-DUP-P-00	Total/NA	Solid	Dry and Grind	
160-18554-1 DU	SU02-EXW-040-SS-P-00	Total/NA	Solid	Dry and Grind	
160-18554-14 DU	SU02-EXB-053-SS-P-00	Total/NA	Solid	Dry and Grind	

### Prep Batch: 264535

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18554-1	SU02-EXW-040-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-2	SU02-EXN-041-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-3	SU02-EXW-042-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-4	SU02-EXB-043-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-5	SU02-EXN-044-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-6	SU02-EXB-045-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-7	SU02-EXW-046-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-8	SU02-EXW-047-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-9	SU02-EXB-048-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-10	SU02-EXB-049-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-11	SU02-EXB-050-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-12	SU02-EXW-051-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-13	SU02-EXB-052-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-14	SU02-EXB-053-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-15	SU02-EXB-054-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-16	SU02-EXS-055-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-17	SU02-EXB-056-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-18	SU02-EXB-057-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-19	SU02-EXW-047-SS-DUP-P-00	Total/NA	Solid	Fill_Geo-21	264093
160-18554-20	SU02-EXB-049-SS-DUP-P-00	Total/NA	Solid	Fill_Geo-21	264093
MB 160-264535/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	
LCS 160-264535/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
160-18554-1 DU	SU02-EXW-040-SS-P-00	Total/NA	Solid	Fill_Geo-21	264093

## QC Association Summary

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

TestAmerica Job ID: 160-18554-1

### Rad (Continued)

#### Prep Batch: 266564

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18554-1	SU02-EXW-040-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-2	SU02-EXN-041-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-3	SU02-EXW-042-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-4	SU02-EXB-043-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-5	SU02-EXN-044-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-6	SU02-EXB-045-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-7	SU02-EXW-046-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-8	SU02-EXW-047-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-9	SU02-EXB-048-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-10	SU02-EXB-049-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-11	SU02-EXB-050-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-12	SU02-EXW-051-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-13	SU02-EXB-052-SS-P-00	Total/NA	Solid	ExtChrom	264093
MB 160-266564/1-A	Method Blank	Total/NA	Solid	ExtChrom	
LCS 160-266564/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	

#### Prep Batch: 266565

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18554-14	SU02-EXB-053-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-15	SU02-EXB-054-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-16	SU02-EXS-055-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-17	SU02-EXB-056-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-18	SU02-EXB-057-SS-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-19	SU02-EXW-047-SS-DUP-P-00	Total/NA	Solid	ExtChrom	264093
160-18554-20	SU02-EXB-049-SS-DUP-P-00	Total/NA	Solid	ExtChrom	264093
MB 160-266565/1-A	Method Blank	Total/NA	Solid	ExtChrom	
LCS 160-266565/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
160-18554-14 DU	SU02-EXB-053-SS-P-00	Total/NA	Solid	ExtChrom	264093

# Lab Chronicle

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXW-040-SS-P-00**

**Date Collected: 08/08/16 11:41**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-1**

**Matrix: Solid**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267756	09/01/16 11:54	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268510	09/07/16 14:24	ALD	TAL SL

**Client Sample ID: SU02-EXN-041-SS-P-00**

**Date Collected: 08/08/16 11:49**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-2**

**Matrix: Solid**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267755	09/01/16 11:52	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	267516	08/31/16 19:45	ALD	TAL SL

**Client Sample ID: SU02-EXW-042-SS-P-00**

**Date Collected: 08/08/16 12:12**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-3**

**Matrix: Solid**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267754	09/01/16 11:51	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	267517	08/31/16 19:45	ALD	TAL SL

**Client Sample ID: SU02-EXB-043-SS-P-00**

**Date Collected: 08/08/16 12:08**

**Date Received: 08/09/16 09:20**

**Lab Sample ID: 160-18554-4**

**Matrix: Solid**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267757	09/01/16 12:31	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	267518	08/31/16 19:45	ALD	TAL SL

# Lab Chronicle

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXN-044-SS-P-00**

**Lab Sample ID: 160-18554-5**

**Date Collected: 08/08/16 12:03**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267758	09/01/16 12:32	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	267519	08/31/16 19:45	ALD	TAL SL

**Client Sample ID: SU02-EXB-045-SS-P-00**

**Lab Sample ID: 160-18554-6**

**Date Collected: 08/08/16 11:58**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267760	09/01/16 12:33	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	267520	08/31/16 19:45	ALD	TAL SL

**Client Sample ID: SU02-EXW-046-SS-P-00**

**Lab Sample ID: 160-18554-7**

**Date Collected: 08/08/16 12:24**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267761	09/01/16 12:33	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	267521	08/31/16 19:45	ALD	TAL SL

**Client Sample ID: SU02-EXW-047-SS-P-00**

**Lab Sample ID: 160-18554-8**

**Date Collected: 08/08/16 12:18**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267762	09/01/16 12:35	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	267522	08/31/16 19:45	ALD	TAL SL

## Lab Chronicle

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXB-048-SS-P-00**

**Lab Sample ID: 160-18554-9**

**Date Collected: 08/08/16 12:44**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267763	09/01/16 12:36	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268509	09/07/16 14:24	ALD	TAL SL

**Client Sample ID: SU02-EXB-049-SS-P-00**

**Lab Sample ID: 160-18554-10**

**Date Collected: 08/08/16 13:22**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267756	09/01/16 12:44	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	267524	08/31/16 19:45	ALD	TAL SL

**Client Sample ID: SU02-EXB-050-SS-P-00**

**Lab Sample ID: 160-18554-11**

**Date Collected: 08/08/16 13:33**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267754	09/01/16 12:42	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268563	09/07/16 14:24	ALD	TAL SL

**Client Sample ID: SU02-EXW-051-SS-P-00**

**Lab Sample ID: 160-18554-12**

**Date Collected: 08/08/16 12:28**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267757	09/01/16 13:09	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268508	09/07/16 14:24	ALD	TAL SL

TestAmerica St. Louis



# Lab Chronicle

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXB-052-SS-P-00**

**Lab Sample ID: 160-18554-13**

**Date Collected: 08/08/16 12:40**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267758	09/01/16 13:10	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266564	08/25/16 15:51	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268507	09/07/16 14:24	ALD	TAL SL

**Client Sample ID: SU02-EXB-053-SS-P-00**

**Lab Sample ID: 160-18554-14**

**Date Collected: 08/08/16 13:28**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267760	09/01/16 13:11	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266565	08/25/16 15:54	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268480	09/07/16 14:38	ALD	TAL SL

**Client Sample ID: SU02-EXB-054-SS-P-00**

**Lab Sample ID: 160-18554-15**

**Date Collected: 08/08/16 13:25**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267761	09/01/16 13:12	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266565	08/25/16 15:54	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268649	09/08/16 15:56	ALD	TAL SL

**Client Sample ID: SU02-EXS-055-SS-P-00**

**Lab Sample ID: 160-18554-16**

**Date Collected: 08/08/16 12:33**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267762	09/01/16 13:13	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266565	08/25/16 15:54	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268483	09/07/16 14:38	ALD	TAL SL



# Lab Chronicle

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

TestAmerica Job ID: 160-18554-1

**Client Sample ID: SU02-EXB-056-SS-P-00**

**Lab Sample ID: 160-18554-17**

**Date Collected: 08/08/16 13:20**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267763	09/01/16 13:14	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266565	08/25/16 15:54	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268484	09/07/16 14:38	ALD	TAL SL

**Client Sample ID: SU02-EXB-057-SS-P-00**

**Lab Sample ID: 160-18554-18**

**Date Collected: 08/08/16 13:15**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267754	09/01/16 13:24	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266565	08/25/16 15:54	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268485	09/07/16 14:38	ALD	TAL SL

**Client Sample ID: SU02-EXW-047-SS-DUP-P-00**

**Lab Sample ID: 160-18554-19**

**Date Collected: 08/08/16 12:18**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267755	09/01/16 13:25	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266565	08/25/16 15:54	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268486	09/07/16 14:38	ALD	TAL SL

**Client Sample ID: SU02-EXB-049-SS-DUP-P-00**

**Lab Sample ID: 160-18554-20**

**Date Collected: 08/08/16 13:22**

**Matrix: Solid**

**Date Received: 08/09/16 09:20**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			264535	08/11/16 15:20	R1S	TAL SL
Total/NA	Analysis	901.1		1	267756	09/01/16 13:26	RTM	TAL SL
Total/NA	Leach	Dry and Grind			264093	08/09/16 16:01	DRO	TAL SL
Total/NA	Prep	ExtChrom			266565	08/25/16 15:54	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	268487	09/07/16 14:38	ALD	TAL SL

## Lab Chronicle

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

TestAmerica Job ID: 160-18554-1

### 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: 160-18554-1

## 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: 160-18554-1

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: 160-18554-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-18554-1	SU02-EXW-040-SS-P-00	Solid	08/08/16 11:41	08/09/16 09:20
160-18554-2	SU02-EXN-041-SS-P-00	Solid	08/08/16 11:49	08/09/16 09:20
160-18554-3	SU02-EXW-042-SS-P-00	Solid	08/08/16 12:12	08/09/16 09:20
160-18554-4	SU02-EXB-043-SS-P-00	Solid	08/08/16 12:08	08/09/16 09:20
160-18554-5	SU02-EXN-044-SS-P-00	Solid	08/08/16 12:03	08/09/16 09:20
160-18554-6	SU02-EXB-045-SS-P-00	Solid	08/08/16 11:58	08/09/16 09:20
160-18554-7	SU02-EXW-046-SS-P-00	Solid	08/08/16 12:24	08/09/16 09:20
160-18554-8	SU02-EXW-047-SS-P-00	Solid	08/08/16 12:18	08/09/16 09:20
160-18554-9	SU02-EXB-048-SS-P-00	Solid	08/08/16 12:44	08/09/16 09:20
160-18554-10	SU02-EXB-049-SS-P-00	Solid	08/08/16 13:22	08/09/16 09:20
160-18554-11	SU02-EXB-050-SS-P-00	Solid	08/08/16 13:33	08/09/16 09:20
160-18554-12	SU02-EXW-051-SS-P-00	Solid	08/08/16 12:28	08/09/16 09:20
160-18554-13	SU02-EXB-052-SS-P-00	Solid	08/08/16 12:40	08/09/16 09:20
160-18554-14	SU02-EXB-053-SS-P-00	Solid	08/08/16 13:28	08/09/16 09:20
160-18554-15	SU02-EXB-054-SS-P-00	Solid	08/08/16 13:25	08/09/16 09:20
160-18554-16	SU02-EXS-055-SS-P-00	Solid	08/08/16 12:33	08/09/16 09:20
160-18554-17	SU02-EXB-056-SS-P-00	Solid	08/08/16 13:20	08/09/16 09:20
160-18554-18	SU02-EXB-057-SS-P-00	Solid	08/08/16 13:15	08/09/16 09:20
160-18554-19	SU02-EXW-047-SS-DUP-P-00	Solid	08/08/16 12:18	08/09/16 09:20
160-18554-20	SU02-EXB-049-SS-DUP-P-00	Solid	08/08/16 13:22	08/09/16 09:20

# REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

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 & Ziegler, 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 & Ziegler, 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
82236-334_00001	06/02/60	Eckert & Ziegler, Lot 82236-334			(Purchased Reagent)		Americium-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)		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
							Pulser	
							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 & Ziegler, Lot 82244-334			(Purchased Reagent)		Americium-241	6.897 Bq
							Pu-239	6.717 Bq
							Pulser	
							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
82246-334_00001	06/09/60	Eckert & Ziegler, Lot 82246-334			(Purchased Reagent)		Americium-241	6.002 Bq
							Pu-239	5.353 Bq
							Thorium-230	5.57 Bq

# REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

SDG No.: \_\_\_\_\_

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
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
							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	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	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

# REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

SDG No.: \_\_\_\_\_

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Hg-203	9699.6 Bq
							Sn-113	7626.6 Bq
							Y-88	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	7626.6 Bq
							Y-88	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	7626.6 Bq
							Y-88	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	7626.6 Bq
							Y-88	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	7626.6 Bq
							Y-88	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	7626.6 Bq



REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

SDG No.: \_\_\_\_\_

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Y-88	12712 Bq
<b>Source F_00001</b>	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
							Y-88	2572.87 Bq
.Gamma Ampuole_00003	01/19/61		Analytics, Lot 83725-334		(Purchased Reagent)		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
							Y-88	12657.4 Bq
<b>Source G_00001</b>	01/01/61	01/01/11	water, Lot 83725-334	10 mL	Gamma Ampuole_00003	1.8639 g	Americium-241	1693.09 Bq
							Cd-109	24592.1 Bq
							Ce-139	816.481 Bq
							Cesium-137	681.815 Bq
							Co-57	532.386 Bq
							Cobalt-60	1120.87 Bq
							Hg-203	1766.08 Bq
							Sn-113	1445.98 Bq
							Y-88	2359.21 Bq
.Gamma Ampuole_00003	01/19/61		Analytics, Lot 83725-334		(Purchased Reagent)		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
							Y-88	12657.4 Bq
<b>Source H_00002</b>	01/01/51	01/01/12	wataer, Lot 83725-334	10 mL	Gamma Ampuole_00003	2.1184 g	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
							Y-88	2681.34 Bq

# REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

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)		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
							Y-88	12657.4 Bq
Source I_00001	01/01/61	01/01/12	wataer, Lot 83725-334	10 mL	Gamma Ampuole_00003	1.9559 g	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
							Y-88	2475.66 Bq
.Gamma Ampuole_00003	01/19/61	Analytics, Lot 83725-334			(Purchased Reagent)		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
							Y-88	12657.4 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
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

# REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

SDG No.: \_\_\_\_\_

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							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
<b>Tuna Can_00003</b>	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
<b>Tuna Can_00006</b>	03/01/16	Eckert & Ziegler, Lot 83814-334			(Purchased Reagent)		Y-88	1590 Bq
							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
							Y-88	1568 Bq

# **ALPHA SPECTROSCOPY**

# Method A-01-R Th

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

# Prep Batch: 266564

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Preparation, Extraction  
Chromatography Resin Actinide  
Separation

# Alpha Spectroscopy Analysis Detail Report

## Prep Batch: 266564

Lab ID: MB 160-266564/1-A  
 Client ID:  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 Detector: AV191  
 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	0.05641	0.0338	0.0342		pCi/g	0.100	0.0304	267504	
Thorium-232	0.01380	0.0159	0.0160		pCi/g	0.100	0.0138	267504	
Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	3.053	0.239	0.351		pCi/g	0.0376	3.03	101	30 - 110

Lab ID: LCS 160-266564/2-A  
 Client ID:  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 Detector: AV194  
 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	25.71	1.01	2.38		pCi/g	0.100	0.0647	267505	
Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	5.605	0.452	0.653		pCi/g	0.0599	6.06	92.5	30 - 110

Lab ID: 160-18554-1  
 Client ID: SU02-EXW-040-SS-P-00  
 Sigma: 2

Analyzed: 09/07/16 14:24  
 Detector: AV222  
 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	1.15	0.153	0.181		pCi/g	0.100	0.0279	268510	
Thorium-232	1.14	0.151	0.179		pCi/g	0.100	0.0151	268510	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.76	0.225	0.323		pCi/g	0.0138	3.03	91.0	30 - 110

Lab ID: 160-18554-2  
 Client ID: SU02-EXN-041-SS-P-00  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 Detector: AV212  
 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	1.31	0.158	0.192		pCi/g	0.100	0.0263	267516	
Thorium-232	1.15	0.148	0.176		pCi/g	0.100	0.0142	267516	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.67	0.211	0.308		pCi/g	0.0126	3.03	88.0	30 - 110

# Alpha Spectroscopy Analysis Detail Report

## Prep Batch: 266564

Lab ID: 160-18554-3  
 Client ID: SU02-EXW-042-SS-P-00  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 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	1.14	0.147	0.176		pCi/g	0.100	0.0143	267517	
Thorium-232	0.934	0.133	0.154		pCi/g	0.100	0.0142	267517	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.88	0.229	0.333		pCi/g	0.0298	3.03	95.3	30 - 110

Lab ID: 160-18554-4  
 Client ID: SU02-EXB-043-SS-P-00  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 Detector: AV214  
 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	0.143	0.171		pCi/g	0.100	0.0255	267518	
Thorium-232	0.972	0.134	0.157		pCi/g	0.100	0.0138	267518	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	3.02	0.236	0.347		pCi/g	0.0304	3.02	100	30 - 110

Lab ID: 160-18554-5  
 Client ID: SU02-EXN-044-SS-P-00  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 Detector: AV215  
 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	2.07	0.201	0.266		pCi/g	0.100	0.0358	267519	
Thorium-232	1.32	0.160	0.195		pCi/g	0.100	0.0267	267519	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.70	0.216	0.313		pCi/g	0.0130	3.03	89.1	30 - 110

Lab ID: 160-18554-6  
 Client ID: SU02-EXB-045-SS-P-00  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 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	1.63	0.180	0.226		pCi/g	0.100	0.0149	267520	
Thorium-232	1.34	0.163	0.198		pCi/g	0.100	0.0274	267520	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.64	0.214	0.308		pCi/g	0.0130	3.03	87.1	30 - 110



# Alpha Spectroscopy Analysis Detail Report

## Prep Batch: 266564

Lab ID: 160-18554-7  
 Client ID: SU02-EXW-046-SS-P-00  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 Detector: AV218  
 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	1.14	0.147	0.175		pCi/g	0.100	0.0262	267521	
Thorium-232	1.24	0.153	0.185		pCi/g	0.100	0.0284	267521	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.72	0.215	0.314		pCi/g	0.0280	3.03	89.7	30 - 110

Lab ID: 160-18554-8  
 Client ID: SU02-EXW-047-SS-P-00  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 Detector: AV219  
 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	1.30	0.156	0.191		pCi/g	0.100	0.0308	267522	
Thorium-232	1.16	0.147	0.176		pCi/g	0.100	0.0140	267522	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	3.03	0.239	0.349		pCi/g	0.0141	3.03	100	30 - 110

Lab ID: 160-18554-9  
 Client ID: SU02-EXB-048-SS-P-00  
 Sigma: 2

Analyzed: 09/07/16 14:24  
 Detector: AV221  
 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	2.00	0.207	0.267		pCi/g	0.100	0.0162	268509	
Thorium-232	1.25	0.164	0.194		pCi/g	0.100	0.0296	268509	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.54	0.215	0.303		pCi/g	0.0297	3.03	83.9	30 - 110

Lab ID: 160-18554-10  
 Client ID: SU02-EXB-049-SS-P-00  
 Sigma: 2

Analyzed: 08/31/16 19:45  
 Detector: AV221  
 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	2.04	0.211	0.272		pCi/g	0.100	0.0437	267524	
Thorium-232	1.15	0.158	0.185		pCi/g	0.100	0.0299	267524	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.52	0.214	0.301		pCi/g	0.0136	3.03	83.3	30 - 110

# Alpha Spectroscopy Analysis Detail Report

## Prep Batch: 266564

Lab ID: 160-18554-11  
Client ID: SU02-EXB-050-SS-P-00  
Sigma: 2

Analyzed: 09/07/16 14:24  
Detector: AV220  
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	1.65	0.183	0.230		pCi/g	0.100	0.0331	268563	
Thorium-232	1.11	0.150	0.177		pCi/g	0.100	0.0349	268563	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.78	0.227	0.325		pCi/g	0.0371	3.03	91.6	30 - 110

Lab ID: 160-18554-12  
Client ID: SU02-EXW-051-SS-P-00  
Sigma: 2

Analyzed: 09/07/16 14:24  
Detector: AV219  
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	1.31	0.168	0.201		pCi/g	0.100	0.0461	268508	
Thorium-232	1.12	0.154	0.180		pCi/g	0.100	0.0159	268508	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.67	0.224	0.317		pCi/g	0.0162	3.03	88.1	30 - 110

Lab ID: 160-18554-13  
Client ID: SU02-EXB-052-SS-P-00  
Sigma: 2

Analyzed: 09/07/16 14:24  
Detector: AV218  
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	4.44	0.306	0.482		pCi/g	0.100	0.0291	268507	
Thorium-232	1.66	0.186	0.233		pCi/g	0.100	0.0289	268507	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.45	0.205	0.290		pCi/g	0.0314	3.03	81.0	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 160-266564/1-A	Thorium-230			0.05641		pCi/g							3.302616
MB 160-266564/1-A	Thorium-232			0.01380		pCi/g							15
													1.727485
													91
Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-266564/2-A	Thorium-230		24.5	25.71		pCi/g	105	81 - 118					.7320772
													248

# Alpha Spectroscopy Analysis Detail Report

## Prep Batch: 266564

### Glossary:

Ts = Count Duration, Sample

## ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

SDG No.: \_\_\_\_\_

Batch Number: 266564 Batch Start Date: 08/25/16 15:51 Batch Analyst: Bernsen, Sarah CBatch Method: ExtChrom Batch End Date: 08/31/16 15:02

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00021	TRM-2 00001	AnalysisComment		
MB 160-266564/1		ExtChrom, A-01-R		1.0 g	0.1 mL				
LCS 160-266564/2		ExtChrom, A-01-R		0.4996 g	0.1 mL	0.4998 g	TRM		
160-18554-A-1-A	SU02-EXW-040-SS- P-00	ExtChrom, A-01-R	T	0.9992 g	0.1 mL				
160-18554-A-2-A	SU02-EXN-041-SS- P-00	ExtChrom, A-01-R	T	0.9988 g	0.1 mL				
160-18554-A-3-A	SU02-EXW-042-SS- P-00	ExtChrom, A-01-R	T	1.0003 g	0.1 mL				
160-18554-A-4-A	SU02-EXB-043-SS- P-00	ExtChrom, A-01-R	T	1.0015 g	0.1 mL				
160-18554-A-5-A	SU02-EXN-044-SS- P-00	ExtChrom, A-01-R	T	0.9995 g	0.1 mL				
160-18554-A-6-A	SU02-EXB-045-SS- P-00	ExtChrom, A-01-R	T	1.0009 g	0.1 mL				
160-18554-A-7-A	SU02-EXW-046-SS- P-00	ExtChrom, A-01-R	T	0.9996 g	0.1 mL				
160-18554-A-8-A	SU02-EXW-047-SS- P-00	ExtChrom, A-01-R	T	0.9996 g	0.1 mL				
160-18554-A-9-A	SU02-EXB-048-SS- P-00	ExtChrom, A-01-R	T	0.9998 g	0.1 mL				
160-18554-A-10-A	SU02-EXB-049-SS- P-00	ExtChrom, A-01-R	T	0.9991 g	0.1 mL				
160-18554-A-11-A	SU02-EXB-050-SS- P-00	ExtChrom, A-01-R	T	0.9987 g	0.1 mL				
160-18554-A-12-A	SU02-EXW-051-SS- P-00	ExtChrom, A-01-R	T	1.0003 g	0.1 mL				
160-18554-A-13-A	SU02-EXB-052-SS- P-00	ExtChrom, A-01-R	T	0.9996 g	0.1 mL				

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 2

## ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

SDG No.: \_\_\_\_\_

Batch Number: 266564 Batch Start Date: 08/25/16 15:51 Batch Analyst: Bernsen, Sarah CBatch Method: ExtChrom Batch End Date: 08/31/16 15:02

Batch Notes	
Balance ID	0034150065
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	rjs
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.

# Prep Batch: 266565

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Preparation, Extraction  
Chromatography Resin Actinide  
Separation

# Alpha Spectroscopy Analysis Detail Report

## Prep Batch: 266565

Lab ID: MB 160-266565/1-A  
 Client ID:  
 Sigma: 2

Analyzed: 09/07/16 14:38  
 Detector: AV171  
 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	0.09373	0.0422	0.0430		pCi/g	0.100	0.0143	268478	
Thorium-232	0.004736	0.00947	0.00948	U	pCi/g	0.100	0.0142	268478	
Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.922	0.232	0.338		pCi/g	0.0339	3.03	96.5	30 - 110

Lab ID: LCS 160-266565/2-A  
 Client ID:  
 Sigma: 2

Analyzed: 09/07/16 14:38  
 Detector: AV172  
 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	25.18	0.982	2.33		pCi/g	0.100	0.0287	268479	
Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	5.865	0.467	0.679		pCi/g	0.0685	6.05	97.0	30 - 110

Lab ID: 160-18554-14  
 Client ID: SU02-EXB-053-SS-P-00  
 Sigma: 2

Analyzed: 09/07/16 14:38  
 Detector: AV173  
 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	1.30	0.156	0.190		pCi/g	0.100	0.0306	268480	
Thorium-232	1.23	0.151	0.183		pCi/g	0.100	0.0139	268480	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.87	0.226	0.330		pCi/g	0.0291	3.03	94.8	30 - 110

Lab ID: 160-18554-14 DU  
 Client ID: SU02-EXB-053-SS-P-00  
 Sigma: 2

Analyzed: 09/07/16 14:38  
 Detector: AV175  
 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	1.307	0.165	0.198		pCi/g	0.100	0.0383	268481	
Thorium-232	1.056	0.148	0.172		pCi/g	0.100	0.0155	268481	
Tracer	DU Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.496	0.207	0.295		pCi/g	0.0316	3.03	82.5	30 - 110

# Alpha Spectroscopy Analysis Detail Report

## Prep Batch: 266565

Lab ID: 160-18554-15  
Client ID: SU02-EXB-054-SS-P-00  
Sigma: 2

Analyzed: 09/08/16 15:56  
Detector: AV147  
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	0.893	0.136	0.156		pCi/g	0.100	0.0340	268649	
Thorium-232	1.10	0.150	0.176		pCi/g	0.100	0.0285	268649	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.52	0.210	0.299		pCi/g	0.0552	3.03	83.3	30 - 110

Lab ID: 160-18554-16  
Client ID: SU02-EXS-055-SS-P-00  
Sigma: 2

Analyzed: 09/07/16 14:38  
Detector: AV188  
Dil Fac: 1

Decay Corrected: No  
Yield Truncated: No  
Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Any Batch	
Thorium-230	1.15	0.155	0.182		pCi/g	0.100	0.0341	268483	
Thorium-232	1.07	0.148	0.173		pCi/g	0.100	0.0155	268483	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.67	0.221	0.315		pCi/g	0.0300	3.03	88.0	30 - 110

Lab ID: 160-18554-17  
Client ID: SU02-EXB-056-SS-P-00  
Sigma: 2

Analyzed: 09/07/16 14:38  
Detector: AV189  
Dil Fac: 1

Decay Corrected: No  
Yield Truncated: No  
Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Any Batch	
Thorium-230	0.993	0.141	0.164		pCi/g	0.100	0.0399	268484	
Thorium-232	1.24	0.157	0.188		pCi/g	0.100	0.0363	268484	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.63	0.212	0.306		pCi/g	0.0156	3.03	86.6	30 - 110

Lab ID: 160-18554-18  
Client ID: SU02-EXB-057-SS-P-00  
Sigma: 2

Analyzed: 09/07/16 14:38  
Detector: AV190  
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	1.20	0.150	0.181		pCi/g	0.100	0.0141	268485	
Thorium-232	1.23	0.152	0.184		pCi/g	0.100	0.0140	268485	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.74	0.217	0.316		pCi/g	0.0368	3.03	90.7	30 - 110



# Alpha Spectroscopy Analysis Detail Report

## Prep Batch: 266565

Lab ID: 160-18554-19  
 Client ID: SU02-EXW-047-SS-DUP-P-00  
 Sigma: 2

Analyzed: 09/07/16 14:38  
 Detector: AV191  
 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	0.604	0.106	0.117		pCi/g	0.100	0.0336	268486	
Thorium-232	0.694	0.113	0.127		pCi/g	0.100	0.0365	268486	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	3.10	0.241	0.355		pCi/g	0.0307	3.03	103	30 - 110

Lab ID: 160-18554-20  
 Client ID: SU02-EXB-049-SS-DUP-P-00  
 Sigma: 2

Analyzed: 09/07/16 14:38  
 Detector: AV193  
 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	0.671	0.115	0.128		pCi/g	0.100	0.0148	268487	
Thorium-232	0.892	0.133	0.153		pCi/g	0.100	0.0323	268487	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.72	0.220	0.317		pCi/g	0.0292	3.02	89.9	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 160-266565/1-A	Thorium-230			0.09373		pCi/g							4.36243907
MB 160-266565/1-A	Thorium-232			0.004736	U	pCi/g							.99911917
Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-266565/2-A	Thorium-230		24.5	25.18		pCi/g	103	81 - 118					.4226744371
Duplicate ID:	Analyte	Parent Result	Spike Added	DU Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
160-18554-14	Thorium-230	1.30		1.307		pCi/g			0.9	0.03	0.08	1	
160-18554-14	Thorium-232	1.23		1.056		pCi/g			15	0.49	1.37	1	

Glossary:  
 Ts = Count Duration, Sample

## ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-18554-1

SDG No.: \_\_\_\_\_

Batch Number: 266565 Batch Start Date: 08/25/16 15:54 Batch Analyst: Bernsen, Sarah CBatch Method: ExtChrom Batch End Date: 08/31/16 11:14

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00021	TRM-2 00001	AnalysisComment		
MB 160-266565/1		ExtChrom, A-01-R		1.0 g	0.1 mL				
LCS 160-266565/2		ExtChrom, A-01-R		0.5006 g	0.1 mL	0.5006 g	TRM		
160-18554-A-14-A	SU02-EXB-053-SS-P-00	ExtChrom, A-01-R	T	0.9994 g	0.1 mL				
160-18554-A-14-A DU	SU02-EXB-053-SS-P-00	ExtChrom, A-01-R	T	1.0006 g	0.1 mL				
160-18554-A-15-A	SU02-EXB-054-SS-P-00	ExtChrom, A-01-R	T	0.9996 g	0.1 mL				
160-18554-A-16-A	SU02-EXS-055-SS-P-00	ExtChrom, A-01-R	T	0.9990 g	0.1 mL				
160-18554-A-17-A	SU02-EXB-056-SS-P-00	ExtChrom, A-01-R	T	0.9988 g	0.1 mL				
160-18554-A-18-A	SU02-EXB-057-SS-P-00	ExtChrom, A-01-R	T	1.0007 g	0.1 mL				
160-18554-A-19-A	SU02-EXW-047-SS-DUP-P-00	ExtChrom, A-01-R	T	1.0002 g	0.1 mL				
160-18554-A-20-A	SU02-EXB-049-SS-DUP-P-00	ExtChrom, A-01-R	T	1.0012 g	0.1 mL				

Batch Notes	
Balance ID	0034150065
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	rjs
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.

# 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
09/08/16 10:49	1	PULSER 160-268649/1		268649			ALD
09/08/16 15:56	400	160-18554-15	SU02-EXB-054-SS-P-00	268649	266565	A-01-R	ALD

## Detector: AV171

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 18:59	140	IC 160-223468/1		223468			PS
10/26/15 20:28	60	ICV 160-223586/1		223586			PS
09/01/16 15:17	960	ICB 160-268043/1		268043			PS
09/06/16 13:58	60	CCV 160-268329/1		268329			PS
09/07/16 12:23	1	PULSER 160-268478/1		268478			ALD
09/07/16 14:38	400	MB 160-266565/1-A		268478	266565	A-01-R	ALD

## Detector: AV172

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 18:59	140	IC 160-223469/1		223469			PS
10/26/15 20:29	60	ICV 160-223587/1		223587			PS
09/01/16 15:17	960	ICB 160-268044/1		268044			PS
09/06/16 13:58	60	CCV 160-268330/1		268330			PS
09/07/16 12:23	1	PULSER 160-268479/1		268479			ALD
09/07/16 14:38	400	LCS 160-266565/2-A		268479	266565	A-01-R	ALD

## Detector: AV173

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 19:04	140	IC 160-223470/1		223470			PS
10/26/15 20:29	60	ICV 160-223588/1		223588			PS
09/02/16 10:55	960	ICB 160-268125/1		268125			PS
09/06/16 16:42	60	CCV 160-268331/1		268331			PS
09/07/16 12:23	1	PULSER 160-268480/1		268480			ALD
09/07/16 14:38	400	160-18554-14	SU02-EXB-053-SS-P-00	268480	266565	A-01-R	ALD

## Detector: AV175

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 14:48	140	IC 160-223472/1		223472			PS
10/31/15 14:14	60	ICV 160-223590/1		223590			
10/31/15 17:26	60	ICV 160-223590/2		223590			PS
09/01/16 15:17	960	ICB 160-268047/1		268047			PS
09/07/16 08:37	60	CCV 160-268386/1		268386			PS
09/07/16 12:23	1	PULSER 160-268481/1		268481			ALD
09/07/16 14:38	400	160-18554-14 DU	SU02-EXB-053-SS-P-00 DU	268481	266565	A-01-R	ALD

# Alpha Spectroscopy Run Log

## Detector: AV188

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 14:51	140	IC 160-223485/1		223485			PS
10/31/15 14:17	60	ICV 160-223603/1		223603			PS
09/01/16 15:17	960	ICB 160-268052/1		268052			PS
09/06/16 13:58	60	CCV 160-268333/1		268333			
09/06/16 16:43	60	CCV 160-268333/2		268333			PS
09/07/16 12:23	1	PULSER 160-268483/1		268483			ALD
09/07/16 14:38	400	160-18554-16	SU02-EXS-055-SS-P-00	268483	266565	A-01-R	ALD

## Detector: AV189

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 18:19	140	IC 160-223486/1		223486			PS
11/01/15 14:23	60	ICV 160-223604/1		223604			PS
09/01/16 15:17	960	ICB 160-268053/1		268053			PS
09/06/16 14:01	60	CCV 160-268334/1		268334			PS
09/07/16 12:23	1	PULSER 160-268484/1		268484			ALD
09/07/16 14:38	400	160-18554-17	SU02-EXB-056-SS-P-00	268484	266565	A-01-R	ALD

## Detector: AV190

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 18:13	140	IC 160-223487/1		223487			PS
11/01/15 14:23	60	ICV 160-223605/1		223605			PS
09/01/16 15:17	960	ICB 160-268054/1		268054			PS
09/06/16 14:01	60	CCV 160-268335/1		268335			PS
09/07/16 12:23	1	PULSER 160-268485/1		268485			ALD
09/07/16 14:38	400	160-18554-18	SU02-EXB-057-SS-P-00	268485	266565	A-01-R	ALD

## Detector: AV191

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 18:13	140	IC 160-223488/1		223488			PS
11/01/15 14:23	60	ICV 160-223606/1		223606			
11/01/15 18:11	60	ICV 160-223606/2		223606			PS
07/22/16 15:43	960	ICB 160-261937/1		261937			PS
07/26/16 17:46	60	CCV 160-262173/1		262173			PS
08/31/16 09:07	1	PULSER 160-267504/1		267504			ALD
08/31/16 14:07	180	ZZZZZ		267504			
08/31/16 19:45	400	MB 160-266564/1-A		267504	266564	A-01-R	ALD
09/01/16 15:17	960	ICB 160-268055/1		268055			PS
09/06/16 14:00	60	CCV 160-268336/1		268336			PS
09/07/16 12:23	1	PULSER 160-268486/1		268486			ALD
09/07/16 14:38	400	160-18554-19	SU02-EXW-047-SS-DUP-P-00	268486	266565	A-01-R	ALD

## Detector: AV193

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 18:13	140	IC 160-223490/1		223490			PS
11/01/15 14:24	60	ICV 160-223608/1		223608			PS
09/01/16 15:17	960	ICB 160-268057/1		268057			PS
09/06/16 14:00	60	CCV 160-268338/1		268338			PS
09/07/16 12:23	1	PULSER 160-268487/1		268487			ALD

# Alpha Spectroscopy Run Log

## Detector: AV193 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
09/07/16 14:38	400	160-18554-20	SU02-EXB-049-SS-DUP-1-00	268487	266565	A-01-R	ALD

## Detector: AV194

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 18:13	140	IC 160-223491/1		223491			PS
11/01/15 14:24	60	ICV 160-223609/1		223609			PS
07/22/16 15:43	960	ICB 160-261940/1		261940			PS
07/26/16 11:01	60	CCV 160-262175/1		262175			PS
08/31/16 09:07	1	PULSER 160-267505/1		267505			ALD
08/31/16 14:07	180	ZZZZZ		267505			
08/31/16 19:45	400	LCS 160-266564/2-A		267505	266564	A-01-R	ALD

## Detector: AV196

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 18:14	140	IC 160-223493/1		223493			PS
11/01/15 14:25	60	ICV 160-223611/1		223611			PS
07/22/16 15:43	960	ICB 160-261942/1		261942			PS
07/26/16 09:35	60	CCV 160-262333/1		262333			PS
08/31/16 09:07	1	PULSER 160-267507/1		267507			ALD
08/31/16 14:15	180	ZZZZZ		267507			
08/31/16 19:45	400	ZZZZZ		267507			

## Detector: AV212

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 16:12	140	IC 160-223509/1		223509			PS
11/01/15 16:03	60	ICV 160-223627/1		223627			
11/01/15 18:11	60	ICV 160-223627/2		223627			PS
07/22/16 15:43	960	ICB 160-261957/1		261957			PS
07/26/16 15:09	60	CCV 160-262186/1		262186			PS
08/31/16 08:34	1	PULSER 160-267516/1		267516			ALD
08/31/16 14:15	180	ZZZZZ		267516			
08/31/16 19:45	400	160-18554-2	SU02-EXN-041-SS-P-00	267516	266564	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
07/25/16 13:14	960	ICB 160-262228/1		262228			PS
07/27/16 06:18	60	CCV 160-262224/1		262224			PS
08/31/16 08:34	1	PULSER 160-267517/1		267517			ALD
08/31/16 14:15	180	ZZZZZ		267517			
08/31/16 19:45	400	160-18554-3	SU02-EXW-042-SS-P-00	267517	266564	A-01-R	ALD

## Detector: AV214

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 16:12	140	IC 160-223510/1		223510			PS

# Alpha Spectroscopy Run Log

## Detector: AV214 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
11/01/15 16:04	60	ICV 160-223629/1		223629			PS
07/22/16 15:43	960	ICB 160-261959/1		261959			PS
07/26/16 16:33	60	CCV 160-262187/1		262187			PS
08/31/16 08:34	1	PULSER 160-267518/1		267518			ALD
08/31/16 14:15	180	ZZZZZ		267518			
08/31/16 19:45	400	160-18554-4	SU02-EXB-043-SS-P-00	267518	266564	A-01-R	ALD

## Detector: AV215

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 16:12	140	IC 160-223511/1		223511			PS
11/01/15 16:04	60	ICV 160-223630/1		223630			PS
07/22/16 15:43	960	ICB 160-261960/1		261960			PS
07/26/16 16:34	60	CCV 160-262188/1		262188			PS
08/31/16 08:34	1	PULSER 160-267519/1		267519			ALD
08/31/16 14:15	180	ZZZZZ		267519			
08/31/16 19:45	400	160-18554-5	SU02-EXN-044-SS-P-00	267519	266564	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
07/22/16 15:43	960	ICB 160-261962/1		261962			PS
07/26/16 16:34	60	CCV 160-262189/1		262189			PS
08/31/16 08:34	1	PULSER 160-267520/1		267520			ALD
08/31/16 14:15	180	ZZZZZ		267520			
08/31/16 19:45	400	160-18554-6	SU02-EXB-045-SS-P-00	267520	266564	A-01-R	ALD

## Detector: AV218

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 18:57	140	IC 160-223514/1		223514			PS
11/01/15 19:17	60	ICV 160-223633/1		223633			PS
07/25/16 13:14	960	ICB 160-262230/1		262230			PS
07/27/16 06:19	60	CCV 160-262225/1		262225			PS
08/31/16 08:34	1	PULSER 160-267521/1		267521			ALD
08/31/16 14:15	180	ZZZZZ		267521			
08/31/16 19:45	400	160-18554-7	SU02-EXW-046-SS-P-00	267521	266564	A-01-R	ALD
09/01/16 15:17	960	ICB 160-268081/1		268081			PS
09/06/16 11:25	60	CCV 160-268358/1		268358			PS
09/07/16 12:28	1	PULSER 160-268507/1		268507			
09/07/16 12:53	1	PULSER 160-268507/2		268507			ALD
09/07/16 14:24	400	160-18554-13	SU02-EXB-052-SS-P-00	268507	266564	A-01-R	ALD

## Detector: AV219

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 18:57	140	IC 160-223515/1		223515			PS
11/01/15 19:17	60	ICV 160-223634/1		223634			PS
07/22/16 15:43	960	ICB 160-261964/1		261964			PS
07/26/16 16:34	60	CCV 160-262190/1		262190			PS
08/31/16 08:34	1	PULSER 160-267522/1		267522			ALD

# Alpha Spectroscopy Run Log

## Detector: AV219 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
08/31/16 14:15	180	ZZZZZ		267522			
08/31/16 19:45	400	160-18554-8	SU02-EXW-047-SS-P-00	267522	266564	A-01-R	ALD
09/02/16 10:55	960	ICB 160-268141/1		268141			PS
09/06/16 11:25	60	CCV 160-268359/1		268359			PS
09/07/16 12:28	1	PULSER 160-268508/1		268508			ALD
09/07/16 14:24	400	160-18554-12	SU02-EXW-051-SS-P-00	268508	266564	A-01-R	ALD

## Detector: AV220

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 18:58	140	IC 160-223516/1		223516			PS
11/01/15 19:17	60	ICV 160-223635/1		223635			PS
09/02/16 10:55	960	ICB 160-268142/1		268142			PS
09/06/16 11:26	60	CCV 160-268360/1		268360			PS
09/07/16 12:29	1	PULSER 160-268563/1		268563			ALD
09/07/16 14:24	400	160-18554-11	SU02-EXB-050-SS-P-00	268563	266564	A-01-R	ALD

## Detector: AV221

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 18:58	140	IC 160-223517/1		223517			PS
11/01/15 19:17	60	ICV 160-223636/1		223636			PS
07/22/16 15:43	960	ICB 160-261966/1		261966			PS
07/26/16 16:34	60	CCV 160-262192/1		262192			PS
08/31/16 08:34	1	PULSER 160-267524/1		267524			ALD
08/31/16 14:15	180	ZZZZZ		267524			
08/31/16 19:45	400	160-18554-10	SU02-EXB-049-SS-P-00	267524	266564	A-01-R	ALD
09/01/16 15:17	960	ICB 160-268084/1		268084			PS
09/06/16 11:26	60	CCV 160-268361/1		268361			PS
09/07/16 12:29	1	PULSER 160-268509/1		268509			ALD
09/07/16 14:24	400	160-18554-9	SU02-EXB-048-SS-P-00	268509	266564	A-01-R	ALD

## Detector: AV222

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/18/15 18:58	140	IC 160-223518/1		223518			PS
11/01/15 19:18	60	ICV 160-223637/1		223637			PS
09/02/16 10:55	960	ICB 160-268143/1		268143			PS
09/06/16 10:08	60	CCV 160-268362/1		268362			PS
09/07/16 12:29	1	PULSER 160-268510/1		268510			ALD
09/07/16 14:24	400	160-18554-1	SU02-EXW-040-SS-P-00	268510	266564	A-01-R	ALD



# **GAMMA SPECTROSCOPY**

# Method 901.1

## Ra-226

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

# Prep Batch: 264535

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Fill Geometry, 21-Day In-Growth

# Gamma Spectroscopy Analysis Detail Report

## Prep Batch: 264535

Lab ID: MB 160-264535/1-A Analyzed: 09/01/16 11:46 Ts: 30 Sigma: 2  
Client ID: Detector: GV16 Decay Corrected: No

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	0.02099	0.0211	0.0212	U	pCi/g	0.500	0.325	267762

Lab ID: LCS 160-264535/2-A Analyzed: 09/01/16 11:51 Ts: 30 Sigma: 2  
Client ID: Detector: GV17 Decay Corrected: No

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Americium-241	91.28	1.55	9.60		pCi/g		1.13	267763
Cesium-137	28.58	0.676	3.05		pCi/g		0.245	267763
Cobalt-60	16.11	0.418	1.67		pCi/g		0.0756	267763

Lab ID: 160-18554-1 Analyzed: 09/01/16 11:54 Ts: 30 Sigma: 2  
Client ID: SU02-EXW-040-SS-P-00 Detector: GV8 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.28	0.241	0.276		pCi/g	0.500	0.146	267756

Lab ID: 160-18554-1 DU Analyzed: 09/01/16 12:39 Ts: 30 Sigma: 2  
Client ID: SU02-EXW-040-SS-P-00 Detector: GV7 Decay Corrected: No

Analyte	DU Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.206	0.221	0.254		pCi/g	0.500	0.162	267755

Lab ID: 160-18554-2 Analyzed: 09/01/16 11:52 Ts: 30 Sigma: 2  
Client ID: SU02-EXN-041-SS-P-00 Detector: GV7 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.02	0.205	0.231		pCi/g	0.500	0.239	267755

Lab ID: 160-18554-3 Analyzed: 09/01/16 11:51 Ts: 30 Sigma: 2  
Client ID: SU02-EXW-042-SS-P-00 Detector: GV5 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.33	0.292	0.323		pCi/g	0.500	0.247	267754

# Gamma Spectroscopy Analysis Detail Report

## Prep Batch: 264535

Lab ID: 160-18554-4 Analyzed: 09/01/16 12:31 Ts: 30 Sigma: 2  
Client ID: SU02-EXB-043-SS-P-00 Detector: GV12 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.25	0.204	0.241		pCi/g	0.500	0.159	267757

Lab ID: 160-18554-5 Analyzed: 09/01/16 12:32 Ts: 30 Sigma: 2  
Client ID: SU02-EXN-044-SS-P-00 Detector: GV13 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	0.994	0.204	0.228		pCi/g	0.500	0.152	267758

Lab ID: 160-18554-6 Analyzed: 09/01/16 12:33 Ts: 30 Sigma: 2  
Client ID: SU02-EXB-045-SS-P-00 Detector: GV14 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.08	0.225	0.252		pCi/g	0.500	0.183	267760

Lab ID: 160-18554-7 Analyzed: 09/01/16 12:33 Ts: 30 Sigma: 2  
Client ID: SU02-EXW-046-SS-P-00 Detector: GV15 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.66	0.324	0.367		pCi/g	0.500	0.257	267761

Lab ID: 160-18554-8 Analyzed: 09/01/16 12:35 Ts: 30 Sigma: 2  
Client ID: SU02-EXW-047-SS-P-00 Detector: GV16 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.68	0.230	0.289		pCi/g	0.500	0.152	267762

Lab ID: 160-18554-9 Analyzed: 09/01/16 12:36 Ts: 30 Sigma: 2  
Client ID: SU02-EXB-048-SS-P-00 Detector: GV17 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	0.787	0.187	0.205		pCi/g	0.500	0.159	267763

# Gamma Spectroscopy Analysis Detail Report

## Prep Batch: 264535

Lab ID: 160-18554-10      Analyzed: 09/01/16 12:44      Ts: 30      Sigma: 2  
 Client ID: SU02-EXB-049-SS-P-00      Detector: GV8      Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.06	0.243	0.267		pCi/g	0.500	0.183	267756

Lab ID: 160-18554-11      Analyzed: 09/01/16 12:42      Ts: 30      Sigma: 2  
 Client ID: SU02-EXB-050-SS-P-00      Detector: GV5      Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.44	0.324	0.357		pCi/g	0.500	0.258	267754

Lab ID: 160-18554-12      Analyzed: 09/01/16 13:09      Ts: 30      Sigma: 2  
 Client ID: SU02-EXW-051-SS-P-00      Detector: GV12      Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	2.11	0.266	0.345		pCi/g	0.500	0.175	267757

Lab ID: 160-18554-13      Analyzed: 09/01/16 13:10      Ts: 30      Sigma: 2  
 Client ID: SU02-EXB-052-SS-P-00      Detector: GV13      Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.42	0.216	0.262		pCi/g	0.500	0.149	267758

Lab ID: 160-18554-14      Analyzed: 09/01/16 13:11      Ts: 30      Sigma: 2  
 Client ID: SU02-EXB-053-SS-P-00      Detector: GV14      Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.07	0.211	0.238		pCi/g	0.500	0.164	267760

Lab ID: 160-18554-15      Analyzed: 09/01/16 13:12      Ts: 30      Sigma: 2  
 Client ID: SU02-EXB-054-SS-P-00      Detector: GV15      Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.06	0.257	0.279		pCi/g	0.500	0.220	267761

# Gamma Spectroscopy Analysis Detail Report

## Prep Batch: 264535

Lab ID: 160-18554-16 Analyzed: 09/01/16 13:13 Ts: 30 Sigma: 2  
Client ID: SU02-EXS-055-SS-P-00 Detector: GV16 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.57	0.255	0.302		pCi/g	0.500	0.190	267762

Lab ID: 160-18554-17 Analyzed: 09/01/16 13:14 Ts: 30 Sigma: 2  
Client ID: SU02-EXB-056-SS-P-00 Detector: GV17 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.26	0.211	0.249		pCi/g	0.500	0.193	267763

Lab ID: 160-18554-18 Analyzed: 09/01/16 13:24 Ts: 30 Sigma: 2  
Client ID: SU02-EXB-057-SS-P-00 Detector: GV5 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.44	0.268	0.307		pCi/g	0.500	0.192	267754

Lab ID: 160-18554-19 Analyzed: 09/01/16 13:25 Ts: 30 Sigma: 2  
Client ID: SU02-EXW-047-SS-DUP-P-0 Detector: GV7 Decay Corrected: No  
0

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.61	0.259	0.309		pCi/g	0.500	0.184	267755

Lab ID: 160-18554-20 Analyzed: 09/01/16 13:26 Ts: 30 Sigma: 2  
Client ID: SU02-EXB-049-SS-DUP-P-0 Detector: GV8 Decay Corrected: No  
0

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.19	0.230	0.261		pCi/g	0.500	0.152	267756

# Gamma Spectroscopy Analysis Detail Report

## Prep Batch: 264535

### 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 160-264535/1-A	Radium-226			0.02099	U	pCi/g							1.977785 37
Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-264535/2-A	Americium-241		97.1	91.28		pCi/g	94	87 - 116					-.8297516 231
LCS 160-264535/2-A	Cesium-137		29.5	28.58		pCi/g	97	87 - 120					-.4200020 897
LCS 160-264535/2-A	Cobalt-60		16.6	16.11		pCi/g	97	87 - 115					-.4322648 86
Duplicate ID:	Analyte	Parent Result	Spike Added	DU Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
160-18554-1	Radium-226	1.28		1.206		pCi/g			6	0.15	0.42	1	

Glossary:

Ts = Count Duration, Sample



## GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. LouisJob No.: 160-18554-1

SDG No.: \_\_\_\_\_

Batch Number: 264535Batch Start Date: 08/11/16 15:20Batch Analyst: Sloan, Robert 1Batch Method: Fill\_Geo-21Batch End Date: 08/11/16 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	TareWeight	GrossWeight	InitialAmount	IngDecDate1	IngDecDate3	Geometry
MB 160-264535/1		Fill_Geo-21, 901.1				291.18 g	8/11/2016	9/1/2016	Tuna Can
LCS 160-264535/2		Fill_Geo-21, 901.1				341.9 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-1-A	SU02-EXW-040-SS-P-00	Fill_Geo-21, 901.1	T	46.3 g	367.6 g	321.3 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-1-A DU	SU02-EXW-040-SS-P-00	Fill_Geo-21, 901.1	T	46.3 g	367.6 g	321.3 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-2-A	SU02-EXN-041-SS-P-00	Fill_Geo-21, 901.1	T	46.2 g	396.5 g	350.3 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-3-A	SU02-EXW-042-SS-P-00	Fill_Geo-21, 901.1	T	46.4 g	371.6 g	325.2 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-4-A	SU02-EXB-043-SS-P-00	Fill_Geo-21, 901.1	T	46.2 g	418.9 g	372.7 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-5-A	SU02-EXN-044-SS-P-00	Fill_Geo-21, 901.1	T	46.7 g	378.3 g	331.6 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-6-A	SU02-EXB-045-SS-P-00	Fill_Geo-21, 901.1	T	46.3 g	379.5 g	333.2 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-7-A	SU02-EXW-046-SS-P-00	Fill_Geo-21, 901.1	T	46.8 g	349.6 g	302.8 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-8-A	SU02-EXW-047-SS-P-00	Fill_Geo-21, 901.1	T	46.0 g	371.4 g	325.4 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-9-A	SU02-EXB-048-SS-P-00	Fill_Geo-21, 901.1	T	45.5 g	347.1 g	301.6 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-10-A	SU02-EXB-049-SS-P-00	Fill_Geo-21, 901.1	T	46.6 g	365.0 g	318.4 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-11-A	SU02-EXB-050-SS-P-00	Fill_Geo-21, 901.1	T	46.7 g	346.3 g	299.6 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-12-A	SU02-EXW-051-SS-P-00	Fill_Geo-21, 901.1	T	46.7 g	363.6 g	316.9 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-13-A	SU02-EXB-052-SS-P-00	Fill_Geo-21, 901.1	T	45.7 g	348.1 g	302.4 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-14-A	SU02-EXB-053-SS-P-00	Fill_Geo-21, 901.1	T	46.1 g	398.8 g	352.7 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-15-A	SU02-EXB-054-SS-P-00	Fill_Geo-21, 901.1	T	46.0 g	325.0 g	279 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-16-A	SU02-EXS-055-SS-P-00	Fill_Geo-21, 901.1	T	45.7 g	330.1 g	284.4 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-17-A	SU02-EXB-056-SS-P-00	Fill_Geo-21, 901.1	T	46.5 g	370.3 g	323.8 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-18-A	SU02-EXB-057-SS-P-00	Fill_Geo-21, 901.1	T	46.6 g	361.9 g	315.3 g	8/11/2016	9/1/2016	Tuna Can

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.: 160-18554-1

SDG No.: \_\_\_\_\_

Batch Number: 264535 Batch Start Date: 08/11/16 15:20 Batch Analyst: Sloan, Robert 1

Batch Method: Fill\_Geo-21 Batch End Date: 08/11/16 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	TareWeight	GrossWeight	InitialAmount	IngDecDate1	IngDecDate3	Geometry
160-18554-A-19-A	SU02-EXW-047-SS-DUP-P-00	Fill_Geo-21, 901.1	T	45.6 g	334.0 g	288.4 g	8/11/2016	9/1/2016	Tuna Can
160-18554-A-20-A	SU02-EXB-049-SS-DUP-P-00	Fill_Geo-21, 901.1	T	46.1 g	351.3 g	305.2 g	8/11/2016	9/1/2016	Tuna Can

Lab Sample ID	Client Sample ID	Method Chain	Basis	Tuna Can LCS 00005					
MB 160-264535/1		Fill_Geo-21, 901.1							
LCS 160-264535/2		Fill_Geo-21, 901.1		# g					
160-18554-A-1-A	SU02-EXW-040-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-1-A-DU	SU02-EXW-040-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-2-A	SU02-EXN-041-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-3-A	SU02-EXW-042-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-4-A	SU02-EXB-043-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-5-A	SU02-EXN-044-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-6-A	SU02-EXB-045-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-7-A	SU02-EXW-046-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-8-A	SU02-EXW-047-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-9-A	SU02-EXB-048-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-10-A	SU02-EXB-049-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-11-A	SU02-EXB-050-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-12-A	SU02-EXW-051-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-13-A	SU02-EXB-052-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-14-A	SU02-EXB-053-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.: 160-18554-1

SDG No.: \_\_\_\_\_

Batch Number: 264535 Batch Start Date: 08/11/16 15:20 Batch Analyst: Sloan, Robert 1Batch Method: Fill\_Geo-21 Batch End Date: 08/11/16 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	Tuna Can LCS 00005					
160-18554-A-15-A	SU02-EXB-054-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-16-A	SU02-EXS-055-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-17-A	SU02-EXB-056-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-18-A	SU02-EXB-057-SS-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-19-A	SU02-EXW-047-SS-DUP-P-00	Fill_Geo-21, 901.1	T						
160-18554-A-20-A	SU02-EXB-049-SS-DUP-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	ZZZZZ		267754			
09/01/16 11:51	30	160-18554-3	SU02-EXW-042-SS-P-00	267754	264535	901.1	RTM
09/01/16 12:42	30	160-18554-11	SU02-EXB-050-SS-P-00	267754	264535	901.1	RTM
09/01/16 13:24	30	160-18554-18	SU02-EXB-057-SS-P-00	267754	264535	901.1	RTM
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	ZZZZZ		267755			
09/01/16 11:52	30	160-18554-2	SU02-EXN-041-SS-P-00	267755	264535	901.1	RTM
09/01/16 12:39	30	160-18554-1 DU	SU02-EXW-040-SS-P-00 DU	267755	264535	901.1	RTM
09/01/16 13:25	30	160-18554-19	SU02-EXW-047-SS-DUP- P-00	267755	264535	901.1	RTM
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

## Gamma Spectroscopy Run Log

### Detector: GV8 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
08/07/16 22:06		ICB 160-263973/1		263973			ALS
09/01/16 00:24		CCB 160-267756/1		267756			RTM
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	ZZZZZ		267756			
09/01/16 11:54	30	160-18554-1	SU02-EXW-040-SS-P-00	267756	264535	901.1	RTM
09/01/16 12:44	30	160-18554-10	SU02-EXB-049-SS-P-00	267756	264535	901.1	RTM
09/01/16 13:26	30	160-18554-20	SU02-EXB-049-SS-DUP- -00	267756	264535	901.1	RTM
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	ZZZZZ		267757			
09/01/16 11:37	30	ZZZZZ		267757			
09/01/16 12:31	30	160-18554-4	SU02-EXB-043-SS-P-00	267757	264535	901.1	RTM
09/01/16 13:09	30	160-18554-12	SU02-EXW-051-SS-P-00	267757	264535	901.1	RTM
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

## 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 00:27		CCV 160-267758/1		267758			
09/01/16 00:50		CCV 160-267758/2		267758			RTM
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	ZZZZZ		267758			
09/01/16 11:38	30	ZZZZZ		267758			
09/01/16 12:32	30	160-18554-5	SU02-EXN-044-SS-P-00	267758	264535	901.1	RTM
09/01/16 13:10	30	160-18554-13	SU02-EXB-052-SS-P-00	267758	264535	901.1	RTM
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	ZZZZZ		267760			
09/01/16 12:33	30	160-18554-6	SU02-EXB-045-SS-P-00	267760	264535	901.1	RTM
09/01/16 13:11	30	160-18554-14	SU02-EXB-053-SS-P-00	267760	264535	901.1	RTM
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

## 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 08:34	30	ZZZZZ		267761			
09/01/16 09:14	30	ZZZZZ		267761			
09/01/16 09:48	30	ZZZZZ		267761			
09/01/16 10:38	30	ZZZZZ		267761			
09/01/16 11:40	30	ZZZZZ		267761			
09/01/16 12:33	30	160-18554-7	SU02-EXW-046-SS-P-00	267761	264535	901.1	RTM
09/01/16 13:12	30	160-18554-15	SU02-EXB-054-SS-P-00	267761	264535	901.1	RTM
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: GV16

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
07/10/12 10:35		IC 160-12382/1		12382			JLW
07/17/12 11:27		ICV 160-12382/2		12382			JLW
01/22/16 10:56		ACVTOP 160-235879/1		235879			PS
08/06/16 17:37		ICB 160-263719/1		263719			ALS
09/01/16 00:26		CCB 160-267762/1		267762			RTM
09/01/16 05:24		CCV 160-267762/2		267762			
09/01/16 05:48		CCV 160-267762/3		267762			RTM
09/01/16 08:31	60	ZZZZZ		267762			
09/01/16 09:49	30	ZZZZZ		267762			
09/01/16 10:39	30	ZZZZZ		267762			
09/01/16 11:46	30	MB 160-264535/1-A		267762	264535	901.1	RTM
09/01/16 12:35	30	160-18554-8	SU02-EXW-047-SS-P-00	267762	264535	901.1	RTM
09/01/16 13:13	30	160-18554-16	SU02-EXS-055-SS-P-00	267762	264535	901.1	RTM
09/01/16 14:32	30	ZZZZZ		267762			
09/01/16 15:06	30	ZZZZZ		267762			
09/01/16 16:09	30	ZZZZZ		267762			
09/01/16 16:47	30	ZZZZZ		267762			
09/01/16 19:58	120	ZZZZZ		267762			

### 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	ZZZZZ		267763			
09/01/16 11:51	30	LCS 160-264535/2-A		267763	264535	901.1	RTM
09/01/16 12:36	30	160-18554-9	SU02-EXB-048-SS-P-00	267763	264535	901.1	RTM
09/01/16 13:14	30	160-18554-17	SU02-EXB-056-SS-P-00	267763	264535	901.1	RTM



## Gamma Spectroscopy Run Log

### Detector: GV17 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
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

Client Contact		Project Manager: Greg Bright		Regulatory Program: <input type="checkbox"/> BW <input type="checkbox"/> NPDES <input type="checkbox"/> RCRA <input type="checkbox"/> Other:		Site Contact: Bachir Badaoui		Date: 8/8/2016		COC No: 001	
Cabrera Services, Inc		Tel/Fax: 508-315-6246		Analysis Turnaround Time		Lab Contact: Jessica DeHerrera		Carrier:		1 of 2 COCs	
3355 Myrtle Ave, Suite 210		<input type="checkbox"/> CALENDAR DAYS <input checked="" type="checkbox"/> WORKING DAYS		TAT if different from Below: 20		Isotopic Thorium (Th-230, Th-232)				Sampler:	
(916) 334-3740 Phone		<input type="checkbox"/> 2 weeks				Radium 226 - by Gamma spec				For Lab Use Only:	
(916) 334-4867 FAX		<input type="checkbox"/> 1 week				Perform MS / MSD (Y / N)				Walk-in Client:	
Project Name: WR 111 - Little Mountain Test Annex		<input type="checkbox"/> 2 days				Filtered Sample (Y / N)				Lab Sampling:	
Site: Hill Air Force Base, Utah		<input type="checkbox"/> 1 day				# of Cont.				Job / SDG No.:	
PO #11460						Matrix				Sample Specific Notes:	
Sample Identification		Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)							
SU02-EXW-040-SS-P-00	8/8/2016	1141	S	1							
SU02-EXN-041-SS-P-00	8/8/2016	1149	S	1							
SU02-EXW-042-SS-P-00	8/8/2016	1212	S	1							
SU02-EXB-043-SS-P-00	8/8/2016	1208	S	1							
SU02-EXN-044-SS-P-04	8/8/2016	1203	S	1							
SU02-EXB-045-SS-P-00	8/8/2016	1158	S	1							
SU02-EXW-046-SS-P-00	8/8/2016	1224	S	1							
SU02-EXW-047-SS-P-00	8/8/2016	1218	S	1							
SU02-EXB-048-SS-P-00	8/8/2016	1244	S	1							
SU02-EXB-049-SS-P-00	8/8/2016	1322	S	1							
SU02-EXB-050-SS-P-00	8/8/2016	1333	S	1							
SU02-EXW-051-SS-P-00	8/8/2016	1228	S	1							
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other											
Possible Hazard Identification: Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.											
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown											
Special Instructions/QC Requirements & Comments: Gamma spec analysis for Ra-226 which includes 21 day ingrowth. Alpha Spec/ST-RD-0210 (Th-230 and Th-232), Gamma Spec/ST-RD-0102 for (Ra-226)											
Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:		Cooler Temp. (°C):		Obs'd:		Corrd:		Therm ID No.:	
Relinquished by: Bachir Badaoui		Company: Cabrera Services		Date/Time: 8/8/2016 1530		Received by: B.S.		Company: TA		Date/Time: 8/8/16 0920	
Relinquished by:		Company:		Date/Time:		Received by:		Company:		Date/Time:	
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:		Date/Time:	

Earth City, MO 63045  
phone 314.298.8566 fax 314.298.8757

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

**TestAmerica Laboratories, Inc.**

<b>Client Contact</b> Cabrera Services, Inc 3355 Myrtle Ave, Suite 210 North Highlands, CA 95660 (916) 334-3740 Phone (916) 334-4867 FAX Project Name: WR 111 - Little Mountain Test Annex Site: Hill Air Force Base, Utah PO # 11460		<b>Project Manager: Greg Bright</b> Tel/Fax: 508-315-6246 <b>Analysis Turnaround Time</b> <input type="checkbox"/> CALENDAR DAYS <input checked="" type="checkbox"/> WORKING DAYS TAT if different from Below: 20 <input type="checkbox"/> 2 weeks <input type="checkbox"/> 1 week <input type="checkbox"/> 2 days <input type="checkbox"/> 1 day		<b>Site Contact: Bachir Badaoui</b> Lab Contact: Jessica DeHerrera		<b>Date: 7/29/2016</b> Carrier:		<b>COC No: 001</b> 2 of 2 COCs Sampler: <b>For Lab Use Only:</b> Walk-in Client: Lab Sampling: Job / SDG No.:				
<b>Sample Identification</b>		<b>Sample Date</b>	<b>Sample Time</b>	<b>Sample Type</b> (C=Comp, G=Grab)	<b>Matrix</b>	<b># of Cont.</b>	<b>Filtered Sample (Y / N)</b>	<b>Perform MS / MSD (Y / N)</b>	<b>Radium 226- by Gamma spec</b>	<b>Isotopic Thorium (Th-230, Th-232)</b>	<b>Sample Specific Notes:</b>	
SU02-EXB-052-SS-P-00	8/8/2016	1240		S	S	1			X	X		
SU02-EXB-053-SS-P-00	8/8/2016	1328		S	S	1			X	X		
SU02-EXB-054-SS-P-00	8/8/2016	1325		S	S	1			X	X		
SU02-EXS-055-SS-P-00	8/8/2016	1233		S	S	1			X	X		
SU02-EXB-056-SS-P-00	8/8/2016	1320		S	S	1			X	X		
SU02-EXB-057-SS-P-00	8/8/2016	1315		S	S	1			X	X		
SU02-EXW-047-DUP-P-00	8/8/2016	1218		S	S	1			X	X		
SU02-EXB-049-SS-DUP-00	8/8/2016	1322		S	S	1			X	X		
<b>Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other</b>												
<b>Possible Hazard Identification:</b> Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.												
<b>Special Instructions/QC Requirements &amp; Comments:</b> Gamma spec analysis for Ra-226 which includes 21 day ingrowth. Alpha Spec/ST-RD-0210 (Th-230 and Th-232). Gamma Spec/ST-RD-0102 for (Ra-226)												
<b>Custody Seals Intact:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No		<b>Custody Seal No.:</b>		<b>Received by:</b>		<b>Company:</b>		<b>Date/Time:</b>		<b>Therm ID No.:</b>		
Relinquished by: Bachir Badaoui		8/8/2016 1530		8/8/2016 1530		TA		8/9/16 0920				
Relinquished by:												
Relinquished by:												

## Login Sample Receipt Checklist

Client: EA Engineering, Science, and Technology

Job Number: 160-18554-1

**Login Number: 18554**

**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?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	