

**Attachment D**  
**Offsite Laboratory Analytical Reports**

## **ATTACHMENT D. LABORATORY ALPHA SPECTROMETRY RESULTS**

All of the samples collected as part of this investigation were sent to an off-site laboratory for sample preparation and analysis. The samples were analyzed for isotopic U using alpha spectrometry. The laboratory was Department of Defense Environmental Laboratory Accreditation Program (DOD ELAP) certified for performing the required analyses. One half of the filter was analyzed and the other half was stored, in the event that re-analysis is required. The filter was then weighed, ashed, and then dissolved and diluted to a known volume before it was counted by alpha spectrometry. The full laboratory data package including alpha spectrometry spectra and reports, laboratory quality control measurements, and initial calibration of the detectors are included in this appendix.

Case Narrative -1402165

## Isotopic Uranium Case Narrative

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### **Cabrera Services, Inc** **Schofield Barracks – 08-3123.00**

Work Order Number: 1402165

1. This report consists of the analytical results and supporting documentation for 15 filter samples received by ALS on 2/14/2014.
2. These samples were prepared according to the current revisions of SOP 773 and SOP 778.
3. The samples were analyzed for the presence of isotopic uranium according to the current revision of SOP 714. The analyses were completed on 2/22/2014.
4. The isotopic analysis results for these samples are reported on an 'As Received' basis in units of  $\mu\text{Ci/mL}$ .
5. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate.
6. This analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to emission energies between those of U-234 and U-238. A potential limitation of this method is that measurable amounts of U-234 in the sample may cause a small amount of characteristic activity in the U-235 region of interest due to poorly resolved alpha activity at the boundary between the two regions. To minimize the potential for a high bias in the U-235 analytical results, the U-235 region of interest has been narrowed and limited to a lower energy region. An 85.1% abundance correction has been made to the final U-235 results.
7. ALS uses the following convention for reporting significant digits in the TPU and MDC results. The TPU value is rounded to two significant digits. The MDC value is rounded to the same decimal place as the TPU value. In practice, this could result in an MDC reported value of zero for samples with significant activity, including the batch laboratory control sample.
8. The requested MDC for U-238 was not achieved for samples 1402165-1 and -11 following a maximum count time of 1000 minutes. The sample is identified with an "M" flag on the final reports. The results are submitted without further qualification.



9. No further anomalous situations were encountered during the preparation or analysis of these samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Crystal Shaeffer  
Crystal Shaeffer  
Radiochemistry Primary Data Reviewer

2/25/14  
Date

[Signature]  
Radiochemistry Final Data Reviewer

02/26/14  
Date



## Section 1

# CHAIN OF CUSTODY

# ALS Environmental -- FC

## Sample Number(s) Cross-Reference Table

**OrderNum:** 1402165

**Client Name:** Cabrera Services, Inc.

**Client Project Name:** Schofield Barracks

**Client Project Number:** 08-3123.00

**Client PO Number:** 12-3541

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SBHF14-023-ST01-AS-HF	1402165-1		FILTER	06-Feb-14	10:45
SBHF14-024-ST02-AS-HF	1402165-2		FILTER	06-Feb-14	16:12
SBHF14-034-ST01-AS-BK	1402165-3		FILTER	07-Feb-14	15:05
SBHF14-035-ST02-AS-BK	1402165-4		FILTER	07-Feb-14	15:08
SBHF14-001-ST01-AS-BK	1402165-5		FILTER	04-Feb-14	15:27
SBHF14-002-ST02-AS-BK	1402165-6		FILTER	04-Feb-14	15:23
SBHF14-003-ST03-AS-BK	1402165-7		FILTER	04-Feb-14	16:10
SBHF14-004-ST04-AS-BK	1402165-8		FILTER	04-Feb-14	15:59
SBHF14-005-ST05-AS-BK	1402165-9		FILTER	04-Feb-14	15:57
SBHF14-006-ST06-AS-BK	1402165-10		FILTER	04-Feb-14	15:30
SBHF14-007-ST07-AS-BK	1402165-11		FILTER	04-Feb-14	15:32
SBHF14-008-ST08-AS- BK	1402165-12		FILTER	04-Feb-14	15:34
SBHF14-009-ST09-AS-BK	1402165-13		FILTER	04-Feb-14	15:38
SBHF14-010-ST10-AS-BK	1402165-14		FILTER	04-Feb-14	15:41
SBHF14-011-ST11-AS-BK	1402165-15		FILTER	04-Feb-14	15:44



# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

## Chain-of-Custody

WORKORDER # TBD

14021

Form 202r6

<b>SAMPLER</b> Jon A Cote		<b>DATE</b> 2/6/2014	<b>PAGE</b> 1 of 1
<b>PROJECT NAME</b> Schofield Barracks	<b>SITE ID</b> Schofield Barracks	<b>TURNAROUND</b> 30 days	<b>DISPOSAL</b> (By Lab) or Return to Client
<b>PROJECT No.</b> 08-3123.00	<b>EDD FORMAT</b> n/a		
<b>Task</b> 310	<b>PURCHASE ORDER</b> 12-3541		
<b>COMPANY NAME</b> Cabrera Services	<b>BILL TO COMPANY</b> Cabrera Services		
<b>SEND REPORT TO</b> Mike Winters	<b>INVOICE ATTN TO</b> Accounts Payable		
<b>ADDRESS</b> 2318 Bolger Ave	<b>ADDRESS</b> 473 Silver Lane		
<b>CITY / STATE / ZIP</b> Spring Hill, FL 34609	<b>CITY / STATE / ZIP</b> East Hartford, CT 06108		
<b>PHONE</b> 352-810-2150	<b>PHONE</b> 860-569-0095		
<b>FAX</b> n/a	<b>FAX</b> n/a		
<b>E-MAIL</b> mwinters@cabreraservices.com	<b>E-MAIL</b> n/a		

Lab ID	Field ID	Matrix	Sample Date	Sart Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec													
①	SBHF14-023-ST01-AS-HF	F	2/6/2014	9:45	10:45	60	10	X													
②	SBHF14-024-ST02-AS-HF	F	2/6/2014	9:48	16:12	384	10	X													

\*Time Zone (Circle): EST CST MST HAST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

**Comments:**

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/mi  
MDC is 1E-15 uCi/mi; see previously provided work plan for other MQO's  
Bag of blank unused filters included for QC sample purposes  
Preserve half of each sample for re-analysis/follow up testing

**QC PACKAGE (check below)**

	LEVEL II (Standard QC)
	LEVEL III (Std QC + forms)
X	LEVEL IV (Std QC + forms + raw data)

**Preservative Key:** 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>[Signature]</i>	Jon A Cote	2/6/2014	18:30
RECEIVED BY	<i>[Signature]</i>	Pat Horkman	2/6/2014	18:31
RELINQUISHED BY	<i>[Signature]</i>	PAT HORKMAN	2/12/14	1500
RECEIVED BY	<i>[Signature]</i>	C TRIMBLE	2-14-14	1005
RELINQUISHED BY				
RECEIVED BY				

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# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
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## Chain-of-Custody

Form 202a

WORKORDER # TBD

14021

PROJECT NAME		Schofield Barracks	SAMPLER		Jon A Cote	DATE	2/7/2014	PAGE	1 of 1
PROJECT No.		08-3123.00	SITE ID		Schofield Barracks	TURNAROUND	30 days	DISPOSAL	(By Lab) or Return to Client
Task		310	EDD FORMAT		n/a				
COMPANY NAME		Cabrera Services	PURCHASE ORDER		12-3541				
SEND REPORT TO		Mike Winters	BILL TO COMPANY		Cabrera Services				
ADDRESS		2318 Bolger Ave	INVOICE ATTN TO		Accounts Payable				
CITY / STATE / ZIP		Spring Hill, FL 34609	ADDRESS		473 Silver Lane				
PHONE		352-610-2150	CITY / STATE / ZIP		East Hartford, CT 06108				
FAX		n/a	PHONE		860-569-0095				
E-MAIL		mwinters@cabreraseservices.com	FAX		n/a				
			E-MAIL		n/a				

Lab ID	Field ID	Matrix	Sample Date	Sart Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec										
③	SBHF14-034-ST01-AS-BK	F	2/7/2014	8:28	15:05	399	10	X										
④	SBHF14-035-ST02-AS-BK	F	2/7/2014	8:28	15:08	400	10	X										

\*Time Zone (Circle): EST CST MST **HAST** Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

<b>Comments:</b>  Volumes provided in ft <sup>3</sup> ; results requested in units of uCi/ml MDC is 1E-15 uCi/ml; see previously provided work plan for other MQO's Bag of blank unused filters included for QC sample purposes Preserve half of each sample for re-analysis/follow up testing Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degree C 9-5035	<b>QC PACKAGE (check below)</b>	
	<input type="checkbox"/>	LEVEL II (Standard QC)
	<input type="checkbox"/>	LEVEL III (Std QC + forms)
	<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)
	<input type="checkbox"/>	

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>[Signature]</i>	Jon A Cote	2/7/2014	15:30
RECEIVED BY	<i>[Signature]</i>	Pat Horkman	2/7/2014	15:31
RELINQUISHED BY	<i>[Signature]</i>	PAT HORKMAN	2/12/14	1500
RECEIVED BY	<i>[Signature]</i>	C Trumble	2-14-14	1005
RELINQUISHED BY				
RECEIVED BY				



# ALS Laboratory Group

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## Chain-of-Custody

WORKORDER # TBD

1402105

Form 202a

SAMPLER	Jon A Cote	DATE	2/4/2014	PAGE	1 of 1
PROJECT NAME	Schofield Barracks	TURNAROUND	30 days	DISPOSAL	By Lab or Return to Client
PROJECT No.	08-3123.00	EDD FORMAT	n/a		
	Task 310	PURCHASE ORDER	12-3541		
COMPANY NAME	Cabrera Services	BILL TO COMPANY	Cabrera Services		
SEND REPORT TO	Mike Winters	INVOICE ATTN TO	Accounts Payable		
ADDRESS	2318 Bolger Ave	ADDRESS	473 Silver Lane		
CITY / STATE / ZIP	Spring Hill, FL 34609	CITY / STATE / ZIP	East Hartford, CT 06108		
PHONE	352-610-2150	PHONE	860-569-0095		
FAX	n/a	FAX	n/a		
E-MAIL	mwinters@cabreraservices.com	E-MAIL	n/a		

Lab ID	Field ID	Matrix	Sample Date	Start Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec											
5	SBHF14-001-ST01-AS-BK	F	2/4/2014	12:00	15:27	207	10	X											
6	SBHF14-002-ST02-AS-BK	F	2/4/2014	11:50	15:23	213	10	X											

\*Time Zone (Circle): EST CST MST HAST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

Comments:  Volumes provided in ft <sup>3</sup> ; results requested in units of uCi/ml MDC is 1E-15 uCi/ml; see previously provided work plan for other MCO's Bag of blank unused filters included for QC sample purposes Preserve half of each sample for re-analysis/follow up testing	QC PACKAGE (check below)	
	<input type="checkbox"/>	LEVEL II (Standard QC)
	<input type="checkbox"/>	LEVEL III (Std QC + forms)
	<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)
	<input type="checkbox"/>	

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

SIGNATURE	PRINTED NAME	DATE	TIME
<i>[Signature]</i>	Jon A Cote	2/4/2014	15:45
<i>[Signature]</i>	Pat Horkman	2/4/2014	15:48
<i>[Signature]</i>	Pat Horkman	2/12/14	1550
<i>[Signature]</i>	C Trimble	2-14-14	1005
RELINQUISHED BY			
RECEIVED BY			
RELINQUISHED BY			
RECEIVED BY			
RELINQUISHED BY			
RECEIVED BY			

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# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
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## Chain-of-Custody

Form 202r6

WORKORDER # TBD

1402105

PROJECT NAME		Schofield Barracks	SAMPLER		Stephan Owe	DATE	2/4/2014	PAGE	1 of 1	
PROJECT No.		08-3123.00	SITE ID		Schofield Barracks	TURNAROUND	30 days	DISPOSAL	(By Lab) or Return to Client	
Task 310		EDD FORMAT		n/a						
COMPANY NAME		Cabrera Services	PURCHASE ORDER		12-3541					
SEND REPORT TO		Mike Winters	BILL TO COMPANY		Cabrera Services					
ADDRESS		2318 Bolger Ave	INVOICE ATTN TO		Accounts Payable					
CITY / STATE / ZIP		Spring Hill, FL 34609	ADDRESS		473 Silver Lane					
PHONE		352-610-2150	CITY / STATE / ZIP		East Hartford, CT 06108					
FAX		n/a	PHONE		860-569-0095					
E-MAIL		mwinters@cabreraservices.com	FAX		n/a					
			E-MAIL		n/a					

Lab ID	Field ID	Matrix	Sample Date	Start Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec												
1	SBHF14-003-ST03-AS-BK	F	2/4/2014	12:25	16:10	225	10	X												
2	SBHF14-004-ST04-AS-BK	F	2/4/2014	12:37	15:59	202	10	X												
3	SBHF14-005-ST05-AS-BK	F	2/4/2014	12:42	15:57	195	10	X												
4	SBHF14-006-ST06-AS-BK	F	2/4/2014	12:52	15:30	158	10	X												
5	SBHF14-007-ST07-AS-BK	F	2/4/2014	12:56	15:32	156	10	X												
6	SBHF14-008-ST08-AS-BK	F	2/4/2014	13:00	15:34	154	10	X												
7	SBHF14-009-ST09-AS-BK	F	2/4/2014	13:07	15:38	151	10	X												
8	SBHF14-010-ST10-AS-BK	F	2/4/2014	13:13	15:41	148	10	X												
9	SBHF14-011-ST11-AS-BK	F	2/4/2014	13:19	15:44	145	10	X												

\*Time Zone (Circle): EST CST MST **HAST** Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

Comments:

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/ml  
MDC is 1E-15 uCi/ml; see previously provided work plan for other MQC's  
Bag of blank unused filters included for QC sample purposes  
Preserve half of each sample for re-analysis/follow up testing

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degree C 9-5035

GC PACKAGE (check below)	
<input type="checkbox"/>	LEVEL II (Standard QC)
<input type="checkbox"/>	LEVEL III (Std QC + forms)
<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)

RELINQUISHED BY	SIGNATURE	PRINTED NAME	DATE	TIME
		Stephan Owe	2/4/2014	16:30
		Pat Horkman	2/4/2014	16:31
		Pat Horkman / C Trumble	2/12/14 16:00	2-17-14 10:05

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ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: Cabrera

Workorder No: 1402165

Project Manager: LS

Initials: CDT Date: 2-14-14

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	<input checked="" type="radio"/> NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		YES	<input checked="" type="radio"/> NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	<input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	<input checked="" type="radio"/> NO
Cooler #: <u>1</u>			
Temperature (°C): <u>Amb</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: <u>10</u>			
Background µR/hr reading: <u>11</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES <input type="radio"/> NO / NA (If no, see Form 008.)			

DOT Survey  
Acceptance  
Information

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

Sample 7 Field ID on COC SBHF14-006-STD3-AS-BK should read SBHF14-003-STD3-AS-BK. DATE AND TIME (1610) ARE THE SAME AS "003" AND THERE IS A SECOND "006".

Correction noted

If applicable, was the client contacted? YES /  NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 2/14/14

1402165

ORIGIN ID:SAFA (505) 665-9966  
KEITH GREENE  
LOS ALAMOS NATL LAB.  
TA00 BLDG 1237 DPU 03

SHIP DATE: 13FEB14  
ACTWGT: 15.0 LB MAN  
CAD: 0014176/CAFE2704

LOS ALAMOS, NM 87545  
UNITED STATES US

BILL SENDER

TO LANCE STEERE  
PARAGON  
225 COMMERCE

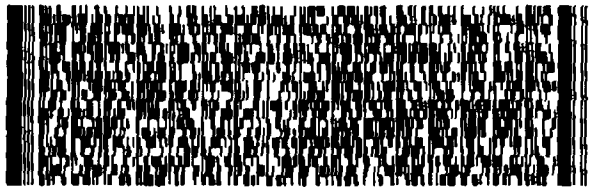
LO  
-0

FORT COLLINS CO 80524

(800) 448-1511

REF: WE7111460000

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED DATE 11/11/03 BY 60322 UCBAW/STP



FedEx  
Express



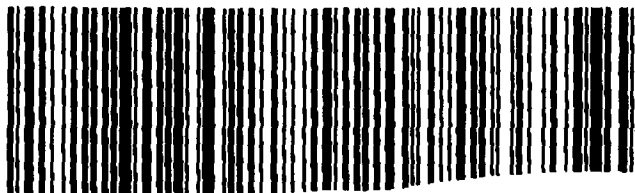
FRI - 14 FEB 10:30A  
PRIORITY OVERNIGHT

TRK# 5908 1776 6907  
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XH FTCA

80524  
CO-US DEN

Part # 156148-434 RIT2 08/10





Section 2

2

# SAMPLE RESULTS SUMMARY

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402165

**Page:** 1 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:03:27 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402165-1	SBHF14-023-ST01-AS-HF	Sample	U-234	3.4E-15 +/- 2E-15	7E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-1	SBHF14-023-ST01-AS-HF	Sample	U-235	-3E-16 +/- 1.5E-15	2.3E-15	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-1	SBHF14-023-ST01-AS-HF	Sample	U-238	1.6E-15 +/- 1.5E-15	1.9E-15	uCi/ml	FILTER	AS140215-1	2/21/2014	U,M
1402165-2	SBHF14-024-ST02-AS-HF	Sample	U-234	3.8E-16 +/- 3.8E-16	2.1E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-2	SBHF14-024-ST02-AS-HF	Sample	U-235	2.7E-16 +/- 4.4E-16	2.4E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-2	SBHF14-024-ST02-AS-HF	Sample	U-238	-8E-17 +/- 3.8E-16	7.1E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-3	SBHF14-034-ST01-AS-BK	Sample	U-234	-4E-17 +/- 2.2E-16	4.8E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-3	SBHF14-034-ST01-AS-BK	Sample	U-235	9E-17 +/- 2.1E-16	1.2E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-3	SBHF14-034-ST01-AS-BK	Sample	U-238	7E-17 +/- 1.8E-16	3.4E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U

**Comments:**

**Data Package ID:** UR1402165-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402165

**Page:** 2 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:03:28 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402165-4	SBHF14-035-ST02-AS-BK	Sample	U-234	2.3E-16 +/- 1.7E-16	8E-17	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-4	SBHF14-035-ST02-AS-BK	Sample	U-235	0E+00 +/- 1.7E-16	3.1E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-4	SBHF14-035-ST02-AS-BK	Sample	U-238	1.7E-16 +/- 1.4E-16	8E-17	uCi/ml	FILTER	AS140215-1	2/21/2014	LT
1402165-5	SBHF14-001-ST01-AS-BK	Sample	U-234	6E-16 +/- 5.9E-16	3.2E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-5	SBHF14-001-ST01-AS-BK	Sample	U-235	0E+00 +/- 6.9E-16	3.8E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-5	SBHF14-001-ST01-AS-BK	Sample	U-238	3.6E-16 +/- 5.9E-16	3.2E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	LT
1402165-6	SBHF14-002-ST02-AS-BK	Sample	U-234	2.1E-16 +/- 3.4E-16	5.1E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-6	SBHF14-002-ST02-AS-BK	Sample	U-235	-8E-17 +/- 4E-16	7.6E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-6	SBHF14-002-ST02-AS-BK	Sample	U-238	3.5E-16 +/- 3.5E-16	1.9E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	LT

**Comments:**

**Data Package ID:** UR1402165-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit



# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402165

**Page:** 3 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:03:28 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402165-7	SBHF14-003-ST03-AS-BK	Sample	U-234	3.1E-16 +/- 3.1E-16	1.7E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-7	SBHF14-003-ST03-AS-BK	Sample	U-235	7E-17 +/- 3.6E-16	5.4E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-7	SBHF14-003-ST03-AS-BK	Sample	U-238	1.9E-16 +/- 3.1E-16	4.6E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-8	SBHF14-004-ST04-AS-BK	Sample	U-234	1.6E-16 +/- 3.9E-16	5.8E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-8	SBHF14-004-ST04-AS-BK	Sample	U-235	0E+00 +/- 4.6E-16	6.9E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-8	SBHF14-004-ST04-AS-BK	Sample	U-238	7.9E-16 +/- 6.5E-16	8.5E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-9	SBHF14-005-ST05-AS-BK	Sample	U-234	3.3E-16 +/- 4.5E-16	7.2E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-9	SBHF14-005-ST05-AS-BK	Sample	U-235	3.1E-16 +/- 3.9E-16	2.1E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-9	SBHF14-005-ST05-AS-BK	Sample	U-238	1.3E-16 +/- 3.3E-16	1.8E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U

**Comments:**

**Data Package ID:** UR1402165-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402165

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**Reported on:** Tuesday, February 25, 2014  
 2:03:28 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402165-10	SBHF14-006-ST06-AS-BK	Sample	U-234	5.3E-16 +/- 4.4E-16	2.4E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-10	SBHF14-006-ST06-AS-BK	Sample	U-235	0E+00 +/- 5.1E-16	2.8E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-10	SBHF14-006-ST06-AS-BK	Sample	U-238	2.6E-16 +/- 4.7E-16	8.2E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-11	SBHF14-007-ST07-AS-BK	Sample	U-234	8.5E-16 +/- 7.1E-16	3.8E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-11	SBHF14-007-ST07-AS-BK	Sample	U-235	1.7E-16 +/- 8.2E-16	1.55E-15	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-11	SBHF14-007-ST07-AS-BK	Sample	U-238	5.7E-16 +/- 7E-16	1.04E-15	uCi/ml	FILTER	AS140215-1	2/21/2014	U,M
1402165-12	SBHF14-008-ST08-AS- BK	Sample	U-234	8E-17 +/- 3.7E-16	2E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-12	SBHF14-008-ST08-AS- BK	Sample	U-235	9E-17 +/- 4.3E-16	2.4E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-12	SBHF14-008-ST08-AS- BK	Sample	U-238	1.5E-16 +/- 4.3E-16	8.1E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U

**Comments:**

**Data Package ID:** UR1402165-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402165

**Page:** 5 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:03:28 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402165-13	SBHF14-009-ST09-AS-BK	Sample	U-234	6.6E-16 +/- 5.3E-16	6.1E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-13	SBHF14-009-ST09-AS-BK	Sample	U-235	0E+00 +/- 4.8E-16	7.1E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-13	SBHF14-009-ST09-AS-BK	Sample	U-238	8E-17 +/- 5E-16	9.9E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-14	SBHF14-010-ST10-AS-BK	Sample	U-234	2.6E-16 +/- 6.3E-16	1.15E-15	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-14	SBHF14-010-ST10-AS-BK	Sample	U-235	0E+00 +/- 5.1E-16	1.11E-15	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-14	SBHF14-010-ST10-AS-BK	Sample	U-238	1.8E-16 +/- 5E-16	9.4E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U
1402165-15	SBHF14-011-ST11-AS-BK	Sample	U-234	1.66E-14 +/- 3.8E-15	1.1E-15	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-15	SBHF14-011-ST11-AS-BK	Sample	U-235	9.6E-16 +/- 7.7E-16	8.8E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	
1402165-15	SBHF14-011-ST11-AS-BK	Sample	U-238	6.1E-16 +/- 5.9E-16	7.5E-16	uCi/ml	FILTER	AS140215-1	2/21/2014	U

**Comments:**

**Data Package ID:** UR1402165-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit



## Section 3

# QC RESULTS SUMMARY



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-1MMB	Sample Matrix: FILTER Prep SOP: PAI 778 Rev 14	Prep Batch: AS140215-1 QC Batch ID: AS140215-1-1	Final Aliquot: 30200000 ml Result Units: uCi/ml
	Date Collected: 15-Feb-14 Date Prepared: 15-Feb-14 Date Analyzed: 22-Feb-14	Run ID: AS140215-1UR Count Time: 1000 minutes	File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.4E-16 +/- 2.8E-16	1.5E-16		
15117-96-1	U-235	2E-16 +/- 3.2E-16	4.8E-16		U
7440-61-1	U-238	1.1E-16 +/- 2.7E-16	4.1E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Minimum Detectable Concentration  
BDL - Below Detection Limit

M - Requested MDC not met.  
B - Analyte concentration greater than MDC.  
B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-1PMB

Sample Matrix: FILTER

Prep Batch: AS140215-1

Final Aliquot: 30200000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-1-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-1UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 22-Feb-14

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.5E-16 +/- 3.8E-16	5.2E-16		U
15117-96-1	U-235	0E+00 +/- 4E-16	6.1E-16		U
7440-61-1	U-238	7E-17 +/- 3.7E-16	7.6E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-1LCS	Sample Matrix: FILTER	Prep Batch: AS140215-1	Final Aliquot: 30200000 ml
	Prep SOP: PAI 778 Rev 14	QCBatchID: AS140215-1-1	Result Units: uCi/ml
	Date Collected: 15-Feb-14	Run ID: AS140215-1UR	File Name: Spectrum #1
	Date Prepared: 15-Feb-14	Count Time: 1000 minutes	
	Date Analyzed: 22-Feb-14		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	7.4E-14 +/- 1.3E-14	1E-15	7.320E-14	101	82 - 122	P
7440-61-1	U-238	7.4E-14 +/- 1.3E-14	0E+00	7.600E-14	97.6	82 - 122	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
L - LCS Recovery below lower control limit.  
H - LCS Recovery above upper control limit.  
P - LCS Recovery within control limits.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Minimum Detectable Concentration

Data Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental – FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

<b>Lab ID:</b> AS140215-1LCSD	<b>Sample Matrix:</b> FILTER	<b>Prep Batch:</b> AS140215-1	<b>Final Aliquot:</b> 30200000 ml
	<b>Prep SOP:</b> PAI 778 Rev 14	<b>QC Batch ID:</b> AS140215-1-1	<b>Result Units:</b> uCi/ml
	<b>Date Collected:</b> 15-Feb-14	<b>Run ID:</b> AS140215-1UR	<b>File Name:</b> Spectrum #1
	<b>Date Prepared:</b> 15-Feb-14	<b>Count Time:</b> 1000 minutes	
	<b>Date Analyzed:</b> 22-Feb-14		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	7.4E-14 +/- 1.3E-14	0E+00	7.320E-14	101	82 - 122	P
7440-61-1	U-238	8.4E-14 +/- 1.4E-14	1E-15	7.600E-14	110	82 - 122	P

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration

Data Package ID: UR1402165-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Duplicate Sample Results (DER)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID:  
Lab ID: AS140215-1LCSD

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 15-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 22-Feb-14

Prep Batch: AS140215-1  
QCBatchID: AS140215-1-1  
Run ID: AS140215-1UR  
Count Time: 1000 minutes

Final Aliquot: 30200000 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
13966-29-5	U-234	7.4E-14 +/- 1.3E-14	1E-15	P	7.4E-14 +/- 1.3E-14	0E+00	P	0.00659	2.13
7440-61-1	U-238	7.4E-14 +/- 1.3E-14	0E+00	P	8.4E-14 +/- 1.4E-14	1E-15	P	0.5	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Package ID: UR1402165-1



## Section 4

# INDIVIDUAL SAMPLE RESULTS

**4**

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-023-ST01-AS-HF

Lab ID: 1402165-1

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 06-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QC Batch ID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 8.50E+06 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.4E-15 +/- 2E-15	7E-16		
15117-96-1	U-235	-3E-16 +/- 1.5E-15	2.3E-15		U
7440-61-1	U-238	1.6E-15 +/- 1.5E-15	1.9E-15	1E-15	U,M

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> SBHF14-024-ST02-AS-HF <b>Lab ID:</b> 1402165-2	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 06-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 21-Feb-14	<b>Prep Batch:</b> AS140215-1 <b>QCBatchID:</b> AS140215-1-1 <b>Run ID:</b> AS140215-1UR <b>Count Time:</b> 1000 minutes <b>Report Basis:</b> As Received	<b>Final Aliquot:</b> 5.45E+07 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.8E-16 +/- 3.8E-16	2.1E-16		
15117-96-1	U-235	2.7E-16 +/- 4.4E-16	2.4E-16		
7440-61-1	U-238	-8E-17 +/- 3.8E-16	7.1E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-034-ST01-AS-BK

Lab ID: 1402165-3

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 07-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QCBatchID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.65E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-4E-17 +/- 2.2E-16	4.8E-16		U
15117-96-1	U-235	9E-17 +/- 2.1E-16	1.2E-16		U
7440-61-1	U-238	7E-17 +/- 1.8E-16	3.4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-035-ST02-AS-BK  
Lab ID: 1402165-4

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 07-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1  
QCBatchID: AS140215-1-1  
Run ID: AS140215-1UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 5.65E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.3E-16 +/- 1.7E-16	8E-17		
15117-96-1	U-235	0E+00 +/- 1.7E-16	3.1E-16		U
7440-61-1	U-238	1.7E-16 +/- 1.4E-16	8E-17	1E-15	LT

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-001-ST01-AS-BK

Lab ID: 1402165-5

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 04-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QCBatchID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 2.93E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	6E-16 +/- 5.9E-16	3.2E-16		
15117-96-1	U-235	0E+00 +/- 6.9E-16	3.8E-16		U
7440-61-1	U-238	3.6E-16 +/- 5.9E-16	3.2E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-002-ST02-AS-BK  
Lab ID: 1402165-6

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 04-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1  
QCBatchID: AS140215-1-1  
Run ID: AS140215-1UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 3.02E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.1E-16 +/- 3.4E-16	5.1E-16		U
15117-96-1	U-235	-8E-17 +/- 4E-16	7.6E-16		U
7440-61-1	U-238	3.5E-16 +/- 3.5E-16	1.9E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-003-ST03-AS-BK

Lab ID: 1402165-7

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 04-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QCBatchID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 3.18E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.1E-16 +/- 3.1E-16	1.7E-16		
15117-96-1	U-235	7E-17 +/- 3.6E-16	5.4E-16		U
7440-61-1	U-238	1.9E-16 +/- 3.1E-16	4.6E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-004-ST04-AS-BK

Lab ID: 1402165-8

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 04-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QCBatchID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 2.86E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.6E-16 +/- 3.9E-16	5.8E-16		U
15117-96-1	U-235	0E+00 +/- 4.6E-16	6.9E-16		U
7440-61-1	U-238	7.9E-16 +/- 6.5E-16	8.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-005-ST05-AS-BK

Lab ID: 1402165-9

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 04-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QCBatchID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 2.76E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.3E-16 +/- 4.5E-16	7.2E-16		U
15117-96-1	U-235	3.1E-16 +/- 3.9E-16	2.1E-16		
7440-61-1	U-238	1.3E-16 +/- 3.3E-16	1.8E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-006-ST06-AS-BK

Lab ID: 1402165-10

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 04-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QCBatchID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 2.24E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	5.3E-16 +/- 4.4E-16	2.4E-16		
15117-96-1	U-235	0E+00 +/- 5.1E-16	2.8E-16		U
7440-61-1	U-238	2.6E-16 +/- 4.7E-16	8.2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> SBHF14-007-ST07-AS-BK <b>Lab ID:</b> 1402165-11	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 04-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 21-Feb-14	<b>Prep Batch:</b> AS140215-1 <b>QCBatchID:</b> AS140215-1-1 <b>Run ID:</b> AS140215-1UR <b>Count Time:</b> 1000 minutes <b>Report Basis:</b> As Received	<b>Final Aliquot:</b> 2.21E+07 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	8.5E-16 +/- 7.1E-16	3.8E-16		
15117-96-1	U-235	1.7E-16 +/- 8.2E-16	1.55E-15		U
7440-61-1	U-238	5.7E-16 +/- 7E-16	1.04E-15	1E-15	U,M

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-008-ST08-AS- BK  
Lab ID: 1402165-12

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 04-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1  
QCBatchID: AS140215-1-1  
Run ID: AS140215-1UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 2.18E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	8E-17 +/- 3.7E-16	2E-16		U
15117-96-1	U-235	9E-17 +/- 4.3E-16	2.4E-16		U
7440-61-1	U-238	1.5E-16 +/- 4.3E-16	8.1E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-009-ST09-AS-BK

Lab ID: 1402165-13

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 04-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QC Batch ID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 2.14E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	6.6E-16 +/- 5.3E-16	6.1E-16		
15117-96-1	U-235	0E+00 +/- 4.8E-16	7.1E-16		U
7440-61-1	U-238	8E-17 +/- 5E-16	9.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-010-ST10-AS-BK  
Lab ID: 1402165-14

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 04-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1  
QCBatchID: AS140215-1-1  
Run ID: AS140215-1UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 2.10E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.6E-16 +/- 6.3E-16	1.15E-15		U
15117-96-1	U-235	0E+00 +/- 5.1E-16	1.11E-15		U
7440-61-1	U-238	1.8E-16 +/- 5E-16	9.4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402165-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402165

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-011-ST11-AS-BK

Lab ID: 1402165-15

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 04-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-1

QCBatchID: AS140215-1-1

Run ID: AS140215-1UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 2.05E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.66E-14 +/- 3.8E-15	1.1E-15		
15117-96-1	U-235	9.6E-16 +/- 7.7E-16	8.8E-16		
7440-61-1	U-238	6.1E-16 +/- 5.9E-16	7.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402165-1



## Section 5

# RAW DATA

**5**

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402165

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Tuesday, February 25, 2014  
7:46:25 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402165-1 SMP	U-232 Tracer	2/6/2014 10:45:00 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	8500000 ml 8500000 ml	AlphaSpec2 81	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	958.000 2.000	30.83% 1000	1000 65.7%	1.65E-13 2.7E-14	2E-15 NA	uCi/ml As Received	NA NA	
1402165-1 SMP	U-234 Trg. Analyte	2/6/2014 10:45:00 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	8500000 ml 8500000 ml	AlphaSpec2 81	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	13.000 0.000	30.83% 1000	1000 65.7%	3.4E-15 2E-15	7E-16 NA	uCi/ml As Received	NA NA	
1402165-1 SMP	U-235 Trg. Analyte	2/6/2014 10:45:00 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	8500000 ml 8500000 ml	AlphaSpec2 81	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	-1.000 1.000	30.83% 1000	1000 65.7%	-3E-16 1.5E-15	2.3E-15 NA	uCi/ml As Received	NA NA	U
1402165-1 SMP	U-238 Trg. Analyte	2/6/2014 10:45:00 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	8500000 ml 8500000 ml	AlphaSpec2 81	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	6.000 1.000	30.83% 1000	1000 65.7%	1.6E-15 1.5E-15	1.9E-15 NA	uCi/ml As Received	NA NA	U,M
1402165-2 SMP	U-232 Tracer	2/6/2014 4:12:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	54500000 ml 54500000 ml	AlphaSpec2 82	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	510.000 2.000	30.65% 1000	1000 35.2%	1.38E-14 2.4E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402165-2 SMP	U-234 Trg. Analyte	2/6/2014 4:12:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	54500000 ml 54500000 ml	AlphaSpec2 82	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	5.000 0.000	30.65% 1000	1000 35.2%	3.8E-16 3.8E-16	2.1E-16 NA	uCi/ml As Received	NA NA	
1402165-2 SMP	U-235 Trg. Analyte	2/6/2014 4:12:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	54500000 ml 54500000 ml	AlphaSpec2 82	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	3.000 0.000	30.65% 1000	1000 35.2%	2.7E-16 4.4E-16	2.4E-16 NA	uCi/ml As Received	NA NA	
1402165-2 SMP	U-238 Trg. Analyte	2/6/2014 4:12:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	54500000 ml 54500000 ml	AlphaSpec2 82	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	-1.000 2.000	30.65% 1000	1000 35.2%	-8E-17 3.8E-16	7.1E-16 NA	uCi/ml As Received	NA NA	U
1402165-3 SMP	U-232 Tracer	2/7/2014 3:05:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 83	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1036.000 1.000	31.20% 1000	1000 70.2%	2.65E-14 4.3E-15	2E-16 NA	uCi/ml As Received	NA NA	
1402165-3 SMP	U-234 Trg. Analyte	2/7/2014 3:05:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 83	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	-1.000 5.000	31.20% 1000	1000 70.2%	-4E-17 2.2E-16	4.8E-16 NA	uCi/ml As Received	NA NA	U
1402165-3 SMP	U-235 Trg. Analyte	2/7/2014 3:05:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 83	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	2.000 0.000	31.20% 1000	1000 70.2%	9E-17 2.1E-16	1.2E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402165-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402165

Analytical SOP: PAI 714

7:46:25 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402165-3 SMP	U-238 Trg. Analyte	2/7/2014 3:05:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 83	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	2.000 2.000	31.20% 1000	1000 70.2%	7E-17 1.8E-16	3.4E-16 NA	uCi/ml As Received	NA NA	U
1402165-4 SMP	U-232 Tracer	2/7/2014 3:08:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 84	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1308.000 2.000	30.40% 1000	1000 91.0%	3.43E-14 5.4E-15	2E-16 NA	uCi/ml As Received	NA NA	
1402165-4 SMP	U-234 Trg. Analyte	2/7/2014 3:08:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 84	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	8.000 0.000	30.40% 1000	1000 91.0%	2.3E-16 1.7E-16	8E-17 NA	uCi/ml As Received	NA NA	
1402165-4 SMP	U-235 Trg. Analyte	2/7/2014 3:08:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 84	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	0.000 2.000	30.40% 1000	1000 91.0%	0E+00 1.7E-16	3.1E-16 NA	uCi/ml As Received	NA NA	U
1402165-4 SMP	U-238 Trg. Analyte	2/7/2014 3:08:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 84	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	6.000 0.000	30.40% 1000	1000 91.0%	1.7E-16 1.4E-16	8E-17 NA	uCi/ml As Received	NA NA	LT
1402165-5 SMP	U-232 Tracer	2/4/2014 3:27:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	29300000 ml 29300000 ml	AlphaSpec2 85	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	608.000 1.000	30.11% 1000	1000 42.7%	3.1E-14 5.2E-15	4E-16 NA	uCi/ml As Received	NA NA	
1402165-5 SMP	U-234 Trg. Analyte	2/4/2014 3:27:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	29300000 ml 29300000 ml	AlphaSpec2 85	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	5.000 0.000	30.11% 1000	1000 42.7%	6E-16 5.9E-16	3.2E-16 NA	uCi/ml As Received	NA NA	
1402165-5 SMP	U-235 Trg. Analyte	2/4/2014 3:27:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	29300000 ml 29300000 ml	AlphaSpec2 85	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	0.000 0.000	30.11% 1000	1000 42.7%	0E+00 6.9E-16	3.8E-16 NA	uCi/ml As Received	NA NA	U
1402165-5 SMP	U-238 Trg. Analyte	2/4/2014 3:27:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	29300000 ml 29300000 ml	AlphaSpec2 85	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	3.000 0.000	30.11% 1000	1000 42.7%	3.6E-16 5.9E-16	3.2E-16 NA	uCi/ml As Received	NA NA	LT
1402165-6 SMP	U-232 Tracer	2/4/2014 3:23:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 86	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1015.000 3.000	30.61% 1000	1000 70.1%	4.95E-14 8E-15	5E-16 NA	uCi/ml As Received	NA NA	
1402165-6 SMP	U-234 Trg. Analyte	2/4/2014 3:23:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 86	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	3.000 1.000	30.61% 1000	1000 70.1%	2.1E-16 3.4E-16	5.1E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID:** UR1402165-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402165

Analytical SOP: PAI 714

7:46:25 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402165-6 SMP	U-235 Trg. Analyte	2/4/2014 3:23:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 86	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	-1.000 2.000	30.61% 1000	1000 70.1%	-8E-17 4E-16	7.6E-16 NA	uCi/ml As Received	NA NA	U
1402165-6 SMP	U-238 Trg. Analyte	2/4/2014 3:23:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 86	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	5.000 0.000	30.61% 1000	1000 70.1%	3.5E-16 3.5E-16	1.9E-16 NA	uCi/ml As Received	NA NA	LT
1402165-7 SMP	U-232 Tracer	2/4/2014 4:10:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	31800000 ml 31800000 ml	AlphaSpec2 87	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1069.000 2.000	31.55% 1000	1000 71.7%	4.79E-14 7.7E-15	4E-16 NA	uCi/ml As Received	NA NA	
1402165-7 SMP	U-234 Trg. Analyte	2/4/2014 4:10:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	31800000 ml 31800000 ml	AlphaSpec2 87	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	5.000 0.000	31.55% 1000	1000 71.7%	3.1E-16 3.1E-16	1.7E-16 NA	uCi/ml As Received	NA NA	
1402165-7 SMP	U-235 Trg. Analyte	2/4/2014 4:10:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	31800000 ml 31800000 ml	AlphaSpec2 87	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1.000 1.000	31.55% 1000	1000 71.7%	7E-17 3.6E-16	5.4E-16 NA	uCi/ml As Received	NA NA	U
1402165-7 SMP	U-238 Trg. Analyte	2/4/2014 4:10:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	31800000 ml 31800000 ml	AlphaSpec2 87	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	3.000 1.000	31.55% 1000	1000 71.7%	1.9E-16 3.1E-16	4.6E-16 NA	uCi/ml As Received	NA NA	U
1402165-8 SMP	U-232 Tracer	2/4/2014 3:59:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	28600000 ml 28600000 ml	AlphaSpec2 88	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	939.000 4.000	30.79% 1000	1000 64.5%	4.8E-14 7.8E-15	6E-16 NA	uCi/ml As Received	NA NA	
1402165-8 SMP	U-234 Trg. Analyte	2/4/2014 3:59:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	28600000 ml 28600000 ml	AlphaSpec2 88	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	2.000 1.000	30.79% 1000	1000 64.5%	1.6E-16 3.9E-16	5.8E-16 NA	uCi/ml As Received	NA NA	U
1402165-8 SMP	U-235 Trg. Analyte	2/4/2014 3:59:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	28600000 ml 28600000 ml	AlphaSpec2 88	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	0.000 1.000	30.79% 1000	1000 64.5%	0E+00 4.6E-16	6.9E-16 NA	uCi/ml As Received	NA NA	U
1402165-8 SMP	U-238 Trg. Analyte	2/4/2014 3:59:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	28600000 ml 28600000 ml	AlphaSpec2 88	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	10.000 3.000	30.79% 1000	1000 64.5%	7.9E-16 6.5E-16	8.5E-16 NA	uCi/ml As Received	NA NA	U
1402165-9 SMP	U-232 Tracer	2/4/2014 3:57:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	27600000 ml 27600000 ml	AlphaSpec2 89	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1158.000 7.000	31.24% 1000	1000 78.4%	6.05E-14 9.7E-15	8E-16 NA	uCi/ml As Received	NA NA	

**Comments:**

**Data Package ID: UR1402165-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR - Tracer
- TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402165

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Tuesday, February 25, 2014  
7:46:25 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402165-9 SMP	U-234 Trg. Analyte	2/4/2014 3:57:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	27600000 ml 27600000 ml	AlphaSpec2 89	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	5.000 3.000	31.24% 1000	1000 78.4%	3.3E-16 4.5E-16	7.2E-16 NA	uCi/ml As Received	NA NA	U
1402165-9 SMP	U-235 Trg. Analyte	2/4/2014 3:57:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	27600000 ml 27600000 ml	AlphaSpec2 89	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	4.000 0.000	31.24% 1000	1000 78.4%	3.1E-16 3.9E-16	2.1E-16 NA	uCi/ml As Received	NA NA	
1402165-9 SMP	U-238 Trg. Analyte	2/4/2014 3:57:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	27600000 ml 27600000 ml	AlphaSpec2 89	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	2.000 0.000	31.24% 1000	1000 78.4%	1.3E-16 3.3E-16	1.8E-16 NA	uCi/ml As Received	NA NA	U
1402165-10 SMP	U-232 Tracer	2/4/2014 3:30:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	22400000 ml 22400000 ml	AlphaSpec2 90	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1085.000 5.000	30.90% 1000	1000 74.3%	7.1E-14 1.1E-14	1E-15 NA	uCi/ml As Received	NA NA	
1402165-10 SMP	U-234 Trg. Analyte	2/4/2014 3:30:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	22400000 ml 22400000 ml	AlphaSpec2 90	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	6.000 0.000	30.90% 1000	1000 74.3%	5.3E-16 4.4E-16	2.4E-16 NA	uCi/ml As Received	NA NA	
1402165-10 SMP	U-235 Trg. Analyte	2/4/2014 3:30:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	22400000 ml 22400000 ml	AlphaSpec2 90	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	0.000 0.000	30.90% 1000	1000 74.3%	0E+00 5.1E-16	2.8E-16 NA	uCi/ml As Received	NA NA	U
1402165-10 SMP	U-238 Trg. Analyte	2/4/2014 3:30:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	22400000 ml 22400000 ml	AlphaSpec2 90	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	3.000 2.000	30.90% 1000	1000 74.3%	2.6E-16 4.7E-16	8.2E-16 NA	uCi/ml As Received	NA NA	U
1402165-11 SMP	U-232 Tracer	2/4/2014 3:32:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	22100000 ml 22100000 ml	AlphaSpec2 91	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	681.000 4.000	30.35% 1000	1000 47.5%	4.57E-14 7.6E-15	8E-16 NA	uCi/ml As Received	NA NA	
1402165-11 SMP	U-234 Trg. Analyte	2/4/2014 3:32:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	22100000 ml 22100000 ml	AlphaSpec2 91	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	6.000 0.000	30.35% 1000	1000 47.5%	8.5E-16 7.1E-16	3.8E-16 NA	uCi/ml As Received	NA NA	
1402165-11 SMP	U-235 Trg. Analyte	2/4/2014 3:32:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	22100000 ml 22100000 ml	AlphaSpec2 91	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1.000 2.000	30.35% 1000	1000 47.5%	1.7E-16 8.2E-16	1.55E-15 NA	uCi/ml As Received	NA NA	U
1402165-11 SMP	U-238 Trg. Analyte	2/4/2014 3:32:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	22100000 ml 22100000 ml	AlphaSpec2 91	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	4.000 1.000	30.35% 1000	1000 47.5%	5.7E-16 7E-16	1.04E-15 NA	uCi/ml As Received	NA NA	U,M

**Comments:**

**Data Package ID: UR1402165-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
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- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
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**Abbreviations:**

- TR - Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
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- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402165

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Tuesday, February 25, 2014  
7:46:25 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402165-12 SMP	U-232 Tracer	2/4/2014 3:34:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21800000 ml 21800000 ml	AlphaSpec2 92	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1302.000 1.000	31.14% 1000	8.6E-14 1000	0E+00 NA	uCi/ml As Received	NA NA		
1402165-12 SMP	U-234 Trg. Analyte	2/4/2014 3:34:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21800000 ml 21800000 ml	AlphaSpec2 92	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1.000 0.000	31.14% 1000	8E-17 88.4%	2E-16 3.7E-16	uCi/ml As Received	NA NA		U
1402165-12 SMP	U-235 Trg. Analyte	2/4/2014 3:34:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21800000 ml 21800000 ml	AlphaSpec2 92	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1.000 0.000	31.14% 1000	9E-17 88.4%	2.4E-16 4.3E-16	uCi/ml As Received	NA NA		U
1402165-12 SMP	U-238 Trg. Analyte	2/4/2014 3:34:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21800000 ml 21800000 ml	AlphaSpec2 92	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	2.000 3.000	31.14% 1000	1.5E-16 88.4%	8.1E-16 4.3E-16	uCi/ml As Received	NA NA		U
1402165-13 SMP	U-232 Tracer	2/4/2014 3:38:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21400000 ml 21400000 ml	AlphaSpec2 93	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1206.000 7.000	32.05% 1000	7.9E-14 79.6%	1E-15 1.3E-14	uCi/ml As Received	NA NA		
1402165-13 SMP	U-234 Trg. Analyte	2/4/2014 3:38:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21400000 ml 21400000 ml	AlphaSpec2 93	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	8.000 1.000	32.05% 1000	6.6E-16 79.6%	6.1E-16 5.3E-16	uCi/ml As Received	NA NA		
1402165-13 SMP	U-235 Trg. Analyte	2/4/2014 3:38:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21400000 ml 21400000 ml	AlphaSpec2 93	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	0.000 1.000	32.05% 1000	0E+00 79.6%	7.1E-16 4.8E-16	uCi/ml As Received	NA NA		U
1402165-13 SMP	U-238 Trg. Analyte	2/4/2014 3:38:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21400000 ml 21400000 ml	AlphaSpec2 93	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1.000 4.000	32.05% 1000	8E-17 79.6%	9.9E-16 5E-16	uCi/ml As Received	NA NA		U
1402165-14 SMP	U-232 Tracer	2/4/2014 3:41:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21000000 ml 21000000 ml	AlphaSpec2 94	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1159.000 2.000	32.10% 1000	7.8E-14 76.4%	1E-15 1.2E-14	uCi/ml As Received	NA NA		
1402165-14 SMP	U-234 Trg. Analyte	2/4/2014 3:41:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21000000 ml 21000000 ml	AlphaSpec2 94	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	3.000 5.000	32.10% 1000	2.6E-16 76.4%	1.15E-15 6.3E-16	uCi/ml As Received	NA NA		U
1402165-14 SMP	U-235 Trg. Analyte	2/4/2014 3:41:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21000000 ml 21000000 ml	AlphaSpec2 94	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	0.000 3.000	32.10% 1000	0E+00 76.4%	1.11E-15 5.1E-16	uCi/ml As Received	NA NA		U

**Comments:**

**Data Package ID: UR1402165-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

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- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402165

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Tuesday, February 25, 2014  
7:46:25 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DeclEv	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402165-14 SMP	U-238 Trg. Analyte	2/4/2014 3:41:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	21000000 ml 21000000 ml	AlphaSpec2 94	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	2.000 3.000	32.10% 1000	1000 76.4%	1.8E-16 5E-16	9.4E-16 NA	uCi/ml As Received	NA NA	NA U
1402165-15 SMP	U-232 Tracer	2/4/2014 3:44:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	20500000 ml 20500000 ml	AlphaSpec2 95	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	1018.000 3.000	32.13% 1000	1000 67.0%	7E-14 1.1E-14	1E-15 NA	uCi/ml As Received	NA NA	NA
1402165-15 SMP	U-234 Trg. Analyte	2/4/2014 3:44:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	20500000 ml 20500000 ml	AlphaSpec2 95	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	163.000 3.000	32.13% 1000	1000 67.0%	1.66E-14 3.8E-15	1.1E-15 NA	uCi/ml As Received	NA NA	NA
1402165-15 SMP	U-235 Trg. Analyte	2/4/2014 3:44:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	20500000 ml 20500000 ml	AlphaSpec2 95	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	8.000 1.000	32.13% 1000	1000 67.0%	9.6E-16 7.7E-16	8.8E-16 NA	uCi/ml As Received	NA NA	NA
1402165-15 SMP	U-238 Trg. Analyte	2/4/2014 3:44:00 PM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	20500000 ml 20500000 ml	AlphaSpec2 95	AS140215-1UR Spectrum #1	2/21/2014 2:03 PM	6.000 1.000	32.13% 1000	1000 67.0%	6.1E-16 5.9E-16	7.5E-16 NA	uCi/ml As Received	NA NA	NA U
AS140215-1M MB	U-232 Tracer	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 87	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1262.000 2.000	31.55% 1000	1000 84.6%	5.97E-14 9.5E-15	4E-16 NA	uCi/ml As Received	NA NA	NA
AS140215-1M MB	U-234 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 87	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	6.000 0.000	31.55% 1000	1000 84.6%	3.4E-16 2.8E-16	1.5E-16 NA	uCi/ml As Received	NA NA	NA
AS140215-1M MB	U-235 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 87	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	3.000 1.000	31.55% 1000	1000 84.6%	2E-16 3.2E-16	4.8E-16 NA	uCi/ml As Received	NA NA	NA U
AS140215-1M MB	U-238 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 87	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	2.000 1.000	31.55% 1000	1000 84.6%	1.1E-16 2.7E-16	4.1E-16 NA	uCi/ml As Received	NA NA	NA U
AS140215-1P MB	U-232 Tracer	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 88	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1006.000 4.000	30.79% 1000	1000 69.1%	4.88E-14 7.9E-15	6E-16 NA	uCi/ml As Received	NA NA	NA
AS140215-1P MB	U-234 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 88	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	5.000 1.000	30.79% 1000	1000 69.1%	3.5E-16 3.8E-16	5.2E-16 NA	uCi/ml As Received	NA NA	NA U

**Comments:**

**Data Package ID: UR1402165-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit



# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402165

Analytical SOP: PAI 714

7:46:25 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
AS140215-1P MB	U-235 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 88	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	0.000 1.000	30.79% 1000	1000 69.1%	0E+00 4E-16	6.1E-16 NA	uCi/ml As Received	NA NA	U
AS140215-1P MB	U-238 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 88	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1.000 3.000	30.79% 1000	1000 69.1%	7E-17 3.7E-16	7.6E-16 NA	uCi/ml As Received	NA NA	U
AS140215-1 LCS	U-232 Tracer	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 89	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1111.000 7.000	31.24% 1000	1000 75.2%	5.31E-14 8.5E-15	7E-16 NA	uCi/ml As Received	NA NA	
AS140215-1 LCS	U-234 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 89	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1158.000 3.000	31.24% 1000	1000 75.2%	7.4E-14 1.3E-14	1E-15 NA	uCi/ml As Received	NA NA	101 P
AS140215-1 LCS	U-238 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 89	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1167.000 0.000	31.24% 1000	1000 75.2%	7.4E-14 1.3E-14	0E+00 NA	uCi/ml As Received	NA NA	97.6 P
AS140215-1 LCSD	U-232 Tracer	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 90	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1092.000 5.000	30.90% 1000	1000 74.7%	5.28E-14 8.5E-15	6E-16 NA	uCi/ml As Received	NA NA	
AS140215-1 LCSD	U-234 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 90	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1140.000 0.000	30.90% 1000	1000 74.7%	7.4E-14 1.3E-14	0E+00 NA	uCi/ml As Received	0.01 NA	101 P
AS140215-1 LCSD	U-238 Trg. Analyte	2/15/2014 8:04:19 AM	AS140215-1 AS140215-1-1	NA NA	NA NA	FILTER NA	30200000 ml 30200000 ml	AlphaSpec2 90	AS140215-1UR Spectrum #1	2/22/2014 3:03 PM	1294.000 2.000	30.90% 1000	1000 74.7%	8.4E-14 1.4E-14	1E-15 NA	uCi/ml As Received	0.50 NA	110 P

**Comments:**

**Data Package ID:** UR1402165-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
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- N - Matrix Spike Recovery outside control limits
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- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
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**Abbreviations:**

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- TPU - Total Propagated Uncertainty
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- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

4114

# ALS Laboratory Group - Fort Collins

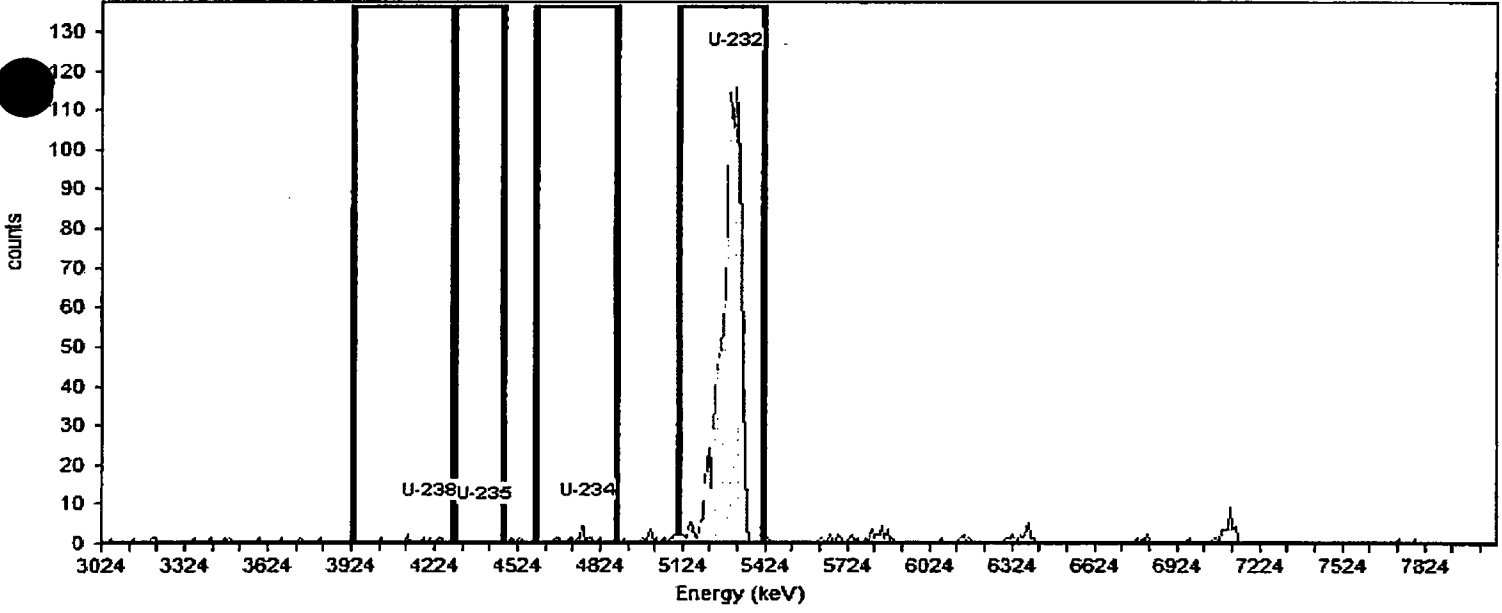
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402165-1  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 81  
 Batch Name: UAS140215-1\_A  
 Nuclide Library: Uranium  
 Analysis Method: ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 2:03:37PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021881; Det: 81; Spectrum #1; 2/18/2014 10:34:49 AM  
 Calibration Date: 2/18/2014 10:14:53AM  
 Efficiency Calibration: C14021881  
 Efficiency: 30.83% +/- 0.20% TPU(2 sigma)  
 Energy Calibration: C14021881  
 Energy Cal: Gain = 9.9176 keV / Ch  
 Offset = 3,014.71 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 65.55%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4204.8	3927.1	4284.2	21.9	100.2	7.00	1.00	6.00	2.7E-002	1.3E-002	1.0E-002	3.3E-002
U-235	4403.2	4294.1	4472.6	.0	80.9	0.00	1.00	-1.00	-5.5E-003	7.8E-003	1.3E-002	4.1E-002
U-234	4780.0	4591.6	4879.2	28.3	100.0	13.00	0.00	13.00	5.8E-002	1.7E-002	0.0E+000	1.2E-002
U-232	5315.6	5107.3	5414.8	66.1	100.1	960.00	2.00	958.00	2.9E+000	9.4E-002	1.5E-002	4.3E-002

Reviewed By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-2  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 82  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.11 min.  
Dead Time: 0.01 %

### Calibration

Bkgd Info: Sample: B14021882; Det: 82; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:11AM

Efficiency Calibration: C14021882

Efficiency: 30.65% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021882

Energy Cal: Gain = 9.9003 keV / Ch

Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

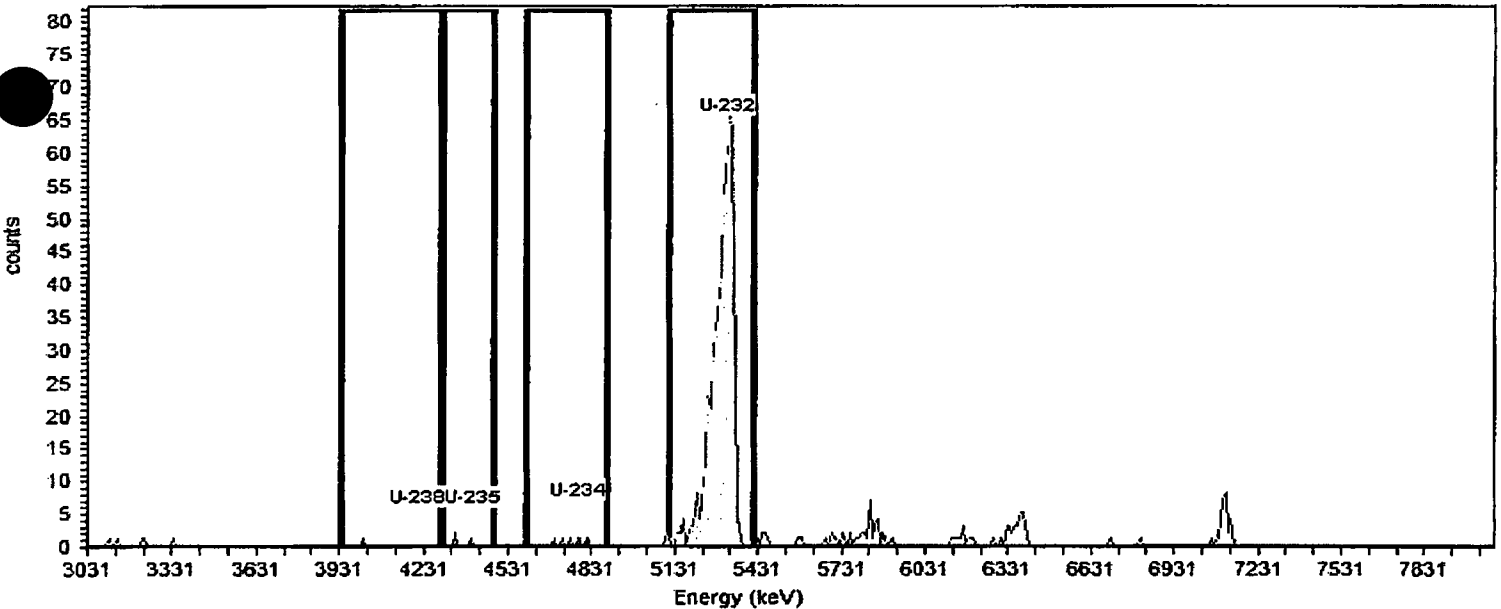
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 35.11%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	59.1	100.2	1.00	2.00	-1.00	-8.4E-003	1.4E-002	2.7E-002	7.8E-002
U-235	4407.3	4298.4	4476.6	24.2	80.9	3.00	0.00	3.00	3.1E-002	2.1E-002	0.0E+000	2.8E-002
U-234	4783.5	4595.4	4882.5	22.3	100.0	5.00	0.00	5.00	4.2E-002	2.1E-002	0.0E+000	2.3E-002
U-232	5318.1	5110.2	5417.1	66.8	100.1	512.00	2.00	510.00	1.6E+000	6.9E-002	2.9E-002	8.1E-002

Reviewed By:

JP

JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

Print Date: 2/24/2014

AlphaVision v5.3

Custom Report Iteration: 05/21/09

48 of 114 of 1

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402165-3  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 83  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.18 min.  
Dead Time: 0.02 %

### Calibration

Bkgd Info: Sample: B14021883; Det: 83; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:30AM

Energy Calibration: C14021883

Efficiency Calibration: C14021883

Energy Cal: Gain = 9.8810 keV / Ch  
Offset = 3,028.21 keV

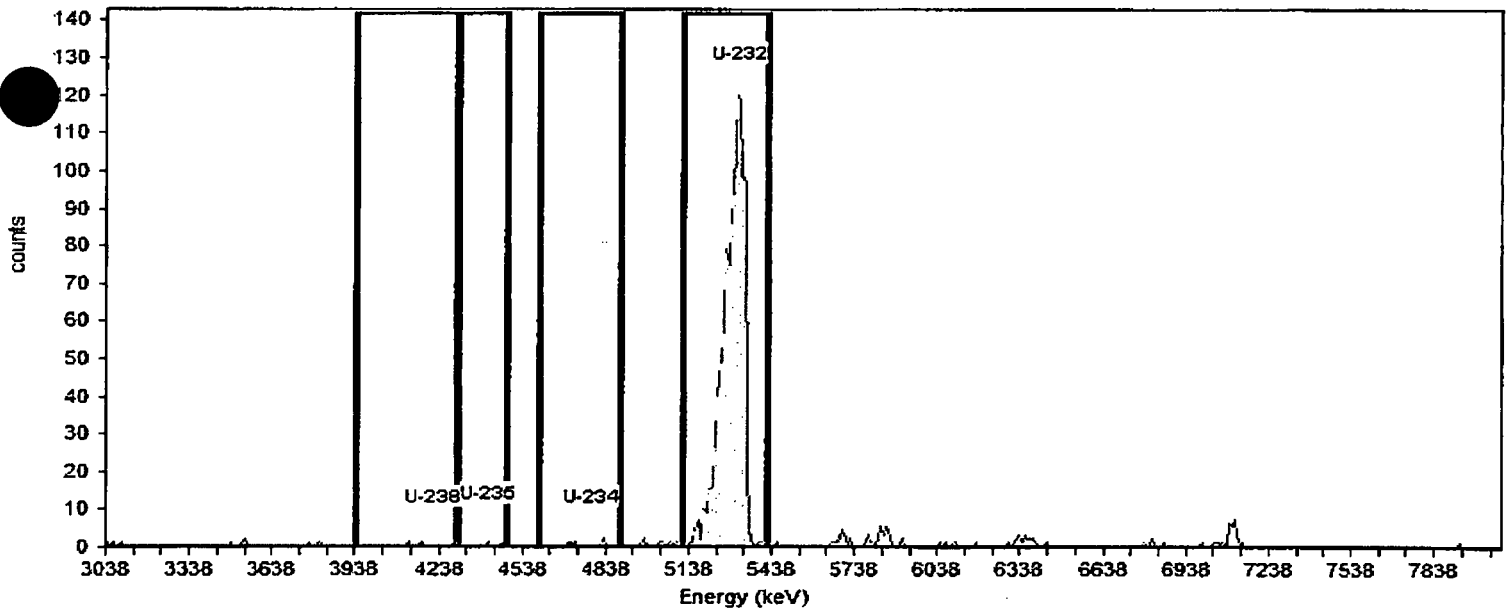
Efficiency: 31.20% +/- 0.16% TPU(2 sigma)

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 70.04%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	.4	100.2	4.00	2.00	2.00	8.2E-003	1.0E-002	1.4E-002	3.8E-002
U-235	4411.5	4302.9	4480.7	14.6	80.9	2.00	0.00	2.00	1.0E-002	8.8E-003	0.0E+000	1.4E-002
U-234	4787.0	4599.3	4885.8	127.8	100.0	4.00	5.00	-1.00	-4.1E-003	1.2E-002	2.1E-002	5.4E-002
U-232	5320.6	5113.1	5419.4	86.2	100.1	1,037.00	1.00	1,036.00	3.1E+000	9.7E-002	9.9E-003	3.1E-002

Reviewed By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-4  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 84  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:34PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.00 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021884; Det: 84; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:49AM

Efficiency Calibration: C14021884

Efficiency: 30.40% +/- 0.21% TPU(2 sigma)

Energy Calibration: C14021884

Energy Cal: Gain = 9.9003 keV / Ch

Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

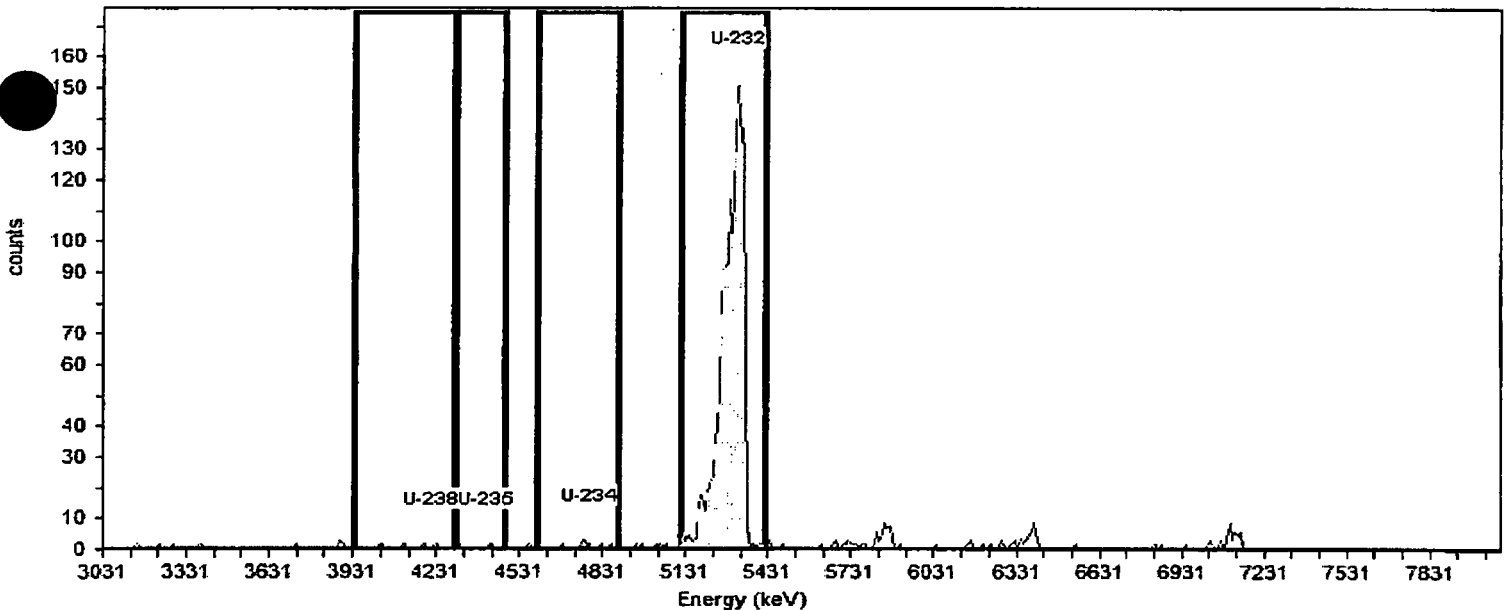
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 90.76%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	.4	100.2	6.00	0.00	6.00	2.0E-002	8.7E-003	0.0E+000	8.8E-003
U-235	4407.3	4298.4	4476.6	16.9	80.9	2.00	2.00	0.00	0.0E+000	8.1E-003	1.3E-002	3.7E-002
U-234	4783.5	4595.4	4882.5	30.7	100.0	8.00	0.00	8.00	2.6E-002	9.9E-003	0.0E+000	8.8E-003
U-232	5318.1	5110.2	5417.1	86.9	100.1	1,310.00	2.00	1,308.00	4.0E+000	1.1E-001	1.1E-002	3.1E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-5  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 85  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021885; Det: 85; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:16:07AM

Efficiency Calibration: C14021885

Efficiency: 30.11% +/- 0.13% TPU(2 sigma)

Energy Calibration: C14021885

Energy Cal: Gain = 9.8224 keV / Ch

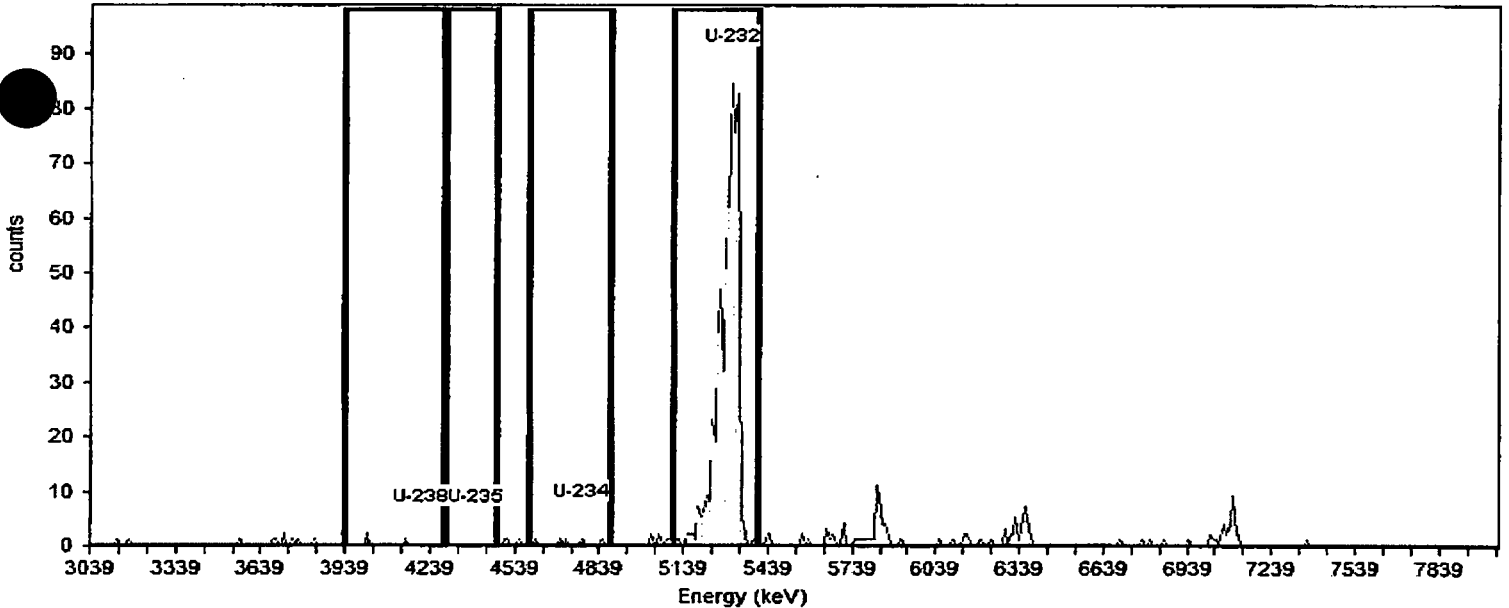
Offset = 3,029.39 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 42.60%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.1	3933.1	4286.7	58.6	100.2	3.00	0.00	3.00	2.1E-002	1.4E-002	0.0E+000	1.9E-002
U-235	4404.5	4296.5	4473.3	.0	80.9	0.00	0.00	0.00	0.0E+000	1.2E-002	0.0E+000	2.3E-002
U-234	4777.8	4591.2	4876.0	130.8	100.0	5.00	0.00	5.00	3.5E-002	1.7E-002	0.0E+000	1.9E-002
U-232	5308.2	5101.9	5406.4	51.3	100.1	609.00	1.00	608.00	1.9E+000	7.7E-002	1.7E-002	5.4E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-6  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 86  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021886; Det: 86; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:16:26AM

Energy Calibration: C14021886

Efficiency Calibration: C14021886

Energy Cal: Gain = 9.8047 keV / Ch

Efficiency: 30.61% +/- 0.15% TPU(2 sigma)

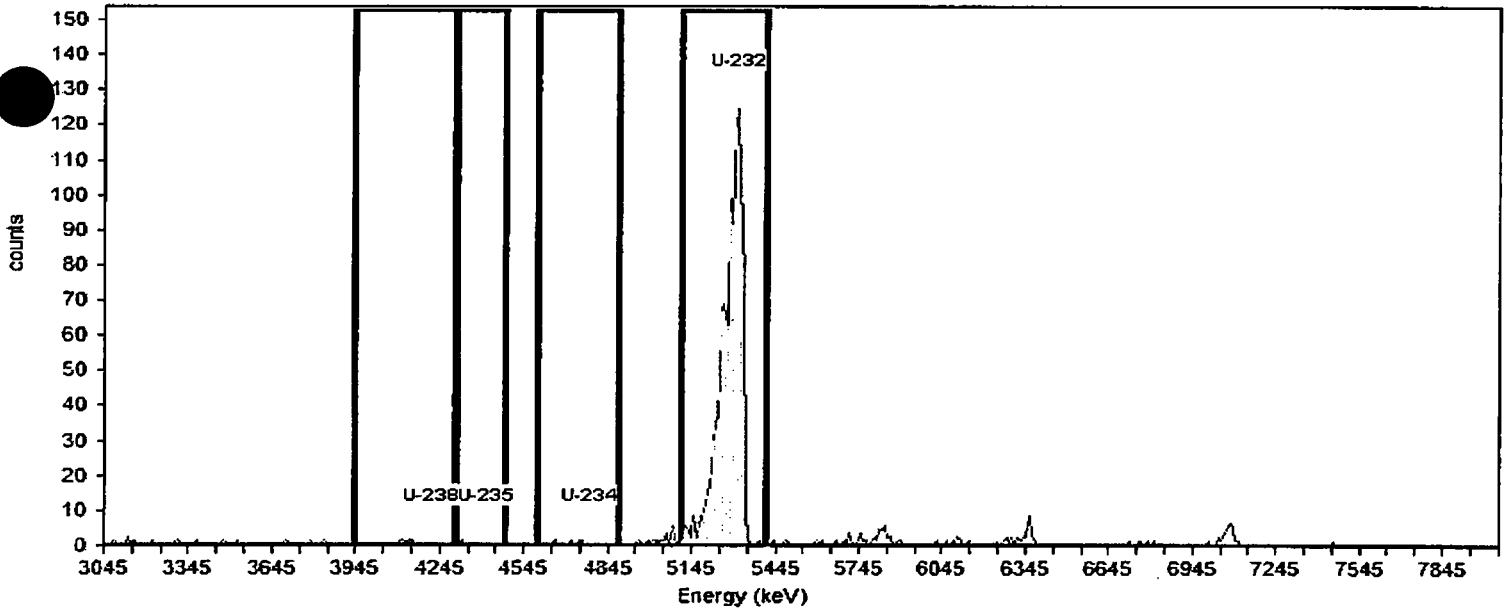
Offset = 3,036.00 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 69.95%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	.0	100.2	5.00	0.00	5.00	2.1E-002	1.0E-002	0.0E+000	1.1E-002
U-235	4408.7	4300.8	4477.3	26.8	80.9	1.00	2.00	-1.00	-5.2E-003	9.0E-003	1.7E-002	4.8E-002
U-234	4781.2	4595.0	4879.3	108.0	100.0	4.00	1.00	3.00	1.3E-002	9.4E-003	9.8E-003	3.1E-002
U-232	5310.7	5104.8	5408.8	80.4	100.1	1,018.00	3.00	1,015.00	3.1E+000	9.8E-002	1.8E-002	4.7E-002

Reviewed By: JP

JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-7  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 87  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.02 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021887; Det: 87; Spectrum #1; 2/18/2014 10:34:51 AM

Calibration Date: 2/18/2014 10:16:46AM

Efficiency Calibration: C14021887

Efficiency: 31.55% +/- 0.19% TPU(2 sigma)

Energy Calibration: C14021887

Energy Cal: Gain = 9.7851 keV / Ch

Offset = 3,042.97 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

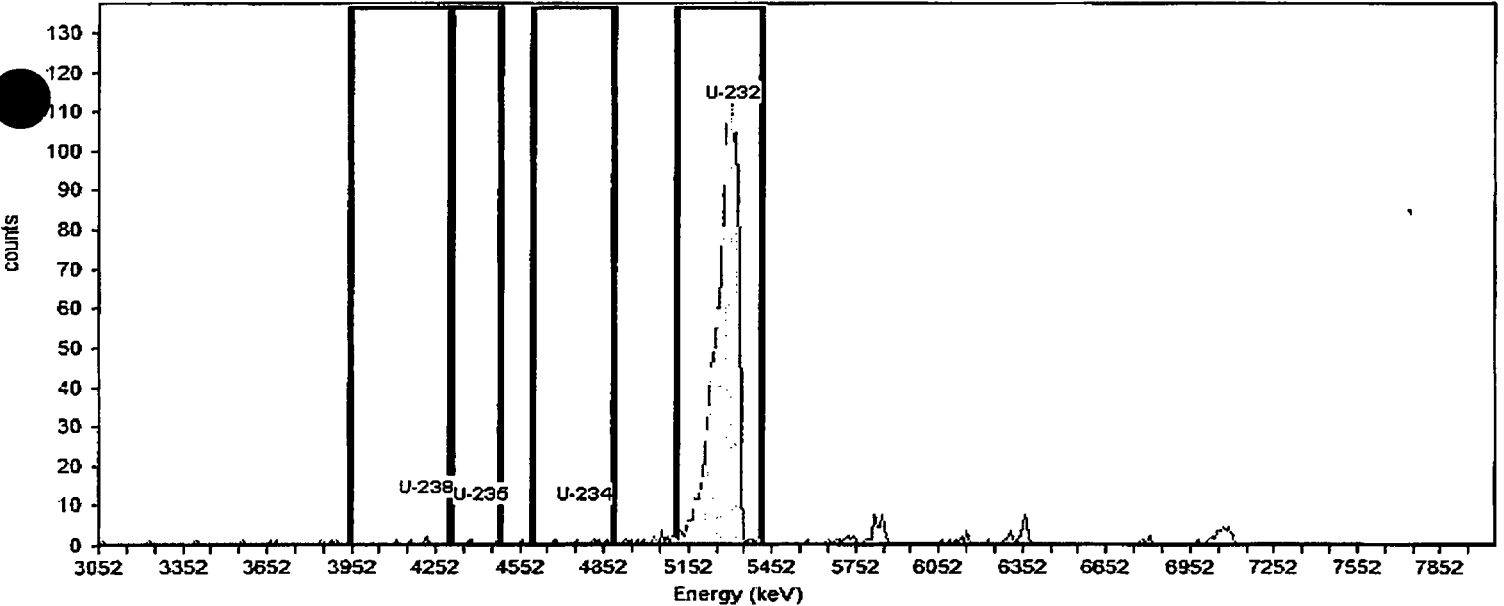
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 71.47%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.2	3943.2	4295.5	127.2	100.2	4.00	1.00	3.00	1.2E-002	8.9E-003	9.3E-003	2.9E-002
U-235	4412.9	4305.2	4481.4	13.2	80.9	2.00	1.00	1.00	4.9E-003	8.6E-003	1.1E-002	3.6E-002
U-234	4784.7	4598.8	4882.6	13.9	100.0	5.00	0.00	5.00	2.0E-002	9.9E-003	0.0E+000	1.1E-002
U-232	5313.1	5107.6	5411.0	78.7	100.1	1,071.00	2.00	1,069.00	3.2E+000	9.7E-002	1.4E-002	3.8E-002

Reviewed By:  

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-8  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 88  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021888; Det: 88; Spectrum #1; 2/18/2014 10:34:51 AM

Calibration Date: 2/18/2014 10:17:09AM

Efficiency Calibration: C14021888

Efficiency: 30.79% +/- 0.12% TPU(2 sigma)

Energy Calibration: C14021888

Energy Cal: Gain = 9.8224 keV / Ch

Offset = 3,029.39 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

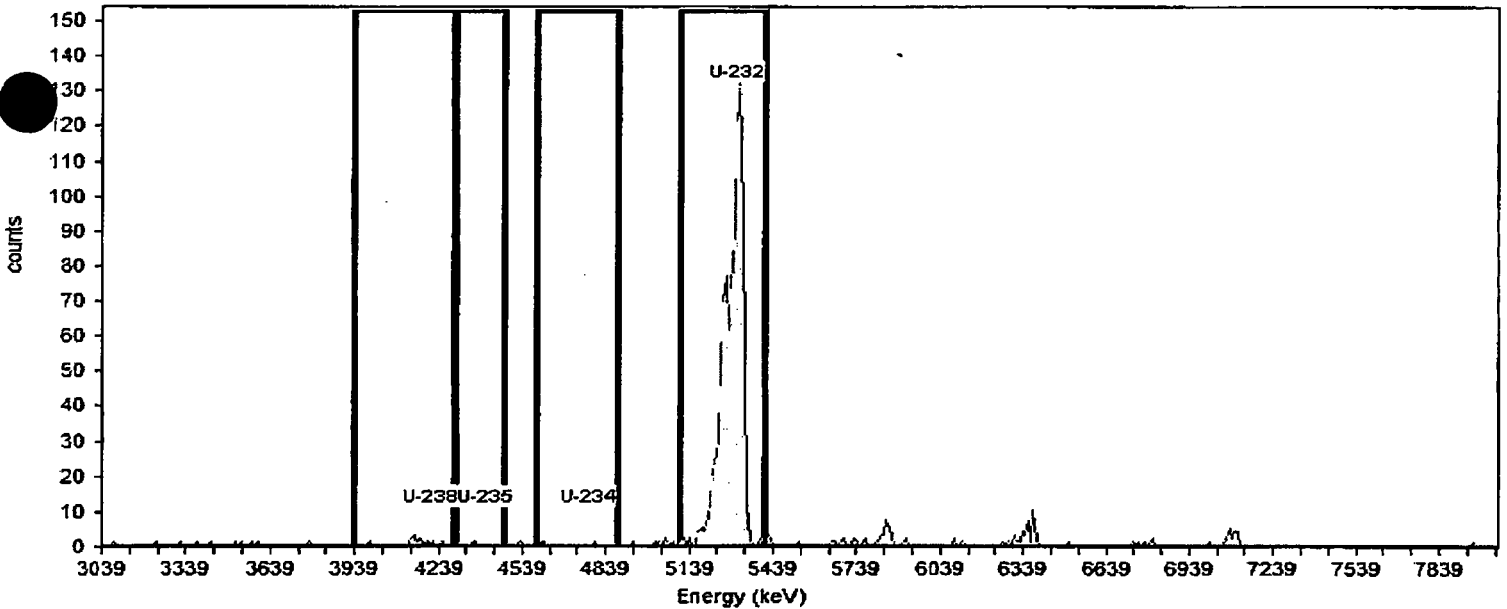
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 64.34%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.1	3933.1	4286.7	60.1	100.2	13.00	3.00	10.00	4.5E-002	1.8E-002	1.8E-002	4.9E-002
U-235	4404.5	4296.5	4473.3	24.1	80.9	1.00	1.00	0.00	0.0E+000	8.0E-003	1.3E-002	4.1E-002
U-234	4777.8	4591.2	4876.0	.4	100.0	3.00	1.00	2.00	9.1E-003	9.1E-003	1.1E-002	3.3E-002
U-232	5308.2	5101.9	5406.4	78.0	100.1	943.00	4.00	939.00	2.8E+000	9.3E-002	2.2E-002	5.7E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

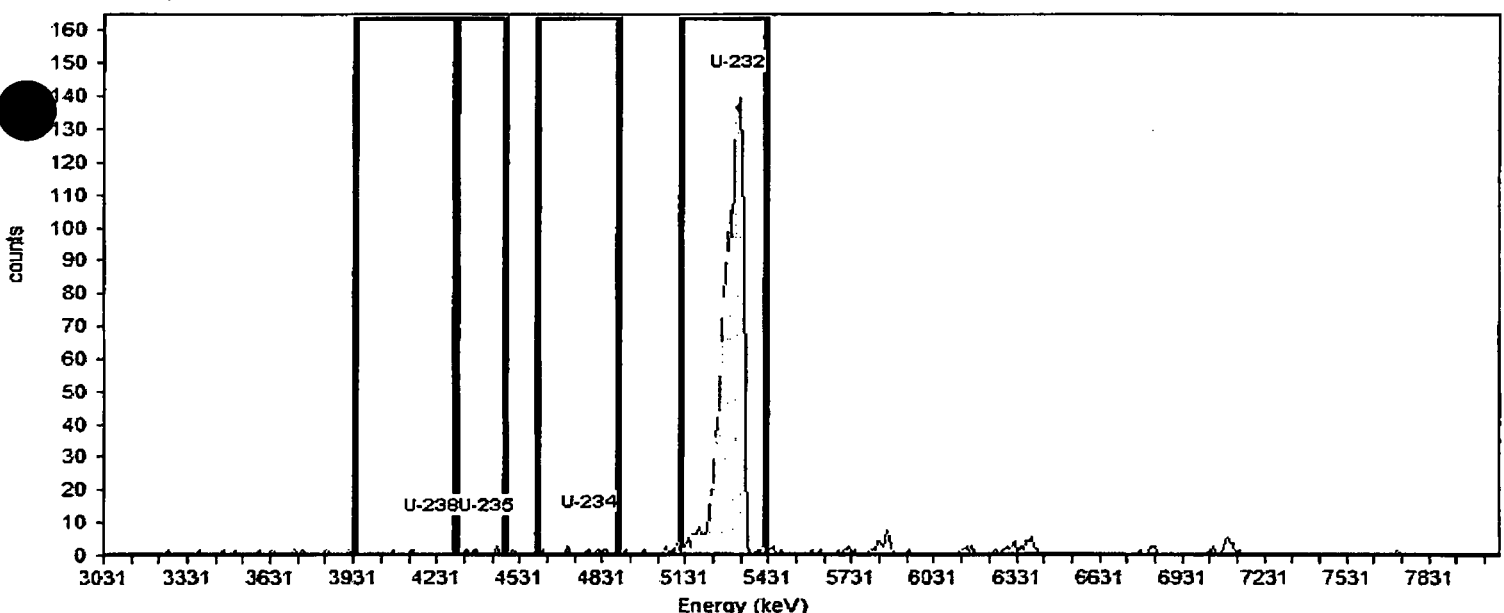
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402165-9      Sample Size : 0.50  
 Spectrum #1      Analysis #1

**Acquisition**  
 Detector: 89      Acquisition Start Date: 2/21/2014 2:03:36PM  
 Batch Name: UAS140215-1\_A      Live Time: 1,000.00 min.  
 Nuclide Library: Uranium      Real Time: 1,000.01 min.  
 Analysis Method: ROI Analysis, Set Name = Uranium Default      Dead Time: 0.00 %  
 ROI Set: Uranium Default

**Calibration**  
 Bkgd Info: Sample: B14021889; Det: 89; Spectrum #1; 2/18/2014 10:35:40 AM  
 Calibration Date: 2/18/2014 10:21:39AM      Energy Calibration: C14021889  
 Efficiency Calibration: C14021889      Energy Cal: Gain = 9.9003 keV / Ch  
 Efficiency: 31.24% +/- 0.20% TPU(2 sigma)      Offset = 3,021.28 keV  
    Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232      Tracer Nuclide: U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM      Tracer Recovery: 78.19%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	127.1	100.2	2.00	0.00	2.00	7.4E-003	6.4E-003	0.0E+000	1.0E-002
U-235	4407.3	4298.4	4476.6	125.1	80.9	4.00	0.00	4.00	1.8E-002	1.0E-002	0.0E+000	1.2E-002
U-234	4783.5	4595.4	4882.5	109.0	100.0	8.00	3.00	5.00	1.8E-002	1.2E-002	1.5E-002	4.0E-002
U-232	5318.1	5110.2	5417.1	77.8	100.1	1,165.00	7.00	1,158.00	3.5E+000	1.0E-001	2.4E-002	5.7E-002

*JP*

*JA*

Reviewed By:

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-10  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 90  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021890; Det: 90; Spectrum #1; 2/18/2014 10:35:40 AM

Calibration Date: 2/18/2014 10:21:56AM

Efficiency Calibration: C14021890

Efficiency: 30.90% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021890

Energy Cal: Gain = 9.9003 keV / Ch

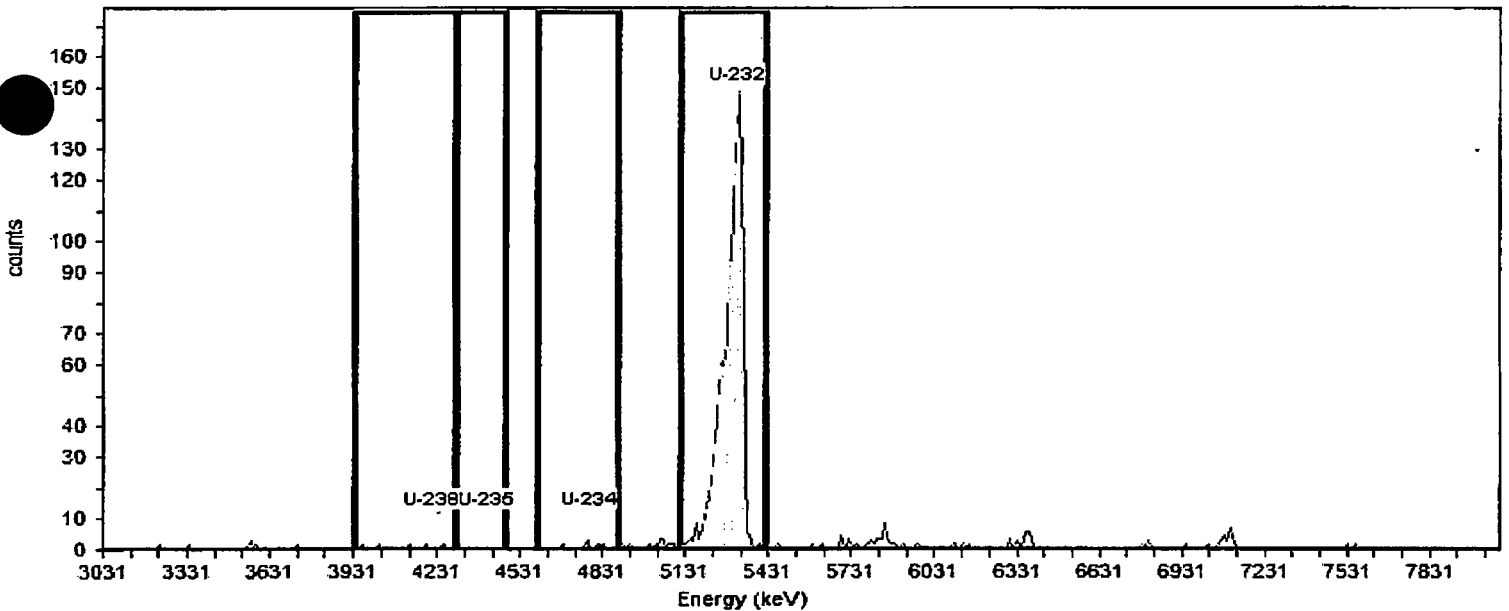
Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 74.07%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	12.6	100.2	5.00	2.00	3.00	1.2E-002	1.0E-002	1.3E-002	3.6E-002
U-235	4407.3	4298.4	4476.6	.0	80.9	0.00	0.00	0.00	0.0E+000	6.9E-003	0.0E+000	1.3E-002
U-234	4783.5	4595.4	4882.5	112.6	100.0	6.00	0.00	6.00	2.4E-002	1.1E-002	0.0E+000	1.1E-002
U-232	5318.1	5110.2	5417.1	60.0	100.1	1,090.00	5.00	1,085.00	3.3E+000	1.0E-001	2.1E-002	5.3E-002

Reviewed By: JP

JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

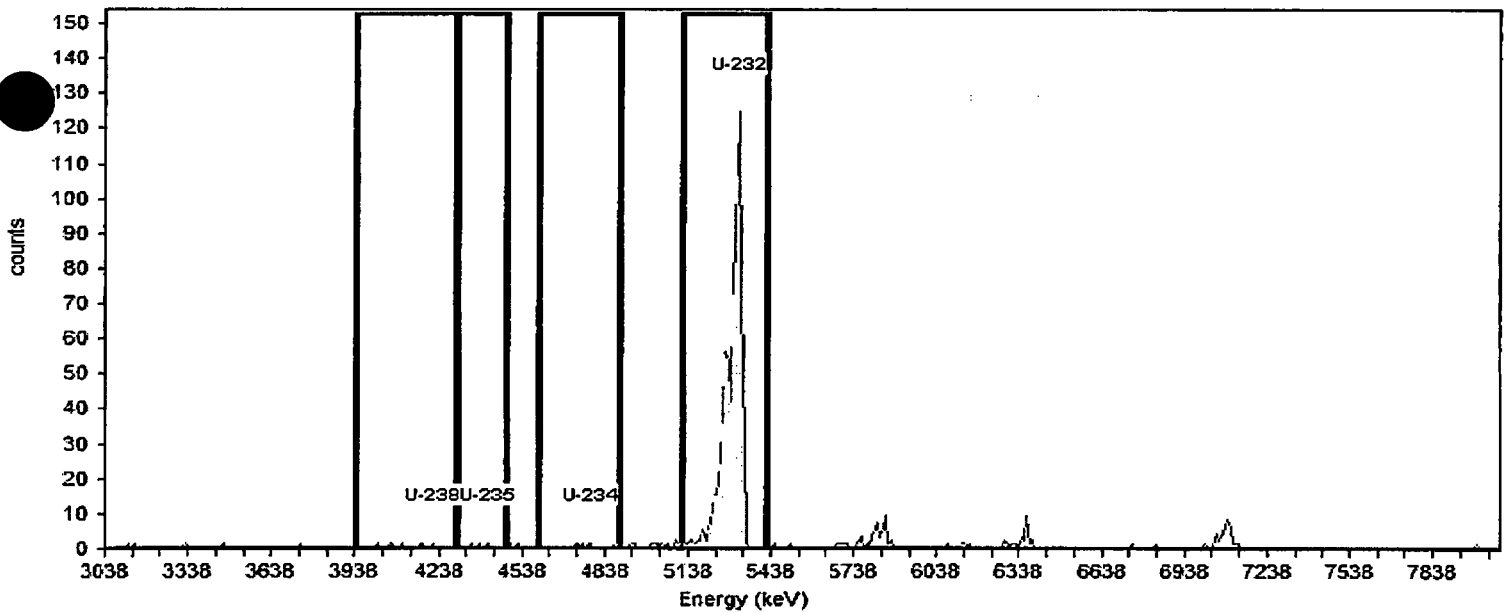
## Alpha-Spectroscopy Analysis Report

Sample: 1402165-11 Sample Size : 0.50  
Spectrum #1 Analysis #1


Detector: 91 Acquisition Start Date: 2/21/2014 2:03:36PM  
Batch Name: UAS140215-1\_A Live Time: 1,000.00 min.  
Nuclide Library: Uranium Real Time: 1,000.01 min.  
Analysis Method: ROI Analysis, Set Name = Uranium Default Dead Time: 0.00 %  
ROI Set: Uranium Default

Calibration  
Bkgd Info: Sample: B14021891; Det: 91; Spectrum #1; 2/18/2014 10:35:41 AM  
Calibration Date: 2/18/2014 10:22:19AM Energy Calibration: C14021891  
Efficiency Calibration: C14021891 Energy Cal: Gain = 9.8810 keV / Ch  
Efficiency: 30.35% +/- 0.16% TPU(2 sigma) Offset = 3,028.21 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Tracer  
Tracer Name: 914.4095.46\_U-232 Tracer Nuclide: U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM Tracer Recovery: 47.34%



Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	113.8	100.2	5.00	1.00	4.00	2.5E-002	1.5E-002	1.5E-002	4.6E-002
U-235	4411.5	4302.9	4480.7	83.0	80.9	3.00	2.00	1.00	7.8E-003	1.7E-002	2.6E-002	7.2E-002
U-234	4787.0	4599.3	4885.8	199.9	100.0	6.00	0.00	6.00	3.8E-002	1.7E-002	0.0E+000	1.7E-002
U-232	5320.6	5113.1	5419.4	37.8	100.1	685.00	4.00	681.00	2.1E+000	8.1E-002	3.0E-002	7.8E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402165-12  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 92  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.00 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021892; Det: 92; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:22:35AM

Efficiency Calibration: C14021892

Efficiency: 31.14% +/- 0.21% TPU(2 sigma)

Energy Calibration: C14021892

Energy Cal: Gain = 9.7851 keV / Ch

Offset = 3,042.97 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

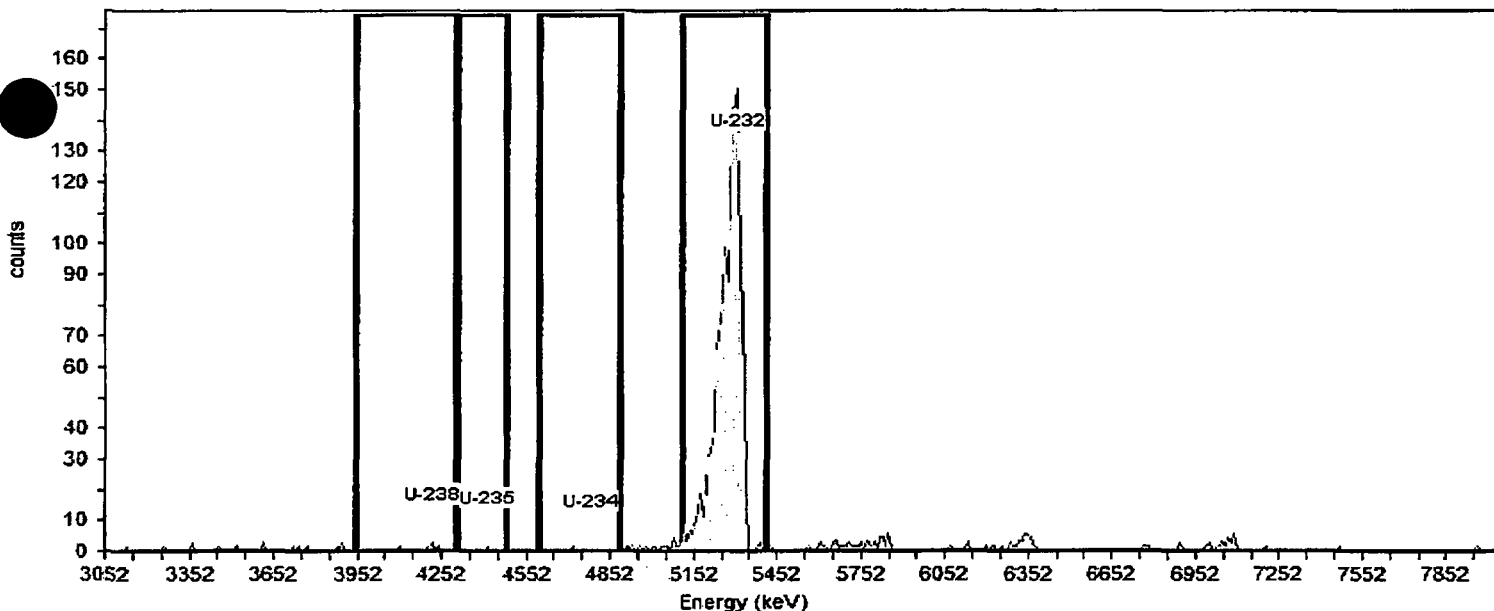
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 88.21%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.2	3943.2	4295.5	55.3	100.2	5.00	3.00	2.00	6.5E-003	9.3E-003	1.3E-002	3.5E-002
U-235	4412.9	4305.2	4481.4	24.0	80.9	1.00	0.00	1.00	4.1E-003	5.7E-003	0.0E+000	1.1E-002
U-234	4784.7	4598.8	4882.6	24.0	100.0	1.00	0.00	1.00	3.3E-003	4.6E-003	0.0E+000	8.9E-003
U-232	5313.1	5107.6	5411.0	83.1	100.1	1,303.00	1.00	1,302.00	3.9E+000	1.1E-001	7.9E-003	2.5E-002

Reviewed By:

*[Handwritten Signature]*

*[Handwritten Signature]*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-13  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 93  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021893; Det: 93; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:22:53AM

Energy Calibration: C14021893

Efficiency Calibration: C14021893

Energy Cal: Gain = 9.9003 keV / Ch

Efficiency: 32.05% +/- 0.13% TPU(2 sigma)

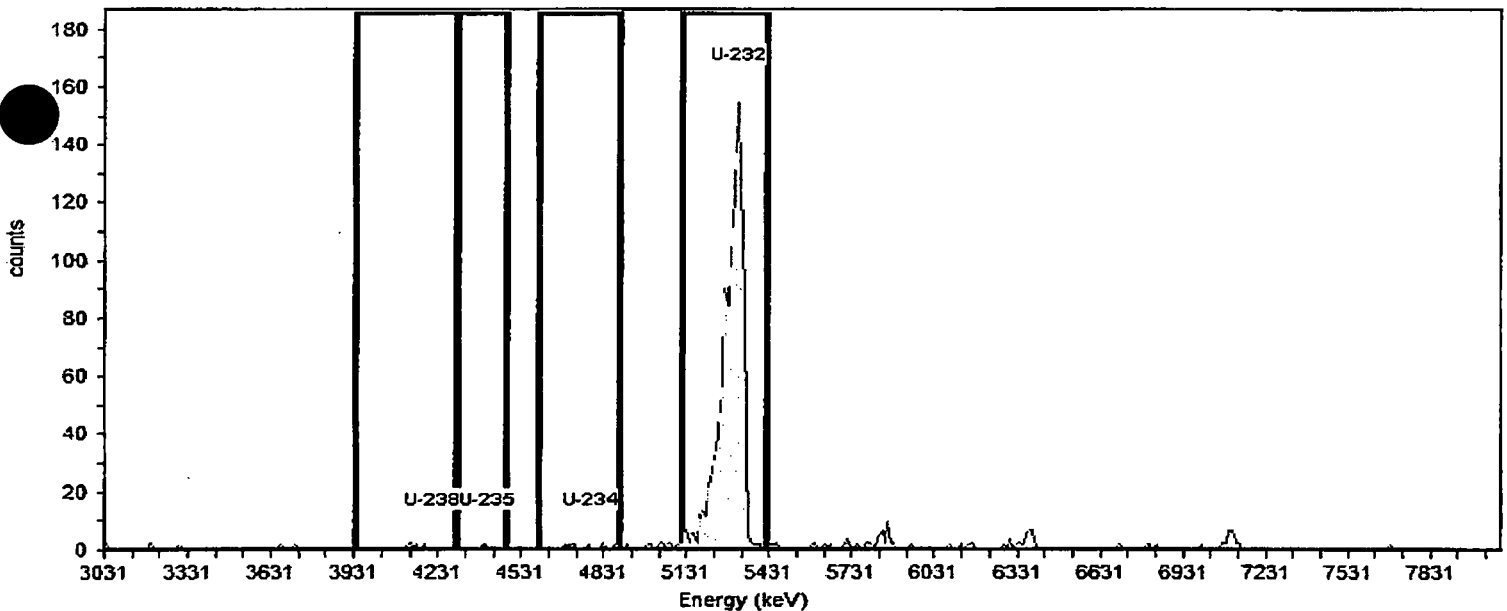
Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 79.38%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	62.2	100.2	5.00	4.00	1.00	3.5E-003	1.1E-002	1.6E-002	4.2E-002
U-235	4407.3	4298.4	4476.6	24.2	80.9	1.00	1.00	0.00	0.0E+000	6.2E-003	1.0E-002	3.2E-002
U-234	4783.5	4595.4	4882.5	331.5	100.0	9.00	1.00	8.00	2.8E-002	1.1E-002	8.2E-003	2.6E-002
U-232	5318.1	5110.2	5417.1	74.6	100.1	1,213.00	7.00	1,206.00	3.5E+000	1.0E-001	2.3E-002	5.5E-002

Reviewed By: *[Signature]*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402165-14  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 94  
Batch Name: UAS140215-1\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 2:03:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.12 min.  
Dead Time: 0.01 %

### Calibration

Bkgd Info: Sample: B14021894; Det: 94; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:23:21AM

Efficiency Calibration: C14021894

Efficiency: 32.10% +/- 0.16% TPU(2 sigma)

Energy Calibration: C14021894

Energy Cal: Gain = 9.8810 keV / Ch

Offset = 3,028.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

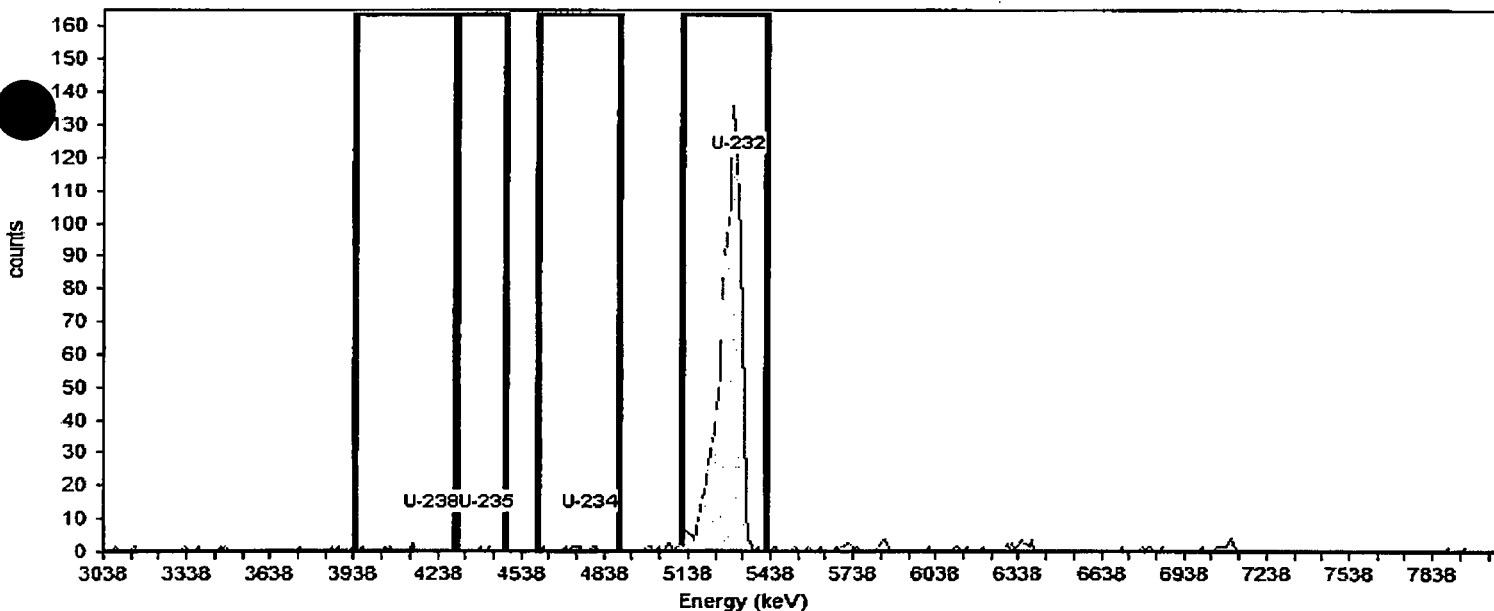
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 76.17%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	223.8	100.2	5.00	3.00	2.00	7.4E-003	1.0E-002	1.5E-002	4.0E-002
U-235	4411.5	4302.9	4480.7	.0	80.9	3.00	3.00	0.00	0.0E+000	1.1E-002	1.8E-002	4.9E-002
U-234	4787.0	4599.3	4885.8	44.4	100.0	8.00	5.00	3.00	1.1E-002	1.3E-002	1.9E-002	4.8E-002
U-232	5320.6	5113.1	5419.4	80.6	100.1	1,161.00	2.00	1,159.00	3.4E+000	9.9E-002	1.3E-002	3.5E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

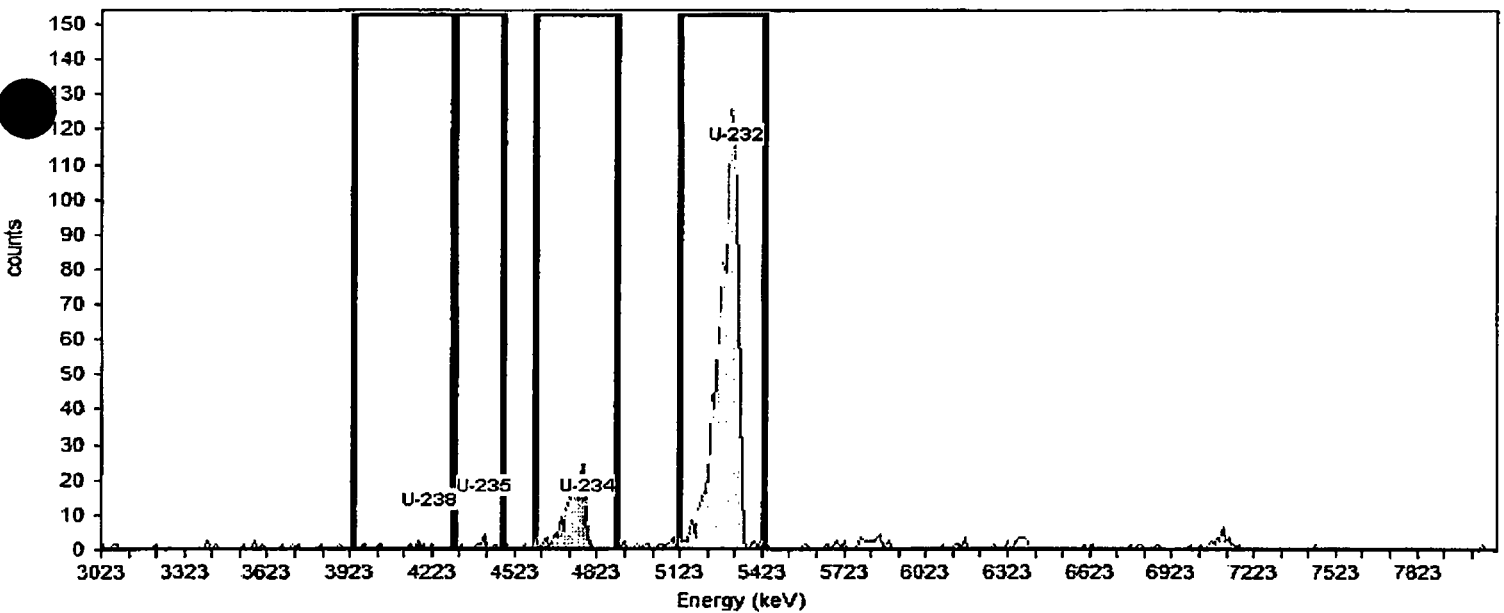
## Alpha-Spectroscopy Analysis Report

Sample: 1402165-15      Sample Size : 0.50  
 Spectrum #1      Analysis #1

**Acquisition**  
 Detector: 95      Acquisition Start Date: 2/21/2014 2:03:35PM  
 Batch Name: UAS140215-1\_A      Live Time: 1,000.00 min.  
 Nuclide Library: Uranium      Real Time: 1,000.02 min.  
 Analysis Method: ROI Analysis, Set Name = Uranium Default      Dead Time: 0.00 %  
 ROI Set: Uranium Default

**Calibration**  
 Bkgd Info: Sample: B14021895; Det: 95; Spectrum #1; 2/18/2014 10:35:41 AM  
 Calibration Date: 2/18/2014 10:23:39AM      Energy Calibration: C14021895  
 Efficiency Calibration: C14021895      Energy Cal: Gain = 9.9784 keV / Ch  
 Efficiency: 32.13% +/- 0.19% TPU(2 sigma)      Offset = 3,013.21 keV  
    Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232      Tracer Nuclide: U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM      Tracer Recovery: 66.84%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4210.6	3931.2	4290.5	72.2	100.2	7.00	1.00	6.00	2.5E-002	1.2E-002	9.7E-003	3.1E-002
U-235	4410.2	4300.4	4480.0	27.6	80.9	9.00	1.00	8.00	4.1E-002	1.7E-002	1.2E-002	3.8E-002
U-234	4789.4	4599.8	4889.2	69.8	100.0	166.00	3.00	163.00	6.8E-001	6.8E-002	1.7E-002	4.5E-002
U-232	5328.2	5118.7	5428.0	76.4	100.1	1,021.00	3.00	1,018.00	3.0E+000	9.3E-002	1.8E-002	4.7E-002

*JP*

*JA*

Reviewed By:

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS140215-1MMB  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 87  
Batch Name: UAS140215-1\_B  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/22/2014 3:03:40PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021887; Det: 87; Spectrum #1; 2/18/2014 10:34:51 AM

Calibration Date: 2/18/2014 10:16:46AM

Efficiency Calibration: C14021887

Efficiency: 31.55% +/- 0.19% TPU(2 sigma)

Energy Calibration: C14021887

Energy Cal: Gain = 9.7851 keV / Ch

Offset = 3,042.97 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

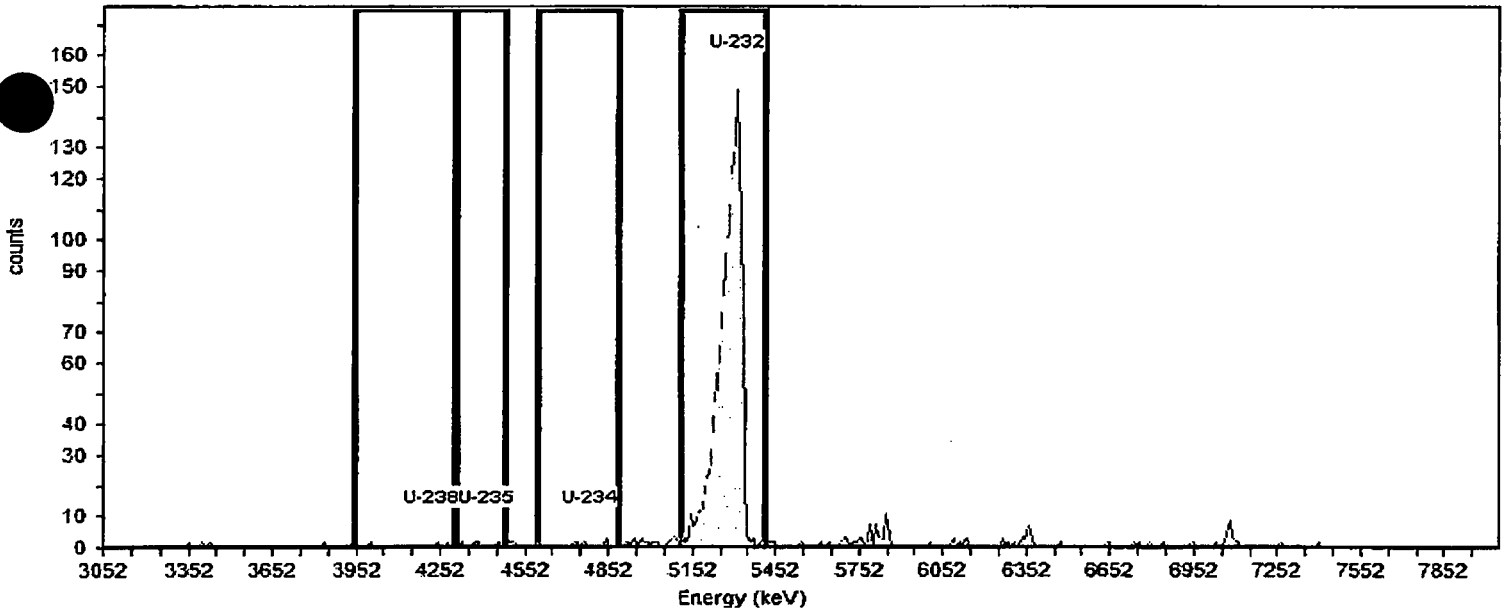
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 84.38%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.2	3943.2	4295.5	14.9	100.2	3.00	1.00	2.00	6.8E-003	6.8E-003	7.9E-003	2.5E-002
U-235	4412.9	4305.2	4481.4	74.3	80.9	4.00	1.00	3.00	1.3E-002	9.4E-003	9.7E-003	3.1E-002
U-234	4784.7	4598.8	4882.6	.0	100.0	6.00	0.00	6.00	2.0E-002	9.0E-003	0.0E+000	9.2E-003
U-232	5313.1	5107.6	5411.0	78.4	100.1	1,264.00	2.00	1,262.00	3.7E+000	1.1E-001	1.2E-002	3.3E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

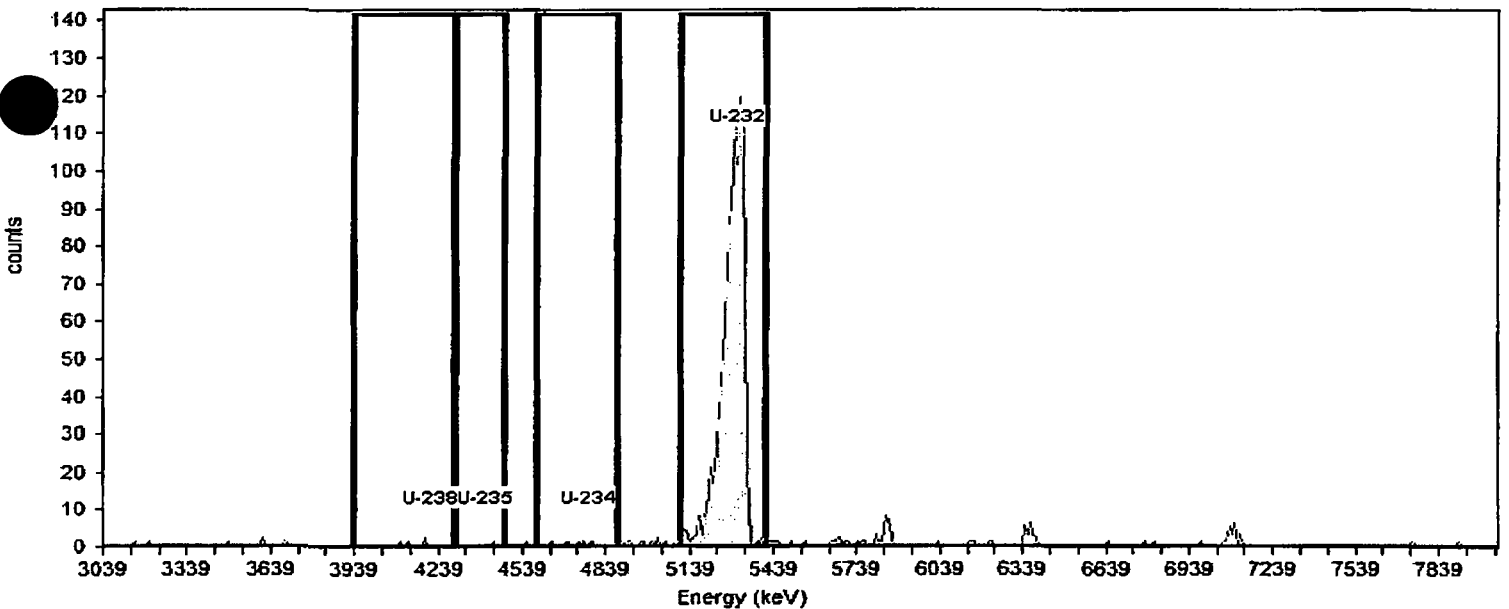
## Alpha-Spectroscopy Analysis Report

**Sample**  
Sample: AS140215-1PMB Sample Size : 0.50  
Spectrum #1 Analysis #1

**Acquisition**  
Detector: 88 Acquisition Start Date: 2/22/2014 3:03:40PM  
Batch Name: UAS140215-1\_B Live Time: 1,000.00 min.  
Nuclide Library: Uranium Real Time: 1,000.02 min.  
Analysis Method: ROI Analysis, Set Name = Uranium Default Dead Time: 0.00 %  
ROI Set: Uranium Default

**Calibration**  
Bkgd Info: Sample: B14021888; Det: 88; Spectrum #1; 2/18/2014 10:34:51 AM  
Calibration Date: 2/18/2014 10:17:09AM Energy Calibration: C14021888  
Efficiency Calibration: C14021888 Energy Cal: Gain = 9.8224 keV / Ch  
Efficiency: 30.79% +/- 0.12% TPU(2 sigma) Offset = 3,029.39 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
Tracer Nuclide: U-232  
Tracer Recovery: 68.93%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.1	3933.1	4286.7	127.5	100.2	4.00	3.00	1.00	4.2E-003	1.1E-002	1.7E-002	4.6E-002
U-235	4404.5	4296.5	4473.3	24.1	80.9	1.00	1.00	0.00	0.0E+000	7.4E-003	1.2E-002	3.9E-002
U-234	4777.8	4591.2	4876.0	.4	100.0	6.00	1.00	5.00	2.1E-002	1.1E-002	9.9E-003	3.1E-002
U-232	5308.2	5101.9	5406.4	77.6	100.1	1,010.00	4.00	1,006.00	3.0E+000	9.7E-002	2.0E-002	5.3E-002

Reviewed By:  

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

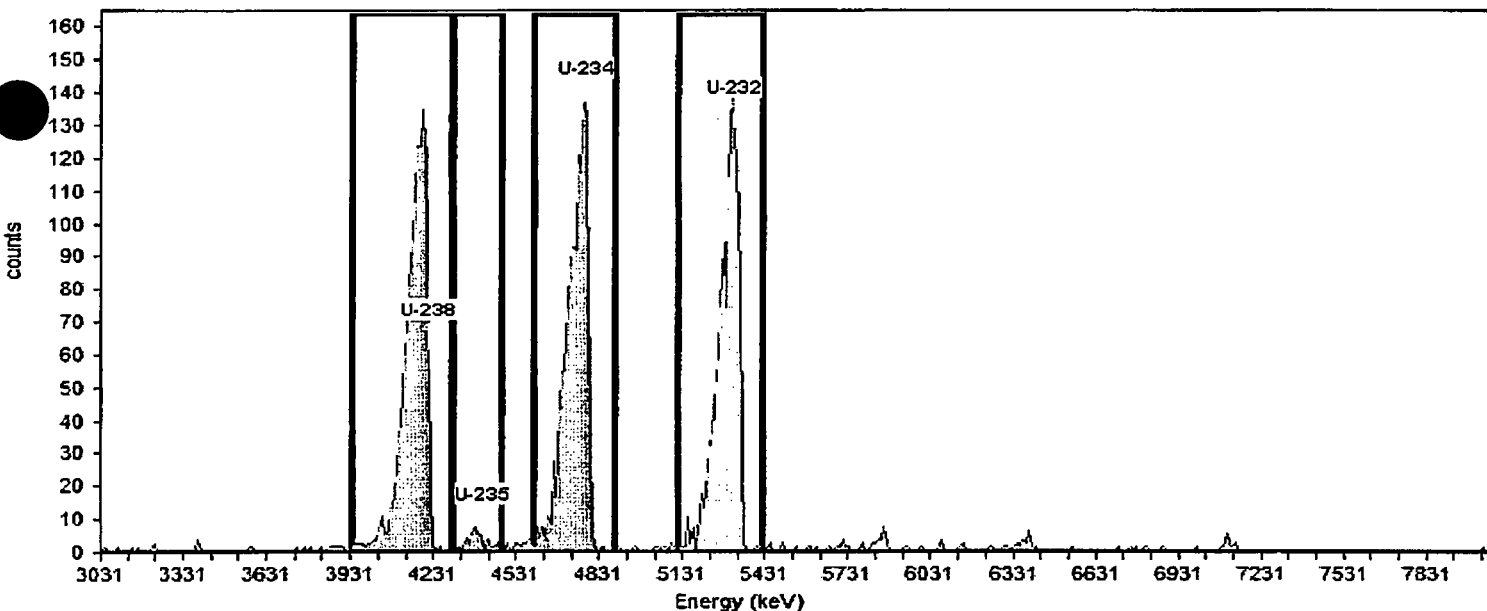
## Alpha-Spectroscopy Analysis Report

Sample: AS140215-1LCS      Sample Size : 0.50  
Spectrum #1      Analysis #1

Detector: 89      Acquisition Start Date: 2/22/2014 3:03:40PM  
Batch Name: UAS140215-1\_B      Live Time: 1,000.00 min.  
Nuclide Library: Uranium      Real Time: 1,000.02 min.  
Analysis Method: ROI Analysis, Set Name = Uranium Default      Dead Time: 0.00 %  
ROI Set: Uranium Default

Bkgd Info: Sample: B14021889; Det: 89; Spectrum #1; 2/18/2014 10:35:40 AM  
Calibration Date: 2/18/2014 10:21:39AM      Energy Calibration: C14021889  
Efficiency Calibration: C14021889      Energy Cal: Gain = 9.9003 keV / Ch  
Efficiency: 31.24% +/- 0.20% TPU(2 sigma)      Offset = 3,021.28 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Tracer Name: 914.4095.46\_U-232      Tracer Nuclide: U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM      Tracer Recovery: 75.02%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	85.0	100.2	1,167.00	0.00	1,167.00	4.5E+000	2.9E-001	0.0E+000	1.0E-002
U-235	4407.3	4298.4	4476.6	43.5	80.9	41.00	0.00	41.00	1.9E-001	3.3E-002	0.0E+000	1.3E-002
U-234	4783.5	4595.4	4882.5	81.6	100.0	1,161.00	3.00	1,158.00	4.4E+000	2.9E-001	1.5E-002	4.1E-002
U-232	5318.1	5110.2	5417.1	76.8	100.1	1,118.00	7.00	1,111.00	3.3E+000	1.0E-001	2.5E-002	6.0E-002

Reviewed By: \_\_\_\_\_

*JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

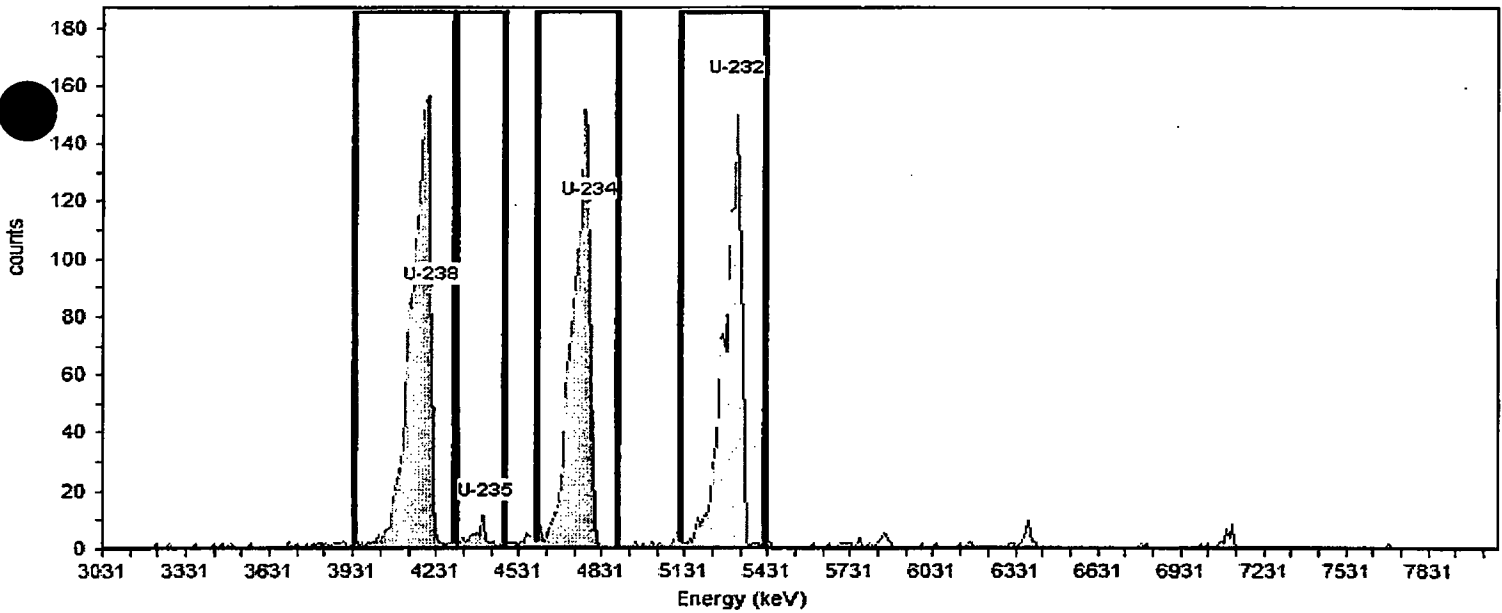
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-1LCSD  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 90  
 Batch Name: UAS140215-1\_B  
 Nuclide Library: Uranium  
 Analysis Method: ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/22/2014 3:03:40PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021890; Det: 90; Spectrum #1; 2/18/2014 10:35:40 AM  
 Calibration Date: 2/18/2014 10:21:56AM  
 Efficiency Calibration: C14021890  
 Efficiency: 30.90% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021890  
 Energy Cal: Gain = 9.9003 keV / Ch  
 Offset = 3,021.28 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 74.55%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	84.9	100.2	1,296.00	2.00	1,294.00	5.0E+000	3.3E-001	1.3E-002	3.6E-002
U-235	4407.3	4298.4	4476.6	54.1	80.9	52.00	0.00	52.00	2.5E-001	3.8E-002	0.0E+000	1.3E-002
U-234	4783.5	4595.4	4882.5	72.8	100.0	1,140.00	0.00	1,140.00	4.5E+000	2.9E-001	0.0E+000	1.1E-002
U-232	5318.1	5110.2	5417.1	77.9	100.1	1,097.00	5.00	1,092.00	3.3E+000	1.0E-001	2.1E-002	5.3E-002

Reviewed By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

ALS

Alpha Spectrometer Instrument Run Log

SOP 714; FORM 746r8.xls (10/2/07)

Date: 2/21/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
91	TAS140217-2A	1402223-11	Th/S	360	JA
92		-12			
93		-13			
94		-14			
95	↓	↓ -15	↓	↓	↓
29	UAS140219-1-B	1402211-1	Ur/W	360	JA
13	UAS140215-2-A	1402166-1	Ur/F	1000	JA
14		-2			
16		-3			
25		-4			
26		-5			
29		-6			
30		-7			
31		-8			
32		-9			
43		-10			
45		-11			
46		-12			
47	↓	↓ -13	↓	↓	↓
9	TAS140217-1-C	1402222-9	Th/S	600	JA
10	↓	AS140217-1-MB	↓	↓ 600	↓
11	UAS140215-5-B	AS140215-5-LS	7000	Ur/F	JA
12	↓	↓ -570SD	↓	↓	↓

JMA 2/21/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
81	UAS140215-1-A	1402165-1	Ur/F	1000	JA
82		-2			
83		-3			
84		-4			
85		-5			
86		-6			
87		-7			
88		-8			
89		-9			
90		-10			
91		-11			
92		-12			
93		-13			
94		-14			
95	↓	↓ -15	↓	↓	↓

12 2/22/14

Notes:

Reviewed by: TE

Date: 2/22/14

ALS

Alpha Spectrometer Instrument Run Log

SOP 714; FORM 746r8.xls (10/2/07)

Date: 2/22/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
9	TAS140217-2-B	1402223-16	ThS	360	TC
10		-17			
11		-18			
12		-19			
13		-20			
14		AS140217-2MB			
16		LC5			
25	TAS140217-3-A	1402223-21	ThS	360	TC
26		21D			
29		22			
30		1402225-1			
31		-2			
32		-3			
43		-4			
45		-5			
46		-6			
47		-7			
81		-8			
82		-9			
83		-10			
84		-11			
85		-12			
86		-13			
87		-14			

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
88	TAS140217-3-A	1402225-15	ThS	360	TC
89		-16			
90		-17			
91		-18			
92		AS140217-3MB			
93		LC5			
81	UAS140215-2-B	1402166-14	U/F	1000	TC
82		15			
83		AS140215-2MB			
84		PMB			
85		LC5			
86		LCSD			
87	UAS140215-1-B	AS140215-1MB	U/F	1000	TC
88		PMB			
89		LC5			
90		LCSD			
91	TAS140217-4-A	1402225-19	ThS	360	TC
92		20			
93		1402226-1			
94		2			
95		3			
9		4			
10		5			
11		6			

Notes:

Reviewed by: TC  
Date: 2/22/14



## Section 6

# QUALITY ASSURANCE SUMMARY REPORTS

**6**



**No *NON-CONFORMANCE REPORTS* or *QUALITY ASSURANCE SUMMARY SHEETS* are included in this data package.**





## Section 7

# LABORATORY BENCH SHEETS

**7**

Flower 5 Only

Prep Procedure: UIISO V-Default 1E-09

1000 Mln

Analytical QASS / NCR? Y N ONA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
1	1402165-1	SMP	0.5	0.5	sample	uCi/ml	_21651	81	1E	_21651			_21651			A
1	1402165-2	SMP	0.5	0.5	sample	uCi/ml	_21652	82		_21652			_21652			
1	1402165-3	SMP	0.5	0.5	sample	uCi/ml	_21653	83		_21653			_21653			
1	1402165-4	SMP	0.5	0.5	sample	uCi/ml	_21654	84		_21654			_21654			
1	1402165-5	SMP	0.5	0.5	sample	uCi/ml	_21655	85		_21655			_21655			
1	1402165-6	SMP	0.5	0.5	sample	uCi/ml	_21656	86		_21656			_21656			
1	1402165-7	SMP	0.5	0.5	sample	uCi/ml	_21657	87		_21657			_21657			
1	1402165-8	SMP	0.5	0.5	sample	uCi/ml	_21658	88		_21658			_21658			
1	1402165-9	SMP	0.5	0.5	sample	uCi/ml	_21659	89		_21659			_21659			
1	1402165-10	SMP	0.5	0.5	sample	uCi/ml	_216510	90		_216510			_216510			
1	1402165-11	SMP	0.5	0.5	sample	uCi/ml	_216511	91		_216511			_216511			
1	1402165-12	SMP	0.5	0.5	sample	uCi/ml	_216512	92		_216512			_216512			
1	1402165-13	SMP	0.5	0.5	sample	uCi/ml	_216513	93		_216513			_216513			
1	1402165-14	SMP	0.5	0.5	sample	uCi/ml	_216514	94		_216514			_216514			
1	1402165-15	SMP	0.5	0.5	sample	uCi/ml	_216515	95		_216515			_216515			
1	AS140215-1M	MB	0.5	0.5	sample	uCi/ml	_2151MB	87	NA	_2151MB			_2151MB			B
1	AS140215-1P	MB	0.5	0.5	sample	uCi/ml	_2151PB	88		_2151PB			_2151PB			
1	AS140215-1	LCS	0.5	0.5	sample	uCi/ml	_2151L	89		_2151L			_2151L			JP 2/25/14
1	AS140215-1	LCSD	0.5	0.5	sample	uCi/ml	_2151LD	90		_2151LD			_2151LD			JP 2/25/14

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016

Sample Barcodes

1402165-1 AS140215-1PS1		1402165-2 AS140215-1PS2		1402165-3 AS140215-1PS3	
1402165-4 AS140215-1PS4		1402165-5 AS140215-1PS5		1402165-6 AS140215-1PS6	

Prep Procedure: UIISO

Analytical QASS / NCR? Y N NA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1402165-7 AS140215-1PS7								1402165-8 AS140215-1PS8					1402165-9 AS140215-1PS9				
1402165-10 AS140215-1PS10								1402165-11 AS140215-1PS11					1402165-12 AS140215-1PS12				
1402165-13 AS140215-1PS13								1402165-14 AS140215-1PS14					1402165-15 AS140215-1PS15				
AS140215-1MMB AS140215-1PS16								AS140215-1PMB AS140215-1PS17					AS140215-1LCS AS140215-1PS18				
AS140215-1LCSD AS140215-1PS19																	

Reporting Units

LabID:	TstGrpName:	RptUnits:
1402165-1	IsoU_PNV_Air Filter	uCi/ml
1402165-2	IsoU_PNV_Air Filter	uCi/ml
1402165-3	IsoU_PNV_Air Filter	uCi/ml
1402165-4	IsoU_PNV_Air Filter	uCi/ml
1402165-5	IsoU_PNV_Air Filter	uCi/ml
1402165-6	IsoU_PNV_Air Filter	uCi/ml
1402165-7	IsoU_PNV_Air Filter	uCi/ml
1402165-8	IsoU_PNV_Air Filter	uCi/ml
1402165-9	IsoU_PNV_Air Filter	uCi/ml
1402165-10	IsoU_PNV_Air Filter	uCi/ml
1402165-11	IsoU_PNV_Air Filter	uCi/ml
1402165-12	IsoU_PNV_Air Filter	uCi/ml
1402165-13	IsoU_PNV_Air Filter	uCi/ml
1402165-14	IsoU_PNV_Air Filter	uCi/ml
1402165-15	IsoU_PNV_Air Filter	uCi/ml

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Prep Procedure: **UIISO**

Reviewed By: cas *cas*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  Y  N Batch: *See comments* Re-Prep? Y  N  N Batch: *NIA* Prep QASS / NCR? Y  N  N *NIA*

Prep SOP: PAI 778 Rev: 14 Prep Analyst: Tamrae Elhart Balance:  
 Prep SOP: NONE Prep Date: 2/15/2014 Balance:  
 Matrix Class: solid Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402165-1	SMP		0.5	0.5	As Received			<i>70 2/19/14</i>	T1	
2	1	1402165-2	SMP		0.5	0.5	As Received				T1	
3	1	1402165-3	SMP		0.5	0.5	As Received				T1	
4	1	1402165-4	SMP		0.5	0.5	As Received				T1	
5	1	1402165-5	SMP		0.5	0.5	As Received				T1	
6	1	1402165-6	SMP		0.5	0.5	As Received				T1	
7	1	1402165-7	SMP		0.5	0.5	As Received				T1	
8	1	1402165-8	SMP		0.5	0.5	As Received				T1	
9	1	1402165-9	SMP		0.5	0.5	As Received				T1	
10	1	1402165-10	SMP		0.5	0.5	As Received				T1	
11	1	1402165-11	SMP		0.5	0.5	As Received				T1	
12	1	1402165-12	SMP		0.5	0.5	As Received				T1	
13	1	1402165-13	SMP		0.5	0.5	As Received				T1	
14	1	1402165-14	SMP		0.5	0.5	As Received				T1	
15	1	1402165-15	SMP		0.5	0.5	As Received				T1	
16	1	AS140215-1M	MB		0.5	0.5	As Received				T1	
17	1	AS140215-1P	MB		0.5	0.5	As Received				T1	
18	1	AS140215-1	LCS		0.5	0.5	As Received				S1,T1	
19	1	AS140215-1	LCSD		0.5	0.5	As Received				S1,T1	

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Prep Procedure: **UIISO**

Reviewed By: cas *CS*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  Y /  N Batch: See comments Re-Prep? Y /  N Batch: N/A Prep QASS / NCR? Y /  N N/A

Prep SOP: PAI 778 Rev: 14 Prep Analyst: Tamrae Elhart Balance:  
 Prep SOP: NONE Prep Date: 2/15/2014 Balance:  
 Matrix Class: solid Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
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Comments

Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffled at 600C. After muffling, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: Tamrae Elhart Date: 2/15/2014

Witnessed By: Emily R. Lyons Date: 2/15/2014

Tracer/Carrier Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016

Prep Procedure: **UIISO**

**Prep Batch Not Validated!!!**

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N    Batch: \_\_\_\_\_    Re-Prep? Y / N    Batch: \_\_\_\_\_    Prep QASS / NCR? Y / N \_\_\_\_\_

Prep SOP: PAI 778    Rev: 14    Prep Analyst: Tamrae Elhart    Balance: \_\_\_\_\_

Prep SOP: NONE    Prep Date: 2/15/2014    Balance: \_\_\_\_\_

Matrix Class: solid    Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402165-1	SMP		0.5	0.5	As Received	hooked ID			T1	
2	1	1402165-2	SMP		0.5	0.5	As Received				T1	
3	1	1402165-3	SMP		0.5	0.5	As Received				T1	
4	1	1402165-4	SMP		0.5	0.5	As Received				T1	
5	1	1402165-5	SMP		0.5	0.5	As Received				T1	
6	1	1402165-6	SMP		0.5	0.5	As Received				T1	
7	1	1402165-7	SMP		0.5	0.5	As Received				T1	
8	1	1402165-8	SMP		0.5	0.5	As Received				T1	
9	1	1402165-9	SMP		0.5	0.5	As Received				T1	
10	1	1402165-10	SMP		0.5	0.5	As Received				T1	
11	1	1402165-11	SMP		0.5	0.5	As Received				T1	
12	1	1402165-12	SMP		0.5	0.5	As Received				T1	
13	1	1402165-13	SMP		0.5	0.5	As Received				T1	
14	1	1402165-14	SMP		0.5	0.5	As Received				T1	
15	1	1402165-15	SMP		0.5	0.5	As Received				T1	
16	1	AS140215-1M	MB		1	1	As Received	LL328			T1	
17	1	AS140215-1P	MB		1	1	As Received	LL348			T1	
18	1	AS140215-1	LCS		1	1	As Received	506			S1,T1	
19	1	AS140215-1	LCSD		1	1	As Received	507			S1,T1	

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Prep Procedure: **UIISO**

**Prep Batch Not Validated!!!**

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: \_\_\_\_\_ Re-Prep? Y / N Batch: \_\_\_\_\_ Prep QASS / NCR? Y / N \_\_\_\_\_

Prep SOP: PAI 778 Rev: 14

Prep Analyst: Tamrae Elhart *TE*

Balance:

Prep SOP: NONE

Prep Date: 2/15/2014

Balance:

Matrix Class: solid

Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
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Comments

Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffled at 600C. After muffling, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: *TE* Date: *2/15/14*

Witnessed By: *EM* Date: *2.15.14*

Tracer/Carrier Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016

*10.29.14*

*Exp*

*620.14*

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## Sample Condition Form (Solids)

Analyst: TC

Analysis Date: 2/15/14

Method: Prep

Sample Condition (Visual Appearance of Analysis Aliquot at Time of Prep)

Work Order	Sample ID	Dry/Wet/ Moist	Texture	Remarks
<u>1402165</u>	<u>1</u>	<u>dry</u>	<u>filter</u>	<u>1-half filter</u>
	<u>2</u>			
	<u>3</u>			
	<u>4</u>			
	<u>5</u>			
	<u>6</u>			
	<u>7</u>			
	<u>8</u>			
	<u>9</u>			
	<u>10</u>			
	<u>11</u>			
	<u>12</u>			
	<u>13</u>			
	<u>14</u>			
	<u>15</u>			
<u>TC 2/15/14</u>				



**1402165 Filter Weight Spreadsheet**

<b>Sample ID</b>	<b>Beaker ID</b>	<b>Beaker, Watch glass wt (g)</b>	<b>Beaker, Watch Glass, Filter Wt (g)</b>	<b>Beaker, Watch Glass, Ashed Filter Wt (g)</b>	<b>Net Filter Wt (g)</b>	<b>Net Ash Wt (g)</b>
1402165-1	479	87.6504	88.0161	87.6507	0.3657	0.0003
1402165-2	495	88.7242	89.1387	88.7255	0.4145	0.0013
1402165-3	498	92.0894	92.4743	92.0902	0.3849	0.0008
1402165-4	486	91.1197	91.5255	91.1201	0.4058	0.0004
1402165-5	472	88.8783	89.2544	88.8788	0.3761	0.0005
1402165-6	503	91.7313	92.136	91.7322	0.4047	0.0009
1402165-7	504	89.3632	89.76	89.3638	0.3968	0.0006
1402165-8	513	93.7149	94.1118	93.7153	0.3969	0.0004
1402165-9	508	85.3015	85.68	85.3021	0.3785	0.0006
1402165-10	488	88.8644	89.2537	88.8656	0.3893	0.0012
1402165-11	489	88.7296	89.1539	88.7313	0.4243	0.0017
1402165-12	LL100	76.9374	77.3489	76.9374	0.4115	0
1402165-13	500	89.1846	89.5845	89.1859	0.3999	0.0013
1402165-14	515	89.2591	89.6518	89.2602	0.3927	0.0011
1402165-15	LL324	76.0586	76.4816	76.0595	0.423	0.0009

Balance: 27

Note: Prior to aliquotting, the filters were cut in half. Only one half of the filter was placed into the weighed beaker, spiked/traced, and muffled. Following muffling, the beaker/filter was reweighed to determine ash weight.

Batch: AS140215-1

**U Solid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Conc. Hydrofluoric Acid	0000061467
Boric Acid	J23624
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MK BK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467

**U Liquid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MK BK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467



## Section 8

# STANDARDS TRACEABILITY DOCUMENTS

8

Prepare a working dilution of 843.3610.56

1. Density of 1M HNO<sub>3</sub>, lot # K16045  
 Mass of 100mL vol. flask: 68.2981g Balance # 12  
 Mass of flask & 100mL acid: 171.5705g Balance# 12  
 Net Mass: 103.2724g  
 Density: 1.0327g/mL

2. Mass of 843.3610.56 transferred:  
 Mass of open empty nalgene: 74.7438 Balance# 12  
 Mass of nalgene & standard: 82.4483 Balance# 12  
 Net mass of standard transferred: 7.7045g Balance# NA

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1003.9g Balance# 26  
 Mass of empty nalgene (from above): 74.7438 Balance# 12  
 Net mass of new dilution: 929.1562g Balance# NA

4. Final activity calculation:  
 (U-238):  $2377.34 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 20.36 \text{ dpm/mL}$

(U-235):  $109.44 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 0.92 \text{ dpm/mL}$

(U-234):  $2289.91 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 19.61 \text{ dpm/mL}$

Std ID: 843.3610.100

Description: U-238  
 Expiration: 8/4/2012  
 Activity: 20.36 dpm/mL

2s Uncertainty: 0.12 dpm/mL  
 Ref. Date: 8/1/1977 1997  
 Ref Time: N/A JP 7/9/11  
 Prep Date: 8/3/2011 Prep by: TE  
 Matrix/Comp. 1M HNO<sub>3</sub>  
 Half Life (y): 4.47E+09

Reverification Log		
Analysis Date	Initials	Expiration Date
7/11/12	JP	7/10/13
6/20/13	JP	6/20/2014

Continued on Page

Read and Understood By

TE  
Signed

8/3/11  
Date

Renee Helloc  
Signed

10/21/11  
Date

Prepare an intermediate Dilution of RSO # 843

Diluent is (M)  $HNO_3$  lot # H31041  
g from Pal 54 this logbook (3610)  
 $\rho = 1.0283 \frac{g}{ml}$

lot #

Mass of Parent Transferred

Mass of Open, full Ampule + beaker	38.1504g	12
Mass of Empty Ampule + beaker	32.9991g	1
Net Mass transferred	5.1513g	

Dilute to Final Volume

Mass of Open Empty 40 ml VOA	21.6331g	12
Mass of Open full Vial	53.0961g	1
Net mass of New Dilution	31.4624g	

Final Activity (U-238)


$$\left( \frac{247.0 \frac{Bq}{g}}{g} \right) \left( \frac{60 \text{ dpm}}{Bq} \right) \left( \frac{5.1513 \text{ g}}{31.4624 \text{ g}} \right) = \frac{2382.5 \text{ dpm}}{2372.34 \text{ g}}$$

Final activity (U-235): 109.44 dpm/g  
(RSO: 843 = 11.14 Bq/g)

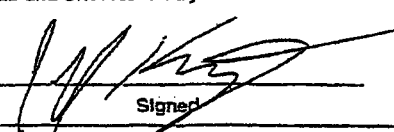
Final activity (U-234): 2289.91 dpm/g  
(RSO: 843 = 233.1 Bq/g)

Continued on Page

Read and Understood By

  
Signed

4/23/10  
Date

  
Signed

5/11/10  
Date



# National Institute of Standards & Technology Certificate

RSO #  
843  
rec. 7-20-07

## Standard Reference Material 4321C Natural Uranium Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive uranium-238, uranium-235, and uranium-234 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. The solution, whose composition is specified in Table 1, is contained in a flame-sealed, 5 mL, NIST, borosilicate-glass ampoule (see Note 1)\*.

The certified massic activities for the uranium isotopes at a Reference Time of 1200 EST, 1 August 1997, are:

Uranium-238:  $(242.0 \pm 1.5) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-235:  $(11.14 \pm 0.07) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-234:  $(233.1 \pm 2.2) \text{ Bq}\cdot\text{g}^{-1}$

Additional physical, chemical, and radiological properties for the SRM, as well as details on the standardization method, are given in Table 1. Uncertainty intervals for certified quantities are expanded ( $k=2$ ) uncertainties calculated according to the ISO and NIST Guidelines (see Note 2). Table 2 contains a specification of the components that comprise the uncertainty analyses.

The certification of this SRM, within the measurement uncertainties specified, is valid for at least five (5) years after receipt. The solution matrix, in an unopened ampoule, is believed to be indefinitely homogeneous and stable, within its half-life-dependent, useful lifetime. NIST will monitor this material and will report any substantive changes in certification to the purchaser. Should any of the certified values change, purchasers of this SRM will be notified of the change by NIST.

This SRM may represent a radiological hazard and a chemical hazard. Consult the Material Safety Data Sheet (MSDS), enclosed with the SRM shipment, for details (see Note 1).

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dr. M.P. Unterwiesing, Acting Group Leader. The overall technical direction and physical measurements leading to certification were provided by Dr. L.L. Lucas of the Radioactivity Group. The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program.

Gaithersburg, Maryland 20899  
November 1997

Text revised and expiration date extended February 2007

Lisa R. Karam, Deputy Chief  
Ionizing Radiation Division

Robert L. Watters, Jr., Chief  
Measurement Services Division

Table 1. Properties of SRM 4321C

Certified values	
Radionuclides	Natural Uranium (Mixture of $^{238}\text{U}$ , $^{235}\text{U}$ , and $^{234}\text{U}$ )
Reference time	1200 EST, 1 August 1997
Massic activities of the solution	$^{238}\text{U}$ : 242.0 Bq·g <sup>-1</sup> $^{235}\text{U}$ : 11.14 Bq·g <sup>-1</sup> $^{234}\text{U}$ : 233.1 Bq·g <sup>-1</sup>
Relative expanded uncertainties ( $k=2$ )	$^{238}\text{U}$ : 0.60% (see Note 2)* $^{235}\text{U}$ : 0.60% (see Note 2) $^{234}\text{U}$ : 0.96% (see Note 2)

Uncertified information	
Source description	Liquid in flame-sealed, 5 mL NIST borosilicate ampoule (see Note 1)
Solution composition	1.0 mol·L <sup>-1</sup> HCl with 30 mg UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> per gram of solution
Solution density	(1.053 ± 0.001) g·mL <sup>-1</sup> at 21.4 °C (see Note 3)
Solution mass	(5.258 ± 0.002) g (see Note 3)
Mass fraction of uranium	(0.01960 ± 0.00010) g·g <sup>-1</sup> (see Note 5)
Photon-emitting impurities	None detected (see Note 4)
Half-lives used [1]	$^{238}\text{U}$ : (4.468 ± 0.003) × 10 <sup>8</sup> a $^{235}\text{U}$ : (7.038 ± 0.005) × 10 <sup>8</sup> a $^{234}\text{U}$ : (2.455 ± 0.006) × 10 <sup>5</sup> a
Calibration method (and instruments)	The certified massic activity for natural uranium was obtained by mass spectrometer, silicon surface-barrier detector, and 4π liquid scintillation (LS) counting systems.

\* See Note 5

Table 2. Uncertainty evaluation for the massic activity for SRM 4321C

	Uncertainty component	Assessment Type <sup>†</sup>	Relative standard uncertainty contribution on massic activity of Natural Uranium (%)
1	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>238</sup> U	A	0.001
2	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>235</sup> U	A	0.07
3	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>234</sup> U	A	0.3
4	Half life of <sup>238</sup> U; standard uncertainty of the half-life	A	0.07
5	Half life of <sup>235</sup> U; standard uncertainty of the half-life	A	0.07
6	Half life of <sup>234</sup> U; standard uncertainty of the half-life	A	0.24
7	Uranium mass fraction in SRM 960; from SRM960 certificate	B	0.003
8	Quantitative dissolution	B	0.25
9	Gravimetric (mass) measurements	B	0.10
10	Limit for photon-emitting impurities	B	0.10
	Relative combined standard uncertainty		
		<sup>238</sup> U	0.30
		<sup>235</sup> U	0.50
		<sup>234</sup> U	0.48
	Relative expanded uncertainty (k = 2)		
		<sup>238</sup> U	0.60
		<sup>235</sup> U	0.60
		<sup>234</sup> U	0.96

<sup>†</sup> = (A) denotes evaluation by statistical methods; (B) denotes evaluation by other methods.



## NOTES

Note 1. Refer to <http://physics.nist.gov/Divisions/Div846/srm.html> for the standardized ampoule dimensions and for assistance and instructions on how to properly open an ampoule. Information on additional storage and handling requirements is also included in the website.

Note 2. The uncertainties on certified values are expanded uncertainties,  $U = k u_c$ . The quantity  $u_c$  is the combined standard uncertainty calculated according to the ISO and NIST Guides (see references [2] and [3]). The combined standard uncertainty is multiplied by a coverage factor of  $k = 2$  and was chosen to obtain an approximate 95 % level of confidence.

Note 3. The stated uncertainty is two times the standard uncertainty. See reference [3].

Note 4. The estimated lower limits of detection for photon-emitting impurities, expressed as massic photon emission rates are:

1.4  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $8 \text{ keV} < E < 59 \text{ keV}$

1.1  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $67 \text{ keV} < E < 88 \text{ keV}$

0.5  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $102 \text{ keV} < E < 197 \text{ keV}$

0.3  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $205 \text{ keV} < E < 762 \text{ keV}$

0.2  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $770 \text{ keV} < E < 996 \text{ keV}$ , and

0.1  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $1006 \text{ keV} < E < 1900 \text{ keV}$

provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{234}\text{U}$ , or their progeny

Note 5. The stated uncertainty is the standard uncertainty. See reference [3].

## REFERENCES

- [1] Evaluated Nuclear Structure Data File (ENSDF), online database, National Nuclear Data Center, Brookhaven Laboratory (Upton, NY), August 2007. Refer to <http://www.nndc.bnl.gov/ensdf/>
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993 (corrected and reprinted, 1995). Available from Global Engineering Documents, 12 Inverness Way East, Englewood, CO 80112, U.S.A. Telephone 1-800-854-7179.
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.

TE 10/22/13

Prepare a working dilution of 914.3610.62

1. Density of 1M HNO<sub>3</sub>, lot # 000045470  
 Mass of 100mL vol. flask: 66.4318g Balance # 12  
 Mass of flask & 100mL acid: 169.6212g Balance# 12  
 Net Mass: 103.1894g  
 Density: 1.0319 g/mL

2. Mass of 914.3610.62 transferred:  
 Mass of open empty nalgene: 75.4800g Balance# 12  
 Mass of nalgene & standard: 78.3581g Balance# 12  
 Net mass of standard transferred: 2.8781g Balance# NA

TE 10/22/13

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1173.7g Balance# 26  
 Mass of empty nalgene (from above): 75.4800g Balance# 12  
 Net mass of new dilution: 1098.22g Balance# NA

4. Final activity calculation:  
 $7261.8 \text{ dpm/g} \left( \frac{2.8781 \text{ g}}{1098.22 \text{ g}} \right) (1.0319 \text{ g/mL}) = 19.64 \text{ dpm/mL}$

TE 10/22/13

JP 11/5/13

Std ID: 914.4095.46

Description: **U-232**  
 Expiration: **10/29/2014**  
 Activity: **19.64 dpm/mL**  
 2s Uncertainty: **0.96 dpm/mL**  
 Ref. Date: **5/27/2010**  
 Ref Time: **N/A**  
 Prep Date: **10/22/2013** Prep by: **TE**  
 Matrix/Comp. **1M HNO<sub>3</sub>**  
 Half Life (y): **6.89E+01**

JP 11/5/13

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 11/5/13

Continued on Page

7 Elbert 10/22/13  
 Signed Date

[Signature] 11/05/13  
 Read and Understood By Signed Date

Prepare a Intermediate dilution of RCO # 914

Diluent is  $1M HNO_3$  Acid lot # J11044

Mass of parent transferred		bal #
Mass of Open full Ampule + Beaker	38.0670 g	12
Mass of Empty Ampule + Beaker	32.9311 g	12
Net mass transferred	5.1379 g	

Dilute to final Mass

Mass of Vial Std + Diluent	58.6555 g	12
Mass of Vial	21.5781 g	1
Net Mass of New dilution	37.0574 g	

Final Activity

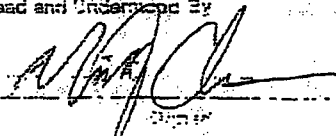
$$\frac{(4.552 \times 10^3 \text{ Bq}) (60 \text{ dpm}) (5.1379 \text{ g})}{(1 \text{ Bq}) (5.21457 \text{ g}) (37.0574 \text{ g})} = 7261.8$$

Continued on Page

Read and Understood By

  
Signed

6/4/10

  
Date

06-17-2010



**Eckert & Ziegler**  
Analytics

*Rec 6-1-10 255# 914*

1380 Seaboard Industrial Blvd.  
Atlanta, Georgia 30318  
Tel 404-352-8677  
Fax 404-352-2837  
www.analyticinc.com

**CERTIFICATE OF CALIBRATION**  
Standard Radionuclide Source

82306-307

U-232 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins  
P.O. No.: 73625 04-28-10, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclides purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.18, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			$k_x$	$k_y$	U	
U-232	2.817E+04	4.882E+09	0.8	2.4	4.9	05/27/2010

\*Uncertainty: U - Relative expanded uncertainty,  $k=2$ . See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

**Comments:**

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%. 8.31488 g 1M HNO3 solution, carrier free.

Source Prepared by: *W. Mao*  
W. Mao, Radiochemist

QA Approved: *J. D. McCorvey*  
J. D. McCorvey, QA Manager Alternate

Date: 5/27/10

ANA Form 006 Rev. 1

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office  
24937 Avenue Tibbitts Valencia, California 91355

Laboratory  
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318



## Section 9

# **ADDITIONAL SUPPORTING DOCUMENTATION**



**Alpha Spectroscopy**

**Quality Control Data**

**Weekly Background, Energy, and  
Efficiency Calibrations**

# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402165

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Tuesday, February 25, 2014  
7:46:25 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402165-1 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	81	C14021881	2/18/2014	30.83	Pass	29.34	29.86	31.89	32.42
					B14021881	2/18/2014	0.1050	Pass	0.0000	0.0500	0.5000	0.7500
					C14021881	2/18/2014	5553.6	Pass	5505.8	5515.8	5595.8	5605.8
1402165-2 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	82	C14021882	2/18/2014	30.65	Pass	29.85	30.38	32.46	32.99
					B14021882	2/18/2014	0.0990	Pass	0.0000	0.0500	0.5000	0.7500
					C14021882	2/18/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
1402165-3 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	83	C14021883	2/18/2014	31.20	Pass	29.72	30.25	32.31	32.84
					B14021883	2/18/2014	0.1290	Pass	0.0000	0.0500	0.5000	0.7500
					C14021883	2/18/2014	5557.7	Pass	5505.8	5515.8	5595.8	5605.8
1402165-4 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	84	C14021884	2/18/2014	30.40	Pass	28.92	29.44	31.44	31.96
					B14021884	2/18/2014	0.1410	Pass	0.0000	0.0500	0.5000	0.7500
					C14021884	2/18/2014	5555.8	Pass	5493.9	5503.9	5583.9	5593.9
1402165-5 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	85	C14021885	2/18/2014	30.11	Pass	28.78	29.30	31.30	31.82
					B14021885	2/18/2014	0.1040	Pass	0.0000	0.0500	0.5000	0.7500
					C14021885	2/18/2014	5543.9	Pass	5496.0	5506.0	5586.0	5596.0
1402165-6 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	86	C14021886	2/18/2014	30.61	Pass	28.91	29.42	31.42	31.94
					B14021886	2/18/2014	0.1000	Pass	0.0000	0.0500	0.5000	0.7500
					C14021886	2/18/2014	5546.0	Pass	5505.8	5515.8	5595.8	5605.8
1402165-7 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	87	C14021887	2/18/2014	31.55	Pass	29.84	30.37	32.45	32.98
					B14021887	2/18/2014	0.1180	Pass	0.0000	0.0500	0.5000	0.7500
					C14021887	2/18/2014	5548.0	Pass	5505.8	5515.8	5595.8	5605.8
1402165-8 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	88	C14021888	2/18/2014	30.79	Pass	28.96	29.47	31.48	32.00
					B14021888	2/18/2014	0.0940	Pass	0.0000	0.0500	0.5000	0.7500
					C14021888	2/18/2014	5543.9	Pass	5505.8	5515.8	5595.8	5605.8
1402165-9 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	89	C14021889	2/18/2014	31.24	Pass	29.50	30.02	32.07	32.60
					B14021889	2/18/2014	0.0990	Pass	0.0000	0.0500	0.5000	0.7500
					C14021889	2/18/2014	5555.8	Pass	5505.8	5515.8	5595.8	5605.8

Data Package ID: UR1402165-1

92	Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
		Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit

CI - The Analysis Date exceeds the Calibration Date by more than 14 days.

# Calibration Data Summary

Laboratory Name: ALS Environmental – FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402165

Analytical SOP: PAI 714

7:46:25 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402165-10 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	90	C14021890	2/18/2014	30.90	Pass	29.66	30.19	32.25	32.78
					B14021890	2/18/2014	0.1110	Pass	0.0000	0.0500	0.5000	0.7500
					C14021890	2/18/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
1402165-11 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	91	C14021891	2/18/2014	30.35	Pass	28.95	29.46	31.48	31.99
					B14021891	2/18/2014	0.0970	Pass	0.0000	0.0500	0.5000	0.7500
					C14021891	2/18/2014	5557.7	Pass	5507.8	5517.8	5597.8	5607.8
1402165-12 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	92	C14021892	2/18/2014	31.14	Pass	29.21	29.74	31.76	32.29
					B14021892	2/18/2014	0.1040	Pass	0.0000	0.0500	0.5000	0.7500
					C14021892	2/18/2014	5548.0	Pass	5507.8	5517.8	5597.8	5607.8
1402165-13 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	93	C14021893	2/18/2014	32.05	Pass	30.54	31.09	33.21	33.76
					B14021893	2/18/2014	0.1080	Pass	0.0000	0.0500	0.5000	0.7500
					C14021893	2/18/2014	5555.8	Pass	5507.8	5517.8	5597.8	5607.8
1402165-14 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	94	C14021894	2/18/2014	32.10	Pass	30.23	30.77	32.87	33.41
					B14021894	2/18/2014	0.0830	Pass	0.0000	0.0500	0.5000	0.7500
					C14021894	2/18/2014	5557.7	Pass	5507.8	5517.8	5597.8	5607.8
1402165-15 Spectrum #1 2/21/2014	SMP	AS140215-1 AS140215-1UR	UIISO	95	C14021895	2/18/2014	32.13	Pass	30.55	31.10	33.22	33.77
					B14021895	2/18/2014	0.0920	Pass	0.0000	0.0500	0.5000	0.7500
					C14021895	2/18/2014	5567.7	Pass	5507.8	5517.8	5597.8	5607.8
AS140215-1M Spectrum #1 2/22/2014	MB	AS140215-1 AS140215-1UR	UIISO	87	C14021887	2/18/2014	31.55	Pass	29.84	30.37	32.45	32.98
					B14021887	2/18/2014	0.1180	Pass	0.0000	0.0500	0.5000	0.7500
					C14021887	2/18/2014	5548.0	Pass	5505.8	5515.8	5595.8	5605.8
AS140215-1P Spectrum #1 2/22/2014	MB	AS140215-1 AS140215-1UR	UIISO	88	C14021888	2/18/2014	30.79	Pass	28.96	29.47	31.48	32.00
					B14021888	2/18/2014	0.0940	Pass	0.0000	0.0500	0.5000	0.7500
					C14021888	2/18/2014	5543.9	Pass	5505.8	5515.8	5595.8	5605.8
AS140215-1 Spectrum #1 2/22/2014	LCS	AS140215-1 AS140215-1UR	UIISO	89	C14021889	2/18/2014	31.24	Pass	29.50	30.02	32.07	32.60
					B14021889	2/18/2014	0.0990	Pass	0.0000	0.0500	0.5000	0.7500
					C14021889	2/18/2014	5555.8	Pass	5505.8	5515.8	5595.8	5605.8

Data Package ID: UR1402165-1

93	Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
		Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
					CI - The Analysis Date exceeds the Calibration Date by more than 14 days.

Date Printed: Tuesday, February 25, 2014

ALS Environmental -- FC

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LIMS Version: 6.695



# Calibration Data Summary

Laboratory Name: **ALS Environmental -- FC**

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402165

Analytical SOP: PAI 714

7:46:25 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	<u>RESULTS</u>	<u>FLAGS</u>	<u>LCL</u>	<u>LWL</u>	<u>UWL</u>	<u>UCL</u>
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
AS140215-1 Spectrum #1 2/22/2014	LCSD	AS140215-1 AS140215-1UR	UI50	90	C14021890 B14021890 C14021890	2/18/2014 2/18/2014 2/18/2014	30.90 0.1110 5555.8	Pass Pass Pass	29.66 0.0000 5496.0	30.19 0.0500 5506.0	32.25 0.5000 5586.0	32.78 0.7500 5596.0

Data Package ID: **UR1402165-1**

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
				CI - The Analysis Date exceeds the Calibration Date by more than 14 days.

Date Printed: Tuesday, February 25, 2014

**ALS Environmental -- FC**

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LIMS Version: 6.695

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# Alpha Spec Calibration Source Re-Certification

Recalibration performed by Isotope Products Laboratories

**Primary Certified Source**

Source PA ID: 190  
 Planchet Label: 0  
 Recalibrated on: 10/15/2013  
 Received by ALS on: 10/18/2013

Values from certificate	
Source ID:	92MX223027
Total Activity:	3745.2 dpm
Ref. Date:	10/15/2013

Nuclide	Act (Bq)	Act (dpm)	Half-Life (yrs)	Decay Corrected
U-234:	49.54	2972.4	2.48E+05	2972.40 dpm
U-235:	1.09	65.58	7.04E+08	65.58 dpm
Am-241:	11.79	707.4	432.17	707.38 dpm
<b>TOTAL</b>				<b>3745.36 dpm</b>

**Efficiency Determination for Detector:**

13

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Total cpm	Known dpm	Detector efficiency
92MX223027	190	97-19-103-06	10/21/13	7888	32739	1135	2100		1187.43	3745.36	31.70%

**Sources 1 through 8 activity determination**

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Detector Efficiency	Am-241 dpm	U-234 dpm	U-235 dpm	Combined dpm
92MX2203026	182	97-19-103-01	10/21/13	13543	81484	2680	2100		31.70%	1220.49	7343.29	242.33	8806.10
92MX2203028	183	97-19-103-02	10/21/13	15830	156715	4155	2100		31.70%	1426.59	14123.06	374.45	15924.09
92MX2203024	184	97-19-103-03	10/21/13	71764	74298	2052	2100		31.70%	6467.33	6695.69	164.92	13347.94
92MX2203021	185	97-19-103-04	10/21/13	22944	62381	2198	2100		31.70%	2067.70	5821.74	155.08	7887.52
92MX2203025	186	97-19-103-05	10/21/13	103302	124917	3425	2100		31.70%	9309.51	11257.44	308.66	20876.61
92MX2203022	187	97-19-103-06	10/21/13	78934	84490	2349	2100		31.70%	7113.48	7614.19	211.69	14939.36
92MX2203023	188	97-19-103-07	10/21/13	46085	71762	1847	2100		31.70%	4153.15	6467.15	155.45	10786.75
92MX2203029	189	97-19-103-08	10/21/13	34624	218016	6721	2100		31.70%	3120.29	19647.47	603.69	23373.45

**Efficiency Verification**

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	Count dur (s)	Total cpm	Known dpm	Detector efficiency	RPD	FLAG
92MX223027	190	97-19-103-09	10/21/13	7807	32933	1155	2100	1197.00	3745.36	31.98%	-0.80%	PASS

**Sources 1 through 8 activity re-verification**

Source Serial#	PA ID	Sequential #	Combined Observed dpm	Combined Certified dpm*	Percent Difference %	Within 5% of Certified value?
92MX2203026	182	97-19-103-01	8806.10	8855.90	-0.56%	Yes
92MX2203028	183	97-19-103-02	15924.09	15999.04	-0.47%	Yes
92MX2203024	184	97-19-103-03	13347.94	13533.39	-1.37%	Yes
92MX2203021	185	97-19-103-04	7887.52	8170.91	-3.47%	Yes
92MX2203025	186	97-19-103-05	20875.61	21020.88	-0.69%	Yes
92MX2203022	187	97-19-103-06	14939.36	15319.53	-2.48%	Yes
92MX2203023	188	97-19-103-07	10786.75	10744.16	0.40%	Yes
92MX2203029	189	97-19-103-08	23373.45	23608.79	-1.00%	Yes

**Data from certificates**

Reference Date	U-234 (Bq)	U-234 (dpm)	U-235 (Bq)	U-235 (dpm)	Am-241 (Bq)	Am-241 (dpm)
5/1/2003	24.10	7448.00	2.43	145.74	21.43	1285.80
5/1/2003	39.30	14358.00	4.20	252.00	23.55	1413.00
5/1/2003	19.40	7164.00	1.93	115.56	106.00	6360.00
4/1/2003	01.00	6060.00	1.26	75.84	34.50	2070.00
4/1/2003	03.00	12180.00	3.41	204.72	146.40	8764.00
4/1/2003	32.90	7974.00	3.17	189.96	121.30	7278.00
4/1/2003	07.10	6426.00	0.93	55.54	72.26	4335.80
5/1/2003	34.80	20088.00	6.55	393.18	53.02	3181.20

New Expiration Date => 10/21/2014  
 JP 10/22/13



Eckert & Ziegler

Isotope Products

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010

Fax 661-257-8303

#190  
Received 10/18/13

# CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

Radionuclide:	U-234	Customer:	ALS LABORATORY
Radionuclide:	U-235	P.O. No.:	FC 35957 R5576
Radionuclide:	Am-241	Catalog No.:	*SOURCE-RECAL-STD
Half-life (U-234):	(2.454 ± 0.006)E+05 years	Reference Date:	15-Oct-13 12:00 PST
Half-life (U-235):	(7.037 ± 0.011)E+08 years	Source No.:	92MIX223027
Half-life (Am-241):	432.17 ± 0.66 years		

**Contained Radioactivity:**

U-234:	1.339	nCi,	49.54	Bq	Am-241:	0.3187	nCi,	11.79	Bq
U-235:	0.02954	nCi,	1.093	Bq	Total Activity:	1.687	nCi,	62.42	Bq

**Physical Description:**

- A. Capsule type: Disk (22 mm OD x 0.79 mm THK)
- B. Nature of active deposit: Electrodeposited and diffusion bonded oxide
- C. Active diameter/volume: 19 mm
- D. Backing: Stainless steel
- E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in May 2001.

**Uncertainty of Measurement:**

- A. Type A (random) uncertainty: ± 0.5 %
- B. Type B (systematic) uncertainty: ± 3.0 %
- C. Uncertainty in aliquot weighing: ± 0.0 %
- D. Total uncertainty at the 99% confidence level: ± 3.0 %

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 1893 α/min in 2π on 20-Sep-13.

*Daniel James Van Dalsen*  
Quality Control

2-OCT-13  
Date

IPL Ref. No.: 987-28

ISO 9001 CERTIFIED



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Re-Calibrated 10/21/13

$\alpha$  1

New Exp Date

=> 10/21/2014

PAI 187

~~Recalibrated 4-15-03~~

JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203026
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**Contained Radioactivity:**

U-234: 3.354 nCi (124.1 Bq) U-235: 0.06566 nCi (2.429 Bq)	Am-241: 0.5793 nCi (21.43 Bq) Total Activity: 3.999 nCi (148.0 Bq)
--	---

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4483  $\alpha$ /min in 2 $\pi$  on 11 Apr 03.

*Donald James Van Dalsen*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13  
New Exp Date  
=> 10/21/2014  
d2  
PAI 183  
Recalibrated 4-15-03  
JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b>	U-234	<b>Customer:</b>	PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b>	U-235	<b>P.O. No.:</b>	EW040203/R2193
<b>Radionuclide C:</b>	Am-241	<b>Catalog No.:</b>	MISC-STD
<b>Half Life (U-234):</b>	(2.454 ± 0.006)E+05 years	<b>Reference Date:</b>	1-May-03 12:00 PST
<b>Half Life (U-235):</b>	(7.037 ± 0.011)E+08 years	<b>Source No.:</b>	92MIX2203028
<b>Half Life (Am-241):</b>	432.17 ± 0.66 years		

**Contained Radioactivity:**

U-234:	6.467 nCi (239.3 Bq)	Am-241:	0.6366 nCi (23.55 Bq)
U-235:	0.1135 nCi (4.200 Bq)	Total Activity:	7.217 nCi (267.1 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

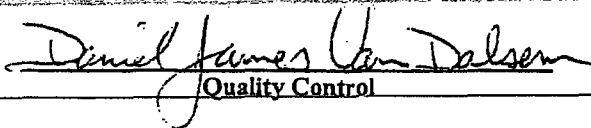
This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 8091  $\alpha$ /min in  $2\pi$  on 11 Apr 03.

  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

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Fax 661-257-8303

Re-Calibrated 10/21/13  
New Exp Date  
=> 10/21/2014  
 $\alpha 3$   
PAT I.D 184  
recalibrated 4-15-03  
JP 10/21/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203024
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**Contained Radioactivity:**

U-234: 3.227 nCi (119.4 Bq) U-235: 0.05205 nCi (1.926 Bq)	Am-241: 2.866 nCi (106.0 Bq) <b>Total Activity:</b> 6.145 nCi (227.3 Bq)
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**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.6%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 6889  $\alpha$ /min in 2 $\pi$  on 11 Apr 03.

*Daniel James Van Dalsen*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

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24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
1800 North Keystone Street Burbank, California 91504



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Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
New Exp Date  
α4 ⇒ 10/21/2014

PAI ID 00188  
rec'd from recalibration  
3-28-03 TP 10/22/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b>	U-234	<b>Customer:</b>	PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b>	U-235	<b>P.O. No.:</b>	EW030603/R2155
<b>Radionuclide C:</b>	Am-241	<b>Catalog No.:</b>	MISC-STD
<b>Half Life (U-234):</b>	(2.454 ± 0.006)E+05 years	<b>Reference Date:</b>	1-Apr-03 12:00 PST
<b>Half Life (U-235):</b>	(7.037 ± 0.011)E+08 years	<b>Source No.:</b>	92MIX2203021
<b>Half Life (Am-241):</b>	432.17 ± 0.66 years		

**Contained Radioactivity:**

U-234:	2.731 nCi (101.0 Bq)	Am-241:	0.9325 nCi (34.50 Bq)
U-235:	0.03416 nCi (1.264 Bq)	Total Activity:	3.698 nCi (136.8 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4145 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

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Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Ke-Calibrated 10/21/13  
 (x5) New Exp Date  
 => 10/21/2014  
 PAI ID 00186  
 special calibration  
 received 186  
 3-28-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203025
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**Contained Radioactivity:**

U-234: 5.486 nCi (203.0 Bq)	Am-241: 3.958 nCi (146.4 Bq)
U-235: 0.09221 nCi (3.412 Bq)	Total Activity: 9.536 nCi (352.8 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 10690 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

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Fax 661-257-8303

*Re-Calibrated 10/21/13  
New Exp Date  
α6 ⇒ 10/21/2014  
RATIO 60187  
rec'd for recalibration  
3-28-03 JP 10/22/13*

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203022
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**Contained Radioactivity:**

U-234: 3.592 nCi (132.9 Bq)	Am-241: 3.279 nCi (121.3 Bq)
U-235: 0.08556 nCi (3.166 Bq)	Total Activity: 6.957 nCi (257.4 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 7799 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
Quality Control

*19-Mar-03*  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

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24937 Avenue Tibbitts Valencia, California 91355

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1800 North Keystone Street Burbank, California 91504



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Re-Calibrated 10/21/13  
α 7 New Exp Date  
 ⇒ 10/21/2014

PA ID 188  
 rec'd for recalibration  
 3-28-03 JP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203023
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**Contained Radioactivity:**

U-234: 2.895 nCi (107.1 Bq)	Am-241: 1.953 nCi (72.26 Bq)
U-235: 0.02502 nCi (0.9257 Bq)	Total Activity: 4.873 nCi (180.3 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 5463 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsem*  
 Quality Control

19-Mar-03  
 Date Signed

IPL Ref. No.: 987-2

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 24937 Avenue Tibbitts Valencia, California 91355

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 1800 North Keystone Street Burbank, California 91504



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Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
28 New Exp Date  
 ⇒ 10/21/2014  
 PAI ID 189  
 rec'd 4-21-03  
 recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203029
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**Contained Radioactivity:**

U-234: 9.048 nCi (334.8 Bq) U-235: 0.1771 nCi (6.553 Bq)	Am-241: 1.433 nCi (53.02 Bq) <b>Total Activity:</b> 10.66 nCi (394.4 Bq)
---	---

**Physical description:**

A. Capsule type:	Disk (22 mm, OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.5%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.0%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 11950 α/min in 2π on 11 Apr 03.

*Daniel James Van Dalen*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
1800 North Keystone Street Burbank, California 91504

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 190\_10.21.13 (#9)

Description:

Analysis Date: 10/21/2013 10:15:08AM

Calibration Type: Efficiency

Source Info

Certificate ID: A9 RSO#190

Prepared by: IPL

Description:

Certification Date: 10/15/2013 10:00:00AM

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 8:31:19AM

Live Time: 35.00 min.

Real Time: 35.01 min.

Energy Calibration Equation:

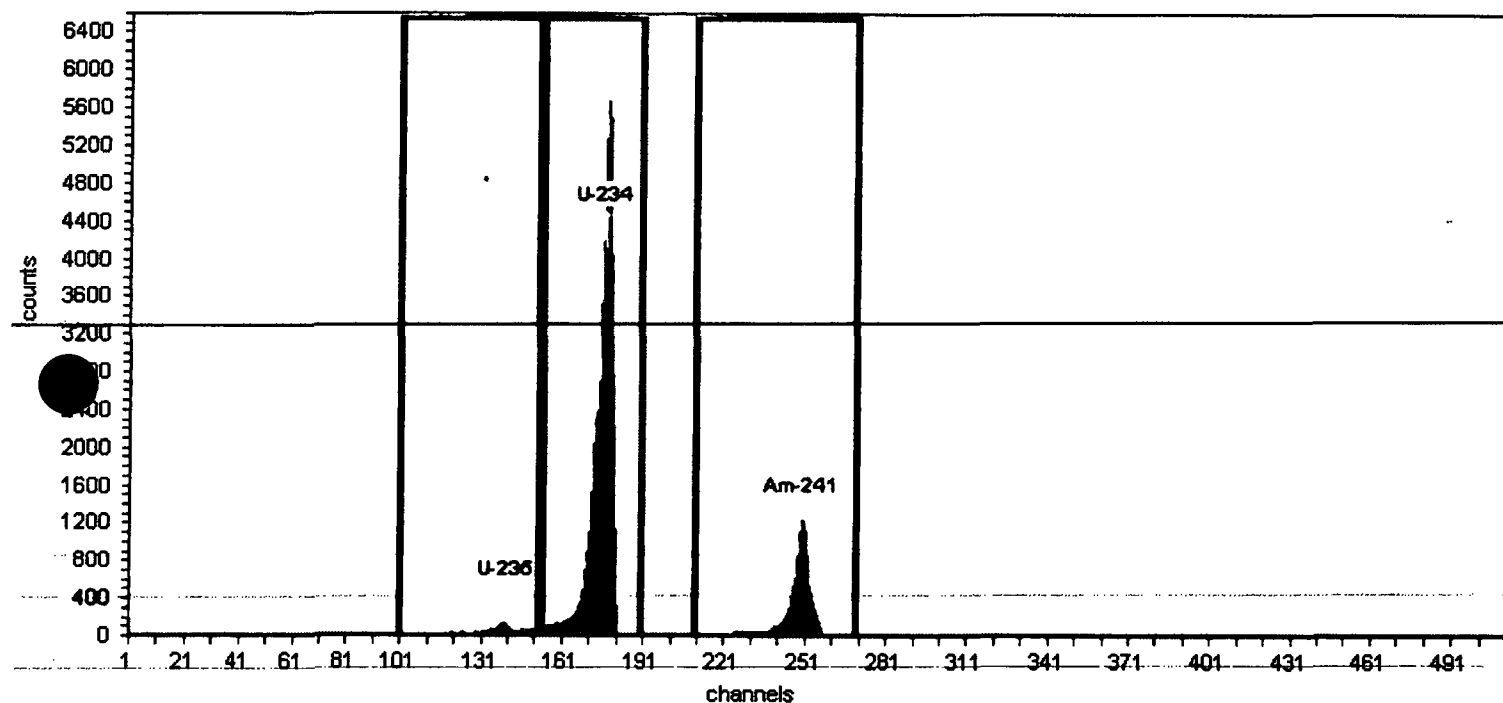
Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 190\_10.21.13 (

Efficiency: 31.46% +/- 0.32% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,135.00	32.43
U-234	176	4.78	153	190	32,739.00	935.40
Am-241	249	5.49	210	270	7,686.00	219.60

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 10:15:34AM  
Calibration Type: Efficiency

Energy Calibration: SOURCE 182\_10.21.13 (#1)

Description:

**Source Info**

Certificate ID: A1 RSO#182

Prepared by: IPL

Certification Date: 5/1/2003 12:00:24PM

Description:

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 9:09:15AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

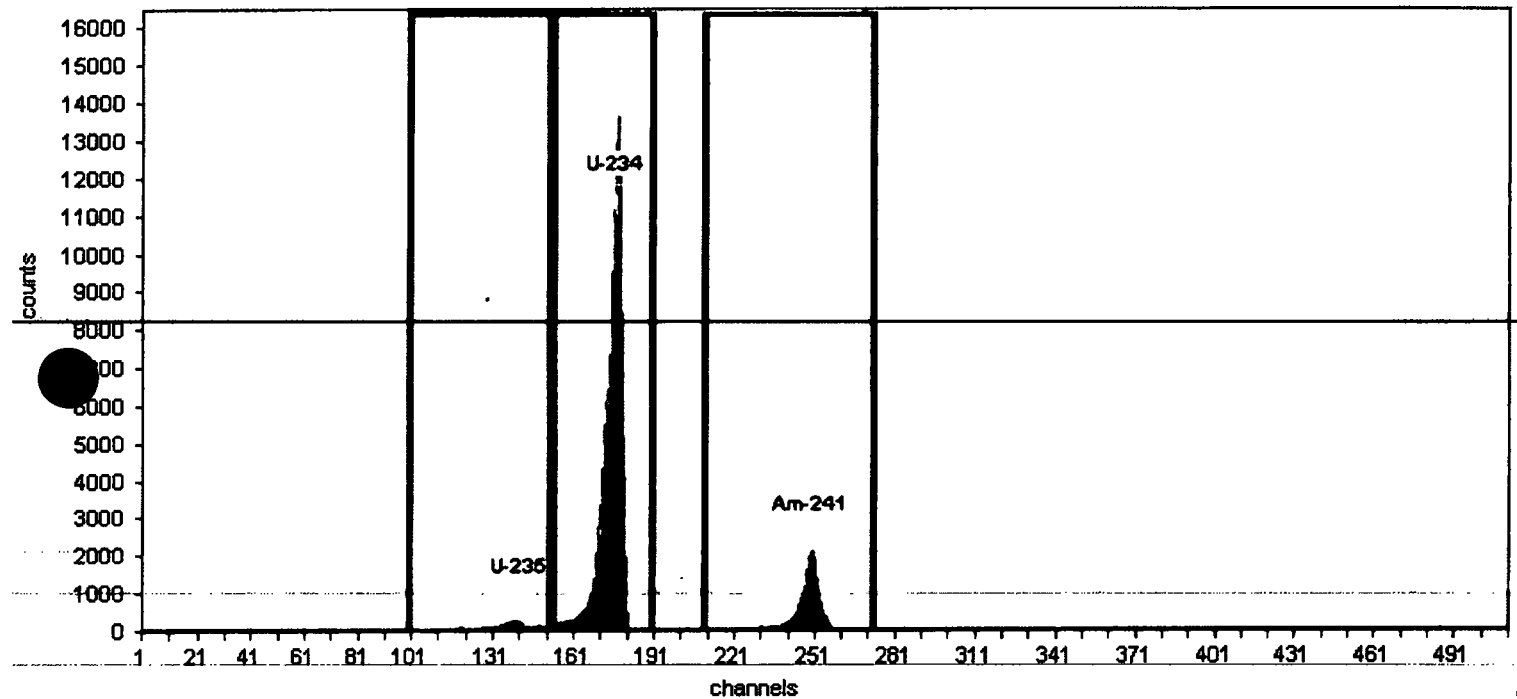
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Live Time: 35.00 min.

Real Time: 35.03 min.

Efficiency: 31.17% +/- 0.20% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 182\_10.21.13 (



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,689.00	76.83
U-234	176	4.78	153	190	81,484.00	2,328.11
Am-241	249	5.49	210	273	13,543.00	386.94

*JP 10/21/13*

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 10:39:26AM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 183\_10.21.13 (#2)

Description:

**Source Info**

Certificate ID: A2 RSO#183

Prepared by: IPL

Certification Date: 5/1/2003 12:00:00PM

Description:

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 9:48:00AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

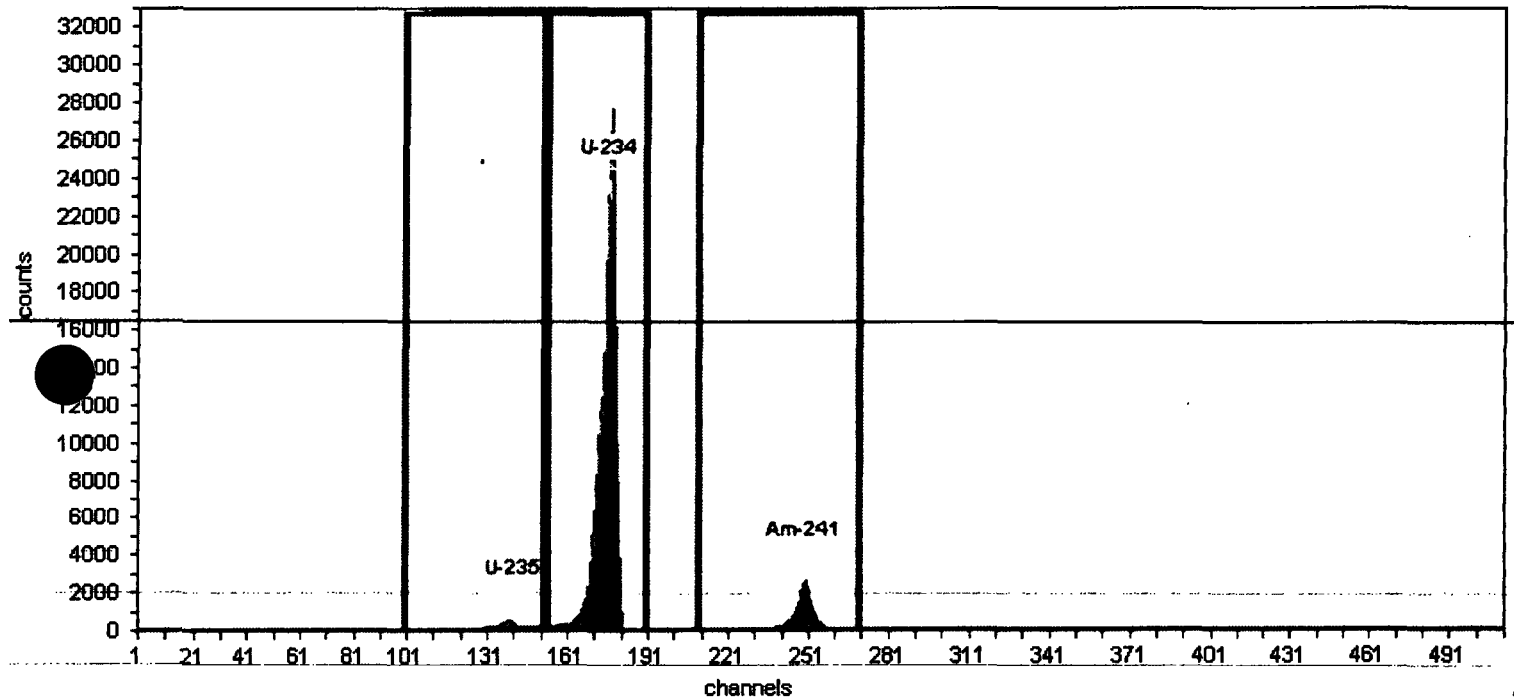
Real Time: 35.06 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 183\_10.21.13 (

Efficiency: 31.40% +/- 0.15% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	4,155.00	118.71
U-234	176	4.78	153	190	156,715.00	4,477.57
Am-241	249	5.49	210	270	15,830.00	452.29

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 11:08:15AM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 184\_10.21.13 (#3)

Detector:

**Source Info**

Certificate ID: A3 RSO#184

Prepared by: IPL

Certification Date: 5/1/2003 12:00:00PM

Description:

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 10:30:47AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

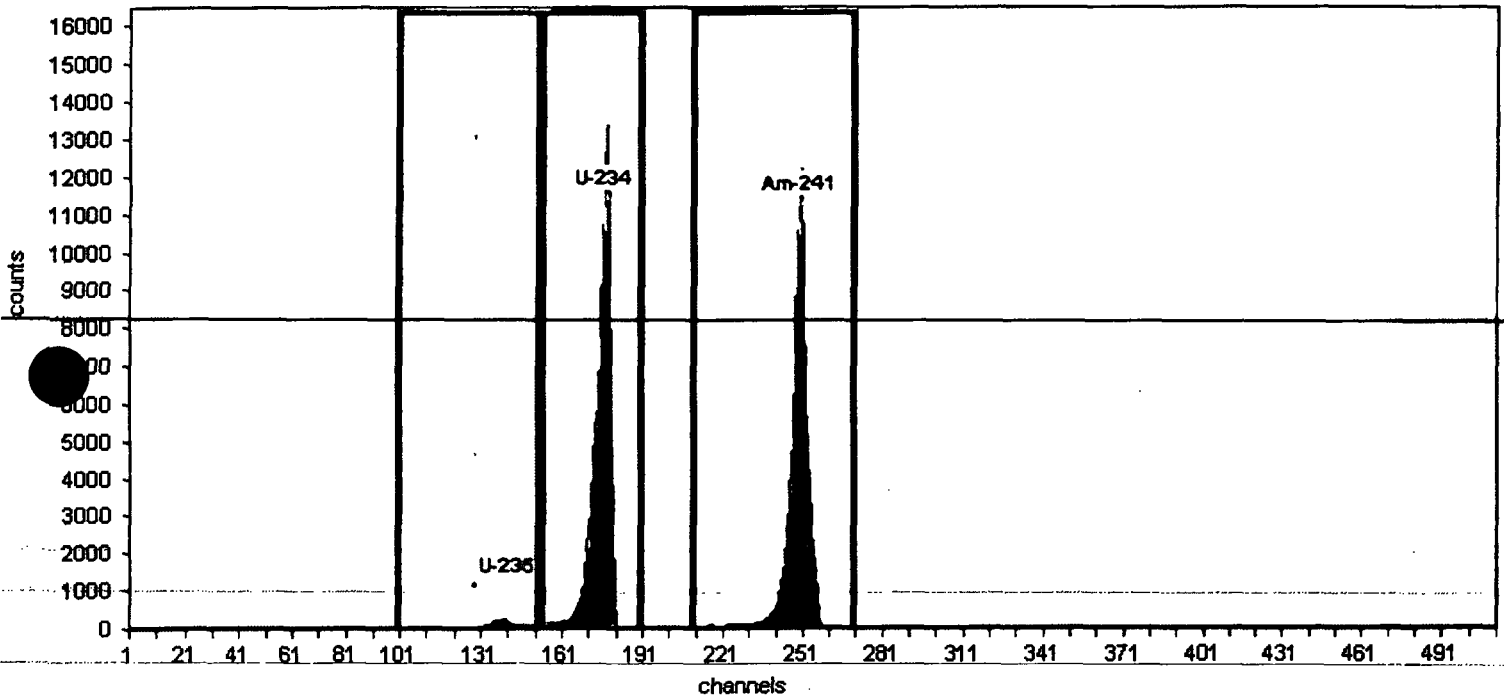
Real Time: 35.05 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 184\_10.21.13 (

Efficiency: 31.06% +/- 0.16% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,052.00	58.63
U-234	176	4.78	153	190	74,298.00	2,122.80
Am-241	249	5.49	210	270	71,764.00	2,050.40

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Energy Calibration: SOURCE 185\_10.21.13 (#4)

Description:

Analysis Date: 10/21/2013 11:44:23AM  
Calibration Type: Energy And Efficiency

**Source Info**

Certificate ID: A4 RSO#185

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

**Acquisition**

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 11:08:08AM

Live Time: 35.00 min.

Real Time: 35.03 min.

Energy Calibration Equation:

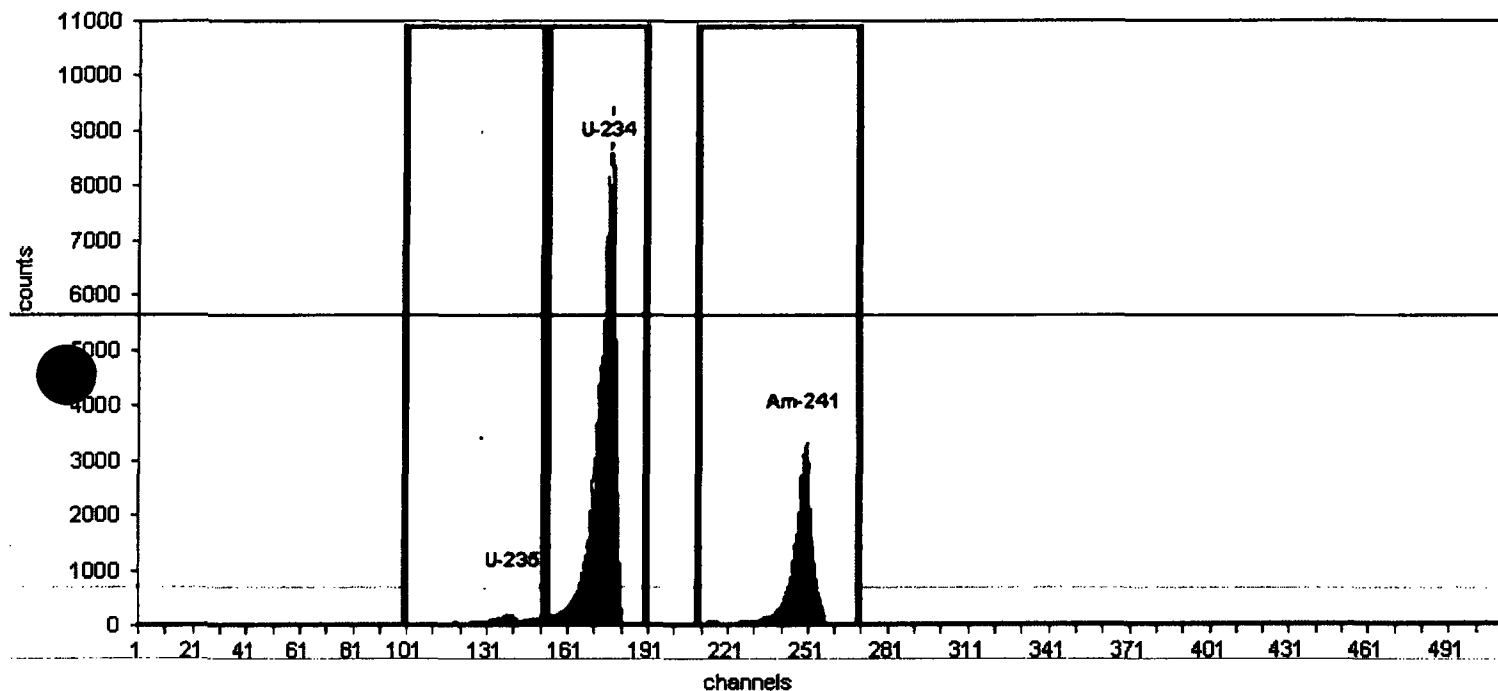
Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 185\_10.21.13 (

Efficiency: 30.07% +/- 0.21% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,198.00	62.80
U-234	176	4.78	153	190	62,381.00	1,782.31
Am-241	249	5.49	210	270	22,944.00	655.54

JP 10/21/13



Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 12:20:40PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 186\_10.21.13 (#5)

Description:

**Source Info**

Certificate ID: A5 RSO#186

Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 11:45:31AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

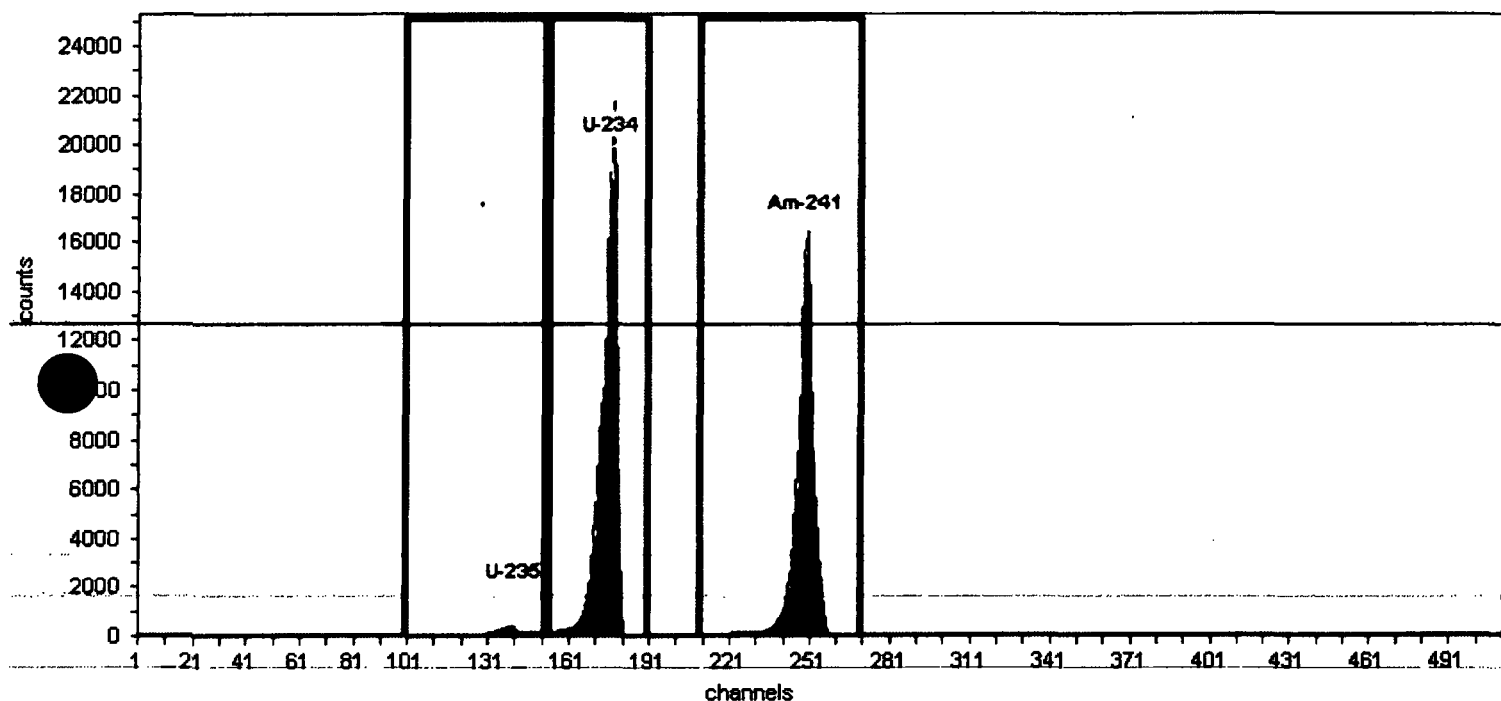
Real Time: 35.08 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 186\_10.21.13 (

Efficiency: 31.20% +/- 0.13% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	3,425.00	97.86
U-234	176	4.78	153	190	124,917.00	3,569.06
Am-241	249	5.49	210	270	103,302.00	2,951.49

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Energy Calibration: SOURCE 187\_10.21.13 (#6)

Description:

Analysis Date: 10/21/2013 12:56:51PM

Calibration Type: Energy And Efficiency

**Source Info**

Certificate ID: A6 RSO#187

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 12:21:22PM

Live Time: 35.00 min.

Real Time: 35.06 min.

Energy Calibration Equation:

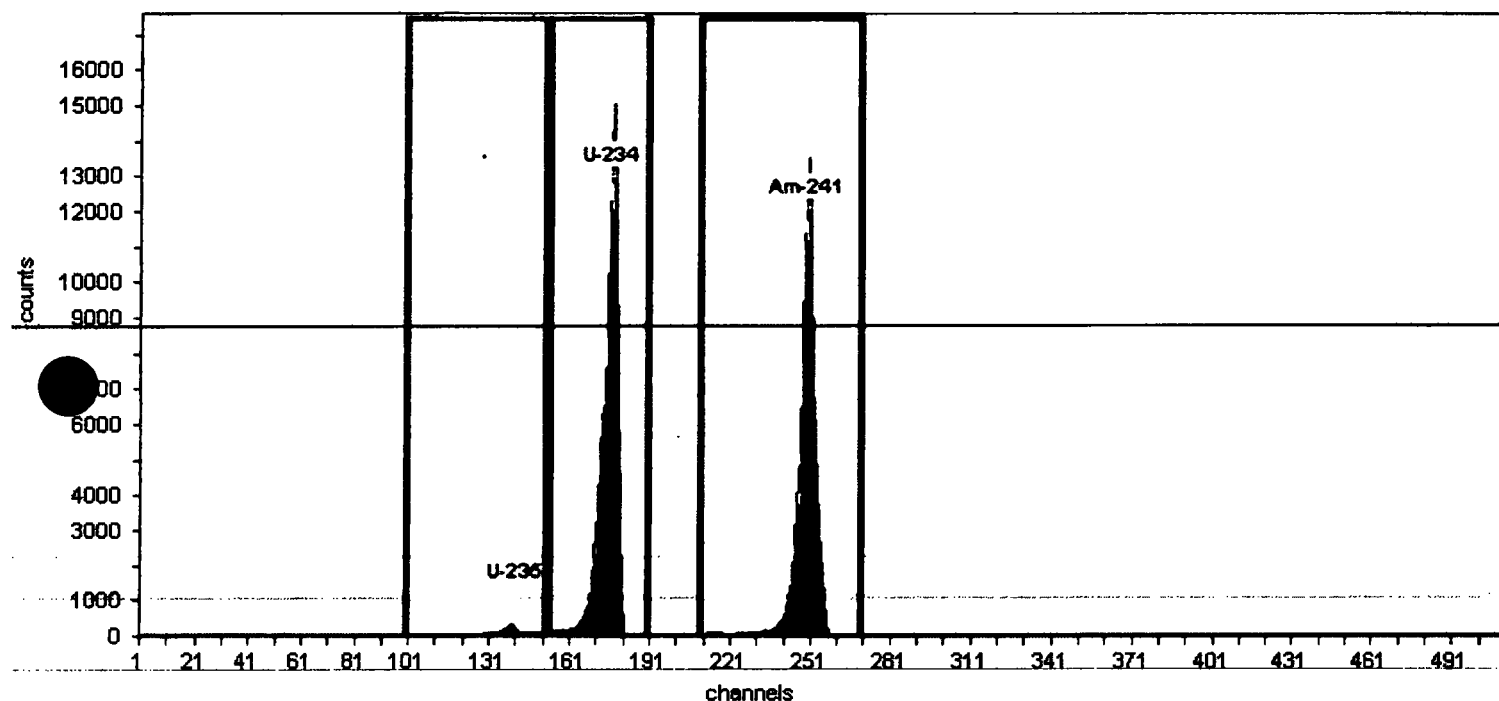
Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 187\_10.21.13 (

Efficiency: 30.89% +/- 0.15% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,349.00	67.11
U-234	176	4.78	153	190	84,490.00	2,414.00
Am-241	249	5.49	210	270	78,934.00	2,255.26

*JP 10/21/13*

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 1:32:57PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 188\_10.21.13 (#7)

Description:

**Source Info**

Certificate ID: A7 RSO#188

Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 12:57:17PM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

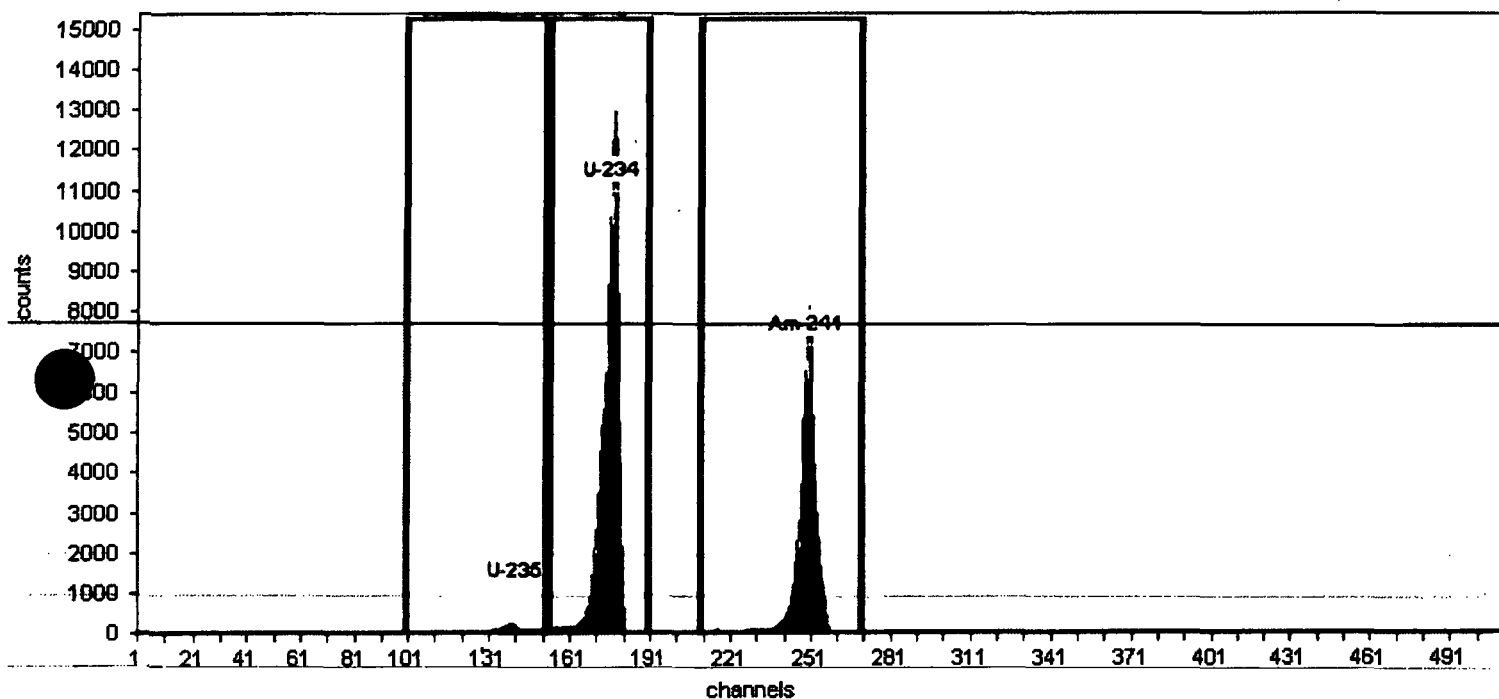
Real Time: 35.04 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 188\_10.21.13 (

Efficiency: 31.50% +/- 0.19% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,847.00	52.77
U-234	176	4.78	153	190	71,762.00	2,050.34
Am-241	249	5.49	210	270	46,085.00	1,316.71

*JP 10/21/13*

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 189\_10.21.13 (#8)  
Description:

Analysis Date: 10/21/2013 2:09:42PM  
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A8 RSO#189  
Prepared by: IPL  
Description:

Certification Date: 4/1/2003 12:00:00PM

Acquisition

Detector: 13a, SN:  
Acquisition Start Date: 10/21/2013 1:34:04PM

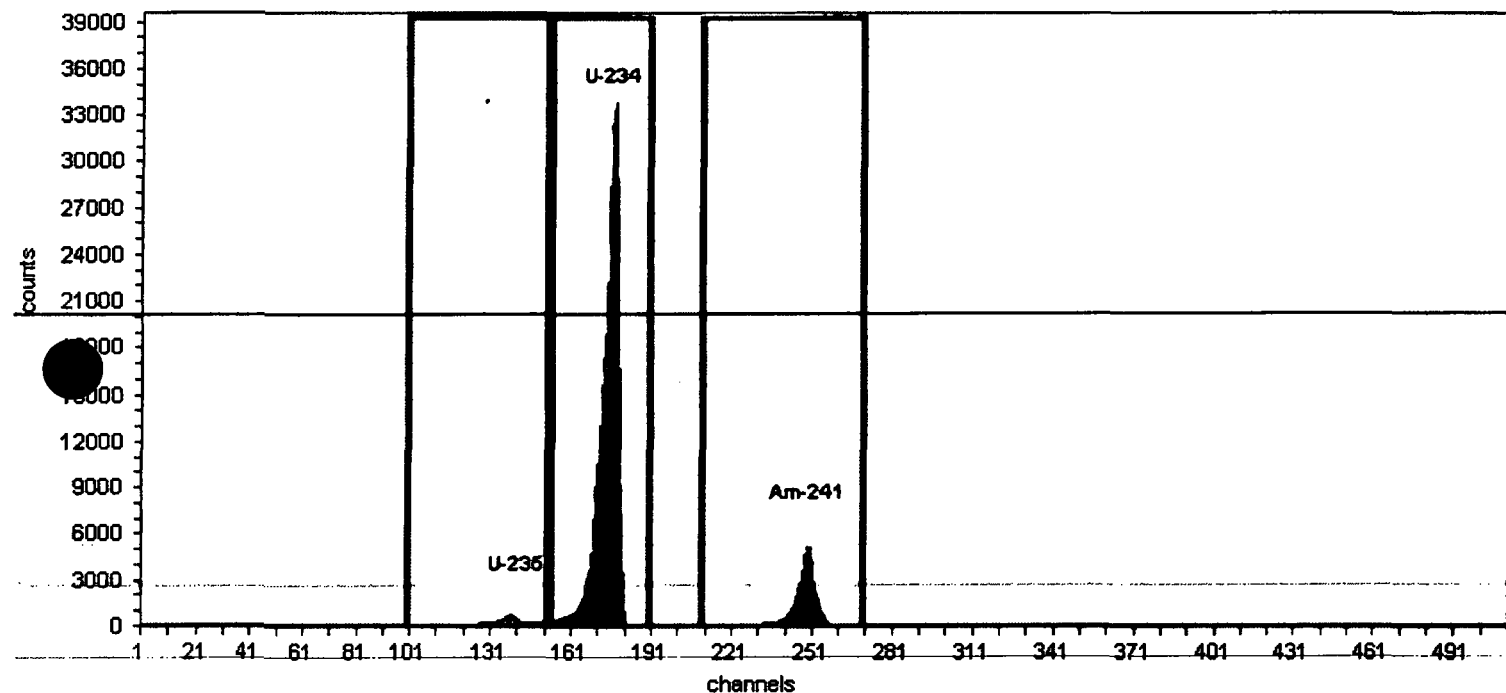
Energy Calibration Equation:  
Gain = 9.9575 keV / Ch

Live Time: 35.00 min.  
Real Time: 35.09 min.

Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 189\_10.21.13 (

Efficiency: 31.23% +/- 0.12% TPU(2 sigma)



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	6,721.00	192.03
U-234	176	4.78	153	190	218,016.00	6,229.03
Am-241	249	5.49	210	270	34,624.00	989.26

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 2:45:56PM

Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 190A\_10.21.13 (#9)

Description:

Source Info

Certificate ID: A9 RSO#190

Prepared by: IPL

Certification Date: 10/15/2013 10:00:00AM

Description:

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 2:10:16PM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

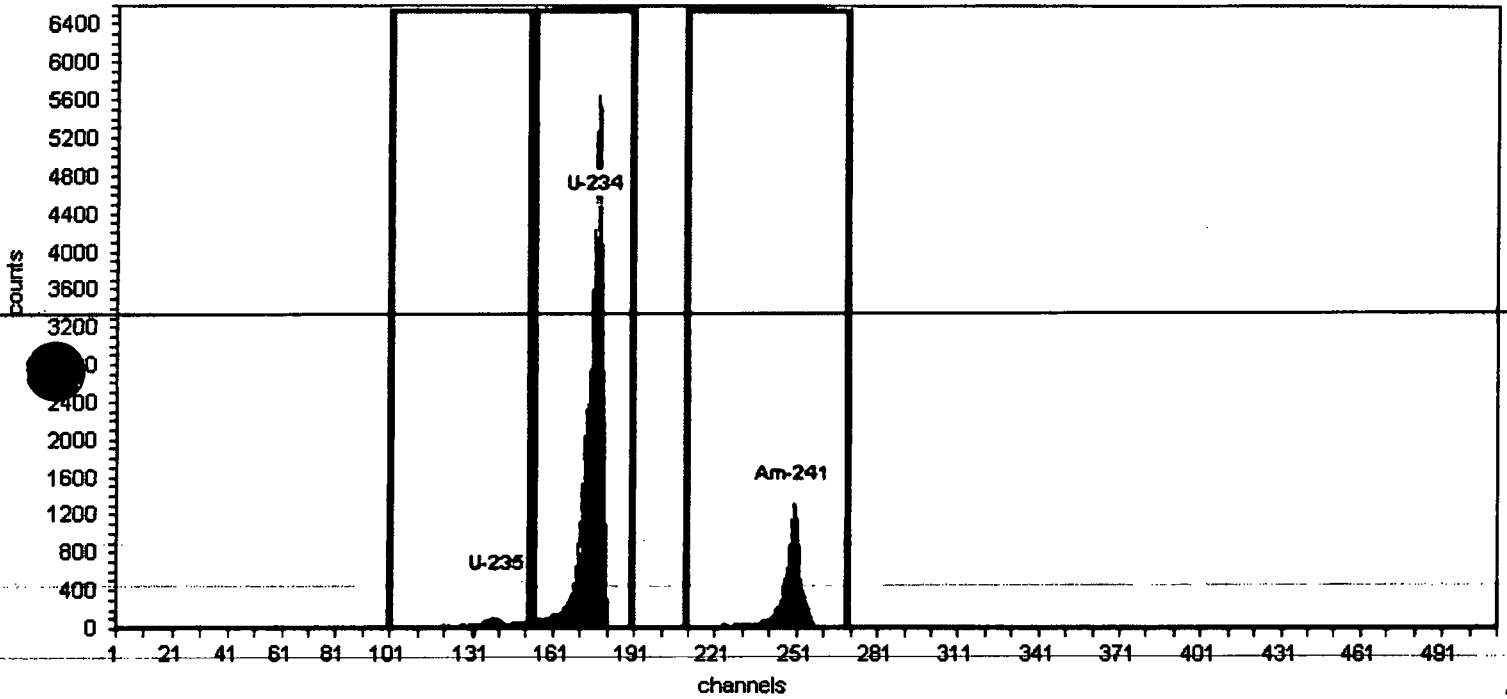
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Live Time: 35.00 min.

Real Time: 35.01 min.

Efficiency: 31.69% +/- 0.32% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 190A\_10.21.13



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,155.00	33.00
U-234	176	4.78	153	190	32,933.00	940.94
Am-241	249	5.49	210	270	7,807.00	223.06

JP 10/21/13

Case Narrative -1402166

## Isotopic Uranium Case Narrative

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### **Cabrera Services, Inc** **Schofield Barracks – 08-3123.00**

Work Order Number: 1402166

1. This report consists of the analytical results and supporting documentation for 15 filter samples received by ALS on 2/14/2014.
2. These samples were prepared according to the current revisions of SOP 773 and SOP 778.
3. The samples were analyzed for the presence of isotopic uranium according to the current revision of SOP 714. The analyses were completed on 2/22/2014.
4. The isotopic analysis results for these samples are reported on an 'As Received' basis in units of  $\mu\text{Ci}/\text{mL}$ .
5. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate.
6. This analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to emission energies between those of U-234 and U-238. A potential limitation of this method is that measurable amounts of U-234 in the sample may cause a small amount of characteristic activity in the U-235 region of interest due to poorly resolved alpha activity at the boundary between the two regions. To minimize the potential for a high bias in the U-235 analytical results, the U-235 region of interest has been narrowed and limited to a lower energy region. An 85.1% abundance correction has been made to the final U-235 results.
7. Uranium-238 activity is reported in the associated method blank AS140215-2PMB above the minimum detectable concentration value, as indicated with a "B3" qualifier on the final reports. The measured blank activity is below the requested MDC. Results are acceptable and are submitted without further qualification.



8. The magnitude of the negative U-234 activity for sample 1402166-1 is greater than the 2 sigma TPU. The analyst's review of the data does not indicate a problem with the instrument data or the subsequent reporting systems. The data quality is not believed to be affected and the results are submitted without qualification. Under typical conditions, where background level sample data is normally distributed and analyzed by paired observations, this event is likely to occur at least 2.5% of the time.
9. No further anomalous situations were encountered during the preparation or analysis of these samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
Crystal Shaeffer  
Radiochemistry Primary Data Reviewer

2/25/14  
Date

  
Radiochemistry Final Data Reviewer

02/26/14  
Date





## Section 1

# CHAIN OF CUSTODY

# ALS Environmental -- FC

## Sample Number(s) Cross-Reference Table

**OrderNum:** 1402166

**Client Name:** Cabrera Services, Inc.

**Client Project Name:** Schofield Barracks

**Client Project Number:** 08-3123.00

**Client PO Number:** 12-3541

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SBHF14-080-ST03-AS-BK	1402166-1		FILTER	11-Feb-14	16:21
SBHF14-081-ST04-AS-BK	1402166-2		FILTER	11-Feb-14	16:10
SBHF14-082-ST05-AS-BK	1402166-3		FILTER	11-Feb-14	16:08
SBHF14-083-ST06-AS-BK	1402166-4		FILTER	11-Feb-14	16:01
SBHF14-084-ST07-AS-BK	1402166-5		FILTER	11-Feb-14	15:56
SBHF14-085-ST08-AS-BK	1402166-6		FILTER	11-Feb-14	15:53
SBHF14-086-ST09-AS-BK	1402166-7		FILTER	11-Feb-14	15:46
SBHF14-087-ST10-AS-BK	1402166-8		FILTER	11-Feb-14	15:42
SBHF14-088-ST11-AS-BK	1402166-9		FILTER	11-Feb-14	15:39
SBHF14-Blank-1	1402166-10		FILTER	11-Feb-14	
SBHF14-Blank-2	1402166-11		FILTER	11-Feb-14	
SBHF14-078-ST01-AS-BK	1402166-12		FILTER	11-Feb-14	15:15
SBHF14-079-ST02-AS-BK	1402166-13		FILTER	11-Feb-14	15:17
SBHF14-067-ST01-AS-HF	1402166-14		FILTER	10-Feb-14	12:40
SBHF14-068-ST02-AS-HF	1402166-15		FILTER	10-Feb-14	12:43



# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 480-1511 FX: (970) 480-1522

## Chain-of-Custody

Form 202r6

WORKORDER # TBD

1402106

<b>SAMPLER</b>	Stephan Owe	<b>DATE</b>	2/11/2014	<b>PAGE</b>	1 of 1
<b>PROJECT NAME</b>	Schofield Barracks	<b>TURNAROUND</b>	30 days	<b>DISPOSAL</b>	(By Lab) or Return to Client
<b>PROJECT No.</b>	08-3123.00	<b>EDD FORMAT</b>	n/a		
	Task 310	<b>PURCHASE ORDER</b>	12-3541		
<b>COMPANY NAME</b>	Cabrera Services	<b>BILL TO COMPANY</b>	Cabrera Services		
<b>SEND REPORT TO</b>	Mike Winters	<b>INVOICE ATTN TO</b>	Accounts Payable		
<b>ADDRESS</b>	2318 Bolger Ave	<b>ADDRESS</b>	473 Silver Lane		
<b>CITY / STATE / ZIP</b>	Spring Hill, FL 34609	<b>CITY / STATE / ZIP</b>	East Hartford, CT 06108		
<b>PHONE</b>	352-610-2150	<b>PHONE</b>	860-568-0095		
<b>FAX</b>	n/a	<b>FAX</b>	n/a		
<b>E-MAIL</b>	mwinters@cabreraseservices.com	<b>E-MAIL</b>	n/a		

Lab ID	Field ID	Matrix	Sample Date	Start Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec											
①	SBHF14-080-ST03-AS-BK	F	2/11/2014	9:34	16:21	407	10	X											
②	SBHF14-081-ST04-AS-BK	F	2/11/2014	8:43	16:10	447	10	X											
③	SBHF14-082-ST05-AS-BK	F	2/11/2014	8:45	16:08	443	10	X											
④	SBHF14-083-ST06-AS-BK	F	2/11/2014	9:22	16:01	399	10	X											
⑤	SBHF14-084-ST07-AS-BK	F	2/11/2014	9:20	15:58	396	10	X											
⑥	SBHF14-085-ST08-AS-BK	F	2/11/2014	9:17	15:53	396	10	X											
⑦	SBHF14-086-ST09-AS-BK	F	2/11/2014	9:13	15:46	393	10	X											
⑧	SBHF14-087-ST10-AS-BK	F	2/11/2014	9:11	15:42	391	10	X											
⑨	SBHF14-088-ST11-AS-BK	F	2/11/2014	9:08	15:39	391	10	X											
⑩	SBHF14-Blank-1	F	2/11/2014																
⑪	SBHF14-Blank-2	F	2/11/2014																

\*Time Zone (Circle): EST CST MST **HAST** Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

**Comments:**

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/ml

MDC is 1E-15 uCi/ml; see previously provided work plan for other MQO's

Bag of blank unused filters included for QC sample purposes

Preserve half of each sample for re-analysis/follow up testing

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

QC PACKAGE (check below)	
<input type="checkbox"/>	LEVEL II (Standard QC)
<input type="checkbox"/>	LEVEL III (Std QC + forms)
<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>[Signature]</i>	Stephan Owe	2/11/2014	15:30
RECEIVED BY	<i>[Signature]</i>	Pat Horkman	2/11/2014	15:31
RELINQUISHED BY	<i>[Signature]</i>	Pat Horkman	2/12/14	1500
RECEIVED BY	<i>[Signature]</i>	C Trumbic	2/11/14	1605
RELINQUISHED BY				
RECEIVED BY				

5 of 113



# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

## Chain-of-Custody

Form 202a

WORKORDER # TBD

140204

<b>PROJECT NAME</b>	Schofield Barracks	<b>SAMPLER</b>	Jon A Cote	<b>DATE</b>	2/11/2014	<b>PAGE</b>	1 of 1
<b>PROJECT No.</b>	08-3123.00	<b>SITE ID</b>	Schofield Barracks	<b>TURNAROUND</b>	30 days	<b>DISPOSAL</b>	(By Lab) or Return to Client
<b>COMPANY NAME</b>	Cabrera Services	<b>EDD FORMAT</b>	n/a				
<b>SEND REPORT TO</b>	Mike Winters	<b>PURCHASE ORDER</b>	12-3541				
<b>ADDRESS</b>	2318 Bolger Ave	<b>BILL TO COMPANY</b>	Cabrera Services				
<b>CITY / STATE / ZIP</b>	Spring Hill, FL 34609	<b>INVOICE ATTN TO</b>	Accounts Payable				
<b>PHONE</b>	352-610-2150	<b>ADDRESS</b>	473 Silver Lane				
<b>FAX</b>	n/a	<b>CITY / STATE / ZIP</b>	East Hartford, CT 06108				
<b>E-MAIL</b>	mwinters@cabreraseservices.com	<b>PHONE</b>	860-569-0095				
		<b>FAX</b>	n/a				
		<b>E-MAIL</b>	n/a				

Lab ID	Field ID	Matrix	Sample Date	Start Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec											
13	SBHF14-078-ST01-AS-BK	F	2/11/2014	8:43	15:15	392	10	X											
	SBHF14-079-ST02-AS-BK	F	2/11/2014	8:45	15:17	392	10	X											

\*Time Zone (Circle): EST CST MST HAST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

<b>Comments:</b>	<input type="checkbox"/>	LEVEL II (Standard QC)
	<input type="checkbox"/>	LEVEL III (Std QC + forms)
	X	LEVEL IV (Std QC + forms + raw data)
	<input type="checkbox"/>	

QC PACKAGE (check below)

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/ml

MDC is 1E-15 uCi/ml; see previously provided work plan for other MQO's

Bag of blank unused filters included for QC sample purposes

Preserve half of each sample for re-analysis/follow up testing

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5036

SIGNATURE	PRINTED NAME	DATE	TIME
<i>[Signature]</i>	Jon A Cote	2/11/2014	15:30
<i>[Signature]</i>	Pat Horkman	2/11/2014	15:31
<i>[Signature]</i>	Pat Horkman	2/12/14	15:00
<i>[Signature]</i>	C Trinkle	2/14/14	10:05

6 of 113



**ALS Laboratory Group**

225 Commerce Drive, Fort Collins, Colorado 80524  
 TF: (800) 443-1511 FH: (970) 480-1511 FX: (970) 480-1522

**Chain-of-Custody**

WORKORDER # TBD

14021

Form 202r

<b>PROJECT NAME</b> Schofield Barracks		<b>SAMPLER</b> Jon A Cote	<b>DATE</b> 2/10/2014	<b>PAGE</b> 1 of 1
<b>PROJECT No.</b> 08-3123.00		<b>SITE ID</b> Schofield Barracks	<b>TURNAROUND</b> 30 days	<b>DISPOSAL</b> (By Lab) or Return to Client
<b>Task</b> 310	<b>EDD FORMAT</b> n/a	<b>PURCHASE ORDER</b> 12-3541		
<b>COMPANY NAME</b> Cabrera Services	<b>BILL TO COMPANY</b> Cabrera Services	<b>INVOICE ATTN TO</b> Accounts Payable		
<b>SEND REPORT TO</b> Mike Winters	<b>ADDRESS</b> 2318 Bolger Ave	<b>ADDRESS</b> 473 Silver Lane		
<b>CITY / STATE / ZIP</b> Spring Hill, FL 34609	<b>PHONE</b> 352-610-2150	<b>CITY / STATE / ZIP</b> East Hartford, CT 06108		
<b>PHONE</b> 352-610-2150	<b>FAX</b> n/a	<b>PHONE</b> 860-569-0095		
<b>FAX</b> n/a	<b>E-MAIL</b> mwinters@cabreraseservices.com	<b>FAX</b> n/a		
<b>E-MAIL</b> mwinters@cabreraseservices.com	<b>E-MAIL</b> n/a			

Lab ID	Field ID	Matrix	Sample Date	Sart Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec												
(17)	SBHF14-067-ST01-AS-HF	F	2/10/2014	7:34	12:40	306	10	X												
(15)	SBHF14-068-ST02-AS-HF	F	2/10/2014	7:37	12:43	306	10	X												

\*Time Zone (Circle): EST CST MST (HAST) Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

**Comments:**

Volumes provided in n<sup>3</sup>; results requested in units of uCi/ml  
 MDC is 1E-15 uCi/ml; see previously provided work plan for other MQO's  
 Bag of blank unused filters included for QC sample purposes  
 Preserve half of each sample for re-analysis/follow up testing

**Preservative Key:** 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

**QC PACKAGE (check below)**

<input type="checkbox"/>	LEVEL II (Standard QC)
<input type="checkbox"/>	LEVEL III (Std QC + forms)
<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)

SIGNATURE	PRINTED NAME	DATE	TIME
<i>Jon A Cote</i>	Jon A Cote	2/10/2014	15:30
<i>Pat Horkman</i>	Pat Horkman	2/10/2014	15:31
<i>Pat Horkman</i>	Pat Horkman	2/12/14	1500
<i>C Trumble</i>	C Trumble	2-14-14	1005



ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: Cabrera

Workorder No: 1402166

Project Manager: LS

Initials: CDT Date: 2-14-14

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	<input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	<input checked="" type="radio"/> NO
Cooler #: <u>1</u>			
Temperature (°C): <u>Amb</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: <u>11</u>			
Background µR/hr reading: <u>11</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES / NO / NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 2/14/14

From: (800) 324-6800  
Pat Huberman (no client account)  
CARRERA SERVICES  
1554 Lyman Road (Mtg 3000)  
Schaumburg, IL 60197

Origin ID: HMLA



Ship Date: 12FEB14  
Address: 1.0 LB  
CAD: 105310400NET3400  
Dim: 12 X 12 X 12 IN

1402166

SHIP TO: (970) 488-1511  
Lance Steere  
ALS Laboratories  
225 COMMERCE DR  
FORT COLLINS, CO 80524

BILL RENDER



Ref # 08-3028.04 Task 021  
Invoice #  
PO # A/S to ALS  
Capt #

FRI - 14 FEB 10:30A  
PRIORITY OVERNIGHT

TRK# 7878 9055 5057  
4821



XH FTCA

11-0

80524  
CO-UB  
DEN



5230488F720

After printing this label:

1. Use the "Print" button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.

Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com. FedEx will not be responsible for any claim in excess of \$100 per package, whether the result of loss, damage, delay, non-delivery, misdelivery, or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim. Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental, consequential, or special is limited to the greater of \$100 or the authorized declared value. Recovery cannot exceed actual documented loss. Maximum for items of extraordinary value is \$1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our Service Guide. Written claims must be filed within strict time limits. See current FedEx Service Guide.



Section 2

2

# **SAMPLE RESULTS SUMMARY**



# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402166

**Page:** 1 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:26:49 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402166-1	SBHF14-080-ST03-AS-BK	Sample	U-234	-4.9E-16 +/- 4.2E-16	8.8E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-1	SBHF14-080-ST03-AS-BK	Sample	U-235	0E+00 +/- 2.7E-16	5.5E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-1	SBHF14-080-ST03-AS-BK	Sample	U-238	-2E-16 +/- 2.5E-16	5.7E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-2	SBHF14-081-ST04-AS-BK	Sample	U-234	6E-17 +/- 3E-16	5.5E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-2	SBHF14-081-ST04-AS-BK	Sample	U-235	7E-17 +/- 1.6E-16	9E-17	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-2	SBHF14-081-ST04-AS-BK	Sample	U-238	1.1E-16 +/- 2E-16	3.4E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-3	SBHF14-082-ST05-AS-BK	Sample	U-234	2.5E-16 +/- 2.3E-16	3.3E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-3	SBHF14-082-ST05-AS-BK	Sample	U-235	1E-16 +/- 1.6E-16	2.4E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-3	SBHF14-082-ST05-AS-BK	Sample	U-238	2.7E-16 +/- 2E-16	2E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	LT

**Comments:**

**Data Package ID:** UR1402166-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402166

**Page:** 2 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:26:49 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402166-4	SBHF14-083-ST06-AS-BK	Sample	U-234	9E-17 +/- 3.4E-16	6.2E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-4	SBHF14-083-ST06-AS-BK	Sample	U-235	0E+00 +/- 2.4E-16	4.9E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-4	SBHF14-083-ST06-AS-BK	Sample	U-238	2.8E-16 +/- 2.8E-16	4.1E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-5	SBHF14-084-ST07-AS-BK	Sample	U-234	3E-17 +/- 5.1E-16	9.2E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-5	SBHF14-084-ST07-AS-BK	Sample	U-235	-1.1E-16 +/- 2.4E-16	5.5E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-5	SBHF14-084-ST07-AS-BK	Sample	U-238	3E-17 +/- 3.6E-16	6.6E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-6	SBHF14-085-ST08-AS-BK	Sample	U-234	0E+00 +/- 2.9E-16	5.7E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-6	SBHF14-085-ST08-AS-BK	Sample	U-235	-8E-17 +/- 2.1E-16	4.6E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-6	SBHF14-085-ST08-AS-BK	Sample	U-238	1.8E-16 +/- 2.4E-16	3.9E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U

**Comments:**

**Data Package ID:** UR1402166-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402166

**Page:** 3 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:26:49 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402166-7	SBHF14-086-ST09-AS-BK	Sample	U-234	3.9E-16 +/- 4.4E-16	6.9E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-7	SBHF14-086-ST09-AS-BK	Sample	U-235	-5E-17 +/- 2.5E-16	4.7E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-7	SBHF14-086-ST09-AS-BK	Sample	U-238	1.3E-16 +/- 2.1E-16	3.2E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-8	SBHF14-087-ST10-AS-BK	Sample	U-234	1.3E-16 +/- 3E-16	5.3E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-8	SBHF14-087-ST10-AS-BK	Sample	U-235	4E-17 +/- 2E-16	4.1E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-8	SBHF14-087-ST10-AS-BK	Sample	U-238	2.6E-16 +/- 2.3E-16	3E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-9	SBHF14-088-ST11-AS-BK	Sample	U-234	1.84E-15 +/- 8.1E-16	9.2E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	
1402166-9	SBHF14-088-ST11-AS-BK	Sample	U-235	-3.8E-16 +/- 3.3E-16	8.6E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-9	SBHF14-088-ST11-AS-BK	Sample	U-238	2.3E-16 +/- 3.1E-16	4.9E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U

**Comments:**

**Data Package ID:** UR1402166-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402166

**Page:** 4 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:26:49 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402166-10	SBHF 14-Blank-1	Sample	U-234	-1.5E-16 +/- 6.5E-16	1.33E-15	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-10	SBHF 14-Blank-1	Sample	U-235	4.5E-16 +/- 4.8E-16	6.6E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-10	SBHF 14-Blank-1	Sample	U-238	3.8E-16 +/- 5.9E-16	1E-15	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-11	SBHF 14-Blank-2	Sample	U-234	4.5E-16 +/- 3.6E-16	4.9E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-11	SBHF 14-Blank-2	Sample	U-235	-5E-17 +/- 2.3E-16	3.5E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-11	SBHF 14-Blank-2	Sample	U-238	4E-17 +/- 2.7E-16	5.3E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-12	SBHF 14-078-ST01-AS-BK	Sample	U-234	1.6E-16 +/- 3.4E-16	5.9E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-12	SBHF 14-078-ST01-AS-BK	Sample	U-235	8E-17 +/- 1.9E-16	2.8E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-12	SBHF 14-078-ST01-AS-BK	Sample	U-238	-3E-17 +/- 1.7E-16	3.9E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U

**Comments:**

**Data Package ID:** UR1402166-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402166

**Page:** 5 of 5  
**Reported on:** Tuesday, February 25, 2014  
 2:26:49 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402166-13	SBHF14-079-ST02-AS-BK	Sample	U-234	-6E-17 +/- 2.6E-16	5.3E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-13	SBHF14-079-ST02-AS-BK	Sample	U-235	7E-17 +/- 1.7E-16	3.3E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-13	SBHF14-079-ST02-AS-BK	Sample	U-238	1.2E-16 +/- 2.3E-16	4E-16	uCi/ml	FILTER	AS140215-2	2/21/2014	U
1402166-14	SBHF14-067-ST01-AS-HF	Sample	U-234	2.4E-16 +/- 2E-16	1.1E-16	uCi/ml	FILTER	AS140215-2	2/22/2014	
1402166-14	SBHF14-067-ST01-AS-HF	Sample	U-235	0E+00 +/- 2.3E-16	3.5E-16	uCi/ml	FILTER	AS140215-2	2/22/2014	U
1402166-14	SBHF14-067-ST01-AS-HF	Sample	U-238	4E-17 +/- 2E-16	3E-16	uCi/ml	FILTER	AS140215-2	2/22/2014	U
1402166-15	SBHF14-068-ST02-AS-HF	Sample	U-234	2.4E-16 +/- 2E-16	1.1E-16	uCi/ml	FILTER	AS140215-2	2/22/2014	
1402166-15	SBHF14-068-ST02-AS-HF	Sample	U-235	1.4E-16 +/- 2.3E-16	1.3E-16	uCi/ml	FILTER	AS140215-2	2/22/2014	
1402166-15	SBHF14-068-ST02-AS-HF	Sample	U-238	2E-16 +/- 2.4E-16	3.7E-16	uCi/ml	FILTER	AS140215-2	2/22/2014	U

**Comments:**

**Data Package ID:** UR1402166-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit



## Section 3

# QC RESULTS SUMMARY

**3**

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-2MMB

Sample Matrix: FILTER

Prep Batch: AS140215-2

Final Aliquot: 54700000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-2-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-2UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 22-Feb-14

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	6E-17 +/- 2.1E-16	4E-16		U
15117-96-1	U-235	7E-17 +/- 1.7E-16	1E-16		U
7440-61-1	U-238	1.2E-16 +/- 1.7E-16	2.8E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-2PMB

Sample Matrix: FILTER

Prep Batch: AS140215-2

Final Aliquot: 54700000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-2-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-2UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 22-Feb-14

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.8E-16 +/- 2E-16	9E-17		
15117-96-1	U-235	-8E-17 +/- 2E-16	3.8E-16		U
7440-61-1	U-238	1E-16 +/- 1.7E-16	9E-17	1E-15	B3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Minimum Detectable Concentration  
BDL - Below Detection Limit

M - Requested MDC not met.  
B - Analyte concentration greater than MDC.  
B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UR1402166-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental – FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-2LCS

Sample Matrix: FILTER

Prep Batch: AS140215-2

Final Aliquot: 54700000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-2-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-2UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 22-Feb-14

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	4.14E-14 +/- 7.1E-15	1E-16	4.040E-14	102	82 - 122	P
7440-61-1	U-238	4.53E-14 +/- 7.7E-15	1E-16	4.190E-14	108	82 - 122	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

Data Package ID: *UR1402166-1*

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-2LCSD	Sample Matrix: FILTER Prep SOP: PAI 778 Rev 14 Date Collected: 15-Feb-14 Date Prepared: 15-Feb-14 Date Analyzed: 22-Feb-14	Prep Batch: AS140215-2 QCBatchID: AS140215-2-1 Run ID: AS140215-2UR Count Time: 1000 minutes	Final Aliquot: 54700000 ml Result Units: uCi/ml File Name: Spectrum #1
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CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	3.98E-14 +/- 6.8E-15	2E-16	4.040E-14	98.6	82 - 122	P
7440-61-1	U-238	4.01E-14 +/- 6.8E-15	1E-16	4.190E-14	95.6	82 - 122	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
L - LCS Recovery below lower control limit.  
H - LCS Recovery above upper control limit.  
P - LCS Recovery within control limits.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Minimum Detectable Concentration

Data Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Duplicate Sample Results (DER)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID:  
Lab ID: AS140215-2LCSD

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 15-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 22-Feb-14

Prep Batch: AS140215-2  
QCBatchID: AS140215-2-1  
Run ID: AS140215-2UR  
Count Time: 1000 minutes

Final Aliquot: 54700000 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
13966-29-5	U-234	4.14E-14 +/- 7.1E-15	1E-16	P	3.98E-14 +/- 6.8E-15	2E-16	P	0.162	2.13
7440-61-1	U-238	4.53E-14 +/- 7.7E-15	1E-16	P	4.01E-14 +/- 6.8E-15	1E-16	P	0.509	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Package ID: UR1402166-1



## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-080-ST03-AS-BK

Lab ID: 1402166-1

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.75E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-4.9E-16 +/- 4.2E-16	8.8E-16		U
15117-96-1	U-235	0E+00 +/- 2.7E-16	5.5E-16		U
7440-61-1	U-238	-2E-16 +/- 2.5E-16	5.7E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-081-ST04-AS-BK

Lab ID: 1402166-2

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.35E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	6E-17 +/- 3E-16	5.5E-16		U
15117-96-1	U-235	7E-17 +/- 1.6E-16	9E-17		U
7440-61-1	U-238	1.1E-16 +/- 2E-16	3.4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-082-ST05-AS-BK

Lab ID: 1402166-3

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.25E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.5E-16 +/- 2.3E-16	3.3E-16		U
15117-96-1	U-235	1E-16 +/- 1.6E-16	2.4E-16		U
7440-61-1	U-238	2.7E-16 +/- 2E-16	2E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-083-ST06-AS-BK

Lab ID: 1402166-4

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.65E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	9E-17 +/- 3.4E-16	6.2E-16		U
15117-96-1	U-235	0E+00 +/- 2.4E-16	4.9E-16		U
7440-61-1	U-238	2.8E-16 +/- 2.8E-16	4.1E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-084-ST07-AS-BK

Lab ID: 1402166-5

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.60E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3E-17 +/- 5.1E-16	9.2E-16		U
15117-96-1	U-235	-1.1E-16 +/- 2.4E-16	5.5E-16		U
7440-61-1	U-238	3E-17 +/- 3.6E-16	6.6E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-085-ST08-AS-BK

Lab ID: 1402166-6

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.60E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	0E+00 +/- 2.9E-16	5.7E-16		U
15117-96-1	U-235	-8E-17 +/- 2.1E-16	4.6E-16		U
7440-61-1	U-238	1.8E-16 +/- 2.4E-16	3.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-086-ST09-AS-BK

Lab ID: 1402166-7

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QC Batch ID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.55E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.9E-16 +/- 4.4E-16	6.9E-16		U
15117-96-1	U-235	-5E-17 +/- 2.5E-16	4.7E-16		U
7440-61-1	U-238	1.3E-16 +/- 2.1E-16	3.2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-087-ST10-AS-BK

Lab ID: 1402166-8

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.55E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.3E-16 +/- 3E-16	5.3E-16		U
15117-96-1	U-235	4E-17 +/- 2E-16	4.1E-16		U
7440-61-1	U-238	2.6E-16 +/- 2.3E-16	3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-088-ST11-AS-BK

Lab ID: 1402166-9

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.55E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.84E-15 +/- 8.1E-16	9.2E-16		
15117-96-1	U-235	-3.8E-16 +/- 3.3E-16	8.6E-16		U
7440-61-1	U-238	2.3E-16 +/- 3.1E-16	4.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-Blank-1

Lab ID: 1402166-10

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QC Batch ID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.20E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-1.5E-16 +/- 6.5E-16	1.33E-15		U
15117-96-1	U-235	4.5E-16 +/- 4.8E-16	6.6E-16		U
7440-61-1	U-238	3.8E-16 +/- 5.9E-16	1E-15	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-Blank-2

Lab ID: 1402166-11

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 11-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.20E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	4.5E-16 +/- 3.6E-16	4.9E-16		U
15117-96-1	U-235	-5E-17 +/- 2.3E-16	3.5E-16		U
7440-61-1	U-238	4E-17 +/- 2.7E-16	5.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-078-ST01-AS-BK  
Lab ID: 1402166-12

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 11-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 21-Feb-14

Prep Batch: AS140215-2  
QCBatchID: AS140215-2-1  
Run ID: AS140215-2UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 5.55E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.6E-16 +/- 3.4E-16	5.9E-16		U
15117-96-1	U-235	8E-17 +/- 1.9E-16	2.8E-16		U
7440-61-1	U-238	-3E-17 +/- 1.7E-16	3.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> SBHF14-079-ST02-AS-BK <b>Lab ID:</b> 1402166-13	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 11-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 21-Feb-14	<b>Prep Batch:</b> AS140215-2 <b>QCBatchID:</b> AS140215-2-1 <b>Run ID:</b> AS140215-2UR <b>Count Time:</b> 1000 minutes <b>Report Basis:</b> As Received	<b>Final Aliquot:</b> 5.55E+07 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-6E-17 +/- 2.6E-16	5.3E-16		U
15117-96-1	U-235	7E-17 +/- 1.7E-16	3.3E-16		U
7440-61-1	U-238	1.2E-16 +/- 2.3E-16	4E-16	1E-15	U

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

**Abbreviations:**

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

**Package ID:** UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-067-ST01-AS-HF

Lab ID: 1402166-14

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 10-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 22-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.33E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.4E-16 +/- 2E-16	1.1E-16		
15117-96-1	U-235	0E+00 +/- 2.3E-16	3.5E-16		U
7440-61-1	U-238	4E-17 +/- 2E-16	3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402166

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-068-ST02-AS-HF

Lab ID: 1402166-15

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 10-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 22-Feb-14

Prep Batch: AS140215-2

QCBatchID: AS140215-2-1

Run ID: AS140215-2UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.33E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.4E-16 +/- 2E-16	1.1E-16		
15117-96-1	U-235	1.4E-16 +/- 2.3E-16	1.3E-16		
7440-61-1	U-238	2E-16 +/- 2.4E-16	3.7E-16	1E-15	U

o

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402166-1



## Section 5

# RAW DATA

5

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Monday, February 24, 2014

PAI Work Order: 1402166

Analytical SOP: PAI 714

3:28:29 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402166-1 SMP	U-232 Tracer	2/11/2014 4:21:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	57500000 ml 57500000 ml	AlphaSpec2 13a	AS140215-2UR Spectrum #1	2/21/2014 1:43 PM	1126.000 28.000	30.84% 1000	1000 77.2%	2.86E-14 4.6E-15	7E-16 NA	uCi/ml As Received	NA NA	
1402166-1 SMP	U-234 Trg. Analyte	2/11/2014 4:21:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	57500000 ml 57500000 ml	AlphaSpec2 13a	AS140215-2UR Spectrum #1	2/21/2014 1:43 PM	-15.000 27.000	30.84% 1000	1000 77.2%	-4.9E-16 4.2E-16	8.8E-16 NA	uCi/ml As Received	NA NA	U
1402166-1 SMP	U-235 Trg. Analyte	2/11/2014 4:21:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	57500000 ml 57500000 ml	AlphaSpec2 13a	AS140215-2UR Spectrum #1	2/21/2014 1:43 PM	0.000 6.000	30.84% 1000	1000 77.2%	0E+00 2.7E-16	5.5E-16 NA	uCi/ml As Received	NA NA	U
1402166-1 SMP	U-238 Trg. Analyte	2/11/2014 4:21:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	57500000 ml 57500000 ml	AlphaSpec2 13a	AS140215-2UR Spectrum #1	2/21/2014 1:43 PM	-6.000 10.000	30.84% 1000	1000 77.2%	-2E-16 2.5E-16	5.7E-16 NA	uCi/ml As Received	NA NA	U
1402166-2 SMP	U-232 Tracer	2/11/2014 4:10:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	63500000 ml 63500000 ml	AlphaSpec2 14a	AS140215-2UR Spectrum #1	2/21/2014 1:44 PM	1192.000 16.000	28.44% 1000	1000 88.7%	2.97E-14 4.7E-15	5E-16 NA	uCi/ml As Received	NA NA	
1402166-2 SMP	U-234 Trg. Analyte	2/11/2014 4:10:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	63500000 ml 63500000 ml	AlphaSpec2 14a	AS140215-2UR Spectrum #1	2/21/2014 1:44 PM	2.000 13.000	28.44% 1000	1000 88.7%	6E-17 3E-16	5.5E-16 NA	uCi/ml As Received	NA NA	U
1402166-2 SMP	U-235 Trg. Analyte	2/11/2014 4:10:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	63500000 ml 63500000 ml	AlphaSpec2 14a	AS140215-2UR Spectrum #1	2/21/2014 1:44 PM	2.000 0.000	28.44% 1000	1000 88.7%	7E-17 1.6E-16	9E-17 NA	uCi/ml As Received	NA NA	U
1402166-2 SMP	U-238 Trg. Analyte	2/11/2014 4:10:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	63500000 ml 63500000 ml	AlphaSpec2 14a	AS140215-2UR Spectrum #1	2/21/2014 1:44 PM	4.000 4.000	28.44% 1000	1000 88.7%	1.1E-16 2E-16	3.4E-16 NA	uCi/ml As Received	NA NA	U
1402166-3 SMP	U-232 Tracer	2/11/2014 4:08:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	62500000 ml 62500000 ml	AlphaSpec2 16a	AS140215-2UR Spectrum #1	2/21/2014 1:44 PM	1241.000 14.000	29.83% 1000	1000 88.0%	3E-14 4.8E-15	5E-16 NA	uCi/ml As Received	NA NA	
1402166-3 SMP	U-234 Trg. Analyte	2/11/2014 4:08:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	62500000 ml 62500000 ml	AlphaSpec2 16a	AS140215-2UR Spectrum #1	2/21/2014 1:44 PM	9.000 4.000	29.83% 1000	1000 88.0%	2.5E-16 2.3E-16	3.3E-16 NA	uCi/ml As Received	NA NA	U
1402166-3 SMP	U-235 Trg. Analyte	2/11/2014 4:08:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	62500000 ml 62500000 ml	AlphaSpec2 16a	AS140215-2UR Spectrum #1	2/21/2014 1:44 PM	3.000 1.000	29.83% 1000	1000 88.0%	1E-16 1.6E-16	2.4E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402166-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Monday, February 24, 2014

PAI Work Order: 1402166

Analytical SOP: PAI 714

3:28:29 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	Spk. Recov Flags
1402166-3 SMP	U-238 Trg. Analyte	2/11/2014 4:08:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	62500000 ml 62500000 ml	AlphaSpec2 16a	AS140215-2UR Spectrum #1	2/21/2014 1:44 PM	10.000 1.000	29.83% 1000	1000 88.0%	2.7E-16 2E-16	2E-16 NA	uCi/ml As Received	NA NA	NA LT
1402166-4 SMP	U-232 Tracer	2/11/2014 4:01:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 25	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1193.000 34.000	29.18% 1000	1000 86.5%	3.26E-14 5.2E-15	8E-16 NA	uCi/ml As Received	NA NA	NA NA
1402166-4 SMP	U-234 Trg. Analyte	2/11/2014 4:01:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 25	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	3.000 13.000	29.18% 1000	1000 86.5%	9E-17 3.4E-16	6.2E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-4 SMP	U-235 Trg. Analyte	2/11/2014 4:01:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 25	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	0.000 5.000	29.18% 1000	1000 86.5%	0E+00 2.4E-16	4.9E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-4 SMP	U-238 Trg. Analyte	2/11/2014 4:01:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56500000 ml 56500000 ml	AlphaSpec2 25	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	9.000 5.000	29.18% 1000	1000 86.5%	2.8E-16 2.8E-16	4.1E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-5 SMP	U-232 Tracer	2/11/2014 3:56:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 26	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1227.000 35.000	30.73% 1000	1000 84.4%	3.21E-14 5.1E-15	8E-16 NA	uCi/ml As Received	NA NA	NA NA
1402166-5 SMP	U-234 Trg. Analyte	2/11/2014 3:56:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 26	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1.000 34.000	30.73% 1000	1000 84.4%	3E-17 5.1E-16	9.2E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-5 SMP	U-235 Trg. Analyte	2/11/2014 3:56:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 26	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	-3.000 7.000	30.73% 1000	1000 84.4%	-1.1E-16 2.4E-16	5.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-5 SMP	U-238 Trg. Analyte	2/11/2014 3:56:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 26	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1.000 16.000	30.73% 1000	1000 84.4%	3E-17 3.6E-16	6.6E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-6 SMP	U-232 Tracer	2/11/2014 3:53:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 29	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1053.000 36.000	27.70% 1000	1000 80.4%	3.06E-14 4.9E-15	9E-16 NA	uCi/ml As Received	NA NA	NA NA
1402166-6 SMP	U-234 Trg. Analyte	2/11/2014 3:53:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 29	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	0.000 8.000	27.70% 1000	1000 80.4%	0E+00 2.9E-16	5.7E-16 NA	uCi/ml As Received	NA NA	NA U

**Comments:**

**Data Package ID: UR1402166-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR - Tracer
- TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402166

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Monday, February 24, 2014  
3:28:29 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402166-6 SMP	U-235 Trg. Analyte	2/11/2014 3:53:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 29	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	-2.000 3.000	27.70% 1000	1000 80.4%	-8E-17 2.1E-16	4.6E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-6 SMP	U-238 Trg. Analyte	2/11/2014 3:53:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 29	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	5.000 3.000	27.70% 1000	1000 80.4%	1.8E-16 2.4E-16	3.9E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-7 SMP	U-232 Tracer	2/11/2014 3:46:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 30	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	888.000 23.000	28.09% 1000	1000 66.9%	2.57E-14 4.2E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
1402166-7 SMP	U-234 Trg. Analyte	2/11/2014 3:46:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 30	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	9.000 8.000	28.09% 1000	1000 66.9%	3.9E-16 4.4E-16	6.9E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-7 SMP	U-235 Trg. Analyte	2/11/2014 3:46:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 30	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	-1.000 2.000	28.09% 1000	1000 66.9%	-5E-17 2.5E-16	4.7E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-7 SMP	U-238 Trg. Analyte	2/11/2014 3:46:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 30	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	3.000 1.000	28.09% 1000	1000 66.9%	1.3E-16 2.1E-16	3.2E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-8 SMP	U-232 Tracer	2/11/2014 3:42:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 31	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1196.000 31.000	29.21% 1000	1000 86.6%	3.32E-14 5.3E-15	8E-16 NA	uCi/ml As Received	NA NA	NA NA
1402166-8 SMP	U-234 Trg. Analyte	2/11/2014 3:42:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 31	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	4.000 9.000	29.21% 1000	1000 86.6%	1.3E-16 3E-16	5.3E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-8 SMP	U-235 Trg. Analyte	2/11/2014 3:42:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 31	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1.000 3.000	29.21% 1000	1000 86.6%	4E-17 2E-16	4.1E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-8 SMP	U-238 Trg. Analyte	2/11/2014 3:42:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 31	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	8.000 2.000	29.21% 1000	1000 86.6%	2.6E-16 2.3E-16	3E-16 NA	uCi/ml As Received	NA NA	NA U
1402166-9 SMP	U-232 Tracer	2/11/2014 3:39:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 32	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	836.000 15.000	29.03% 1000	1000 60.9%	2.34E-14 3.8E-15	6E-16 NA	uCi/ml As Received	NA NA	NA NA

**Comments:**

**Data Package ID:** UR1402166-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Monday, February 24, 2014

PAI Work Order: 1402166

Analytical SOP: PAI 714

3:28:29 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402166-9 SMP	U-234 Trg. Analyte	2/11/2014 3:39:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 32	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	40.000 14.000	29.03% 1000	1000 60.9%	1.84E-15 8.1E-16	9.2E-16 NA	uCi/ml As Received	NA NA	
1402166-9 SMP	U-235 Trg. Analyte	2/11/2014 3:39:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 32	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	-7.000 8.000	29.03% 1000	1000 60.9%	-3.8E-16 3.3E-16	8.6E-16 NA	uCi/ml As Received	NA NA	U
1402166-9 SMP	U-238 Trg. Analyte	2/11/2014 3:39:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 32	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	5.000 3.000	29.03% 1000	1000 60.9%	2.3E-16 3.1E-16	4.9E-16 NA	uCi/ml As Received	NA NA	U
1402166-10 SMP	U-232 Tracer	2/11/2014	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	52000000 ml 52000000 ml	AlphaSpec2 43	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	537.000 47.000	32.34% 1000	1000 35.1%	1.44E-14 2.5E-15	9E-16 NA	uCi/ml As Received	NA NA	
1402166-10 SMP	U-234 Trg. Analyte	2/11/2014	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	52000000 ml 52000000 ml	AlphaSpec2 43	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	-2.000 10.000	32.34% 1000	1000 35.1%	-1.5E-16 6.5E-16	1.33E-15 NA	uCi/ml As Received	NA NA	U
1402166-10 SMP	U-235 Trg. Analyte	2/11/2014	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	52000000 ml 52000000 ml	AlphaSpec2 43	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	5.000 1.000	32.34% 1000	1000 35.1%	4.5E-16 4.8E-16	6.6E-16 NA	uCi/ml As Received	NA NA	U
1402166-10 SMP	U-238 Trg. Analyte	2/11/2014	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	52000000 ml 52000000 ml	AlphaSpec2 43	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	5.000 5.000	32.34% 1000	1000 35.1%	3.8E-16 5.9E-16	1E-15 NA	uCi/ml As Received	NA NA	U
1402166-11 SMP	U-232 Tracer	2/11/2014	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	52000000 ml 52000000 ml	AlphaSpec2 45	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1007.000 33.000	31.65% 1000	1000 67.3%	2.76E-14 4.5E-15	8E-16 NA	uCi/ml As Received	NA NA	
1402166-11 SMP	U-234 Trg. Analyte	2/11/2014	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	52000000 ml 52000000 ml	AlphaSpec2 45	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	11.000 4.000	31.65% 1000	1000 67.3%	4.5E-16 3.6E-16	4.9E-16 NA	uCi/ml As Received	NA NA	U
1402166-11 SMP	U-235 Trg. Analyte	2/11/2014	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	52000000 ml 52000000 ml	AlphaSpec2 45	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	-1.000 1.000	31.65% 1000	1000 67.3%	-5E-17 2.3E-16	3.5E-16 NA	uCi/ml As Received	NA NA	U
1402166-11 SMP	U-238 Trg. Analyte	2/11/2014	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	52000000 ml 52000000 ml	AlphaSpec2 45	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1.000 5.000	31.65% 1000	1000 67.3%	4E-17 2.7E-16	5.3E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402166-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit



# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Monday, February 24, 2014

PAI Work Order: 1402166

Analytical SOP: PAI 714

3:28:29 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402166-12 SMP	U-232 Tracer	2/11/2014 3:15:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 46	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1184.000 18.000	30.58% 1000	1000 81.9%	3.14E-14 5E-15	6E-16 NA	uCi/ml As Received	NA NA	
1402166-12 SMP	U-234 Trg. Analyte	2/11/2014 3:15:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 46	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	5.000 11.000	30.58% 1000	1000 81.9%	1.6E-16 3.4E-16	5.9E-16 NA	uCi/ml As Received	NA NA	U
1402166-12 SMP	U-235 Trg. Analyte	2/11/2014 3:15:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 46	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	2.000 1.000	30.58% 1000	1000 81.9%	8E-17 1.9E-16	2.8E-16 NA	uCi/ml As Received	NA NA	U
1402166-12 SMP	U-238 Trg. Analyte	2/11/2014 3:15:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 46	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	-1.000 4.000	30.58% 1000	1000 81.9%	-3E-17 1.7E-16	3.9E-16 NA	uCi/ml As Received	NA NA	U
1402166-13 SMP	U-232 Tracer	2/11/2014 3:17:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 47	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	1272.000 26.000	30.42% 1000	1000 88.4%	3.39E-14 5.4E-15	7E-16 NA	uCi/ml As Received	NA NA	
1402166-13 SMP	U-234 Trg. Analyte	2/11/2014 3:17:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 47	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	-2.000 10.000	30.42% 1000	1000 88.4%	-6E-17 2.6E-16	5.3E-16 NA	uCi/ml As Received	NA NA	U
1402166-13 SMP	U-235 Trg. Analyte	2/11/2014 3:17:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 47	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	2.000 2.000	30.42% 1000	1000 88.4%	7E-17 1.7E-16	3.3E-16 NA	uCi/ml As Received	NA NA	U
1402166-13 SMP	U-238 Trg. Analyte	2/11/2014 3:17:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 47	AS140215-2UR Spectrum #1	2/21/2014 1:50 PM	4.000 5.000	30.42% 1000	1000 88.4%	1.2E-16 2.3E-16	4E-16 NA	uCi/ml As Received	NA NA	U
1402166-14 SMP	U-232 Tracer	2/10/2014 12:40:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	43300000 ml 43300000 ml	AlphaSpec2 81	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1214.000 2.000	30.83% 1000	1000 83.3%	4.1E-14 6.5E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402166-14 SMP	U-234 Trg. Analyte	2/10/2014 12:40:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	43300000 ml 43300000 ml	AlphaSpec2 81	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	6.000 0.000	30.83% 1000	1000 83.3%	2.4E-16 2E-16	1.1E-16 NA	uCi/ml As Received	NA NA	
1402166-14 SMP	U-235 Trg. Analyte	2/10/2014 12:40:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	43300000 ml 43300000 ml	AlphaSpec2 81	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	0.000 1.000	30.83% 1000	1000 83.3%	0E+00 2.3E-16	3.5E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402166-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer
- TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Monday, February 24, 2014

PAI Work Order: 1402166

Analytical SOP: PAI 714

3:28:29 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402166-14 SMP	U-238 Trg. Analyte	2/10/2014 12:40:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	43300000 ml 43300000 ml	AlphaSpec2 81	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1.000 1.000	30.83% 1000	1000 83.3%	4E-17 2E-16	3E-16 NA	uCi/ml As Received	NA NA	U
1402166-15 SMP	U-232 Tracer	2/10/2014 12:43:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	43300000 ml 43300000 ml	AlphaSpec2 82	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1236.000 2.000	30.65% 1000	1000 85.3%	4.2E-14 6.7E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402166-15 SMP	U-234 Trg. Analyte	2/10/2014 12:43:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	43300000 ml 43300000 ml	AlphaSpec2 82	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	6.000 0.000	30.65% 1000	1000 85.3%	2.4E-16 2E-16	1.1E-16 NA	uCi/ml As Received	NA NA	
1402166-15 SMP	U-235 Trg. Analyte	2/10/2014 12:43:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	43300000 ml 43300000 ml	AlphaSpec2 82	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	3.000 0.000	30.65% 1000	1000 85.3%	1.4E-16 2.3E-16	1.3E-16 NA	uCi/ml As Received	NA NA	
1402166-15 SMP	U-238 Trg. Analyte	2/10/2014 12:43:00 PM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	43300000 ml 43300000 ml	AlphaSpec2 82	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	5.000 2.000	30.65% 1000	1000 85.3%	2E-16 2.4E-16	3.7E-16 NA	uCi/ml As Received	NA NA	U
AS140215-2M MB	U-232 Tracer	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 83	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1290.000 1.000	31.20% 1000	1000 87.4%	3.41E-14 5.4E-15	2E-16 NA	uCi/ml As Received	NA NA	
AS140215-2M MB	U-234 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 83	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	2.000 5.000	31.20% 1000	1000 87.4%	6E-17 2.1E-16	4E-16 NA	uCi/ml As Received	NA NA	U
AS140215-2M MB	U-235 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 83	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	2.000 0.000	31.20% 1000	1000 87.4%	7E-17 1.7E-16	1E-16 NA	uCi/ml As Received	NA NA	U
AS140215-2M MB	U-238 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 83	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	4.000 2.000	31.20% 1000	1000 87.4%	1.2E-16 1.7E-16	2.8E-16 NA	uCi/ml As Received	NA NA	U
AS140215-2P MB	U-232 Tracer	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 84	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1127.000 2.000	30.40% 1000	1000 78.4%	3.05E-14 4.9E-15	3E-16 NA	uCi/ml As Received	NA NA	
AS140215-2P MB	U-234 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 84	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	8.000 0.000	30.40% 1000	1000 78.4%	2.8E-16 2E-16	9E-17 NA	uCi/ml As Received	NA NA	

**Comments:**

**Data Package ID: UR1402166-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
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- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
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**Abbreviations:**

- TR- Tracer TA - Target Analyte
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- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

1402166-1

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Monday, February 24, 2014

PAI Work Order: 1402166

Analytical SOP: PAI 714

3:28:29 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
AS140215-2P MB	U-235 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 84	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	-2.000 2.000	30.40% 1000	1000 78.4%	-8E-17 2E-16	3.8E-16 NA	uCi/ml As Received	NA NA	U
AS140215-2P MB	U-238 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 84	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	3.000 0.000	30.40% 1000	1000 78.4%	1E-16 1.7E-16	9E-17 NA	uCi/ml As Received	NA NA	B3
AS140215-2 LCS	U-232 Tracer	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 85	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1085.000 1.000	30.11% 1000	1000 76.2%	2.97E-14 4.8E-15	2E-16 NA	uCi/ml As Received	NA NA	
AS140215-2 LCS	U-234 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 85	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1153.000 0.000	30.11% 1000	1000 76.2%	4.14E-14 7.1E-15	1E-16 NA	uCi/ml As Received	NA NA	102 P
AS140215-2 LCS	U-238 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 85	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1262.000 0.000	30.11% 1000	1000 76.2%	4.53E-14 7.7E-15	1E-16 NA	uCi/ml As Received	NA NA	108 P
AS140215-2 LCSD	U-232 Tracer	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 86	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1174.000 3.000	30.61% 1000	1000 81.1%	3.16E-14 5E-15	3E-16 NA	uCi/ml As Received	NA NA	
AS140215-2 LCSD	U-234 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 86	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1200.000 1.000	30.61% 1000	1000 81.1%	3.98E-14 6.8E-15	2E-16 NA	uCi/ml As Received	0.16 NA	98.6 P
AS140215-2 LCSD	U-238 Trg. Analyte	2/15/2014 8:11:45 AM	AS140215-2 AS140215-2-1	NA NA	NA NA	FILTER NA	54700000 ml 54700000 ml	AlphaSpec2 86	AS140215-2UR Spectrum #1	2/22/2014 3:01 PM	1208.000 0.000	30.61% 1000	1000 81.1%	4.01E-14 6.8E-15	1E-16 NA	uCi/ml As Received	0.51 NA	95.6 P

**Comments:**

**Data Package ID: UR1402166-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

15113

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402166-1  
Spectrum #1 Analysis #1

Sample Size : 0.50

**Acquisition**

Detector: 13a  
Batch Name: UAS140215-2\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 1:43:59PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.91 min.  
Dead Time: 0.09 %

**Calibration**

Bkgd Info: Sample: B14021013; Det: 13a; Spectrum #1; Feb-10-2014 13:23

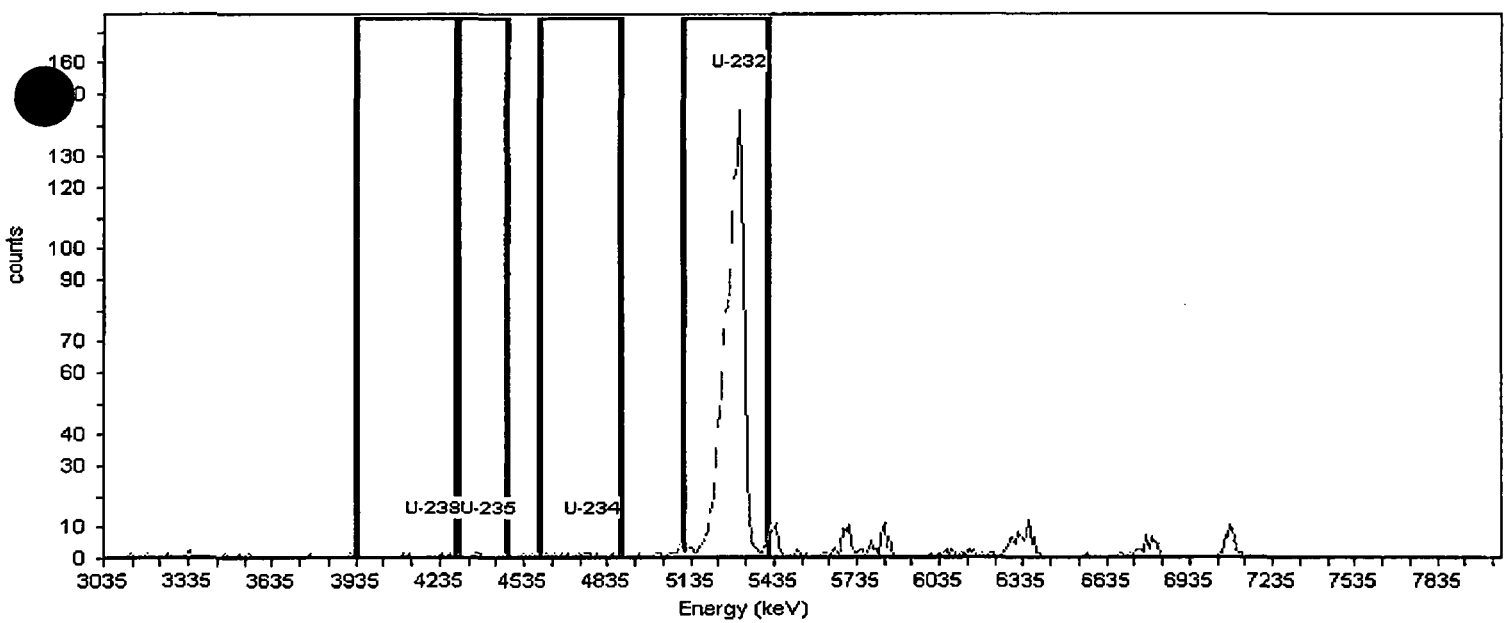
Calibration Date: 2/10/2014 10:51:21AM  
Efficiency Calibration: C14021013  
Efficiency: 30.84% +/- 0.13% TPU(2 sigma)

Energy Calibration: C14021013  
Energy Cal: Gain = 9.8597 keV / Ch  
Offset = 3,025.63 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 77.01%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.8	3932.7	4287.7	42.3	100.2	4.00	10.00	-6.00	-2.3E-002	2.8E-002	2.8E-002	6.6E-002
U-235	4406.0	4297.5	4475.0	298.6	99.7	6.00	6.00	0.00	0.0E+000	2.6E-002	2.2E-002	5.4E-002
U-234	4780.7	4593.3	4879.3	275.1	100.0	12.00	27.00	-15.00	-5.7E-002	4.8E-002	4.6E-002	1.0E-001
U-232	5313.1	5106.0	5411.7	76.5	100.1	1,154.00	28.00	1,126.00	3.4E+000	2.1E-001	4.8E-002	1.1E-001

Revised By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

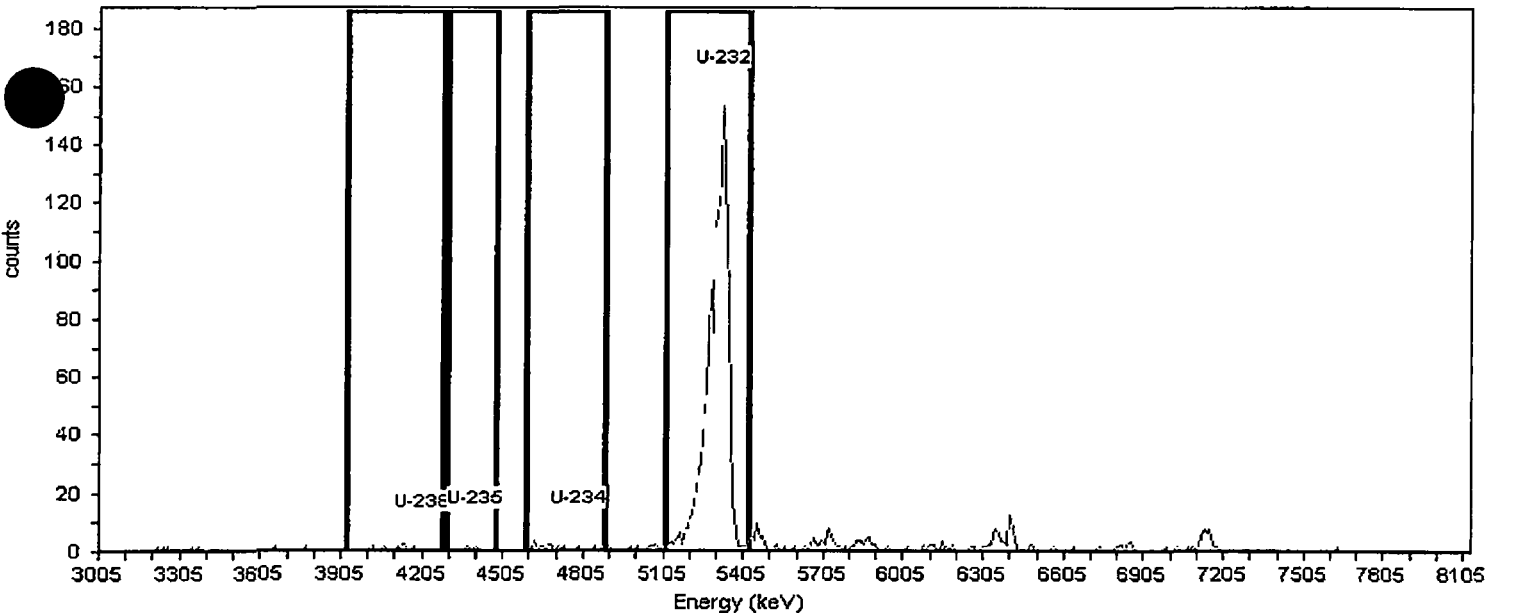
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402166-2  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 14a  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:44:01PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.91 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021014; Det: 14a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:29:50AM  
 Efficiency Calibration: C14021014  
 Efficiency: 28.44% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021014  
 Energy Cal: Gain = 10.0569 keV / Ch  
 Offset = 2,995.13 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 88.44%



Nuclide Summary (ROI)												
Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4202.0	3920.4	4282.4	149.1	100.2	8.00	4.00	4.00	1.4E-002	2.5E-002	1.7E-002	4.3E-002
U-235	4403.1	4292.5	4473.5	22.6	99.7	2.00	0.00	2.00	7.2E-003	1.2E-002	0.0E+000	9.7E-003
U-234	4785.3	4594.2	4885.8	80.6	100.0	15.00	13.00	2.00	7.2E-003	3.8E-002	3.0E-002	7.0E-002
U-232	5328.3	5117.1	5428.9	75.0	100.1	1,208.00	16.00	1,192.00	3.9E+000	2.3E-001	3.5E-002	7.9E-002

Reviewed By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

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## Alpha-Spectroscopy Analysis Report

Sample: 1402166-3  
Spectrum #1 Analysis #1

Sample Size : 0.50

Acquisition

Detector: 16a  
Batch Name: UAS140215-2\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 1:44:00PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.91 min.  
Dead Time: 0.09 %

Calibration

Bkgd Info: Sample: B14021016; Det: 16a; Spectrum #1; Feb-10-2014 13:23

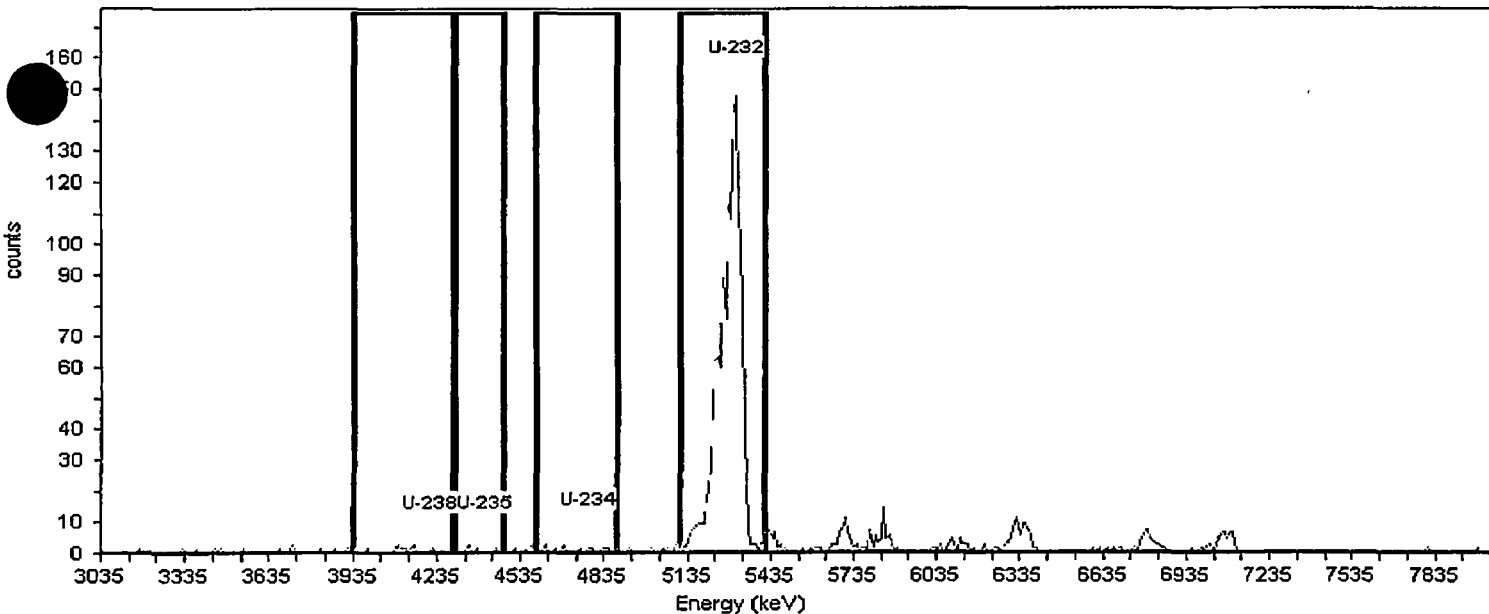
Calibration Date: 2/10/2014 10:57:03AM  
Efficiency Calibration: C14021016  
Efficiency: 29.83% +/- 0.12% TPU(2 sigma)

Energy Calibration: C14021016  
Energy Cal: Gain = 9.8597 keV / Ch  
Offset = 3,025.63 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 87.77%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.8	3932.7	4287.7	78.9	100.2	11.00	1.00	10.00	3.4E-002	2.4E-002	8.0E-003	2.5E-002
U-235	4406.0	4297.5	4475.0	23.7	99.7	4.00	1.00	3.00	1.0E-002	1.5E-002	8.0E-003	2.5E-002
U-234	4780.7	4593.3	4879.3	261.1	100.0	13.00	4.00	9.00	3.1E-002	2.9E-002	1.6E-002	4.1E-002
U-232	5313.1	5106.0	5411.7	73.4	100.1	1,255.00	14.00	1,241.00	3.9E+000	2.2E-001	3.1E-002	7.2E-002

Requested By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

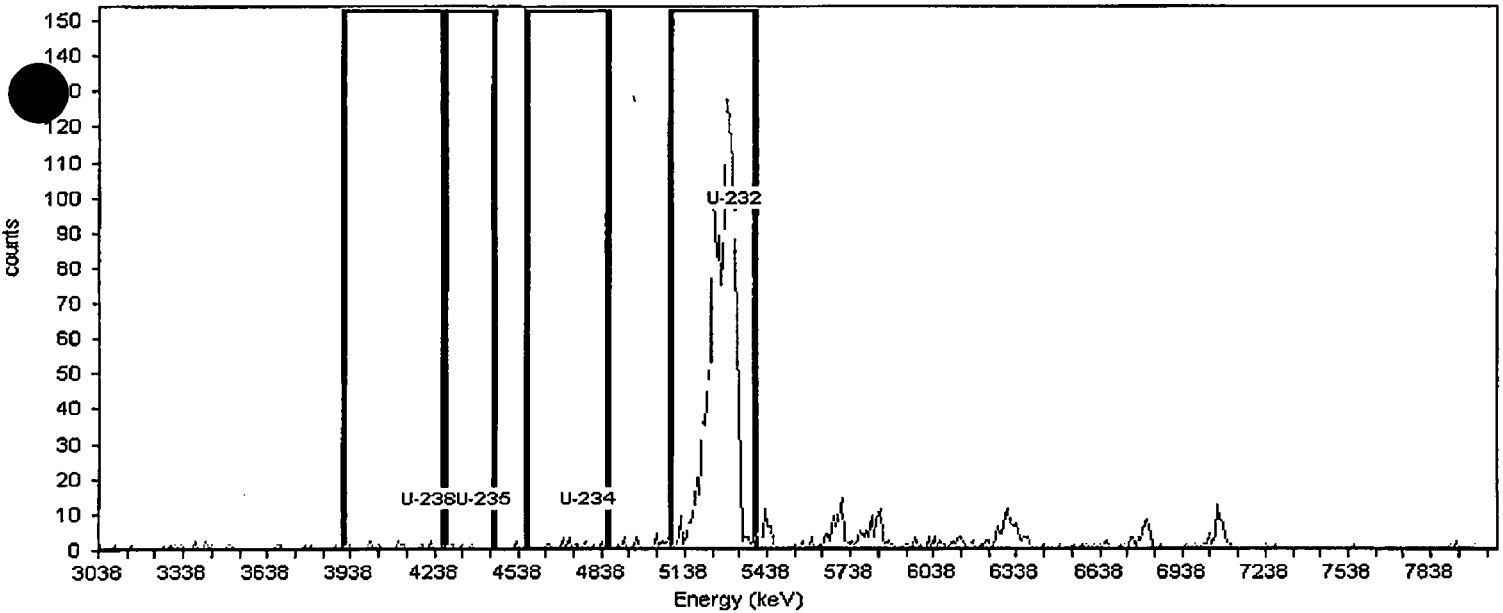
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402166-4  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 25  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:08PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021025; Det: 25; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:03:30PM  
 Efficiency Calibration: C14021025  
 Efficiency: 29.18% +/- 0.20% TPU(2 sigma)  
 Energy Calibration: C14021025  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 86.26%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4184.3	3907.6	4263.3	160.6	100.2	14.00	5.00	9.00	3.2E-002	3.1E-002	1.9E-002	4.7E-002
U-235	4381.9	4273.2	4451.1	.0	99.7	5.00	5.00	0.00	0.0E+000	2.3E-002	1.9E-002	4.7E-002
U-234	4757.4	4569.6	4856.2	47.9	100.0	16.00	13.00	3.00	1.1E-002	3.9E-002	3.0E-002	7.0E-002
U-232	5291.0	5083.5	5389.8	98.3	100.1	1,227.00	34.00	1,193.00	3.8E+000	2.3E-001	5.0E-002	1.1E-001

Recorded By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

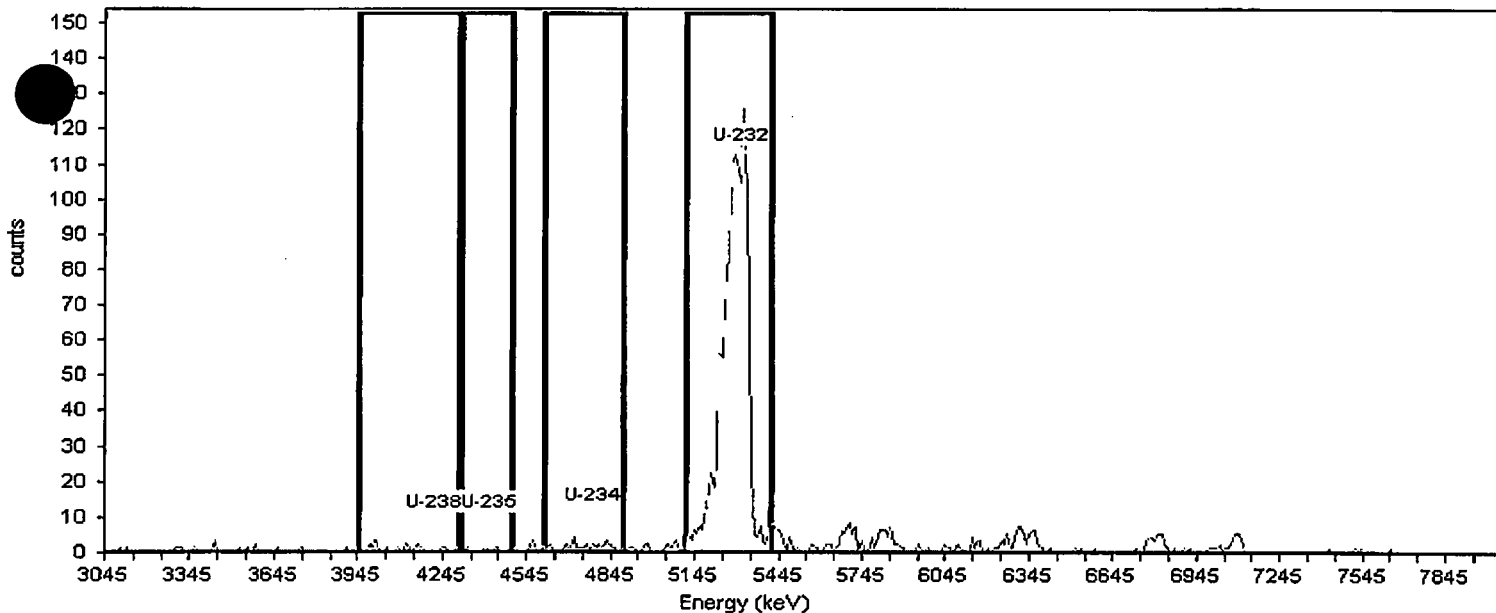
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402166-5  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 26  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:01PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021026; Det: 26; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:04:02PM  
 Efficiency Calibration: C14021026  
 Efficiency: 30.73% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021026  
 Energy Cal: Gain = 9.8047 keV / Ch  
 Offset = 3,036.00 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 84.22%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4222.4	3947.8	4300.8	272.3	100.2	17.00	16.00	1.00	3.5E-003	4.0E-002	3.2E-002	7.4E-002
U-235	4418.5	4310.6	4487.1	118.6	99.7	4.00	7.00	-3.00	0.0E+000	2.3E-002	2.1E-002	5.2E-002
U-234	4791.1	4604.8	4889.1	151.5	100.0	35.00	34.00	1.00	3.5E-003	5.8E-002	4.7E-002	1.0E-001
U-232	5320.5	5114.6	5418.6	100.8	100.1	1,262.00	35.00	1,227.00	3.7E+000	2.2E-001	5.0E-002	1.1E-001

Recorded By: *[Signature]*

*~89kV TP 2/24/14*

*JA*

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# ALS Laboratory Group - Fort Collins

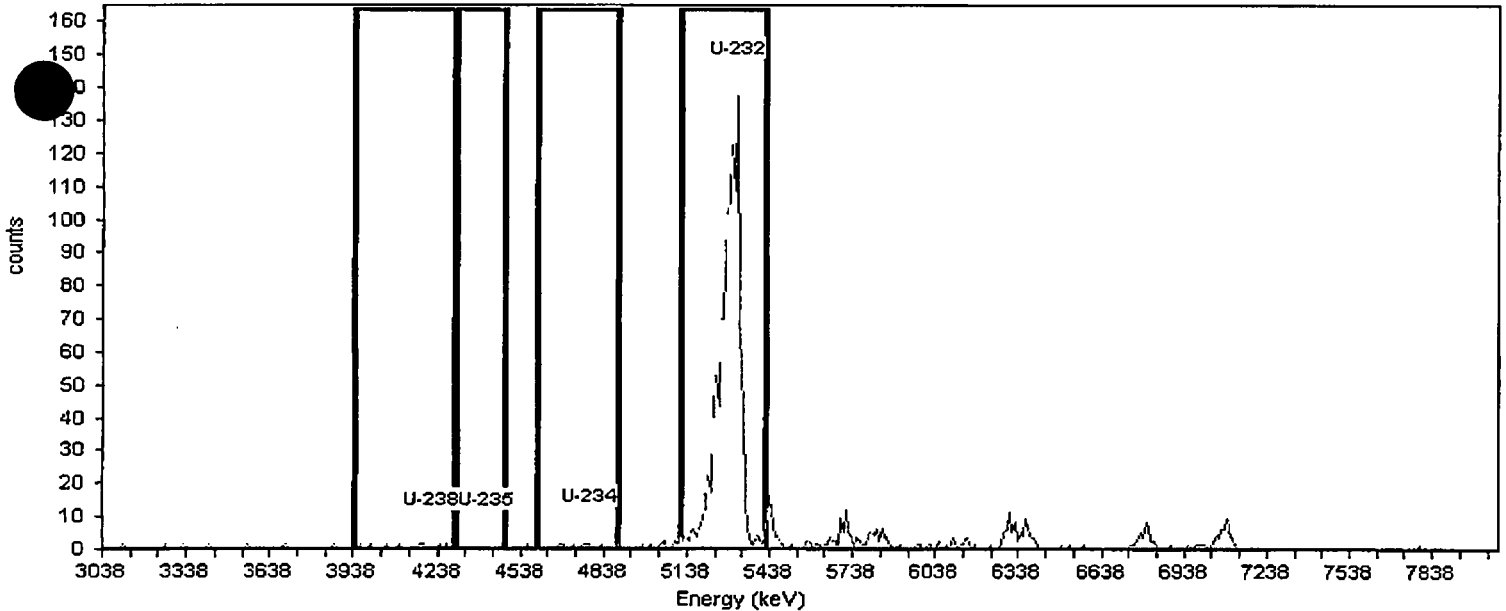
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402166-6  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 29  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:02PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021029; Det: 29; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:04:22PM  
 Efficiency Calibration: C14021029  
 Efficiency: 27.70% +/- 0.12% TPU(2 sigma)  
 Energy Calibration: C14021029  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 80.20%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	32.8	100.2	8.00	3.00	5.00	2.0E-002	2.7E-002	1.6E-002	4.4E-002
U-235	4411.5	4302.9	4480.7	14.6	99.7	1.00	3.00	-2.00	0.0E+000	1.6E-002	1.6E-002	4.4E-002
U-234	4787.0	4599.3	4885.8	204.1	100.0	8.00	8.00	0.00	0.0E+000	3.2E-002	2.7E-002	6.4E-002
U-232	5320.6	5113.1	5419.4	70.8	100.1	1,089.00	36.00	1,053.00	3.5E+000	2.3E-001	5.9E-002	1.3E-001

Recorded By: *JP*

*JA*

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# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402166-7  
Spectrum #1 Analysis #1

Sample Size : 0.50

Acquisition

Detector: 30  
Batch Name: UAS140215-2\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/21/2014 1:50:03PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B14021030; Det: 30; Spectrum #1; Feb-10-2014 13:27

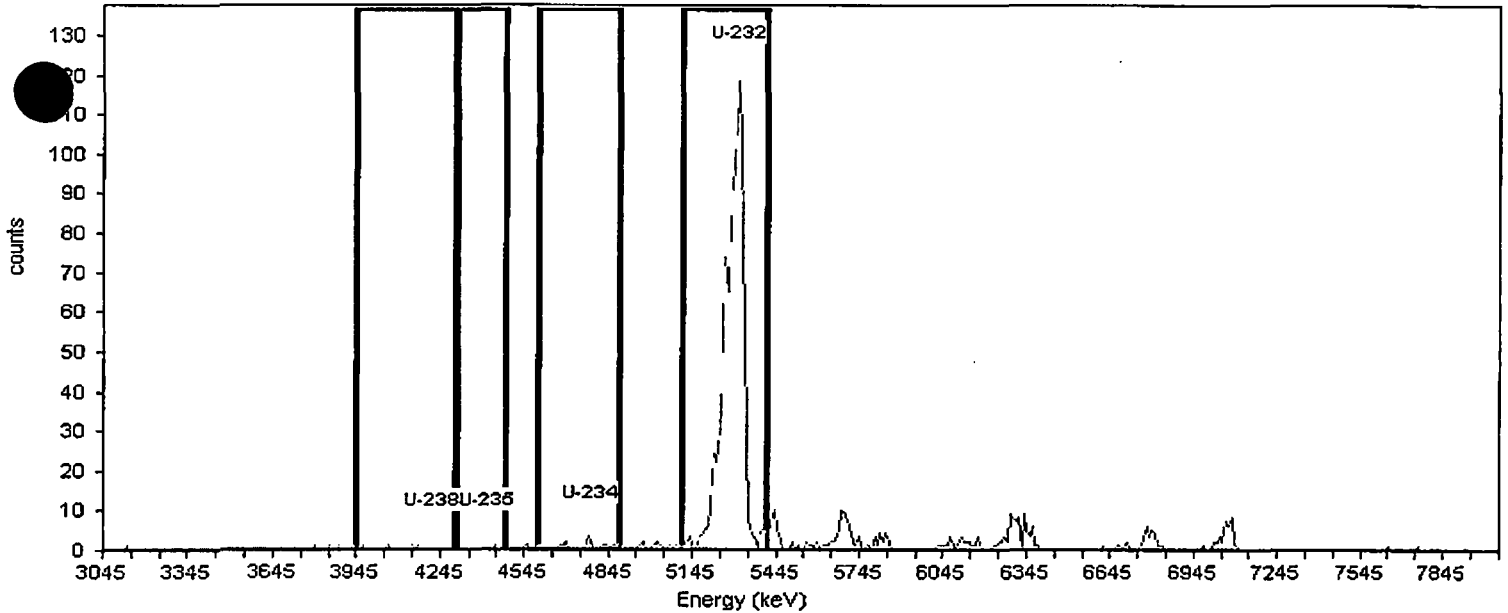
Calibration Date: 2/10/2014 12:04:44PM  
Efficiency Calibration: C14021030  
Efficiency: 28.09% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021030  
Energy Cal: Gain = 9.8047 keV / Ch  
Offset = 3,036.00 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 66.70%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	231.8	100.2	4.00	1.00	3.00	1.4E-002	2.2E-002	1.1E-002	3.5E-002
U-235	4408.7	4300.8	4477.3	24.0	99.7	1.00	2.00	-1.00	0.0E+000	1.7E-002	1.6E-002	4.5E-002
U-234	4781.3	4595.0	4879.3	100.4	100.0	17.00	8.00	9.00	4.3E-002	4.8E-002	3.2E-002	7.6E-002
U-232	5310.7	5104.8	5408.8	75.6	100.1	911.00	23.00	888.00	3.0E+000	2.0E-001	5.6E-002	1.2E-001

Recorded By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

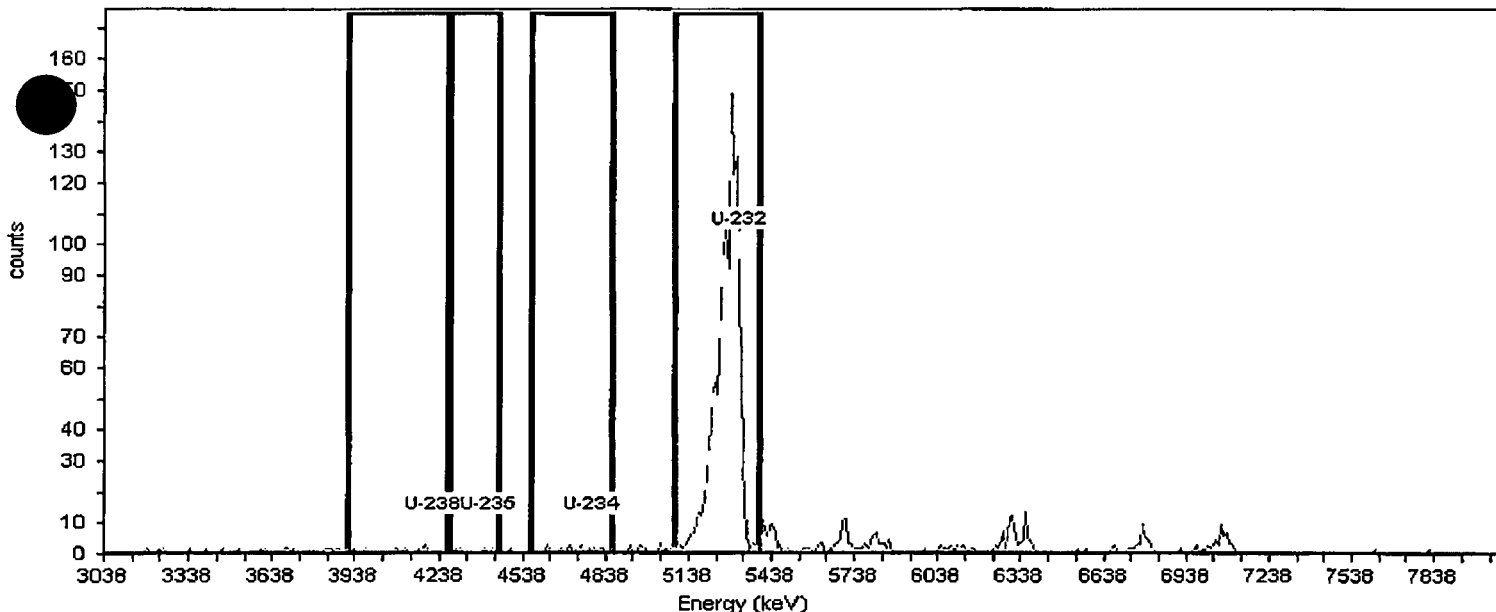
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample ID: 1402166-8  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 31  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:04PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021031; Det: 31; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:05:06PM  
 Efficiency Calibration: C14021031  
 Efficiency: 29.21% +/- 0.18% TPU(2 sigma)  
 Energy Calibration: C14021031  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 86.39%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4184.3	3907.6	4263.3	114.8	100.2	10.00	2.00	8.00	2.8E-002	2.5E-002	1.2E-002	3.3E-002
U-235	4381.9	4273.2	4451.1	16.8	99.7	4.00	3.00	1.00	3.6E-003	1.9E-002	1.4E-002	3.9E-002
U-234	4757.4	4569.6	4856.2	135.2	100.0	13.00	9.00	4.00	1.4E-002	3.4E-002	2.5E-002	5.9E-002
U-232	5291.0	5083.5	5389.8	77.0	100.1	1,227.00	31.00	1,196.00	3.8E+000	2.3E-001	4.8E-002	1.1E-001

Revised By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

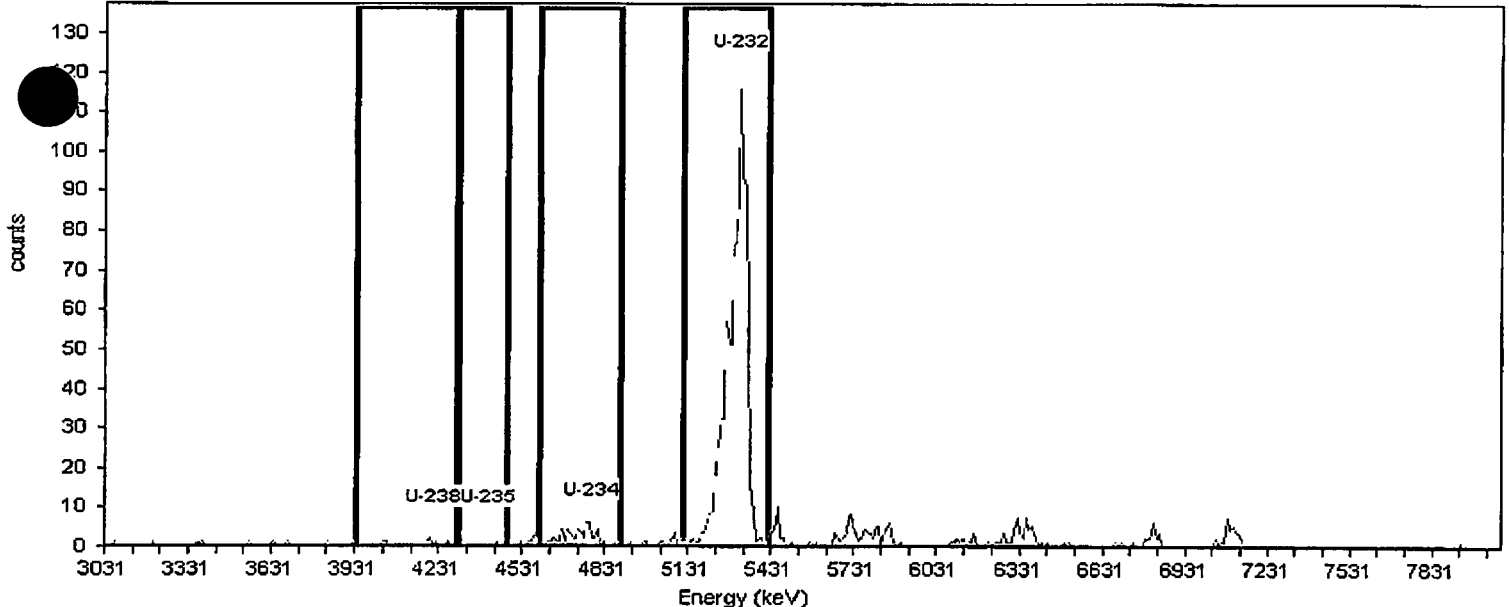
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample ID: 1402166-9  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 32  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:05PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021032; Det: 32; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:05:30PM  
 Efficiency Calibration: C14021032  
 Efficiency: 29.03% +/- 0.12% TPU(2 sigma)  
 Energy Calibration: C14021032  
 Energy Cal: Gain = 9.9003 keV / Ch  
 Offset = 3,021.28 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 60.76%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	81.8	100.2	8.00	3.00	5.00	2.5E-002	3.4E-002	2.1E-002	5.5E-002
U-235	4407.3	4298.4	4476.6	24.2	99.7	1.00	8.00	-7.00	0.0E+000	3.1E-002	3.4E-002	8.1E-002
U-234	4783.5	4595.4	4882.5	99.8	100.0	54.00	14.00	40.00	2.0E-001	8.8E-002	4.4E-002	1.0E-001
U-232	5318.1	5110.2	5417.1	67.4	100.1	851.00	15.00	836.00	2.7E+000	1.9E-001	4.8E-002	1.1E-001

Reviewed By: JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

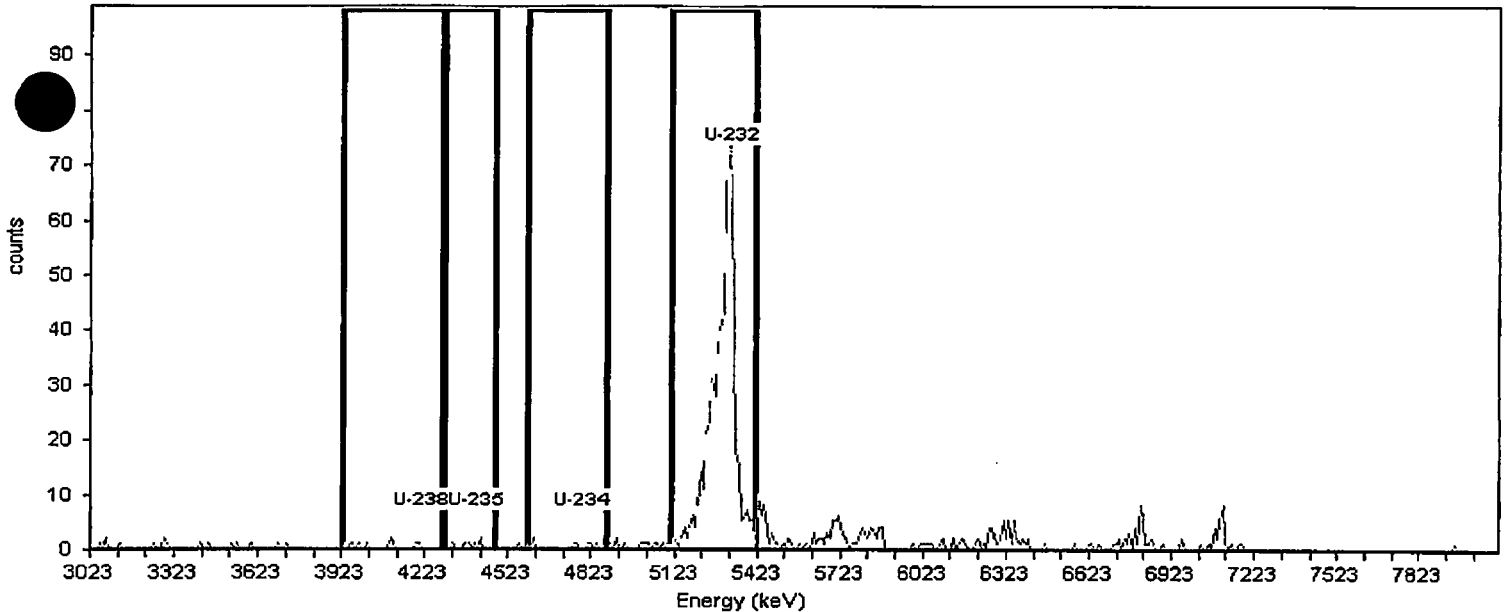
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402166-10  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 43  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:05PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021043; Det: 43; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:46:17PM  
 Efficiency Calibration: C14021043  
 Efficiency: 32.34% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021043  
 Energy Cal: Gain = 9.9784 keV / Ch  
 Offset = 3,013.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 35.03%



Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4200.6	3921.3	4280.5	.0	100.2	10.00	5.00	5.00	4.0E-002	6.2E-002	4.1E-002	1.0E-001
U-235	4400.2	4290.5	4470.1	67.5	99.7	6.00	1.00	5.00	4.0E-002	4.3E-002	1.9E-002	5.9E-002
U-234	4779.4	4589.8	4879.2	278.4	100.0	8.00	10.00	-2.00	0.0E+000	6.7E-002	5.8E-002	1.4E-001
U-232	5318.2	5108.7	5418.0	56.2	100.1	584.00	47.00	537.00	1.5E+000	1.5E-001	1.3E-001	2.9E-001

Recorded By: *JP*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

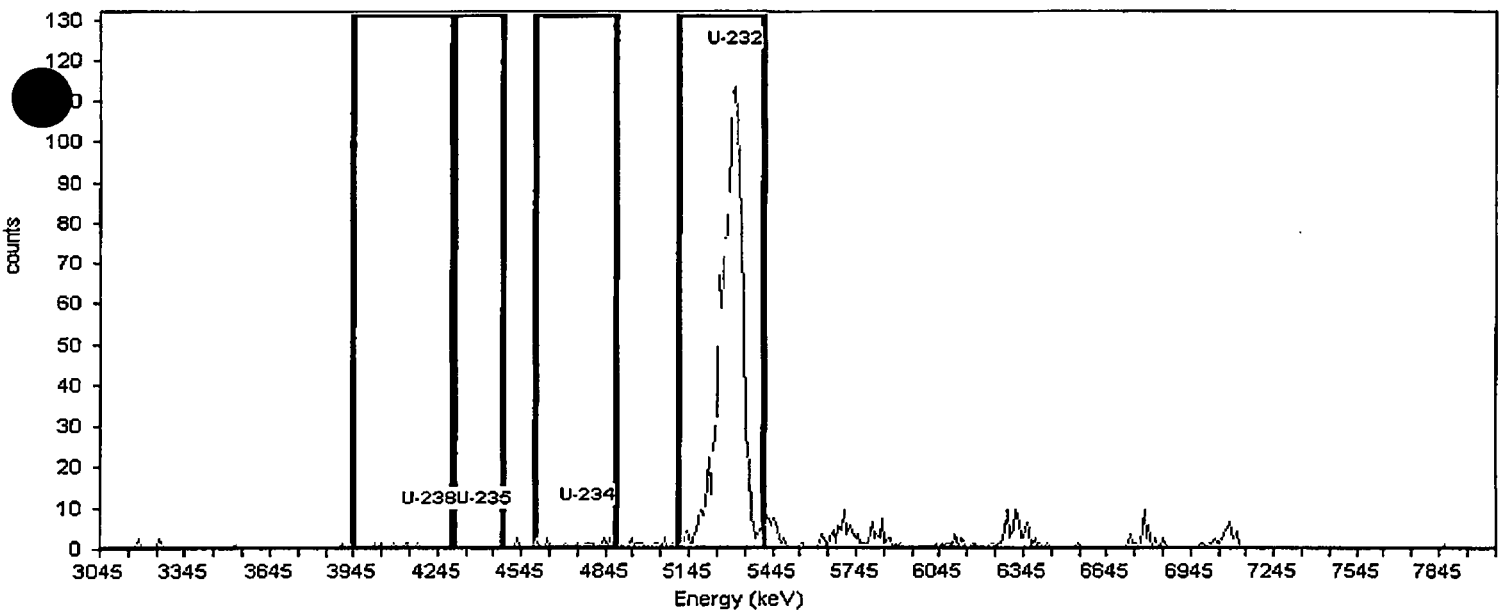
## Alpha-Spectroscopy Analysis Report

**Sample**  
 ID: 1402166-11  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 45  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:07PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021045; Det: 45; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:46:47PM  
 Efficiency Calibration: C14021045  
 Efficiency: 31.65% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021045  
 Energy Cal: Gain = 9.8047 keV / Ch  
 Offset = 3,036.00 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 67.13%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	167.8	100.2	6.00	5.00	1.00	4.2E-003	2.8E-002	2.2E-002	5.5E-002
U-235	4408.7	4300.8	4477.3	.0	99.7	0.00	1.00	-1.00	0.0E+000	1.2E-002	9.9E-003	3.1E-002
U-234	4781.3	4595.0	4879.3	16.8	100.0	15.00	4.00	11.00	4.7E-002	3.7E-002	2.0E-002	5.1E-002
U-232	5310.7	5104.8	5408.8	84.9	100.1	1,040.00	33.00	1,007.00	3.0E+000	1.9E-001	5.9E-002	1.3E-001

Recorded By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

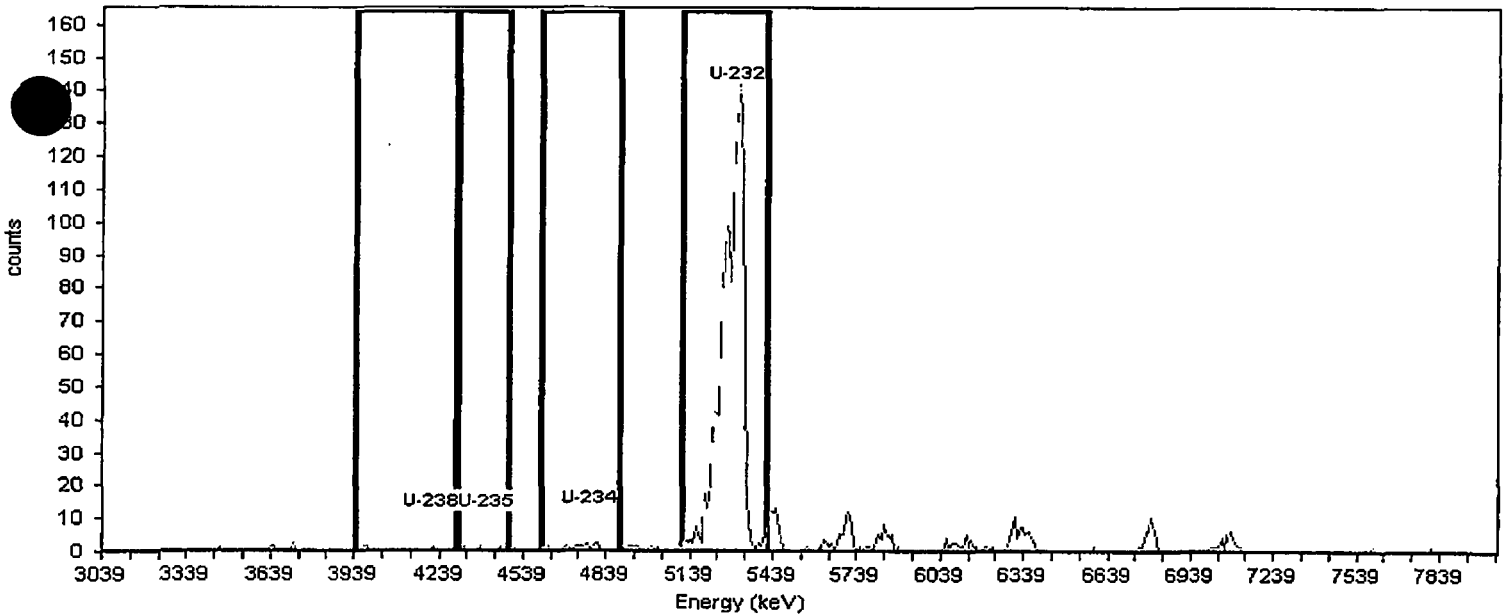
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402166-12  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 46  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:07PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021046; Det: 46; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:47:15PM  
 Efficiency Calibration: C14021046  
 Efficiency: 30.58% +/- 0.16% TPU(2 sigma)  
 Energy Calibration: C14021046  
 Energy Cal: Gain = 9.8224 keV / Ch  
 Offset = 3,029.39 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 81.68%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.9	3942.9	4296.5	48.0	100.2	3.00	4.00	-1.00	0.0E+000	1.9E-002	1.7E-002	4.3E-002
U-235	4414.4	4306.3	4483.1	14.5	99.7	3.00	1.00	2.00	7.2E-003	1.4E-002	8.4E-003	2.7E-002
U-234	4787.6	4601.0	4885.8	200.6	100.0	16.00	11.00	5.00	1.8E-002	3.8E-002	2.8E-002	6.5E-002
U-232	5318.0	5111.8	5416.2	81.1	100.1	1,202.00	18.00	1,184.00	3.6E+000	2.1E-001	3.7E-002	8.4E-002

Recorded By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

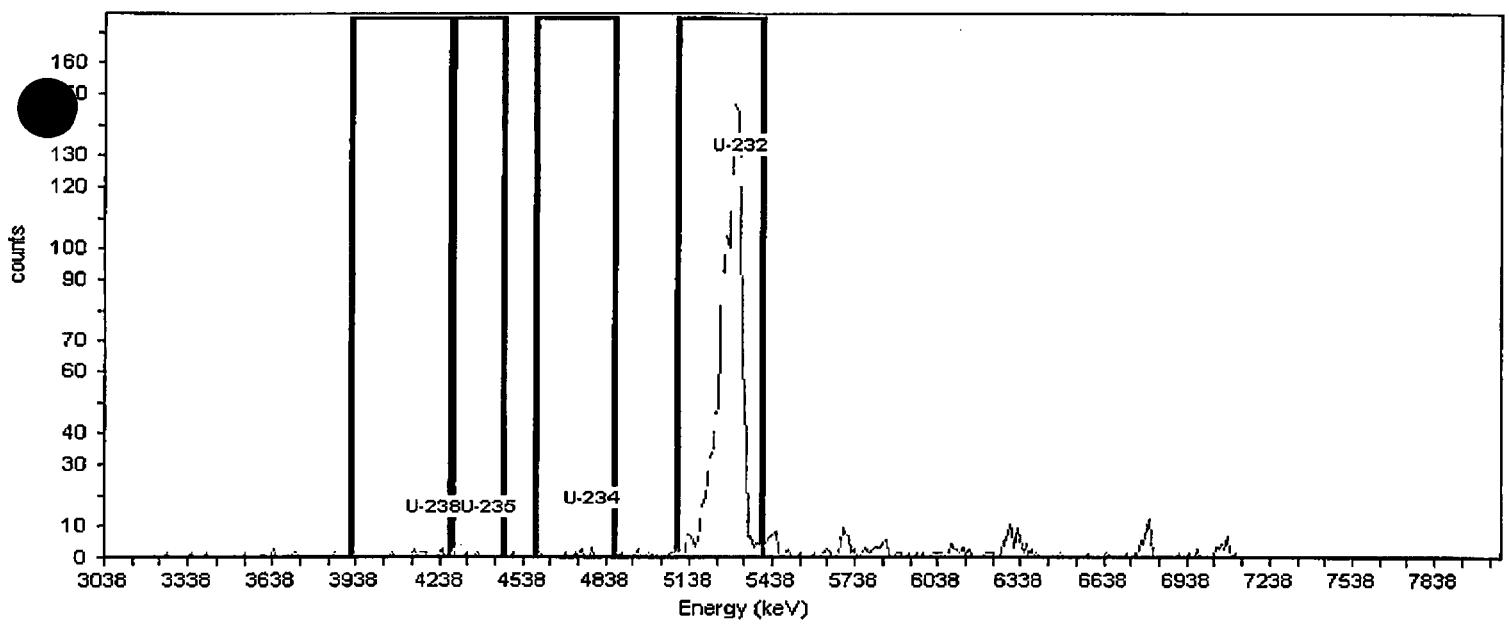
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample ID: 1402166-13  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 47  
 Batch Name: UAS140215-2\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:50:08PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021047; Det: 47; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:47:41PM  
 Efficiency Calibration: C14021047  
 Efficiency: 30.42% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021047  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 88.20%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4194.2	3917.5	4273.2	51.9	100.2	9.00	5.00	4.00	1.3E-002	2.5E-002	1.7E-002	4.4E-002
U-235	4391.8	4283.1	4461.0	63.4	99.7	4.00	2.00	2.00	6.7E-003	1.7E-002	1.1E-002	3.1E-002
U-234	4767.3	4579.5	4866.1	148.5	100.0	8.00	10.00	-2.00	0.0E+000	2.8E-002	2.5E-002	5.8E-002
U-232	5300.8	5093.3	5399.6	81.2	100.1	1,298.00	26.00	1,272.00	3.9E+000	2.2E-001	4.1E-002	9.2E-002

Reported By: *[Signature]* *[Signature]*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

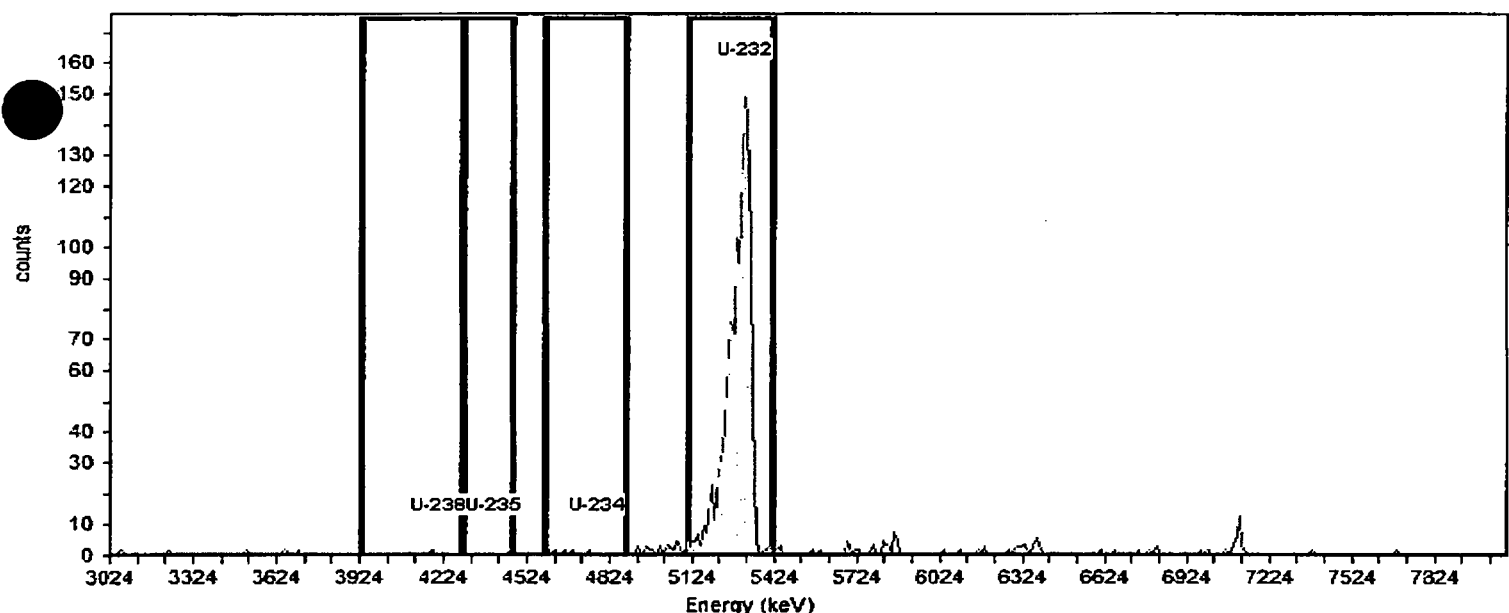
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402166-14  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 81  
 Batch Name: UAS140215-2\_B  
 Nuclide Library: Uranium  
 Analysis Method: ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/22/2014 3:01:42PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021881; Det: 81; Spectrum #1; 2/18/2014 10:34:49 AM  
 Calibration Date: 2/18/2014 10:14:53AM  
 Efficiency Calibration: C14021881  
 Efficiency: 30.83% +/- 0.20% TPU(2 sigma)  
 Energy Calibration: C14021881  
 Energy Cal: Gain = 9.9176 keV / Ch  
 Offset = 3,014.71 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 83.07%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4204.8	3927.1	4284.2	59.3	100.2	2.00	1.00	1.00	3.5E-003	6.1E-003	8.2E-003	2.6E-002
U-235	4403.2	4294.1	4472.6	13.4	80.9	1.00	1.00	0.00	0.0E+000	6.1E-003	1.0E-002	3.2E-002
U-234	4780.0	4591.6	4879.2	.4	100.0	6.00	0.00	6.00	2.1E-002	9.4E-003	0.0E+000	9.5E-003
U-232	5315.6	5107.3	5414.8	70.6	100.1	1,216.00	2.00	1,214.00	3.7E+000	1.1E-001	1.2E-002	3.4E-002

Approved By: *[Signature]*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402166-15  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 82  
Batch Name: UAS140215-2\_B  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/22/2014 3:01:43PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.17 min.  
Dead Time: 0.02 %

### Calibration

Bkgd Info: Sample: B14021882; Det: 82; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:11AM

Energy Calibration: C14021882

Efficiency Calibration: C14021882

Energy Cal: Gain = 9.9003 keV / Ch

Efficiency: 30.65% +/- 0.15% TPU(2 sigma)

Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

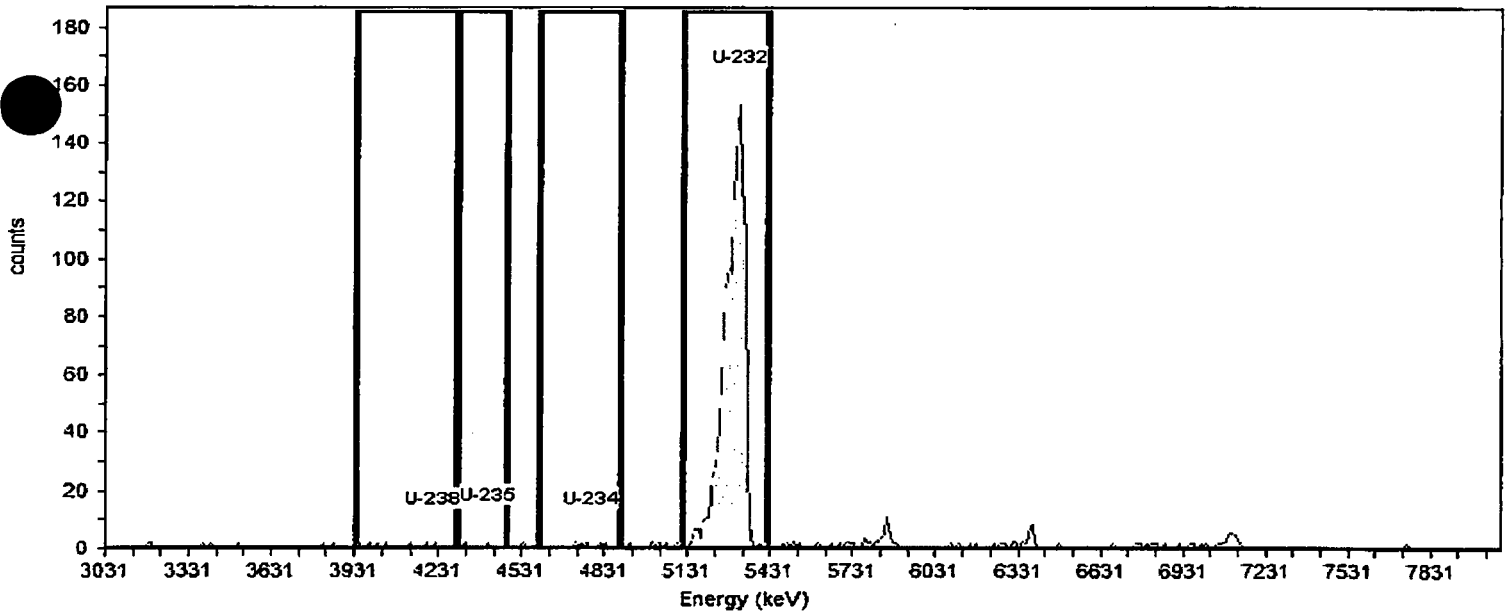
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Nuclide: U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Recovery: 85.09%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	114.4	100.2	7.00	2.00	5.00	1.7E-002	1.0E-002	1.1E-002	3.2E-002
U-235	4407.3	4298.4	4476.6	.0	80.9	3.00	0.00	3.00	1.3E-002	8.6E-003	0.0E+000	1.2E-002
U-234	4783.5	4595.4	4882.5	27.0	100.0	6.00	0.00	6.00	2.1E-002	9.2E-003	0.0E+000	9.3E-003
U-232	5318.1	5110.2	5417.1	81.7	100.1	1,238.00	2.00	1,236.00	3.8E+000	1.1E-001	1.2E-002	3.3E-002

Reviewed By: *[Signature]*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

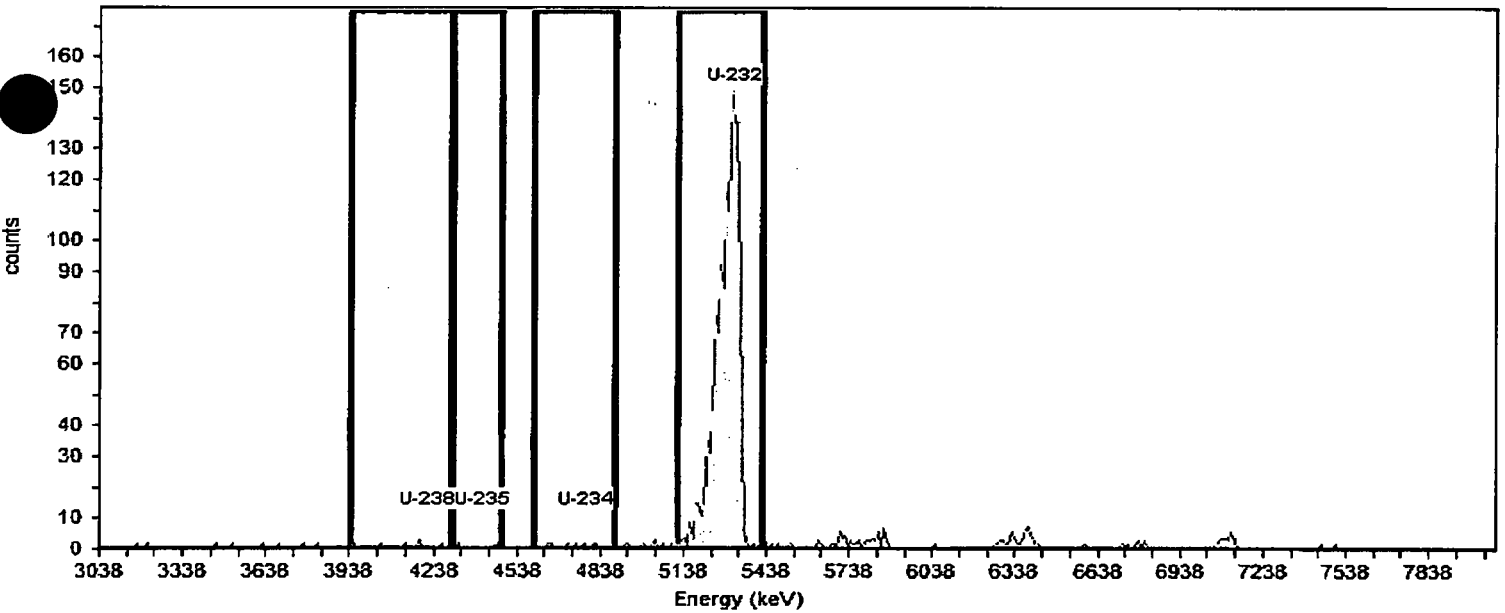
## Alpha-Spectroscopy Analysis Report

Sample: AS140215-2MMB  
Spectrum #1 Analysis #1  
Sample Size : 0.50

Acquisition  
Detector: 83  
Batch Name: UAS140215-2\_B  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default  
Acquisition Start Date: 2/22/2014 3:01:43PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

Calibration  
Bkgd Info: Sample: B14021883; Det: 83; Spectrum #1; 2/18/2014 10:34:50 AM  
Calibration Date: 2/18/2014 10:15:30AM  
Efficiency Calibration: C14021883  
Efficiency: 31.20% +/- 0.16% TPU(2 sigma)  
Energy Calibration: C14021883  
Energy Cal: Gain = 9.8810 keV / Ch  
Offset = 3,028.21 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Tracer  
Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
Tracer Nuclide: U-232  
Tracer Recovery: 87.22%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	13.5	100.2	6.00	2.00	4.00	1.3E-002	9.4E-003	1.1E-002	3.1E-002
U-235	4411.5	4302.9	4480.7	14.6	80.9	2.00	0.00	2.00	8.2E-003	7.1E-003	0.0E+000	1.1E-002
U-234	4787.0	4599.3	4885.8	233.8	100.0	7.00	5.00	2.00	6.6E-003	1.1E-002	1.7E-002	4.3E-002
U-232	5320.6	5113.1	5419.4	87.0	100.1	1,291.00	1.00	1,290.00	3.9E+000	1.1E-001	8.0E-003	2.5E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS140215-2PMB  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 84  
Batch Name: UAS140215-2\_B  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/22/2014 3:01:43PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.00 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021884; Det: 84; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:49AM

Efficiency Calibration: C14021884

Efficiency: 30.40% +/- 0.21% TPU(2 sigma)

Energy Calibration: C14021884

Energy Cal: Gain = 9.9003 keV / Ch

Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

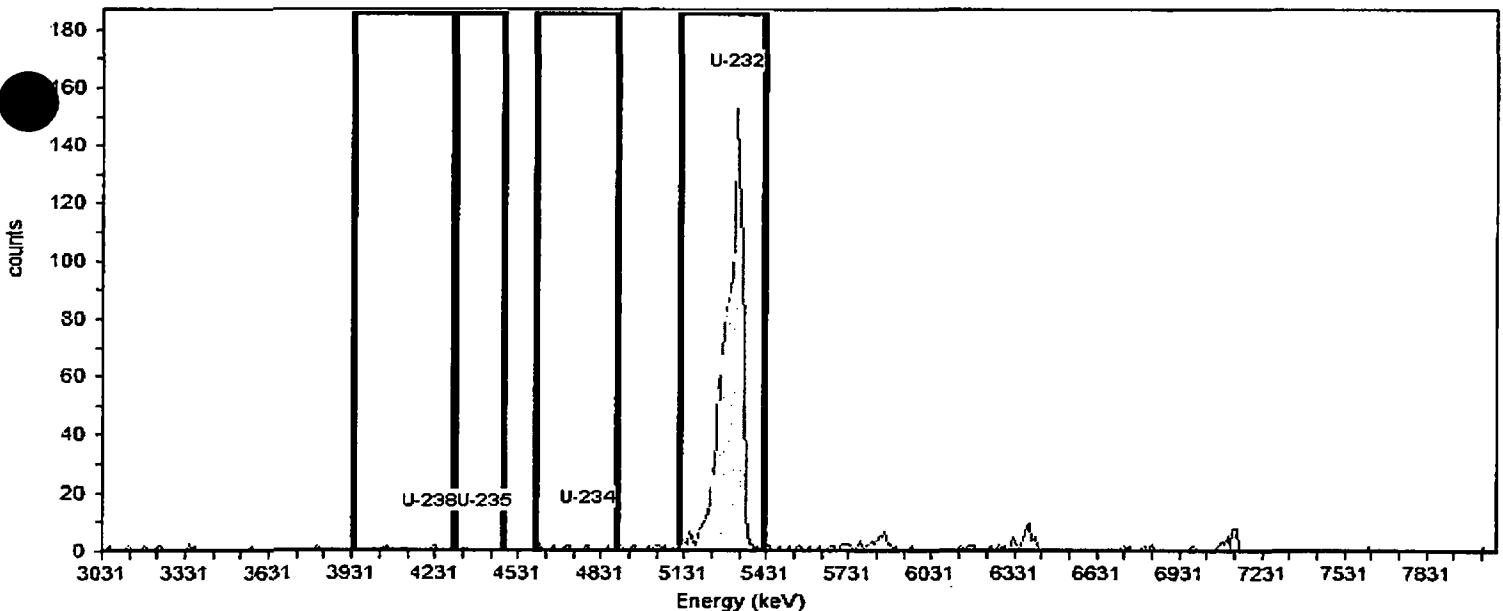
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 78.20%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	203.2	100.2	3.00	0.00	3.00	1.1E-002	7.6E-003	0.0E+000	1.0E-002
U-235	4407.3	4298.4	4476.6	.0	80.9	0.00	2.00	-2.00	-9.4E-003	8.1E-003	1.5E-002	4.3E-002
U-234	4783.5	4595.4	4882.5	16.9	100.0	8.00	0.00	8.00	3.0E-002	1.1E-002	0.0E+000	1.0E-002
U-232	5318.1	5110.2	5417.1	73.6	100.1	1,129.00	2.00	1,127.00	3.5E+000	1.0E-001	1.3E-002	3.6E-002

Reviewed By: \_\_\_\_\_

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

Print Date: 2/24/2014  
10:10:11 AM

AlphaVision v5.3  
Custom Report Iteration: 05/21/09

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# ALS Laboratory Group - Fort Collins

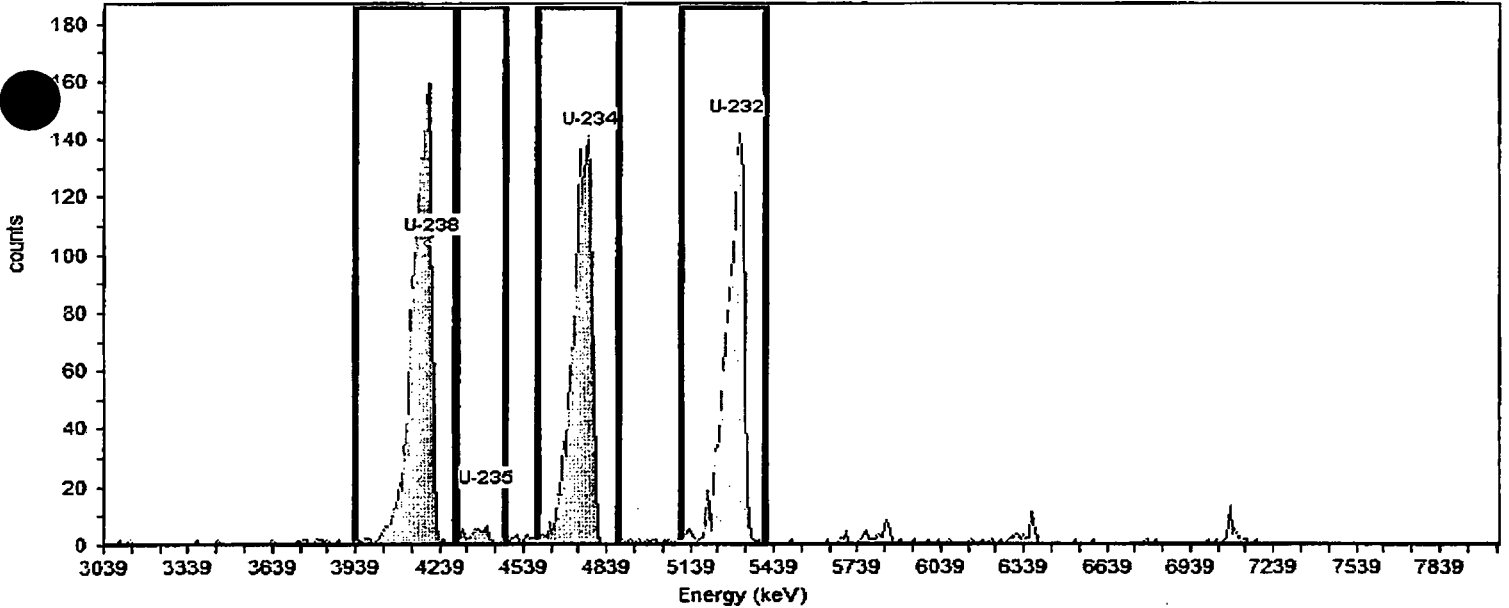
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-2LCS      Sample Size : 0.50  
 Spectrum #1      Analysis #1

**Acquisition**  
 Detector: 85      Acquisition Start Date: 2/22/2014 3:01:43PM  
 Batch Name: UAS140215-2\_B      Live Time: 1,000.00 min.  
 Nuclide Library: Uranium      Real Time: 1,000.01 min.  
 Analysis Method: ROI Analysis, Set Name = Uranium Default      Dead Time: 0.00 %  
 ROI Set: Uranium Default

**Calibration**  
 Bkgd Info: Sample: B14021885; Det: 85; Spectrum #1; 2/18/2014 10:34:50 AM  
 Calibration Date: 2/18/2014 10:16:07AM      Energy Calibration: C14021885  
 Efficiency Calibration: C14021885      Energy Cal: Gain = 9.8224 keV / Ch  
 Efficiency: 30.11% +/- 0.13% TPU(2 sigma)      Offset = 3,029.39 keV  
    Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232      Tracer Nuclide: U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM      Tracer Recovery: 76.03%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.1	3933.1	4286.7	81.6	100.2	1,262.00	0.00	1,262.00	5.0E+000	3.2E-001	0.0E+000	1.1E-002
U-235	4404.5	4296.5	4473.3	106.2	80.9	45.00	0.00	45.00	2.2E-001	3.5E-002	0.0E+000	1.3E-002
U-234	4777.8	4591.2	4876.0	70.3	100.0	1,153.00	0.00	1,153.00	4.5E+000	3.0E-001	0.0E+000	1.1E-002
U-232	5308.2	5101.9	5406.4	69.7	100.1	1,086.00	1.00	1,085.00	3.4E+000	1.0E-001	9.5E-003	3.0E-002

Reviewed By: *[Signature]*      *[Signature]*  
 All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS140215-2LCSD  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 86  
Batch Name: UAS140215-2\_B  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/22/2014 3:01:44PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021886; Det: 86; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:16:26AM

Efficiency Calibration: C14021886

Efficiency: 30.61% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021886

Energy Cal: Gain = 9.8047 keV / Ch

Offset = 3,036.00 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

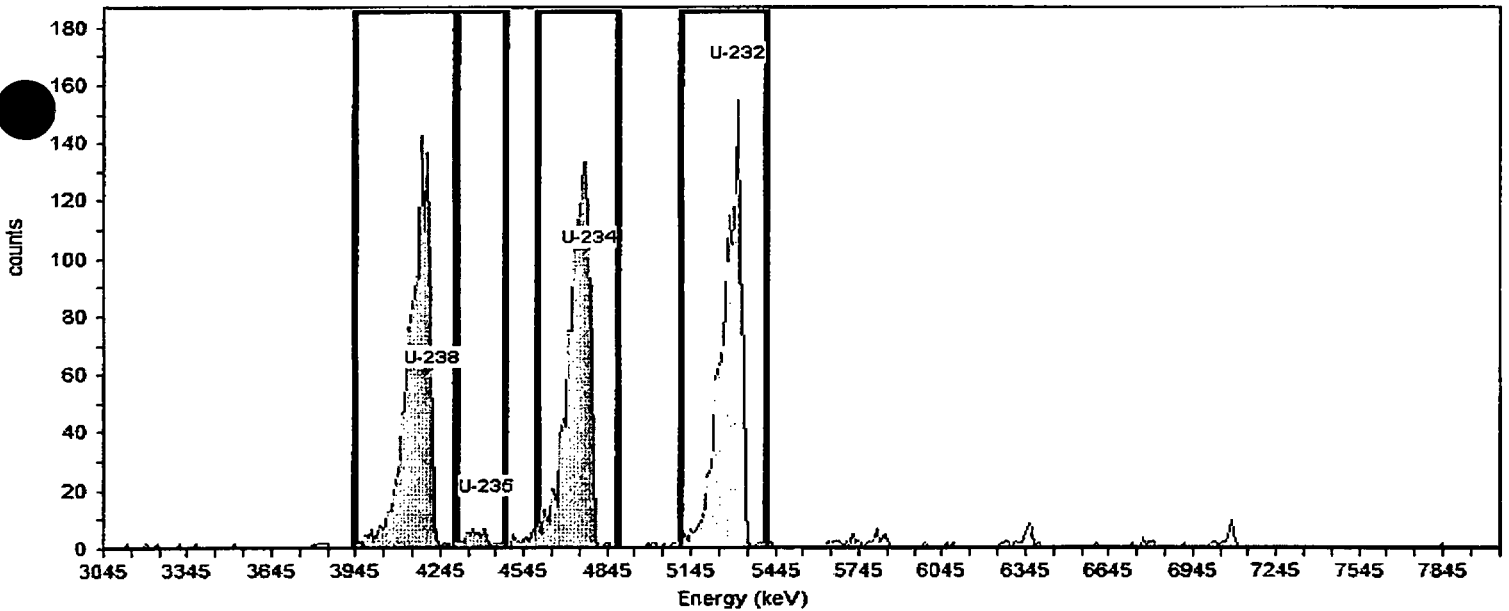
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 80.91%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	89.6	100.2	1,208.00	0.00	1,208.00	4.4E+000	2.8E-001	0.0E+000	9.8E-003
U-235	4408.7	4300.8	4477.3	79.4	80.9	50.00	2.00	48.00	2.2E-001	3.5E-002	1.5E-002	4.2E-002
U-234	4781.2	4595.0	4879.3	81.7	100.0	1,201.00	1.00	1,200.00	4.4E+000	2.8E-001	8.5E-003	2.7E-002
U-232	5310.7	5104.8	5408.8	69.9	100.1	1,177.00	3.00	1,174.00	3.6E+000	1.1E-001	1.5E-002	4.1E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS

## Alpha Spectrometer Instrument Run Log

SOP 714; FORM 746r8.xls (10/2/07)

Date: 2/21/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
91	TAS140217-2 A	1402223 - 11	YH/S	360	JA
92		-12			
93		-13			
94		-14			
95	↓	↓ -15	↓	↓	↓
29	UAS140219-1-B	1402211-1	Ur/W	360	JA
13	UAS140215-2-A	1402166-1	Ur/F	1000	JA
14		-2			
16		-3			
25		-4			
26		-5			
29		-6			
30		-7			
31		-8			
32		-9			
43		-10			
45		-11			
46		-12			
47	↓	↓ -13	↓	↓	↓
9	TAS140217-1-C	1402222-9	YH/S	600	JA
10	↓	AS140217-1MB	↓	↓ 1000	↓
11	UAS140215-5-B	AS140215-5LCS	7000	Ur/F	JA
12	↓	↓ -5LCS	↓	↓	↓

JMA 2/21/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
81	UAS140215-1-A	1402165 - 1	Ur/F	1000	JA
82		-2			
83		-3			
84		-4			
85		-5			
86		-6			
87		-7			
88		-8			
89		-9			
90		-10			
91		-11			
92		-12			
93		-13			
94		-14			
95	↓	↓ -15	↓	↓	↓

TE 2/22/14

Notes:

Reviewed by: TE

Date: 2/22/14

# ALS

## Alpha Spectrometer Instrument Run Log

SOP 714; FORM 746r8.xls (10/2/07)

Date: 2/22/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
9	TAS140217-2-B	1402223-16	Th/S	360	7E
10		-17			
11		-18			
12		-19			
13		-20			
14		AS140217-2MB			
16		LC5			
25	TAS140217-3-A	1402223-21	Th/S	360	7E
26		21D			
29		22			
30		1402225-1			
31		-2			
32		-3			
43		-4			
45		-5			
46		-6			
47		-7			
81		-8			
82		-9			
83		-10			
84		-11			
85		-12			
86		-13			
87		-14			

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
88	TAS140217-3-A	1402225-15	Th/S	360	7E
89		-16			
90		-17			
91		-18			
92		AS140217-3MB			
93		LC5			
81	UAS140215-2-B	1402166-14	U/F	1000	7E
82		15			
83		AS140215-2MB			
84		PMB			
85		LC5			
86		LCSD			
87	UAS140215-1-B	AS140215-1MB	U/F	1000	7E
88		PMB			
89		LC5			
90		LCSD			
91	TAS140217-4-A	1402225-19	Th/S	360	7E
92		20			
93		1402226-1			
94		2			
95		3			
9		4			
10		5			
11		6			

Notes:

Reviewed by: 7E  
Date: 2/22/14





## Section 6

# QUALITY ASSURANCE SUMMARY REPORTS

**6**



**No *NON-CONFORMANCE REPORTS* or *QUALITY ASSURANCE SUMMARY SHEETS* are included in this data package.**



## Section 7

# LABORATORY BENCH SHEETS

**7**

Prep Procedure: UIISO V-Default IE-09 1000M<sub>17</sub> Analytical QASS / NCR? Y N DNA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File	Cnt 1 Ins/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Ins/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Ins/Det	Cnt 3 Pos Chk By	Notes
1	1402166-1	SMP	0.5	0.5	sample	uCi/ml	_21661	13	TE	_21661			_21661			
1	1402166-2	SMP	0.5	0.5	sample	uCi/ml	_21662	14		_21662			_21662			
1	1402166-3	SMP	0.5	0.5	sample	uCi/ml	_21663	16		_21663			_21663			
1	1402166-4	SMP	0.5	0.5	sample	uCi/ml	_21664	25		_21664			_21664			
1	1402166-5	SMP	0.5	0.5	sample	uCi/ml	_21665	26		_21665			_21665			
1	1402166-6	SMP	0.5	0.5	sample	uCi/ml	_21666	29		_21666			_21666			
1	1402166-7	SMP	0.5	0.5	sample	uCi/ml	_21667	30		_21667			_21667			
1	1402166-8	SMP	0.5	0.5	sample	uCi/ml	_21668	31		_21668			_21668			
1	1402166-9	SMP	0.5	0.5	sample	uCi/ml	_21669	32		_21669			_21669			
1	1402166-10	SMP	0.5	0.5	sample	uCi/ml	_216610	43		_216610			_216610			
1	1402166-11	SMP	0.5	0.5	sample	uCi/ml	_216611	45		_216611			_216611			
1	1402166-12	SMP	0.5	0.5	sample	uCi/ml	_216612	46		_216612			_216612			
1	1402166-13	SMP	0.5	0.5	sample	uCi/ml	_216613	47		_216613			_216613			
1	1402166-14	SMP	0.5	0.5	sample	uCi/ml	_216614	81	WCK	_216614			_216614			
1	1402166-15	SMP	0.5	0.5	sample	uCi/ml	_216615	82		_216615			_216615			
1	AS140215-2M	MB	0.5	0.5	sample	uCi/ml	_2152MB	83		_2152MB			_2152MB			
1	AS140215-2P	MB	0.5	0.5	sample	uCi/ml	_2152PB	84		_2152PB			_2152PB			
1	AS140215-2	LCS	0.5	0.5	sample	uCi/ml	_2152L	85		_2152L			_2152L			JP 2/25/14
1	AS140215-2	LCSD	0.5	0.5	sample	uCi/ml	_2152LD	86		_2152LD			_2152LD			JP 2/25/14

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016

Sample Barcodes

1402166-1 AS140215-2PS1		1402166-2 AS140215-2PS2		1402166-3 AS140215-2PS3	
1402166-4 AS140215-2PS4		1402166-5 AS140215-2PS5		1402166-6 AS140215-2PS6	

Prep Procedure: UIISO

Analytical QASS / NCR? Y / N

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
1402166-7 AS140215-2PS7										1402166-8 AS140215-2PS8						1402166-9 AS140215-2PS9
1402166-10 AS140215-2PS10										1402166-11 AS140215-2PS11						1402166-12 AS140215-2PS12
1402166-13 AS140215-2PS13										1402166-14 AS140215-2PS14						1402166-15 AS140215-2PS15
AS140215-2MMB AS140215-2PS16										AS140215-2PMB AS140215-2PS17						AS140215-2LCS AS140215-2PS18
AS140215-2LCSD AS140215-2PS19																

Reporting Units

LabID:	TstGrpName:	RptUnits:
1402166-1	IsoU_PNV_Air Filter	uCi/ml
1402166-2	IsoU_PNV_Air Filter	uCi/ml
1402166-3	IsoU_PNV_Air Filter	uCi/ml
1402166-4	IsoU_PNV_Air Filter	uCi/ml
1402166-5	IsoU_PNV_Air Filter	uCi/ml
1402166-6	IsoU_PNV_Air Filter	uCi/ml
1402166-7	IsoU_PNV_Air Filter	uCi/ml
1402166-8	IsoU_PNV_Air Filter	uCi/ml
1402166-9	IsoU_PNV_Air Filter	uCi/ml
1402166-10	IsoU_PNV_Air Filter	uCi/ml
1402166-11	IsoU_PNV_Air Filter	uCi/ml
1402166-12	IsoU_PNV_Air Filter	uCi/ml
1402166-13	IsoU_PNV_Air Filter	uCi/ml
1402166-14	IsoU_PNV_Air Filter	uCi/ml
1402166-15	IsoU_PNV_Air Filter	uCi/ml

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Prep Procedure: **UI SO**

Reviewed By: cas *cas*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  Y /  N Batch: *see comments* Re-Prep?  Y /  N Batch: *N/A* Prep QASS / NCR?  Y /  N *N/A*

Prep SOP: PAI 778 Rev: 14  
 Prep SOP: NONE  
 Matrix Class: solid

Prep Analyst: Tandrae Elhart  
 Prep Date: 2/15/2014  
 Prep Dept: AP

Balance:  
 Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402166-1	SMP		0.5	0.5	As Received			2/19/14	T1	<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">CAS 2/17/14</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">CAS 2/17/14</div> </div>
2	1	1402166-2	SMP		0.5	0.5	As Received				T1	
3	1	1402166-3	SMP		0.5	0.5	As Received				T1	
4	1	1402166-4	SMP		0.5	0.5	As Received				T1	
5	1	1402166-5	SMP		0.5	0.5	As Received				T1	
6	1	1402166-6	SMP		0.5	0.5	As Received				T1	
7	1	1402166-7	SMP		0.5	0.5	As Received				T1	
8	1	1402166-8	SMP		0.5	0.5	As Received				T1	
9	1	1402166-9	SMP		0.5	0.5	As Received				T1	
10	1	1402166-10	SMP		0.5	0.5	As Received				T1	
11	1	1402166-11	SMP		0.5	0.5	As Received				T1	
12	1	1402166-12	SMP		0.5	0.5	As Received				T1	
13	1	1402166-13	SMP		0.5	0.5	As Received				T1	
14	1	1402166-14	SMP		0.5	0.5	As Received				T1	
15	1	1402166-15	SMP		0.5	0.5	As Received				T1	
16	1	AS140215-2M	MB		0.5	0.5	As Received				T1	
17	1	AS140215-2P	MB		0.5	0.5	As Received				T1	
18	1	AS140215-2	LCS		0.5	0.5	As Received				S1,T1	
19	1	AS140215-2	LCSD		0.5	0.5	As Received				S1,T1	

Prep Procedure: UIISO

Reviewed By: cas

Review Date: 2/17/2014

Non-Routine Pre-Treatment? (Y) N Batch: See Comments Re-Prep? Y / (N) Batch: N/A Prep QASS / NCR? Y / (N) N/A  
 Prep SOP: PAI 778 Rev: 14 Prep Analyst: Tamrae Elhart Balance:  
 Prep SOP: NONE Prep Date: 2/15/2014 Balance:  
 Matrix Class: solid Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
----------	----------	-------	---------	----------	-----------------	----------------	------------	--------------	------------	------------	-----------	------------

Comments  
 Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffled at 600C. After muffling, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: Tamrae Elhart Date: 2/15/2014

Witnessed By: Emily R. Lyons Date: 2/15/2014

Tracer/Carrier Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016	

Spike Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016	
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016	
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016	

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Prep Procedure: **UIISO**

**Prep Batch Not Validated!!!**

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N \_\_\_\_\_ Batch: \_\_\_\_\_ Re-Prep? Y / N \_\_\_\_\_ Batch: \_\_\_\_\_ Prep QASS / NCR? Y / N \_\_\_\_\_

Prep SOP: PAI 778 Rev: 14  
 Prep SOP: NONE  
 Matrix Class: solid

Prep Analyst: Tandrae Elhart *TE*  
 Prep Date: 2/15/2014  
 Prep Dept: AP

Balance:  
 Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402166-1	SMP		0.5	0.5	As Received				T1	
2	1	1402166-2	SMP		0.5	0.5	As Received				T1	
3	1	1402166-3	SMP		0.5	0.5	As Received				T1	
4	1	1402166-4	SMP		0.5	0.5	As Received				T1	
5	1	1402166-5	SMP		0.5	0.5	As Received				T1	
6	1	1402166-6	SMP		0.5	0.5	As Received				T1	
7	1	1402166-7	SMP		0.5	0.5	As Received				T1	
8	1	1402166-8	SMP		0.5	0.5	As Received				T1	
9	1	1402166-9	SMP		0.5	0.5	As Received				T1	
10	1	1402166-10	SMP		0.5	0.5	As Received				T1	
11	1	1402166-11	SMP		0.5	0.5	As Received				T1	
12	1	1402166-12	SMP		0.5	0.5	As Received				T1	
13	1	1402166-13	SMP		0.5	0.5	As Received				T1	
14	1	1402166-14	SMP		0.5	0.5	As Received				T1	
15	1	1402166-15	SMP		0.5	0.5	As Received				T1	
16	1	AS140215-2M	MB		1	1	As Received				T1	LL411
17	1	AS140215-2P	MB		1	1	As Received				T1	492
18	1	AS140215-2	LCS		1	1	As Received				S1,T1	LL445
19	1	AS140215-2	LCSD		1	1	As Received				S1,T1	483

74 of 113



Prep Procedure: **UIISO**

**Prep Batch Not Validated!!!**

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: \_\_\_\_\_ Re-Prep? Y / N Batch: \_\_\_\_\_ Prep QASS / NCR? Y / N \_\_\_\_\_

Prep SOP: PAI 778 Rev: 14  
 Prep SOP: NONE  
 Matrix Class: solid

Prep Analyst: Tambræ Elhart *TE*  
 Prep Date: 2/15/2014  
 Prep Dept: AP

Balance:  
 Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
----------	----------	-------	---------	----------	-----------------	----------------	------------	--------------	------------	------------	-----------	------------

Comments

Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffled at 600C. After muffling, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: *TE* Date: *2/15/14*  
 Witnessed By: *Qu* Date: *2.15.14*

Tracer/Carrier Solution Information								
Soln #	Nuclids	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016

*10.29.14*

*Exp*

*6.20.14*

## Sample Condition Form (Solids)

Analyst: TE

Analysis Date: 2/15/14

Method: Prep

		Sample Condition (Visual Appearance of Analysis Aliquot at Time of Prep)		
Work Order	Sample ID	Dry/Wet/ Moist	Texture	Remarks
1402166 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	1	dry	filter	1 - half filter
	2			↓
	3			
	4			
	5			2 - half filters
	6			1 - half filters
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
				<u>TE 2/15/14</u>

**1402166 Filter Weight Spreadsheet**

<b>Sample ID</b>	<b>Beaker ID</b>	<b>Beaker, Watch glass wt (g)</b>	<b>Beaker, Watch Glass, Filter Wt (g)</b>	<b>Beaker, Watch Glass, Ashed Filter Wt (g)</b>	<b>Net Filter Wt (g)</b>	<b>Net Ash Wt (g)</b>
1402166-1	494	84.793	85.1889	84.796	0.3959	0.003
1402166-2	485	87.4732	87.8715	87.4743	0.3983	0.0011
1402166-3	512	92.0269	92.4166	92.027	0.3897	0.0001
1402166-4	502	87.7408	88.1505	87.7413	0.4097	0.0005
1402166-5	516	84.9978	85.7738	84.9978	0.776	0
1402166-6	476	86.2004	86.5907	86.2008	0.3903	0.0004
1402166-7	499	88.8705	89.2555	88.8718	0.385	0.0013
1402166-8	LL315	76.2043	76.5996	76.2043	0.3953	0
1402166-9	907	90.84	91.2223	90.8402	0.3823	0.0002
1402166-10	LL353	75.2641	75.6522	75.2649	0.3881	0.0008
1402166-11	514	92.734	93.137	92.7341	0.403	0.0001
1402166-12	LL336	77.01	77.4069	77.02	0.3969	0.01
1402166-13	LL347	78.5475	78.9391	78.5478	0.3916	0.0003
1402166-14	482	92.7773	93.1545	92.7775	0.3772	0.0002
1402166-15	LL436	86.1274	86.5532	86.1276	0.4258	0.0002

Balance: 27

Note: Prior to aliquotting, the filters were cut in half. Only one half of the filter was placed into the weighed beaker, spiked/traced, and muffled. Following muffling, the beaker/filter was reweighed to determine ash weight.

Batch: AS14021<sup>5</sup>A-2

002  
21/11/14

**U Solid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Conc. Hydrofluoric Acid	0000061467
Boric Acid	J23624
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MKBK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467

**U Liquid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MKBK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467



## Section 8

# STANDARDS TRACEABILITY DOCUMENTS

8

Prepare a working dilution of 843.3610.56

1. Density of 1M HNO<sub>3</sub>, lot # K16045  
 Mass of 100mL vol. flask: 68.2981g Balance # 12  
 Mass of flask & 100mL acid: 171.5705g Balance# 12  
 Net Mass: 103.2724g  
 Density: 1.0327g/mL

2. Mass of 843.3610.56 transferred:  
 Mass of open empty nalgene: 74.7438 Balance# 12  
 Mass of nalgene & standard: 82.4483 Balance# 12  
 Net mass of standard transferred: 7.7045g Balance# NA

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1003.9g Balance# 26  
 Mass of empty nalgene (from above): 74.7438 Balance# 12  
 Net mass of new dilution: 929.1562g Balance# NA

4. Final activity calculation:

(U-238):  $2377.34 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 20.36 \text{ dpm/mL}$

(U-235):  $109.44 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 0.92 \text{ dpm/mL}$

(U-234):  $2289.91 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 19.61 \text{ dpm/mL}$

Std ID: 843.3610.100

Description: U-238

Expiration: 8/4/2012

Activity: 20.36 dpm/mL

2s Uncertainty: 0.12 dpm/mL

Ref. Date: 8/1/1977 1997

Ref Time: N/A JP 7/19/11

Prep Date: 8/3/2011 Prep by: TE

Matrix/Comp. 1M HNO<sub>3</sub>

Half Life (y): 4.47E+09

Reverification Log		
Analysis Date	Initials	Expiration Date
7/11/12	JP	7/10/13
6/20/13	JP	6/20/14

Continued on Page

Read and Understood By

[Signature]  
Signed

8/3/11  
Date

[Signature]  
Signed

10/21/11  
Date

Prepare an intermediate Dilution of RSO # 843

Diluent is (M)  $HNO_3$  lot # H31041  
g from Page 54 this logbook (3610)  
 $\rho = 1.0283 \frac{g}{ml}$

bu ✓

Mass of Parent Transferred

Mass of Open fall Ampule + beaker	38.1504g	R
Mass of Empty Ampule + beaker	32.9991g	I
Net Mass transferred	5.1513g	

Dilute to Final Volume

Mass of Open Empty 40 ml VOA	21.6331g	R
Mass of Open fall / Vial	53.0961g	I
Net mass of New Dilution	31.4624g	

Final Activity (U-238)

$$\left( \frac{247.0 \frac{Bq}{g}}{g} \right) \left( \frac{60 \text{ dpm}}{Bq} \right) \left( \frac{5.1513 \text{ g}}{31.4624 \text{ g}} \right) = \frac{2382.5 \frac{dpm}{g}}{2372.34 \text{ g}}$$

Final activity (U-235): 109.44 dpm/g  
(RSO: 843 = 11.14 Bq/g)

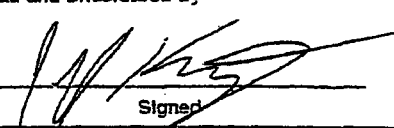
Final activity (U-234): 2289.91 dpm/g  
(RSO: 843 = 233.1 Bq/g)

Continued on Page

Read and Understood By

  
Signed

4/23/10  
Date

  
Signed

5/11/10  
Date



# National Institute of Standards & Technology Certificate

## Standard Reference Material 4321C Natural Uranium Radioactivity Standard

RSD #  
843  
rel 7-20-07

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive uranium-238, uranium-235, and uranium-234 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. The solution, whose composition is specified in Table F, is contained in a flame-sealed, 5 mL, NIST, borosilicate-glass ampoule (see Note 1)\*.

The certified massic activities for the uranium isotopes at a Reference Time of 1200 EST, 1 August 1997 are:

Uranium-238:  $(242.0 \pm 1.5) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-235:  $(11.14 \pm 0.07) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-234:  $(233.1 \pm 2.2) \text{ Bq}\cdot\text{g}^{-1}$

Additional physical, chemical, and radiological properties for the SRM, as well as details on the standardization method, are given in Table 1. Uncertainty intervals for certified quantities are expanded ( $k=2$ ) uncertainties calculated according to the ISO and NIST Guidelines (see Note 2). Table 2 contains a specification of the components that comprise the uncertainty analyses.

The certification of this SRM, within the measurement uncertainties specified, is valid for at least five (5) years after receipt. The solution matrix, in an unopened ampoule, is believed to be indefinitely homogeneous and stable, within its half-life-dependent, useful lifetime. NIST will monitor this material and will report any substantive changes in certification to the purchaser. Should any of the certified values change, purchasers of this SRM will be notified of the change by NIST.

This SRM may represent a radiological hazard and a chemical hazard. Consult the Material Safety Data Sheet (MSDS), enclosed with the SRM shipment, for details (see Note 1).

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dr. M.P. Unterwiesing, Acting Group Leader. The overall technical direction and physical measurements leading to certification were provided by Dr. L.L. Lucas of the Radioactivity Group. The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program.

Gaithersburg, Maryland 20899

November 1997

Text revised and expiration date extended February 2007

Lisa R. Karam, Deputy Chief  
Ionizing Radiation Division

Robert L. Watters, Jr., Chief  
Measurement Services Division

SRM 4321C page 1 of 4

\*Notes and references are on page 4.



Table 1. Properties of SRM 4321C

Certified values	
Radionuclides	Natural Uranium (Mixture of $^{238}\text{U}$ , $^{235}\text{U}$ , and $^{234}\text{U}$ )
Reference time	1200 EST, 1 August 1997
Massic activities of the solution	$^{238}\text{U}$ : 242.0 Bq·g <sup>-1</sup> $^{235}\text{U}$ : 11.14 Bq·g <sup>-1</sup> $^{234}\text{U}$ : 233.1 Bq·g <sup>-1</sup>
Relative expanded uncertainties (k = 2)	$^{238}\text{U}$ : 0.60% (see Note 2) $^{235}\text{U}$ : 0.60% (see Note 2) $^{234}\text{U}$ : 0.96% (see Note 2)

Uncertified information	
Source description	Liquid in flame-sealed, 5 mL NIST borosilicate ampoule (see Note 1)
Solution composition	1.0 mol·L <sup>-1</sup> HCl with 30 mg UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> per gram of solution
Solution density	(1.053 ± 0.001) g·mL <sup>-1</sup> at 21.4°C (see Note 3)
Solution mass	(5.258 ± 0.002) g (see Note 3)
Mass fraction of uranium	(0.01960 ± 0.00010) g·g <sup>-1</sup> (see Note 5)
Photon-emitting impurities	None detected (see Note 4)
Half-lives used [1]	$^{238}\text{U}$ : (4.468 ± 0.003) × 10 <sup>8</sup> a $^{235}\text{U}$ : (7.038 ± 0.005) × 10 <sup>8</sup> a $^{234}\text{U}$ : (2.455 ± 0.006) × 10 <sup>5</sup> a
Calibration method (and instruments)	The certified massic activity for natural uranium was obtained by mass spectrometer, silicon surface-barrier detector, and 4πβ and scintillation (LS) counting systems.

\*See Note 5

Table 2. Uncertainty evaluation for the massic activity for SRM 4321C

Uncertainty component		Assessment Type <sup>†</sup>	Relative standard uncertainty contribution on massic activity of Natural Uranium (%)
1	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>238</sup> U	A	0.001
2	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>235</sup> U	A	0.07
3	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>234</sup> U	A	0.3
4	Half life of <sup>238</sup> U; standard uncertainty of the half-life	A	0.07
5	Half life of <sup>235</sup> U; standard uncertainty of the half-life	A	0.07
6	Half life of <sup>234</sup> U; standard uncertainty of the half-life	A	0.24
7	Uranium mass fraction in SRM 960; from SRM960 certificate	B	0.003
8	Quantitative dissolution	B	0.25
9	Gravimetric (mass) measurements	B	0.10
10	Limit for photon-emitting impurities	B	0.10
<b>Relative combined standard uncertainty</b>			
	<sup>238</sup> U		0.30
	<sup>235</sup> U		0.50
	<sup>234</sup> U		0.48
<b>Relative expanded uncertainty (k = 2)</b>			
	<sup>238</sup> U		0.60
	<sup>235</sup> U		0.60
	<sup>234</sup> U		0.96

<sup>†</sup> = (A) denotes evaluation by statistical methods; (B) denotes evaluation by other methods.

## NOTES

Note 1. Refer to <http://physics.nist.gov/Divisions/Div846/srm.html> for the standardized ampoule dimensions and for assistance and instructions on how to properly open an ampoule. Information on additional storage and handling requirements is also included in the website.

Note 2. The uncertainties on certified values are expanded uncertainties,  $U = k u_c$ . The quantity  $u_c$  is the combined standard uncertainty calculated according to the ISO and NIST Guides (see references [2] and [3]). The combined standard uncertainty is multiplied by a coverage factor of  $k = 2$  and was chosen to obtain an approximate 95 % level of confidence.

Note 3. The stated uncertainty is two times the standard uncertainty. See reference [3].

Note 4. The estimated lower limits of detection for photon-emitting impurities, expressed as massic photon emission rates are:

$$1.4 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 8 \text{ keV} < E < 59 \text{ keV}$$

$$1.1 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 57 \text{ keV} < E < 88 \text{ keV}$$

$$0.5 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 102 \text{ keV} < E < 197 \text{ keV}$$

$$0.3 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 205 \text{ keV} < E < 762 \text{ keV}$$

$$0.2 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 770 \text{ keV} < E < 996 \text{ keV, and}$$

$$0.1 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 1006 \text{ keV} < E < 1900 \text{ keV}$$

provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{234}\text{U}$ , or their progeny

Note 5. The stated uncertainty is the standard uncertainty. See reference [3].

## REFERENCES

- [1] Evaluated Nuclear Structure Data File (ENSDF), online database, National Nuclear Data Center, Brookhaven Laboratory (Upton, NY), August 2007. Refer to <http://www.nndc.bnl.gov/ensdf/>
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993 (corrected and reprinted, 1995). Available from Global Engineering Documents, 12 Inverness Way East, Englewood, CO 80112, U.S.A. Telephone 1-800-854-7179.
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.

TE 10/22/13

Prepare a working dilution of 914.3610.62

1. Density of 1M HNO<sub>3</sub>, lot # 000045470  
 Mass of 100mL vol. flask: 66.4318g Balance # 12  
 Mass of flask & 100mL acid: 169.6212g Balance# 12  
 Net Mass: 103.1894g  
 Density: 1.0319 g/mL

2. Mass of 914.3610.62 transferred:  
 Mass of open empty nalgene: 75.4800g Balance# 12  
 Mass of nalgene & standard: 78.3581g Balance# 12  
 Net mass of standard transferred: 2.8781g Balance# NA

TE 10/22/13

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1173.7g Balance# 26  
 Mass of empty nalgene (from above): 75.4800g Balance# 12  
 Net mass of new dilution: 1098.22g Balance# NA

4. Final activity calculation:

$$7261.8 \text{ dpm/g} \left( \frac{2.8781 \text{ g}}{1098.22 \text{ g}} \right) (1.0319 \text{ g/mL}) = 19.64 \text{ dpm/mL}$$

TE 10/22/13

JP 11/5/13

Std ID: 914.4095.46

Description: **U-232**  
 Expiration: **10/29/2014**  
 Activity: **19.64 dpm/mL**

2s Uncertainty: **0.96 dpm/mL**  
 Ref. Date: **5/27/2010**  
 Ref Time: **N/A**  
 Prep Date: **10/22/2013** Prep by: **TE**  
 Matrix/Comp. **1M HNO<sub>3</sub>**  
 Half Life (y): **6.89E+01**

JP 11/5/13

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 11/5/13

Continued on Page

7 Elbert 10/22/13  
 Signed Date

Read and Understood By [Signature] 11/05/13  
 Signed Date

Prepare a Intermediate dilution of RCO # 914

Diluent is  $1M HNO_3$  Acid lot # J11094

Mass of parent transferred		bal #
Mass of Open Full Ampule + Beaker	38.0670 g	12
Mass of Empty Ampule + Beaker	32.9311 g	1
Net mass transferred	5.1379 g	

Dilute to final Mass

Mass of Vial, Std, + Diluent	58.6555 g	12
Mass of Vial	21.5781 g	1
Net Mass of New dilution	37.0574 g	

Final Activity

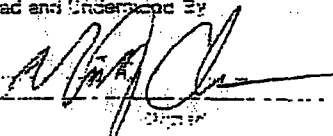
$$\left(4.552 \times 10^3 \text{ Bq}\right) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}}\right) \left(\frac{5.1379 \text{ g}}{5.21459 \text{ g}}\right) \left(\frac{1}{37.0574 \text{ g}}\right) = 7261.8 \text{ dpm/g}$$

Continued on Page

Read and Understood By

  
Signed

6/4/10

  
Date

06-17-ZAPC  
Date



**Eckert & Ziegler**  
Analytics

*Rec. 6-1-10  
RSDH 914*

1380 Seaboard Industrial Blvd.  
Atlanta, Georgia 30318  
Tel 404-352-8677  
Fax 404-352-2837  
www.analyticinc.com

**CERTIFICATE OF CALIBRATION**  
Standard Radionuclide Source

82306-307

U-232 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins  
P.O. No.: 73625 04-28-10, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.18, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolly Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			U <sub>s</sub>	U <sub>d</sub>	U	
U-232	2.617E+04	4.882E+03	0.5	2.4	4.9	05/27/2010

\*Uncertainty: U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1287, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

**Comments:**

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%. 8.21458 g 1M HNO<sub>3</sub> solution, carrier free.

Source Prepared by: *W. Mac*  
W. Mac, Radiochemist

QA Approved: *J.D. McCorvey*  
J.D. McCorvey, QA Manager Alternate

Date: 5/27/10

AMA Form 008 Rev. 11-01

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office  
24937 Avenue Tibbitts, Valencia, California 91355

Laboratory  
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318



## Section 9

# **ADDITIONAL SUPPORTING DOCUMENTATION**



## **Alpha Spectroscopy**

# **Quality Control Data**

## **Weekly Background, Energy, and Efficiency Calibrations**



# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Monday, February 24, 2014

PAI Work Order: 1402166

Analytical SOP: PAI 714

3:28:29 PM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402166-1 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	13a	C14021013	2/10/2014	30.84	Pass	30.25	30.78	32.90	33.43
					B14021013	2/10/2014	0.3870	Pass	0.0000	0.0498	0.4998	0.7500
					C14021013	2/10/2014	5549.7	Pass	5486.2	5496.2	5576.2	5586.2
1402166-2 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	14a	C14021014	2/10/2014	28.44	Pass	27.48	27.98	29.88	30.38
					B14021014	2/10/2014	0.3470	Pass	0.0000	0.0498	0.4998	0.7500
					C14021014	2/10/2014	5569.7	Pass	5503.7	5513.7	5593.7	5603.7
1402166-3 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	16a	C14021016	2/10/2014	29.83	Pass	27.91	28.41	30.35	30.85
					B14021016	2/10/2014	0.3160	Pass	0.0000	0.0498	0.4998	0.7500
					C14021016	2/10/2014	5549.7	Pass	5497.9	5507.9	5587.9	5597.9
1402166-4 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	25	C14021025	2/10/2014	29.18	Pass	26.95	27.42	29.32	29.79
					B14021025	2/10/2014	0.4650	Pass	0.0000	0.0500	0.5000	0.7500
					C14021025	2/10/2014	5557.7	Pass	5496.0	5506.0	5586.0	5596.0
1402166-5 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	26	C14021026	2/10/2014	30.73	Pass	29.40	29.92	31.98	32.50
					B14021026	2/10/2014	0.4800	Pass	0.0000	0.0498	0.4998	0.7500
					C14021026	2/10/2014	5546.0	Pass	5496.0	5506.0	5586.0	5596.0
1402166-6 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	29	C14021029	2/10/2014	27.70	Warning	27.50	27.99	29.92	30.40
					B14021029	2/10/2014	0.3910	Pass	0.0000	0.0500	0.5000	0.7500
					C14021029	2/10/2014	5557.7	Pass	5486.0	5496.0	5576.0	5586.0
1402166-7 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	30	C14021030	2/10/2014	28.09	Pass	26.99	27.46	29.36	29.83
					B14021030	2/10/2014	0.4190	Pass	0.0000	0.0500	0.5000	0.7500
					C14021030	2/10/2014	5546.0	Pass	5514.0	5524.0	5604.0	5614.0
1402166-8 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	31	C14021031	2/10/2014	29.21	Pass	28.09	28.58	30.56	31.05
					B14021031	2/10/2014	0.3950	Pass	0.0000	0.0500	0.5000	0.7500
					C14021031	2/10/2014	5557.7	Pass	5496.0	5506.0	5586.0	5596.0
1402166-9 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	32	C14021032	2/10/2014	29.03	Pass	27.66	28.16	30.08	30.58
					B14021032	2/10/2014	0.3190	Pass	0.0000	0.0500	0.5000	0.7500
					C14021032	2/10/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0

Data Package ID: UR1402166-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
				CI - The Analysis Date exceeds the Calibration Date by more than 14 days.

Date Printed: Tuesday, February 25, 2014

ALS Environmental -- FC

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LIMS Version: 6.695

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# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402166

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Monday, February 24, 2014  
3:28:29 PM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402166-10 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	43	C14021043	2/10/2014	32.34	Pass	30.49	31.03	33.15	33.69
					B14021043	2/10/2014	0.4360	Pass	0.0000	0.0498	0.4998	0.7500
					C14021043	2/10/2014	5567.7	Pass	5496.0	5506.0	5586.0	5596.0
1402166-11 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	45	C14021045	2/10/2014	31.65	Pass	30.63	31.18	33.30	33.85
					B14021045	2/10/2014	0.4130	Pass	0.0000	0.0498	0.4998	0.7500
					C14021045	2/10/2014	5546.0	Pass	5496.0	5506.0	5586.0	5596.0
1402166-12 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	46	C14021046	2/10/2014	30.58	Pass	29.63	30.16	32.22	32.75
					B14021046	2/10/2014	0.3270	Pass	0.0000	0.0498	0.4998	0.7500
					C14021046	2/10/2014	5543.9	Pass	5505.8	5515.8	5595.8	5605.8
1402166-13 Spectrum #1 2/21/2014	SMP	AS140215-2 AS140215-2UR	UIISO	47	C14021047	2/10/2014	30.42	Warning	30.32	30.87	32.97	33.52
					B14021047	2/10/2014	0.3520	Pass	0.0000	0.0498	0.4998	0.7500
					C14021047	2/10/2014	5557.7	Pass	5507.7	5517.7	5597.7	5607.7
1402166-14 Spectrum #1 2/22/2014	SMP	AS140215-2 AS140215-2UR	UIISO	81	C14021881	2/18/2014	30.83	Pass	29.34	29.86	31.89	32.42
					B14021881	2/18/2014	0.1050	Pass	0.0000	0.0500	0.5000	0.7500
					C14021881	2/18/2014	5553.6	Pass	5505.8	5515.8	5595.8	5605.8
1402166-15 Spectrum #1 2/22/2014	SMP	AS140215-2 AS140215-2UR	UIISO	82	C14021882	2/18/2014	30.65	Pass	29.85	30.38	32.46	32.99
					B14021882	2/18/2014	0.0990	Pass	0.0000	0.0500	0.5000	0.7500
					C14021882	2/18/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
AS140215-2M Spectrum #1 2/22/2014	MB	AS140215-2 AS140215-2UR	UIISO	83	C14021883	2/18/2014	31.20	Pass	29.72	30.25	32.31	32.84
					B14021883	2/18/2014	0.1290	Pass	0.0000	0.0500	0.5000	0.7500
					C14021883	2/18/2014	5557.7	Pass	5505.8	5515.8	5595.8	5605.8
AS140215-2P Spectrum #1 2/22/2014	MB	AS140215-2 AS140215-2UR	UIISO	84	C14021884	2/18/2014	30.40	Pass	28.92	29.44	31.44	31.96
					B14021884	2/18/2014	0.1410	Pass	0.0000	0.0500	0.5000	0.7500
					C14021884	2/18/2014	5555.8	Pass	5493.9	5503.9	5583.9	5593.9
AS140215-2 Spectrum #1 2/22/2014	LCS	AS140215-2 AS140215-2UR	UIISO	85	C14021885	2/18/2014	30.11	Pass	28.78	29.30	31.30	31.82
					B14021885	2/18/2014	0.1040	Pass	0.0000	0.0500	0.5000	0.7500
					C14021885	2/18/2014	5543.9	Pass	5496.0	5506.0	5586.0	5596.0

Data Package ID: UR1402166-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
CI - The Analysis Date exceeds the Calibration Date by more than 14 days.				

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# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC

PAI Work Order: 1402166

Prep SOP: PAI 778

Analytical SOP: PAI 714

Reported on: Monday, February 24, 2014

3:28:29 PM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	<u>RESULTS</u>	<u>FLAGS</u>	<u>LCL</u>	<u>LWL</u>	<u>UWL</u>	<u>UCL</u>
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
AS140215-2	LCSD	AS140215-2	UI50	86	C14021886	2/18/2014	30.61	Pass	28.91	29.42	31.42	31.94
Spectrum #1		AS140215-2UR			B14021886	2/18/2014	0.1000	Pass	0.0000	0.0500	0.5000	0.7500
2/22/2014					C14021886	2/18/2014	5546.0	Pass	5505.8	5515.8	5595.8	5605.8

Data Package ID: UR1402166-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
				CI - The Analysis Date exceeds the Calibration Date by more than 14 days.

Date Printed: Tuesday, February 25, 2014

ALS Environmental -- FC

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LIMS Version: 6.695

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# Alpha Spec Calibration Source Re-Certification

Recalibration performed by Isotope Products Laboratories

Primary Certified Source

Source PA ID: 190  
 Planchet Label: 9  
 Recalibrated on: 10/15/2013  
 Received by ALS on: 10/18/2013

Values from certificate	
Source ID:	92MX223027
Total Activity:	3745.2 dpm
Ref. Date:	10/15/2013

Nuclide	Act (Bq)	Act (dpm)	Half-Life (yrs)	Decay Corrected
U-234:	49.54	2972.4	2.48E+05	2972.40 dpm
U-235:	1.09	65.58	7.04E+08	65.58 dpm
Am-241:	11.79	707.4	432.17	707.38 dpm
TOTAL				3745.36 dpm

Efficiency Determination for Detector:

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Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Total cpm	Known dpm	Detector efficiency
92MX223027	190	97-19-103-06	10/21/13	7886	32739	1136	2100		1187.43	3745.36	31.70%

Sources 1 through 8 activity determination

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Detector Efficiency	Am-241 dpm	U-234 dpm	U-235 dpm	Combined dpm
92MX2203026	182	97-19-103-01	10/21/13	13543	81484	2689	2100		31.70%	1220.49	7343.29	242.33	8806.10
92MX2203028	183	97-19-103-02	10/21/13	15630	156715	4155	2100		31.70%	1426.59	14123.06	374.45	15924.09
92MX2203024	184	97-19-103-03	10/21/13	71764	74298	2052	2100		31.70%	6467.33	6695.69	164.92	13347.94
92MX2203021	185	97-19-103-04	10/21/13	22944	62381	2198	2100		31.70%	2067.70	5821.74	193.08	7887.52
92MX2203025	186	97-19-103-05	10/21/13	103302	124917	3425	2100		31.70%	9309.51	11257.44	308.66	20875.61
92MX2203022	187	97-19-103-06	10/21/13	78834	84490	2349	2100		31.70%	7113.48	7614.19	211.69	14939.36
92MX2203023	188	97-19-103-07	10/21/13	46085	71762	1847	2100		31.70%	4153.15	6467.15	169.45	10786.75
92MX2203029	189	97-19-103-08	10/21/13	34624	218016	6721	2100		31.70%	3120.29	19647.47	605.69	23373.45

Efficiency Verification

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	Count dur (s)	Total cpm	Known dpm	Detector efficiency	RPD	FLAG
92MX223027	190	97-19-103-09	10/21/13	7807	32933	1155	2100	1197.00	3745.36	31.96%	-0.26%	PASS

Sources 1 through 8 activity re-verification

Source Serial#	PA ID	Sequential #	Combined Observed dpm	Combined Certified dpm*	Percent Difference %	Within 5% of Certified value?
92MX2203026	182	97-19-103-01	8806.10	8665.90	-0.56%	Yes
92MX2203028	183	97-19-103-02	15924.09	15999.04	-0.47%	Yes
92MX2203024	184	97-19-103-03	13347.94	13533.39	-1.37%	Yes
92MX2203021	185	97-19-103-04	7887.52	8170.91	-3.47%	Yes
92MX2203025	186	97-19-103-05	20875.61	21020.88	-0.69%	Yes
92MX2203022	187	97-19-103-06	14939.36	15319.53	-2.48%	Yes
92MX2203023	188	97-19-103-07	10786.75	10744.16	0.40%	Yes
92MX2203029	189	97-19-103-08	23373.45	23608.79	-1.00%	Yes

Data from certificates

Reference Date	U-234 (Bq)	U-234 (dpm)	U-235 (Bq)	U-235 (dpm)	Am-241 (Bq)	Am-241 (dpm)
5/1/2003	24.10	7446.00	2.43	145.74	21.43	1285.80
5/1/2003	29.30	14358.00	4.20	252.00	23.55	1413.00
5/1/2003	19.40	7164.00	1.93	115.56	106.00	6380.00
4/1/2003	01.00	6060.00	1.26	75.84	34.50	2070.00
4/1/2003	03.00	12180.00	3.41	204.72	146.40	8784.00
4/1/2003	32.90	7974.00	3.17	189.96	121.30	7279.00
4/1/2003	07.10	6426.00	0.93	55.54	72.26	4336.60
5/1/2003	34.80	20088.00	6.55	393.18	53.02	3181.20

New Expiration Date => 10/21/2014  
 JP 10/22/13



**Eckert & Ziegler**

**Isotope Products**

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

#190  
Received 10/18/13

# CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide:</b> U-234	<b>Customer:</b> ALS LABORATORY
<b>Radionuclide:</b> U-235	<b>P.O. No.:</b> FC 35957 R5576
<b>Radionuclide:</b> Am-241	<b>Catalog No.:</b> *SOURCE-RECAL-STD
<b>Half-life (U-234):</b> (2.454 ± 0.006)E+05 years	<b>Reference Date:</b> 15-Oct-13 12:00 PST
<b>Half-life (U-235):</b> (7.037 ± 0.011)E+08 years	<b>Source No.:</b> 92MIX223027
<b>Half-life (Am-241):</b> 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234:	1.339	nCi,	49.54	Bq	Am-241:	0.3187	nCi,	11.79	Bq
U-235:	0.02954	nCi,	1.093	Bq	Total Activity:	1.687	nCi,	62.42	Bq

**Physical Description:**

- A. Capsule type: Disk (22 mm OD x 0.79 mm THK)
- B. Nature of active deposit: Electrodeposited and diffusion bonded oxide
- C. Active diameter/volume: 19 mm
- D. Backing: Stainless steel
- E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in May 2001.

**Uncertainty of Measurement:**

- A. Type A (random) uncertainty: ± 0.5 %
- B. Type B (systematic) uncertainty: ± 3.0 %
- C. Uncertainty in aliquot weighing: ± 0.0 %
- D. Total uncertainty at the 99% confidence level: ± 3.0 %

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 1893 α/min in 2π on 20-Sep-13.

*Donald James Van Dalsem*  
Quality Control

2-OCT-13  
Date

IPL Ref. No.: 987-28

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**

24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory 95 of 113**

1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13

$\alpha 1$

New Exp Date

=> 10/21/2014

PAI 187

re-calibrated 4-15-03

JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203026
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**Contained Radioactivity:**

U-234: 3.354 nCi (124.1 Bq) U-235: 0.06566 nCi (2.429 Bq)	Am-241: 0.5793 nCi (21.43 Bq) Total Activity: 3.999 nCi (148.0 Bq)
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**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4483  $\alpha$ /min in 2 $\pi$  on 11 Apr 03.

*Daniel James Van Dalsem*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

Re-Calibrated 10/21/13  
α 2 New Exp Date  
 => 10/21/2014  
 PAI 183  
 Recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234	<b>Customer:</b> PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b> U-235	<b>P.O. No.:</b> EW040203/R2193
<b>Radionuclide C:</b> Am-241	<b>Catalog No.:</b> MISC-STD
<b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years	<b>Reference Date:</b> 1-May-03 12:00 PST
<b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years	<b>Source No.:</b> 92MIX2203028
<b>Half Life (Am-241):</b> 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234: 6.467 nCi (239.3 Bq)	Am-241: 0.6366 nCi (23.55 Bq)
U-235: 0.1135 nCi (4.200 Bq)	Total Activity: 7.217 nCi (267.1 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radiopurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 8091 α/min in 2π on 11 Apr 03.

*Daniel James Van Dalsen*  
 Quality Control

15-Apr-03  
 Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

Re-Calibrated 10/21/13  
α3 New Exp Date  
 => 10/21/2014  
 PAT I.D. 184  
 recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203024
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**Contained Radioactivity:**

U-234: 3.227 nCi (119.4 Bq)	Am-241: 2.866 nCi (106.0 Bq)
U-235: 0.05205 nCi (1.926 Bq)	Total Activity: 6.145 nCi (227.3 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

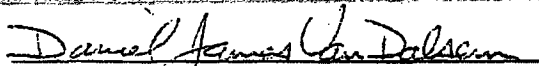
This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.6%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 6889 α/min in 2π on 11 Apr 03.

  
 Quality Control

15-Apr-03  
 Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED





**Isotope Products  
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
New Exp Date  
 $\alpha 4$   $\Rightarrow$  10/21/2014

PAID TO PROCESS  
REC'd from recalibration  
3-28-03 TP 10/22/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b>	U-234	<b>Customer:</b>	PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b>	U-235	<b>P.O. No.:</b>	EW030603/R2155
<b>Radionuclide C:</b>	Am-241	<b>Catalog No.:</b>	MISC-STD
<b>Half Life (U-234):</b>	(2.454 $\pm$ 0.006)E+05 years	<b>Reference Date:</b>	1-Apr-03 12:00 PST
<b>Half Life (U-235):</b>	(7.037 $\pm$ 0.011)E+08 years	<b>Source No.:</b>	92MIX2203021
<b>Half Life (Am-241):</b>	432.17 $\pm$ 0.66 years		

**Contained Radioactivity:**

U-234:	2.731 nCi (101.0 Bq)	Am-241:	0.9325 nCi (34.50 Bq)
U-235:	0.03416 nCi (1.264 Bq)	Total Activity:	3.698 nCi (136.8 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4145  $\alpha$ /min in  $2\pi$  on 18 Mar 03.

Daniel James Van Dalsem  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
1800 North Keystone Street Burbank, California 91504



**Isotope Products  
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Ke-Calibrated 10/21/13  
 (x5) New Exp Date  
 => 10/21/2014  
 PAI ID 00186  
 special calibration  
 received 186  
 3-28-03  
 JP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203025
---	---

**Contained Radioactivity:**

U-234: 5.486 nCi (203.0 Bq) U-235: 0.09221 nCi (3.412 Bq)	Am-241: 3.958 nCi (146.4 Bq) <b>Total Activity:</b> 9.536 nCi (352.8 Bq)
--	---

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 10690 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
 Quality Control

19-Mar-03  
 Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
 24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
 1800 North Keystone Street Burbank, California 91504



**Isotope Products  
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
26 New Exp Date  
 => 10/21/2014  
 RATIO, CC 187  
 rec'd for recalibration  
 3-28-03 JP 10/22/10

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203022
---	---

**Contained Radioactivity:**

U-234: 3.592 nCi (132.9 Bq)	Am-241: 3.279 nCi (121.3 Bq)
U-235: 0.08556 nCi (3.166 Bq)	Total Activity: 6.957 nCi (257.4 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 7799 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
1800 North Keystone Street Burbank, California 91504



**Isotope Products  
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661•309•1010  
Fax 661•257•8303

Re-Calibrated 10/21/13  
New Exp Date  
⇒ 10/21/2014

PA ID 188  
Rec'd for recalibration  
3-28-03 JP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203023
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**Contained Radioactivity:**

U-234: 2.895 nCi (107.1 Bq) U-235: 0.02502 nCi (0.9257 Bq)	Am-241: 1.953 nCi (72.26 Bq) <b>Total Activity:</b> 4.873 nCi (180.3 Bq)
---	---

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 5463 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsem*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
1800 North Keystone Street Burbank, California 91504



**Isotope Products  
Laboratories**

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24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
28 New Exp Date  
 ⇒ 10/21/2014  
 PAI ID 189  
 recd 4-21-03  
 recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203029
---	---

**Contained Radioactivity:**

U-234: 9.048 nCi (334.8 Bq) U-235: 0.1771 nCi (6.553 Bq)	Am-241: 1.433 nCi (53.02 Bq) <b>Total Activity:</b> 10.66 nCi (394.4 Bq)
---	---

**Physical description:**

A. Capsule type:	Disk (22 mm, OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.5%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.0%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15):
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 11950 α/min in 2π on 11 Apr 03.

*Daniel James Van Dalsen*  
 Quality Control

15-Apr-03  
 Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
 24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
 1800 North Keystone Street Burbank, California 91504

Analyst: ORTEC

Detector: 13a

**Calibration**

Energy Calibration: SOURCE 190\_10.21.13 (#9)

Description:

Analysis Date: 10/21/2013 10:15:08AM

Calibration Type: Efficiency

**Source Info**

Certificate ID: A9 RSO#190

Prepared by: IPL

Description:

Certification Date: 10/15/2013 10:00:00AM

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 8:31:19AM

Live Time: 35.00 min.

Real Time: 35.01 min.

Efficiency Calibration Name: SOURCE 190\_10.21.13 (

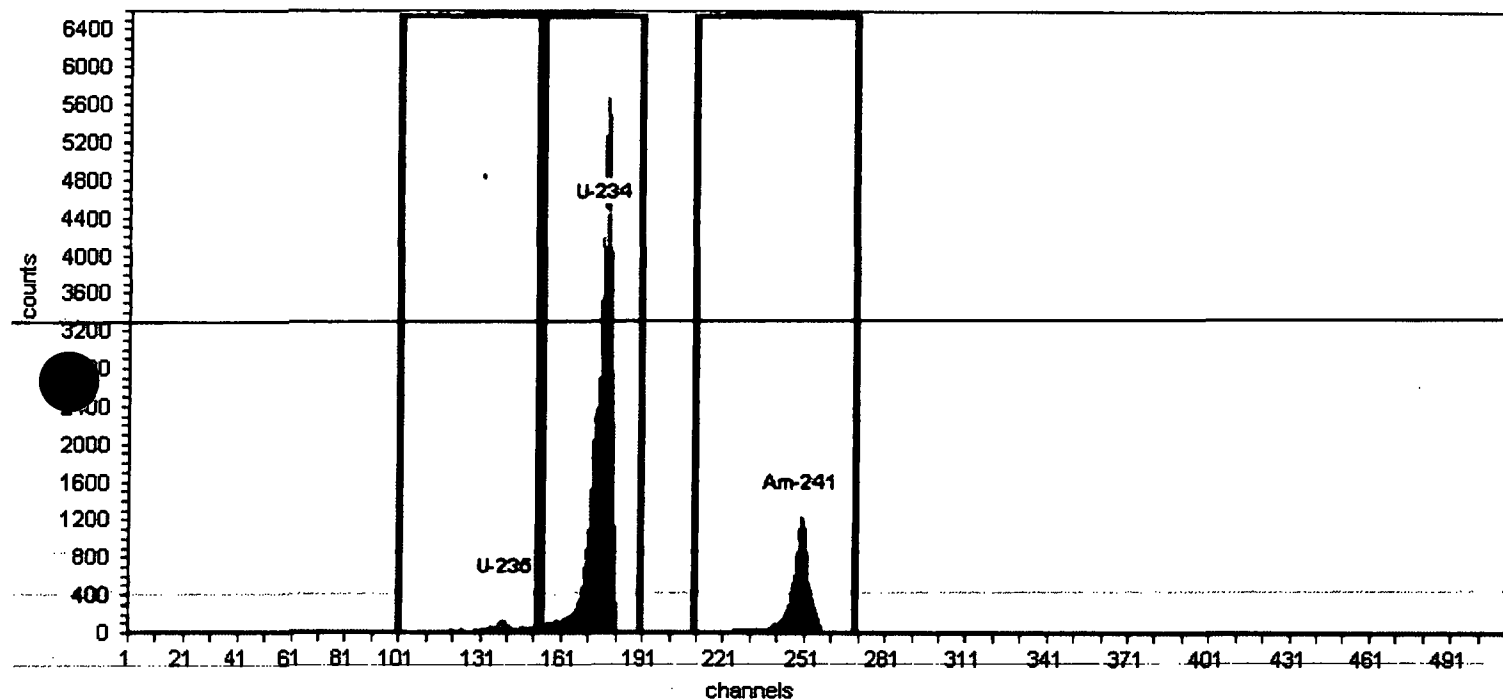
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 31.46% +/- 0.32% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,135.00	32.43
U-234	176	4.78	153	190	32,739.00	935.40
Am-241	249	5.49	210	270	7,686.00	219.60

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 10:15:34AM  
Calibration Type: Efficiency

Energy Calibration: SOURCE 182\_10.21.13 (#1)

Description:

**Source Info**

Certificate ID: A1 RSO#182

Prepared by: IPL

Description:

Certification Date: 5/1/2003 12:00:24PM

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 9:09:15AM

Live Time: 35.00 min.

Real Time: 35.03 min.

Efficiency Calibration Name: SOURCE 182\_10.21.13 (

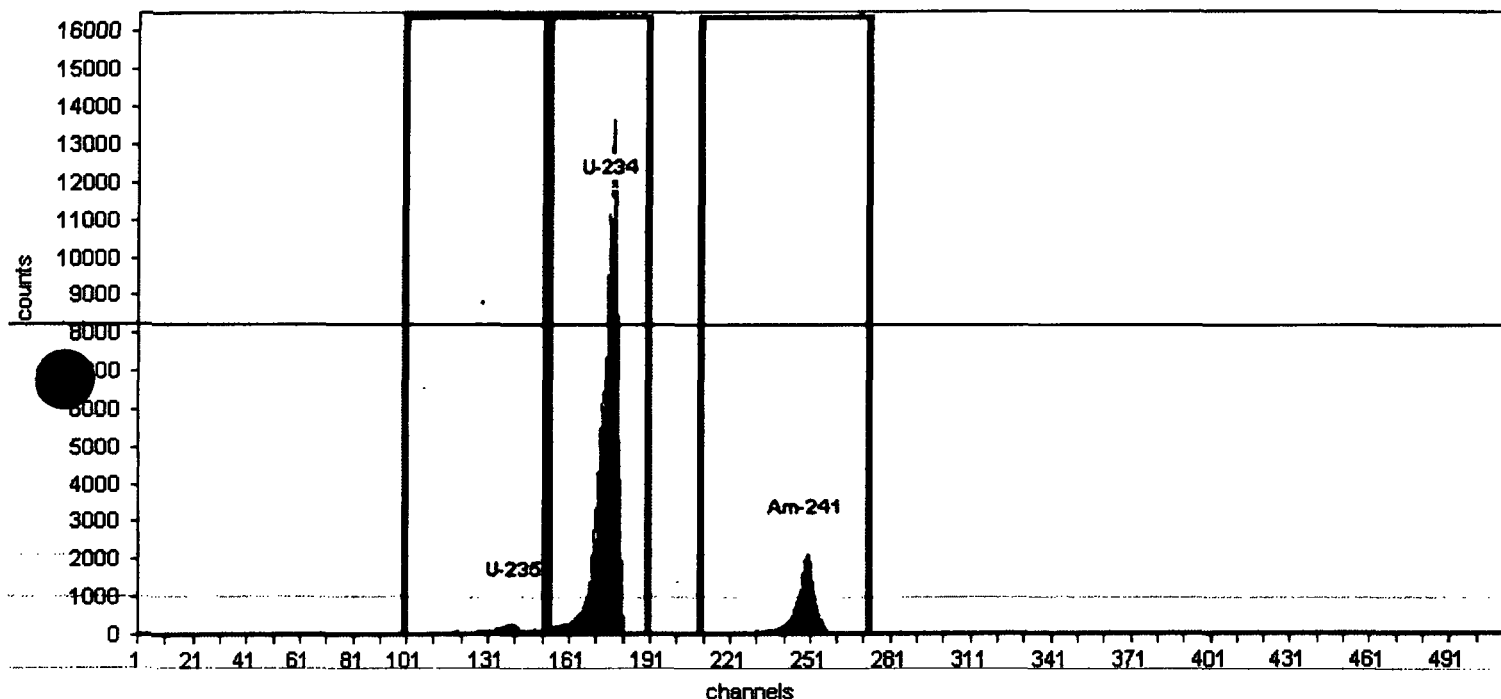
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 31.17% +/- 0.20% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,689.00	76.83
U-234	176	4.78	153	190	81,484.00	2,328.11
Am-241	249	5.49	210	273	13,543.00	386.94

*JP 10/21/13*

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 183\_10.21.13 (#2)

Description:

Analysis Date: 10/21/2013 10:39:26AM

Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A2 RSO#183

Prepared by: IPL

Description:

Certification Date: 5/1/2003 12:00:00PM

Acquisition

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 9:48:00AM

Live Time: 35.00 min.

Real Time: 35.06 min.

Energy Calibration Equation:

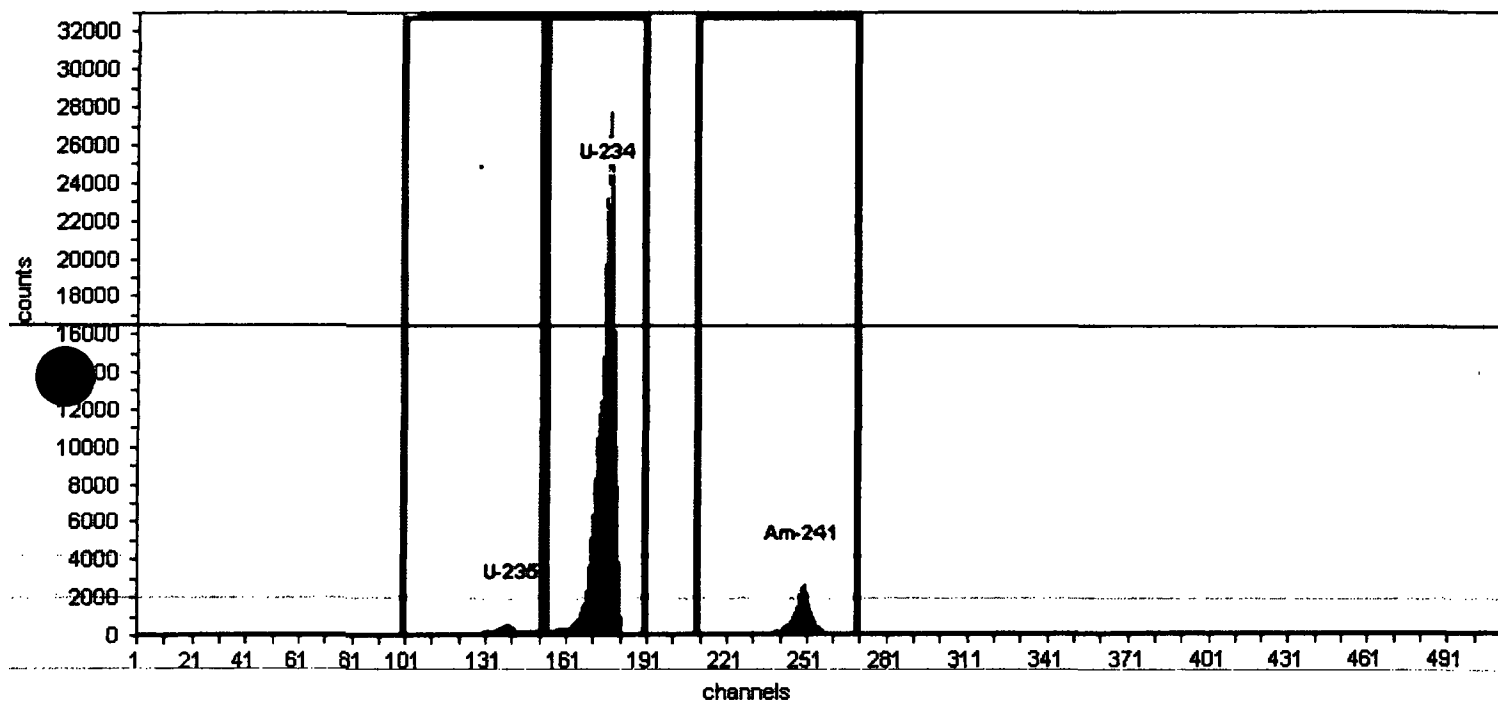
Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 183\_10.21.13 (

Efficiency: 31.40% +/- 0.15% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	4,155.00	118.71
U-234	176	4.78	153	190	156,715.00	4,477.57
Am-241	249	5.49	210	270	15,830.00	452.29

JP 10/21/13



Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 11:08:15AM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 184\_10.21.13 (#3)

Description:

**Source Info**

Certificate ID: A3 RSO#184

Prepared by: IPL

Certification Date: 5/1/2003 12:00:00PM

Description:

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 10:30:47AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

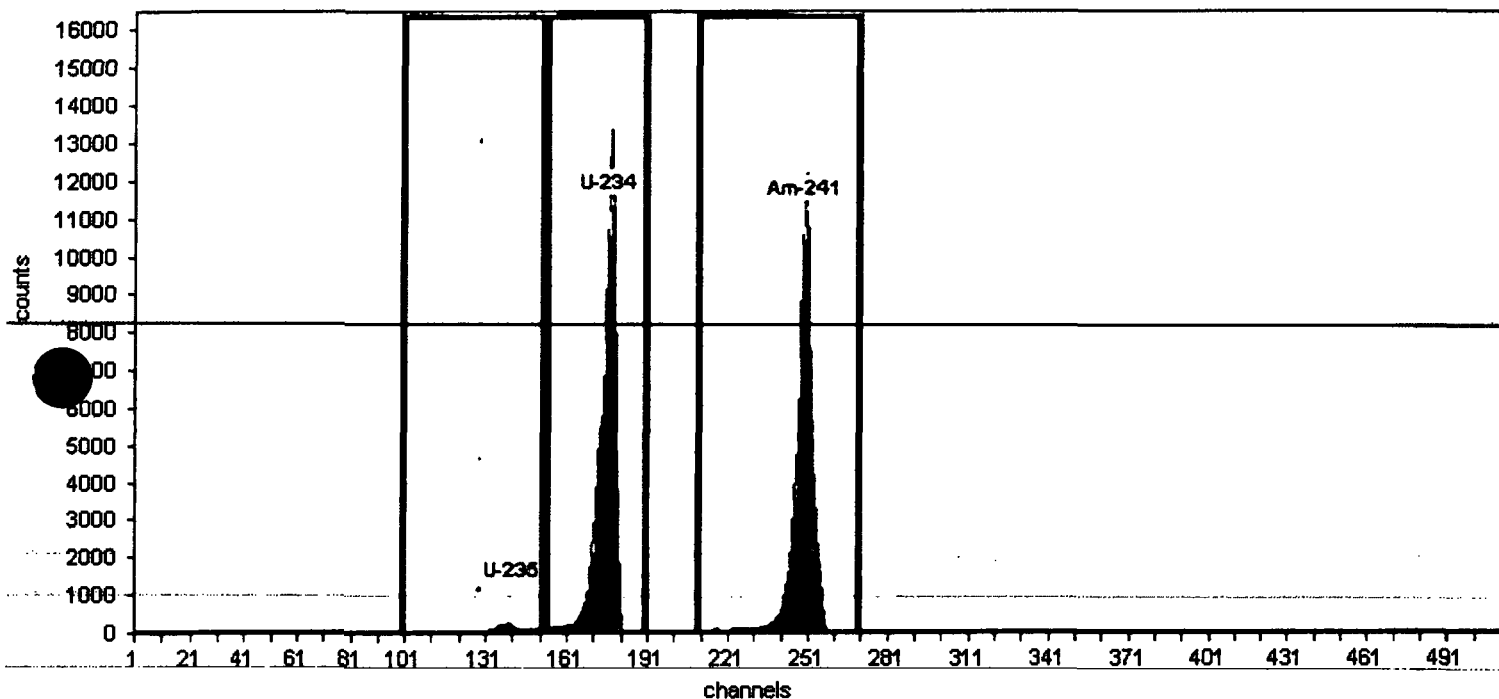
Real Time: 35.05 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 184\_10.21.13 (

Efficiency: 31.06% +/- 0.16% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,052.00	58.63
U-234	176	4.78	153	190	74,298.00	2,122.80
Am-241	249	5.49	210	270	71,764.00	2,050.40

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Energy Calibration: SOURCE 185\_10.21.13 (#4)

Description:

Analysis Date: 10/21/2013 11:44:23AM  
Calibration Type: Energy And Efficiency

**Source Info**

Certificate ID: A4 RSO#185

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 11:08:08AM

Live Time: 35.00 min.

Real Time: 35.03 min.

Efficiency Calibration Name: SOURCE 185\_10.21.13 (

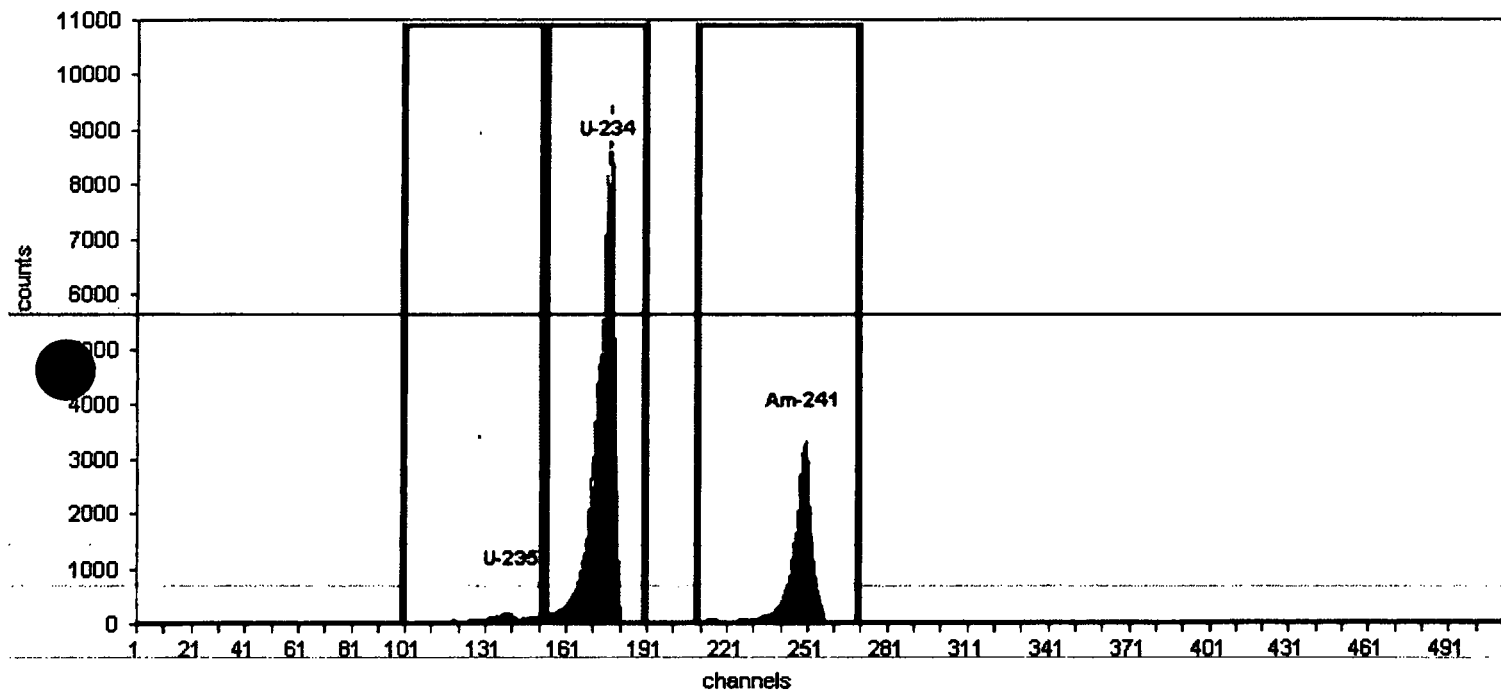
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 30.07% +/- 0.21% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,198.00	62.80
U-234	176	4.78	153	190	62,381.00	1,782.31
Am-241	249	5.49	210	270	22,944.00	655.54

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 12:20:40PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 186\_10.21.13 (#5)  
Description:

**Source Info**

Certification Date: 4/1/2003 12:00:00PM

Certificate ID: A5 RSO#186  
Prepared by: IPL

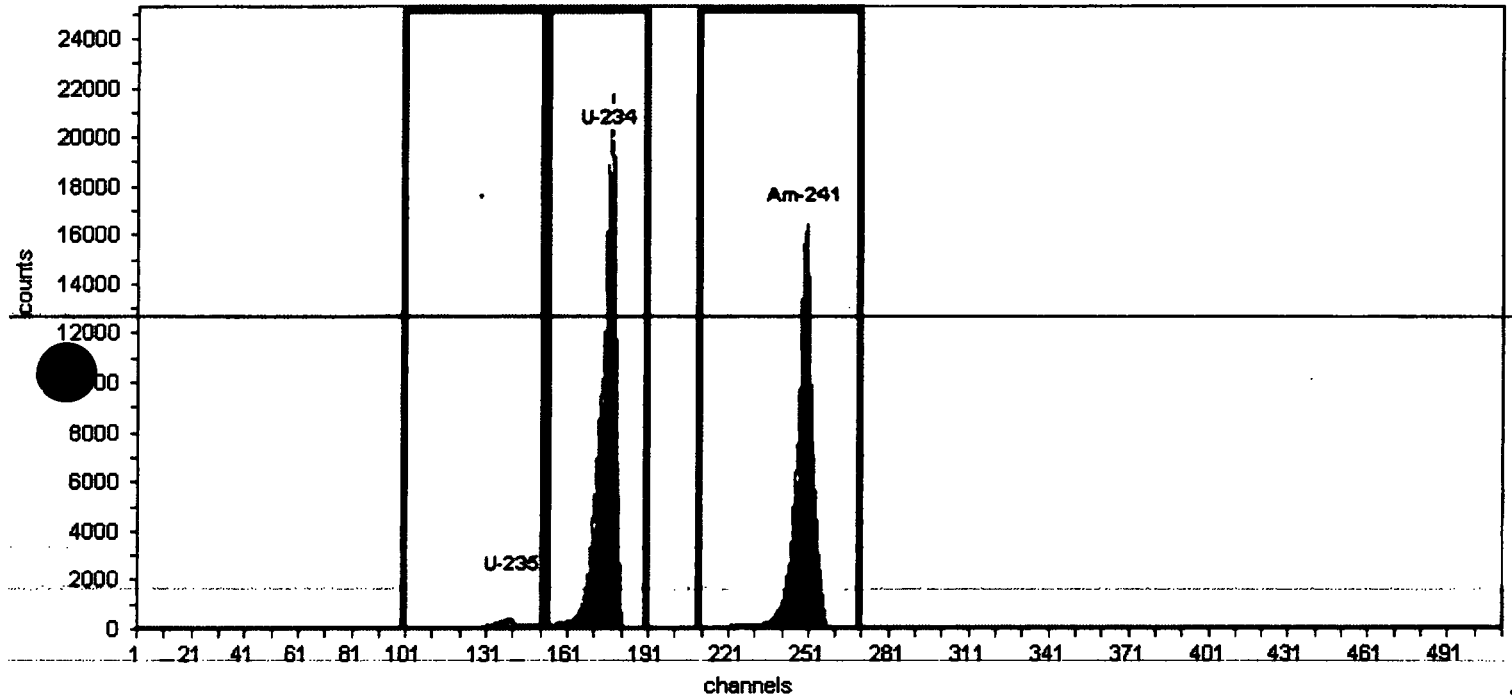
Description:

**Acquisition**

Detector: 13a , SN:  
Acquisition Start Date: 10/21/2013 11:45:31AM  
Live Time: 35.00 min.  
Real Time: 35.08 min.

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch  
Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>  
Efficiency: 31.20% +/- 0.13% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 186\_10.21.13 (



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	3,425.00	97.86
U-234	176	4.78	153	190	124,917.00	3,569.06
Am-241	249	5.49	210	270	103,302.00	2,951.49

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 187\_10.21.13 (#6)

Description:

Analysis Date: 10/21/2013 12:56:51PM

Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A6 RSO#187

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 12:21:22PM

Live Time: 35.00 min.

Real Time: 35.06 min.

Efficiency Calibration Name: SOURCE 187\_10.21.13 (

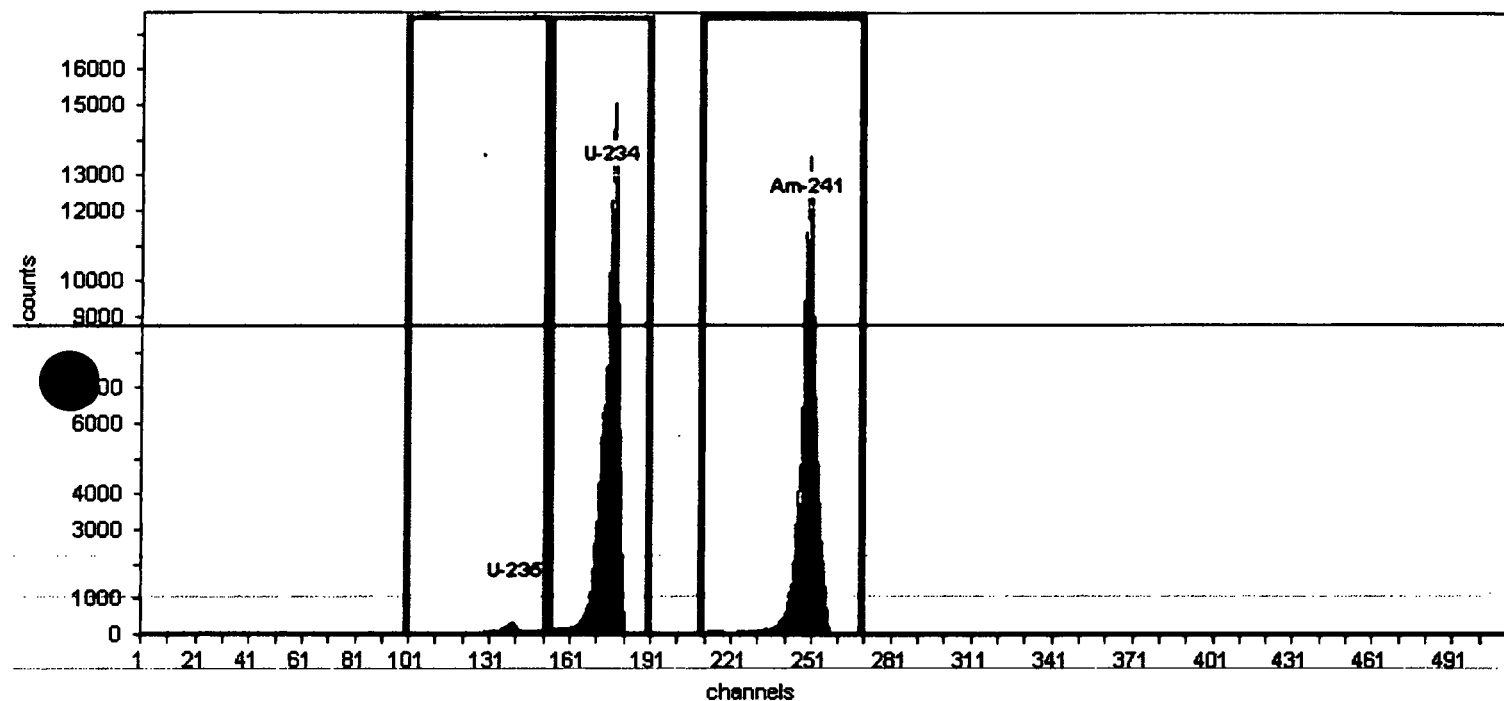
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 30.89% +/- 0.15% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,349.00	67.11
U-234	176	4.78	153	190	84,490.00	2,414.00
Am-241	249	5.49	210	270	78,934.00	2,255.26

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 1:32:57PM

Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 188\_10.21.13 (#7)

Description:

Source Info

Certificate ID: A7 RSO#188

Certification Date: 4/1/2003 12:00:00PM

Prepared by: IPL

Description:

Acquisition

Detector: 13a, SN:

Energy Calibration Equation:

Acquisition Start Date: 10/21/2013 12:57:17PM

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

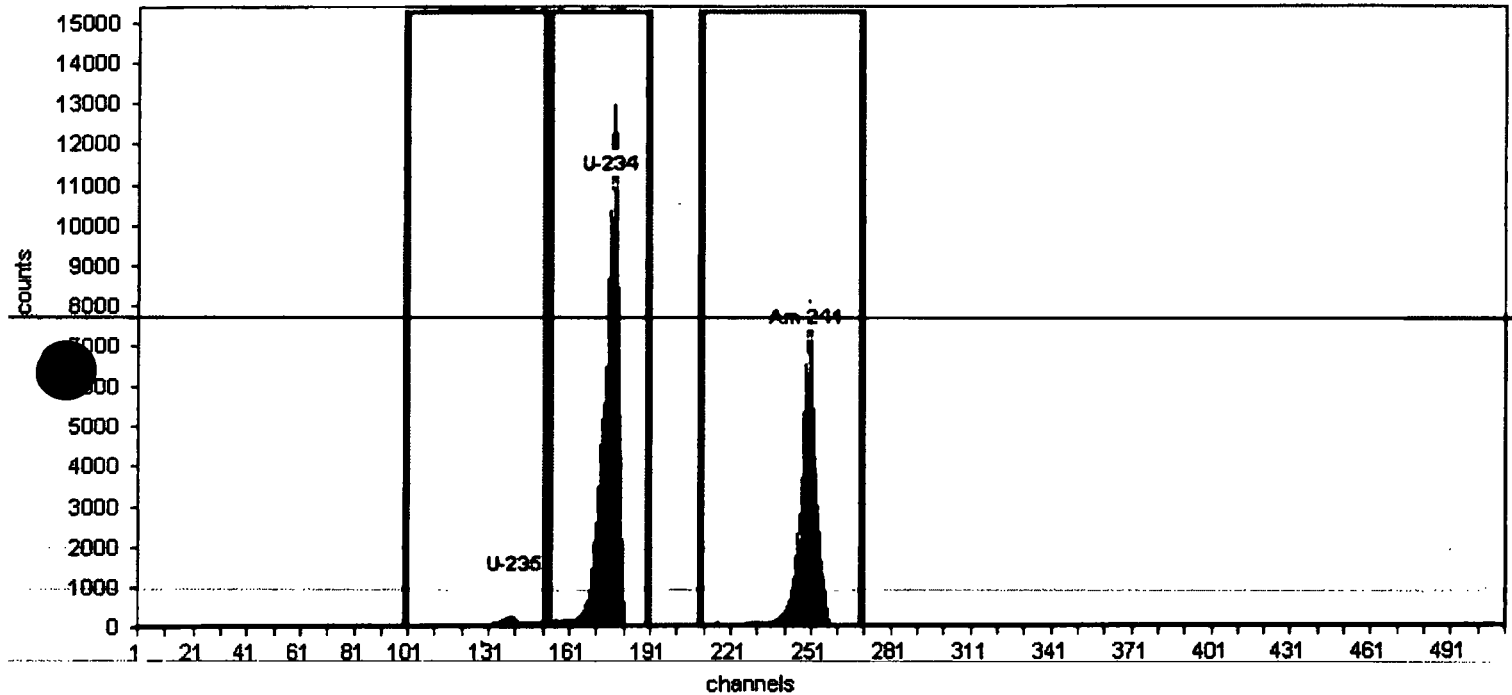
Offset = 3,010.51 keV

Real Time: 35.04 min.

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 188\_10.21.13 (

Efficiency: 31.50% +/- 0.19% TPU(2 sigma)



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,847.00	52.77
U-234	176	4.78	153	190	71,762.00	2,050.34
Am-241	249	5.49	210	270	46,085.00	1,316.71

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 189\_10.21.13 (#8)

Description:

Analysis Date: 10/21/2013 2:09:42PM

Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A8 RSO#189

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

Acquisition

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 1:34:04PM

Live Time: 35.00 min.

Real Time: 35.09 min.

Efficiency Calibration Name: SOURCE 189\_10.21.13 (

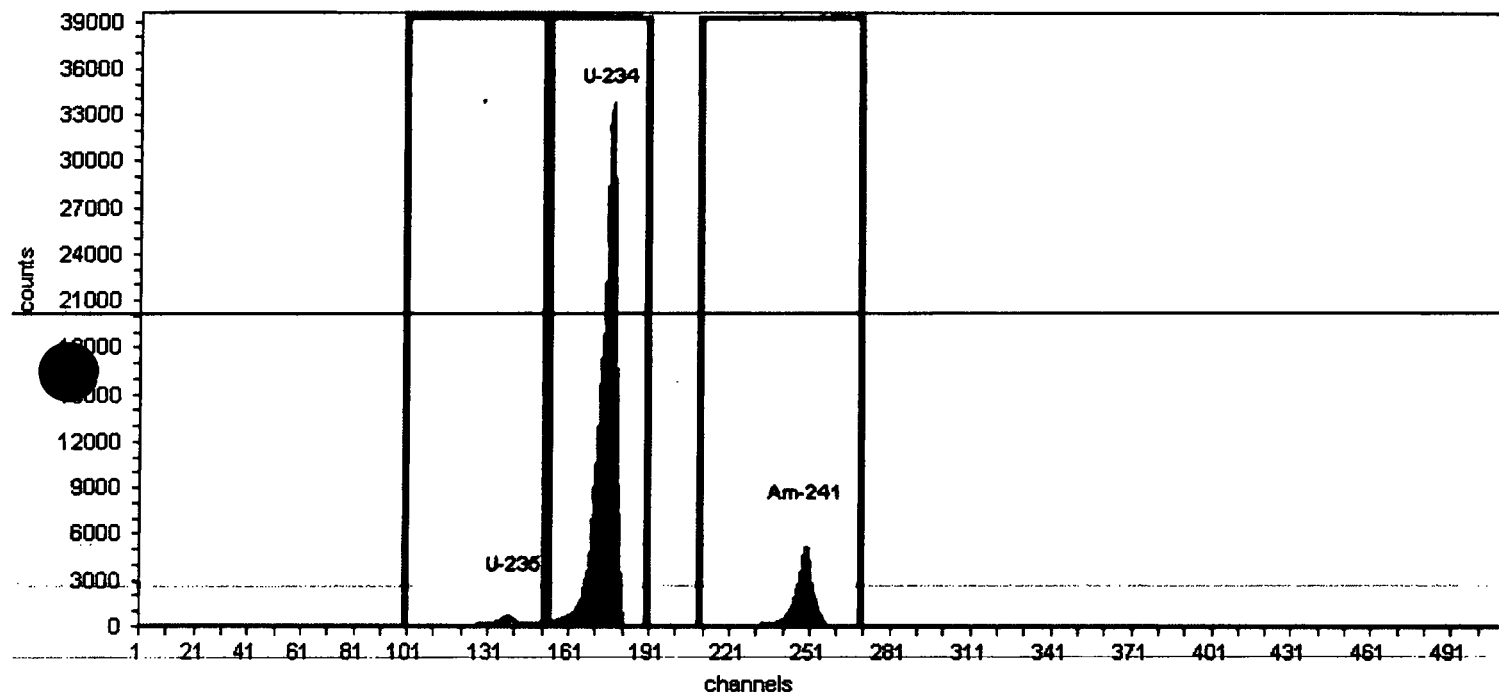
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 31.23% +/- 0.12% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	6,721.00	192.03
U-234	176	4.78	153	190	218,016.00	6,229.03
Am-241	249	5.49	210	270	34,624.00	989.26

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 190A\_10.21.13 (#9)  
Description:

Analysis Date: 10/21/2013 2:45:56PM  
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A9 RSO#190  
Prepared by: IPL

Certification Date: 10/15/2013 10:00:00AM

Description:

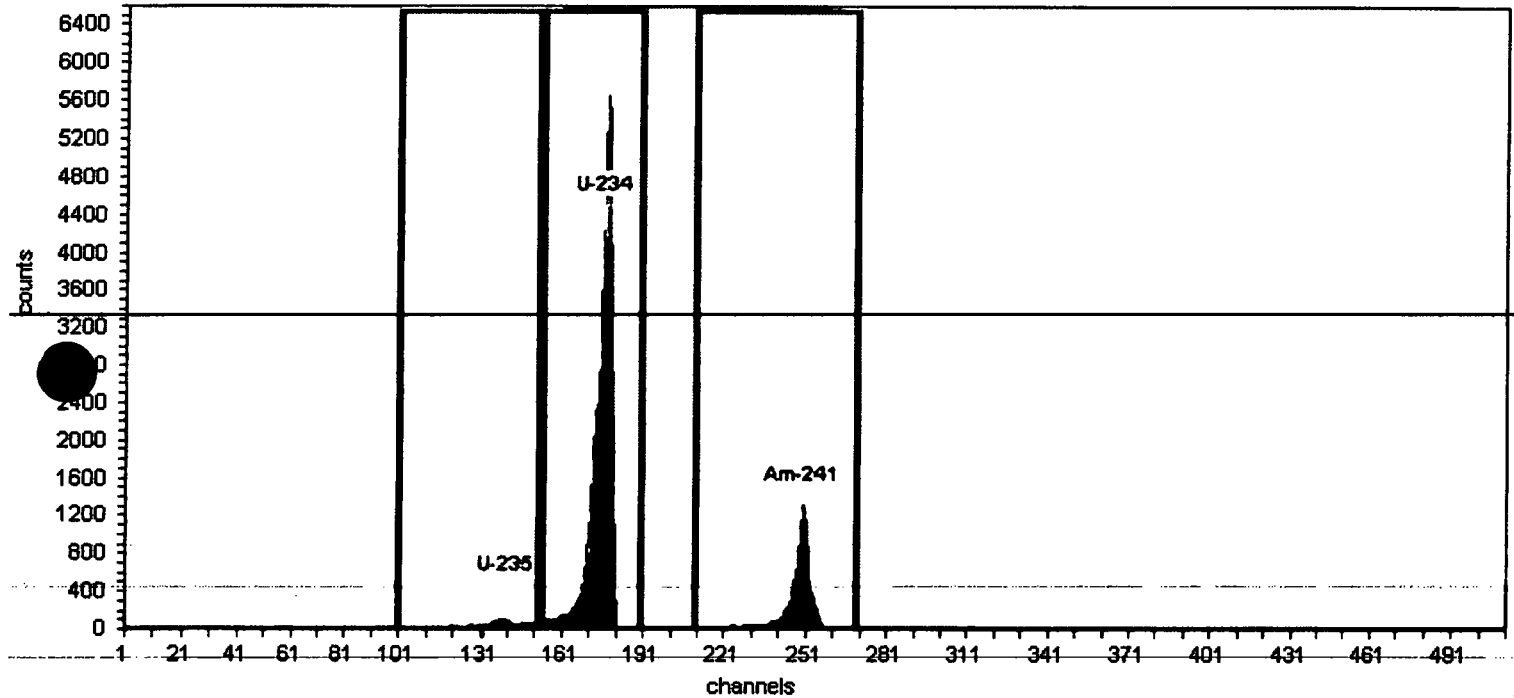
Acquisition

Detector: 13a , SN:  
Acquisition Start Date: 10/21/2013 2:10:16PM

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch  
Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>  
Efficiency: 31.69% +/- 0.32% TPU(2 sigma)

Live Time: 35.00 min.  
Real Time: 35.01 min.

Efficiency Calibration Name: SOURCE 190A\_10.21.13



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,155.00	33.00
U-234	176	4.78	153	190	32,933.00	940.94
Am-241	249	5.49	210	270	7,807.00	223.06

JP 10/21/13

Case Narrative -1402167



## Isotopic Uranium Case Narrative

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### **Cabrera Services, Inc** **Schofield Barracks – 08-3123.00**

Work Order Number: 1402167

1. This report consists of the analytical results and supporting documentation for 20 filter samples received by ALS on 2/14/2014.
2. These samples were prepared according to the current revisions of SOP 773 and SOP 778.
3. The samples were analyzed for the presence of isotopic uranium according to the current revision of SOP 714. The analyses were completed on 2/19/2014.
4. The isotopic analysis results for these samples are reported on an 'As Received' basis in units of  $\mu\text{Ci/mL}$ .
5. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate.
6. This analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to emission energies between those of U-234 and U-238. A potential limitation of this method is that measurable amounts of U-234 in the sample may cause a small amount of characteristic activity in the U-235 region of interest due to poorly resolved alpha activity at the boundary between the two regions. To minimize the potential for a high bias in the U-235 analytical results, the U-235 region of interest has been narrowed and limited to a lower energy region. An 85.1% abundance correction has been made to the final U-235 results.
7. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.



The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Crystal Shaeffer  
Crystal Shaeffer  
Radiochemistry Primary Data Reviewer

2/24/14  
Date

[Signature]  
Radiochemistry Final Data Reviewer

02/24/14  
Date



## Section 1

# CHAIN OF CUSTODY

# ALS Environmental -- FC

## Sample Number(s) Cross-Reference Table

**OrderNum:** 1402167

**Client Name:** Cabrera Services, Inc.

**Client Project Name:** Schofield Barracks

**Client Project Number:** 08-3123.00

**Client PO Number:** 12-3541

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SBHF14-036-ST03-AS-BK	1402167-1		FILTER	07-Feb-14	16:05
SBHF14-037-ST04-AS-BK	1402167-2		FILTER	07-Feb-14	15:54
SBHF14-038-ST05-AS-BK	1402167-3		FILTER	07-Feb-14	15:51
SBHF14-039-ST06-AS-BK	1402167-4		FILTER	07-Feb-14	15:46
SBHF14-040-ST07-AS-BK	1402167-5		FILTER	07-Feb-14	15:43
SBHF14-041-ST08-AS-BK	1402167-6		FILTER	07-Feb-14	15:38
SBHF14-042-ST09-AS-BK	1402167-7		FILTER	07-Feb-14	15:33
SBHF14-043-ST10-AS-BK	1402167-8		FILTER	07-Feb-14	15:30
SBHF14-044-ST11-AS-BK	1402167-9		FILTER	07-Feb-14	15:25
SBHF14-014-ST03-AS-BK	1402167-10		FILTER	05-Feb-14	16:36
SBHF14-015-ST04-AS-BK	1402167-11		FILTER	05-Feb-14	16:24
SBHF14-016-ST05-AS-BK	1402167-12		FILTER	05-Feb-14	16:21
SBHF14-017-ST06-AS-BK	1402167-13		FILTER	05-Feb-14	16:17
SBHF14-018-ST07-AS-BK	1402167-14		FILTER	05-Feb-14	16:14
SBHF14-019-ST08-AS-BK	1402167-15		FILTER	05-Feb-14	16:12
SBHF14-020-ST09-AS-BK	1402167-16		FILTER	05-Feb-14	16:08
SBHF14-021-ST10-AS-BK	1402167-17		FILTER	05-Feb-14	16:03
SBHF14-022-ST11-AS-BK	1402167-18		FILTER	05-Feb-14	16:01
SBHF14-012-ST01-AS-BK	1402167-19		FILTER	05-Feb-14	15:27
SBHF14-013-ST02-AS-BK	1402167-20		FILTER	05-Feb-14	15:23



# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

## Chain-of-Custody

Form 202a

WORKORDER # TBD

1402187

<b>SAMPLER</b> Stephan Owe		<b>DATE</b> 2/7/2014	<b>PAGE</b> 1 of 1
<b>PROJECT NAME</b> Schofield Barracks	<b>SITE ID</b> Schofield Barracks	<b>TURNAROUND</b> 30 days	<b>DISPOSAL</b> (By Lab) or Return to Client
<b>PROJECT No.</b> 08-3123.00	<b>EDD FORMAT</b> n/a		
<b>Task</b> 310	<b>PURCHASE ORDER</b> 12-3541		
<b>COMPANY NAME</b> Cabrera Services	<b>BILL TO COMPANY</b> Cabrera Services		
<b>SEND REPORT TO</b> Mike Winters	<b>INVOICE ATTN TO</b> Accounts Payable		
<b>ADDRESS</b> 2318 Bolger Ave	<b>ADDRESS</b> 473 Silver Lane		
<b>CITY / STATE / ZIP</b> Spring Hill, FL 34609	<b>CITY / STATE / ZIP</b> East Hartford, CT 06108		
<b>PHONE</b> 352-610-2150	<b>PHONE</b> 860-569-0095		
<b>FAX</b> n/a	<b>FAX</b> n/a		
<b>E-MAIL</b> mwinters@cabreraseservices.com	<b>E-MAIL</b> n/a		

Lab ID	Field ID	Matrix	Sample Date	Start Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotope Uranium by Alpha Spec												
1	SBHF14-036-ST03-AS-BK	F	2/7/2014	10:27	16:05	338	10	X												
2	SBHF14-037-ST04-AS-BK	F	2/7/2014	9:58	15:54	356	10	X												
3	SBHF14-038-ST05-AS-BK	F	2/7/2014	8:48	15:51	423	10	X												
4	SBHF14-039-ST06-AS-BK	F	2/7/2014	9:32	15:46	374	10	X												
5	SBHF14-040-ST07-AS-BK	F	2/7/2014	9:29	15:43	374	10	X												
6	SBHF14-041-ST08-AS-BK	F	2/7/2014	9:25	15:38	373	10	X												
7	SBHF14-042-ST09-AS-BK	F	2/7/2014	9:18	15:33	375	10	X												
8	SBHF14-043-ST10-AS-BK	F	2/7/2014	9:15	15:30	375	10	X												
9	SBHF14-044-ST11-AS-BK	F	2/7/2014	9:10	15:25	375	10	X												

\*Time Zone (Circle): EST CST MST HAST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

**Comments:**

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/ml

MDC is 1E-15 uCi/ml; see previously provided work plan for other MQC's

Bag of blank unused filters included for QC sample purposes

Preserve half of each sample for re-analysis/follow up testing

**Preservative Key:** 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

QC PACKAGE (check below)	
<input type="checkbox"/>	LEVEL II (Standard QC)
<input type="checkbox"/>	LEVEL III (Std QC + forms)
<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>[Signature]</i>	Stephan Owe	2/7/2014	16:30
RECEIVED BY	<i>[Signature]</i>	Pat Horkman	2/7/2014	16:31
RELINQUISHED BY	<i>[Signature]</i>	Pat Horkman	2/12/14	1500
RECEIVED BY	<i>[Signature]</i>	C Trumble	2-14-14	1005
RELINQUISHED BY				
RECEIVED BY				

5 of 128



# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 FH: (970) 490-1511 FX: (970) 490-1522

## Chain-of-Custody

Form 202r6

WORKORDER # TBD

1402107

SAMPLER	Stephan Owe	DATE	2/5/2014	PAGE	1 of 1
PROJECT NAME	Schofield Barracks	SITE ID	Schofield Barracks	TURNAROUND	30 days
PROJECT No.	08-3123.00	EDD FORMAT	n/a	DISPOSAL	(By Lab) or Return to Client
	Task 310	PURCHASE ORDER	12-3541		
COMPANY NAME	Cabrera Services	BILL TO COMPANY	Cabrera Services		
SEND REPORT TO	Mike Winters	INVOICE ATTN TO	Accounts Payable		
ADDRESS	2318 Bolger Ave	ADDRESS	473 Silver Lane		
CITY / STATE / ZIP	Spring Hill, FL 34609	CITY / STATE / ZIP	East Hartford, CT 06108		
PHONE	352-610-2150	PHONE	860-569-0095		
FAX	n/a	FAX	n/a		
E-MAIL	mwinters@cabreraseservices.com	E-MAIL	n/a		

Lab ID	Field ID	Matrix	Sample Date	Sart Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec												
10	SBHF14-014-ST03-AS-BK	F	2/5/2014	9:00	16:38	458	10	X												
11	SBHF14-015-ST04-AS-BK	F	2/5/2014	8:42	16:24	462	10	X												
12	SBHF14-016-ST05-AS-BK	F	2/5/2014	8:38	16:21	465	10	X												
13	SBHF14-017-ST06-AS-BK	F	2/5/2014	8:29	16:17	468	10	X												
14	SBHF14-018-ST07-AS-BK	F	2/5/2014	8:24	16:14	470	10	X												
15	SBHF14-019-ST08-AS-BK	F	2/5/2014	8:18	16:12	474	10	X												
16	SBHF14-020-ST09-AS-BK	F	2/5/2014	8:11	16:08	477	10	X												
17	SBHF14-021-ST10-AS-BK	F	2/5/2014	8:05	16:03	478	10	X												
18	SBHF14-022-ST11-AS-BK	F	2/5/2014	7:58	16:01	483	10	X												

\*Time Zone (Circle): EST CST MST (HAST) Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

Comments:

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/ml  
MDC is 1E-15 uCi/ml; see previously provided work plan for other MQO's  
Bag of blank unused filters included for QC sample purposes  
Preserve half of each sample for re-analysis/follow up testing

QC PACKAGE (check below)	
	LEVEL II (Standard QC)
	LEVEL III (Std QC + forms)
X	LEVEL IV (Std QC + forms + raw data)

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY		Stephan Owe	2/4/2014	16:40
RECEIVED BY		Pat Horkman	2/4/2014	16:41
RELINQUISHED BY		PAT HORKMAN	2/12/14	1500
RECEIVED BY		C. Trumbly	2-14-14	1005
RELINQUISHED BY				
RECEIVED BY				



# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

## Chain-of-Custody

Form 202r

WORKORDER # TBD

1402107

<b>SAMPLER</b> Jon A Cote		<b>DATE</b> 2/5/2014	<b>PAGE</b> 1 of 1
<b>PROJECT NAME</b> Schofield Barracks	<b>SITE ID</b> Schofield Barracks	<b>TURNAROUND</b> 30 days	<b>DISPOSAL</b> (By Lab) or Return to Client
<b>PROJECT No.</b> 08-3123.00	<b>EDD FORMAT</b> n/a		
<b>Task</b> 310	<b>PURCHASE ORDER</b> 12-3541		
<b>COMPANY NAME</b> Cabrera Services	<b>BILL TO COMPANY</b> Cabrera Services		
<b>SEND REPORT TO</b> Mike Winters	<b>INVOICE ATTN TO</b> Accounts Payable		
<b>ADDRESS</b> 2318 Bolger Ave	<b>ADDRESS</b> 473 Silver Lane		
<b>CITY / STATE / ZIP</b> Spring Hill, FL 34609	<b>CITY / STATE / ZIP</b> East Hartford, CT 06108		
<b>PHONE</b> 352-610-2150	<b>PHONE</b> 860-589-0095		
<b>FAX</b> n/a	<b>FAX</b> n/a		
<b>E-MAIL</b> mwinters@cabraservices.com	<b>E-MAIL</b> n/a		

Lab ID	Field ID	Matrix	Sample Date	Start Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec												
19	SBHF14-012-ST01-AS-BK	F	2/5/2014	12:00	15:27	207	10	X												
20	SBHF14-013-ST02-AS-BK	F	2/5/2014	11:50 AM	15:23	213	10	X												

\*Time Zone (Circle): EST CST MST HAST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

<b>Comments:</b> Volumes provided in ft <sup>3</sup> ; results requested in units of uCi/ml MDC is 1E-15 uCi/ml; see previously provided work plan for other MCO's Bag of blank unused filters included for QC sample purposes Preserve half of each sample for re-analysis/follow up testing	<b>QC PACKAGE (check below)</b>	
	<input type="checkbox"/>	LEVEL II (Standard QC)
	<input type="checkbox"/>	LEVEL III (Std QC + forms)
	<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)
<b>Preservative Key:</b> 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035		

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>Jon A Cote</i>	Jon A Cote	2/4/2014	15:45
RECEIVED BY	<i>Pat Horkman</i>	Pat Horkman	2/4/2014	15:46
RELINQUISHED BY	<i>C Trumble</i>	Pat Horkman	2/12/14	1500
RECEIVED BY	<i>C Trumble</i>	C Trumble	2-14-14	1005
RELINQUISHED BY				
RECEIVED BY				



ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: CABRERA

Workorder No: 1402167

Project Manager: LS

Initials: CDT Date: 2-14-14

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount of sediment: ___ dusting ___ moderate ___ heavy	Amount <input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	<input checked="" type="radio"/> NO
Cooler #: <u>1</u>			
Temperature (°C): <u>Amb</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: <u>11</u>			
Background µR/hr reading: <u>11</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES / NO / NA (If no, see Form 008.)			

DOT Survey Acceptance Information

**Additional Information:** PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

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If applicable, was the client contacted? YES / NO / NA Contact: [Signature] Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 2/14/14



From: (903) 324-5880  
Pat Hestrom (no Chat GPT)  
CABRERA SERVICES  
1564 Lyman Road (Mtg 3004)  
Schaffeld Branch, TX 78057

Origin ID: HMLA



Ship Date: 12FEB14  
Acct #: 1.0 LB  
CAD: 105318480MET348  
Dim: 12 X 12 X 12 IN

1402167

SHIP TO: (970) 498-1511  
Lance Steere  
ALS Laboratories  
225 COMMERCE DR  
FORT COLLINS, CO 80524

BILL RENDER

Delivery Address Bar Code



Ref # 06-3828.84 Task 021  
Invoice #  
PO # N/A to ALS  
Dept #

FRI - 14 FEB 10:30A  
PRIORITY OVERNIGHT

TRK# 7978 9055 5057  
(6201)



XH FTCA

11  
-0

80524  
CO-LS  
DEN



522016827 F28

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Section 2



# **SAMPLE RESULTS SUMMARY**

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402167

**Page:** 1 of 7  
**Reported on:** Friday, February 21, 2014  
 3:35:27 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402167-1	SBHF14-036-ST03-AS-BK	Sample	U-234	6E-17 +/- 5.1E-16	9.9E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-1	SBHF14-036-ST03-AS-BK	Sample	U-235	0E+00 +/- 4.1E-16	8.8E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-1	SBHF14-036-ST03-AS-BK	Sample	U-238	3.1E-16 +/- 4.5E-16	7.5E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-2	SBHF14-037-ST04-AS-BK	Sample	U-234	0E+00 +/- 4.2E-16	8.8E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-2	SBHF14-037-ST04-AS-BK	Sample	U-235	0E+00 +/- 4.2E-16	6.4E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-2	SBHF14-037-ST04-AS-BK	Sample	U-238	5.9E-16 +/- 5.6E-16	7.9E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-3	SBHF14-038-ST05-AS-BK	Sample	U-234	0E+00 +/- 2.7E-16	5.4E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-3	SBHF14-038-ST05-AS-BK	Sample	U-235	0E+00 +/- 2E-16	4.3E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-3	SBHF14-038-ST05-AS-BK	Sample	U-238	1.4E-16 +/- 2.2E-16	3.7E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U

**Comments:**

**Data Package ID:** UAS1402167-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402167

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**Reported on:** Friday, February 21, 2014  
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Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402167-4	SBHF14-039-ST06-AS-BK	Sample	U-234	2E-16 +/- 3.7E-16	6.4E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-4	SBHF14-039-ST06-AS-BK	Sample	U-235	-5E-17 +/- 2.3E-16	4.4E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-4	SBHF14-039-ST06-AS-BK	Sample	U-238	1.6E-16 +/- 2E-16	3E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-5	SBHF14-040-ST07-AS-BK	Sample	U-234	4.1E-16 +/- 4.1E-16	6.3E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-5	SBHF14-040-ST07-AS-BK	Sample	U-235	4E-17 +/- 2.3E-16	4.8E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-5	SBHF14-040-ST07-AS-BK	Sample	U-238	4.9E-16 +/- 3.2E-16	3.5E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	LT
1402167-6	SBHF14-041-ST08-AS-BK	Sample	U-234	2.5E-16 +/- 4E-16	6.8E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-6	SBHF14-041-ST08-AS-BK	Sample	U-235	-4E-17 +/- 3E-16	6.2E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-6	SBHF14-041-ST08-AS-BK	Sample	U-238	1.8E-16 +/- 2.5E-16	4.2E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U

**Comments:**

**Data Package ID:** UAS1402167-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402167

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**Reported on:** Friday, February 21, 2014  
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Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402167-7	SBHF14-042-ST09-AS-BK	Sample	U-234	1E-16 +/- 3.1E-16	5.7E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-7	SBHF14-042-ST09-AS-BK	Sample	U-235	1.2E-16 +/- 1.9E-16	2.8E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-7	SBHF14-042-ST09-AS-BK	Sample	U-238	2.3E-16 +/- 2.7E-16	4.3E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-8	SBHF14-043-ST10-AS-BK	Sample	U-234	2.3E-16 +/- 2.5E-16	3.9E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-8	SBHF14-043-ST10-AS-BK	Sample	U-235	1.5E-16 +/- 1.9E-16	2.8E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-8	SBHF14-043-ST10-AS-BK	Sample	U-238	1.3E-16 +/- 2.4E-16	4.2E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-9	SBHF14-044-ST11-AS-BK	Sample	U-234	6.4E-15 +/- 1.5E-15	8E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	
1402167-9	SBHF14-044-ST11-AS-BK	Sample	U-235	3.5E-16 +/- 3.1E-16	3.7E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-9	SBHF14-044-ST11-AS-BK	Sample	U-238	9E-17 +/- 2.7E-16	5.2E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U

**Comments:**

**Data Package ID:** UAS1402167-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402167

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**Reported on:** Friday, February 21, 2014  
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Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402167-10	SBHF14-014-ST03-AS-BK	Sample	U-234	2.3E-16 +/- 3.4E-16	5.7E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-10	SBHF14-014-ST03-AS-BK	Sample	U-235	0E+00 +/- 1.9E-16	3.6E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-10	SBHF14-014-ST03-AS-BK	Sample	U-238	1E-16 +/- 2.4E-16	4.3E-16	uCi/ml	FILTER	AS140215-3	2/18/2014	U
1402167-11	SBHF14-015-ST04-AS-BK	Sample	U-234	1.5E-16 +/- 2.8E-16	4.9E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-11	SBHF14-015-ST04-AS-BK	Sample	U-235	3E-17 +/- 2.1E-16	4.1E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-11	SBHF14-015-ST04-AS-BK	Sample	U-238	2.3E-16 +/- 2.4E-16	3.5E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-12	SBHF14-016-ST05-AS- BK	Sample	U-234	0E+00 +/- 1.8E-16	3.9E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-12	SBHF14-016-ST05-AS- BK	Sample	U-235	1.2E-16 +/- 1.9E-16	2.8E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-12	SBHF14-016-ST05-AS- BK	Sample	U-238	1E-16 +/- 2E-16	3.5E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U

**Comments:**

**Data Package ID:** UAS1402167-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402167

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**Reported on:** Friday, February 21, 2014  
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Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402167-13	SBHF14-017-ST06-AS-BK	Sample	U-234	1.2E-16 +/- 3.2E-16	5.7E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-13	SBHF14-017-ST06-AS-BK	Sample	U-235	1.4E-16 +/- 2.2E-16	3.7E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-13	SBHF14-017-ST06-AS-BK	Sample	U-238	1.2E-16 +/- 2E-16	3.5E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-14	SBHF14-018-ST07-AS-BK	Sample	U-234	2.3E-16 +/- 2.4E-16	3.5E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-14	SBHF14-018-ST07-AS-BK	Sample	U-235	1.5E-16 +/- 1.9E-16	2.9E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-14	SBHF14-018-ST07-AS-BK	Sample	U-238	2E-16 +/- 1.9E-16	2.4E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-15	SBHF14-019-ST08-AS-BK	Sample	U-234	1.9E-16 +/- 2.4E-16	3.8E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-15	SBHF14-019-ST08-AS-BK	Sample	U-235	0E+00 +/- 1.8E-16	2.7E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-15	SBHF14-019-ST08-AS-BK	Sample	U-238	1.6E-16 +/- 1.7E-16	2.3E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U

**Comments:**

**Data Package ID:** *UAS1402167-1*

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402167

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**Reported on:** Friday, February 21, 2014  
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Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402167-16	SBHF14-020-ST09-AS-BK	Sample	U-234	-3E-17 +/- 2.5E-16	5.2E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-16	SBHF14-020-ST09-AS-BK	Sample	U-235	-4E-17 +/- 1.9E-16	4.1E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-16	SBHF14-020-ST09-AS-BK	Sample	U-238	1.3E-16 +/- 2.1E-16	3.5E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-17	SBHF14-021-ST10-AS-BK	Sample	U-234	1.3E-16 +/- 3.7E-16	6.7E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-17	SBHF14-021-ST10-AS-BK	Sample	U-235	-1E-16 +/- 2.4E-16	4.6E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-17	SBHF14-021-ST10-AS-BK	Sample	U-238	2.1E-16 +/- 2.3E-16	3.1E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-18	SBHF14-022-ST11-AS-BK	Sample	U-234	2.61E-15 +/- 7.5E-16	5.1E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	
1402167-18	SBHF14-022-ST11-AS-BK	Sample	U-235	1.4E-16 +/- 2.3E-16	3.9E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-18	SBHF14-022-ST11-AS-BK	Sample	U-238	1.5E-16 +/- 1.9E-16	2.8E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U

**Comments:**

**Data Package ID:** *UAS1402167-1*

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit



# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402167

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**Reported on:** Friday, February 21, 2014  
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Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402167-19	SBHF14-012-ST01-AS-BK	Sample	U-234	-7E-17 +/- 6.7E-16	1.31E-15	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-19	SBHF14-012-ST01-AS-BK	Sample	U-235	-2.4E-16 +/- 5.3E-16	1.19E-15	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-19	SBHF14-012-ST01-AS-BK	Sample	U-238	7E-17 +/- 4E-16	8.1E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-20	SBHF14-013-ST02-AS-BK	Sample	U-234	3.1E-16 +/- 2.5E-16	3.4E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-20	SBHF14-013-ST02-AS-BK	Sample	U-235	7E-17 +/- 1.6E-16	2.4E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U
1402167-20	SBHF14-013-ST02-AS-BK	Sample	U-238	0E+00 +/- 1.8E-16	3.7E-16	uCi/ml	FILTER	AS140215-3	2/19/2014	U

**Comments:**

**Data Package ID:** UAS1402167-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit



## Section 3

# QC RESULTS SUMMARY

**3**

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-3MMB

Sample Matrix: FILTER

Prep Batch: AS140215-3

Final Aliquot: 60600000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-3-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-3UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 19-Feb-14

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.8E-16 +/- 4.6E-16	8.1E-16		U
15117-96-1	U-235	5E-17 +/- 2.6E-16	3.9E-16		U
7440-61-1	U-238	1.3E-16 +/- 3E-16	5.4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: *UAS1402167-1*

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-3PMB

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 15-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Final Aliquot: 60600000 ml

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-3E-16 +/- 6.1E-16	1.32E-15		U
15117-96-1	U-235	9E-17 +/- 4.4E-16	8.3E-16		U
7440-61-1	U-238	-8E-17 +/- 4.6E-16	1E-15	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-3LCS	Sample Matrix: FILTER	Prep Batch: AS140215-3	Final Aliquot: 60600000 ml
	Prep SOP: PAI 778 Rev 14	QCBatchID: AS140215-3-1	Result Units: uCi/ml
	Date Collected: 15-Feb-14	Run ID: AS140215-3UR	File Name: Spectrum #1
	Date Prepared: 15-Feb-14	Count Time: 1000 minutes	
	Date Analyzed: 19-Feb-14		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	3.48E-14 +/- 6.5E-15	1.1E-15	3.640E-14	95.4	82 - 122	P
7440-61-1	U-238	3.94E-14 +/- 7.3E-15	7E-16	3.780E-14	104	82 - 122	P

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration

Data Package ID: *UAS1402167-1*

Date Printed: Friday, February 21, 2014

ALS Environmental -- FC

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# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-3LCSD	Sample Matrix: FILTER Prep SOP: PAI 778 Rev 14	Prep Batch: AS140215-3 QCBatchID: AS140215-3-1	Final Aliquot: 60600000 ml Result Units: uCi/ml
	Date Collected: 15-Feb-14 Date Prepared: 15-Feb-14 Date Analyzed: 19-Feb-14	Run ID: AS140215-3UR Count Time: 1000 minutes	File Name: Spectrum #1

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	3.24E-14 +/- 5.8E-15	1.1E-15	3.640E-14	89.0	82 - 122	P
7440-61-1	U-238	3.73E-14 +/- 6.5E-15	8E-16	3.780E-14	98.5	82 - 122	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
L - LCS Recovery below lower control limit.  
H - LCS Recovery above upper control limit.  
P - LCS Recovery within control limits.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Minimum Detectable Concentration

Data Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Duplicate Sample Results (DER)

**Lab Name:** ALS Environmental -- FC  
**Work Order Number:** 1402167  
**Client Name:** Cabrera Services, Inc.  
**ClientProject ID:** Schofield Barracks 08-3123.00

**Field ID:**  
**Lab ID:** AS140215-3LCSD

**Sample Matrix:** FILTER  
**Prep SOP:** PAI 778 Rev 14  
**Date Collected:** 15-Feb-14  
**Date Prepared:** 15-Feb-14  
**Date Analyzed:** 19-Feb-14

**Prep Batch:** AS140215-3  
**QCBatchID:** AS140215-3-1  
**Run ID:** AS140215-3UR  
**Count Time:** 1000 minutes

**Final Aliquot:** 60600000 ml  
**Prep Basis:** As Received  
**Moisture(%):** NA  
**Result Units:** uCi/ml  
**File Name:** Spectrum #1

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
13966-29-5	U-234	3.48E-14 +/- 6.5E-15	1.1E-15	P	3.24E-14 +/- 5.8E-15	1.1E-15	P	0.267	2.13
7440-61-1	U-238	3.94E-14 +/- 7.3E-15	7E-16	P	3.73E-14 +/- 6.5E-15	8E-16	P	0.214	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

**Package ID:** UAS1402167-1



## Section 4

# INDIVIDUAL SAMPLE RESULTS

4



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-036-ST03-AS-BK

Lab ID: 1402167-1

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 07-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.78E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	6E-17 +/- 5.1E-16	9.9E-16		U
15117-96-1	U-235	0E+00 +/- 4.1E-16	8.8E-16		U
7440-61-1	U-238	3.1E-16 +/- 4.5E-16	7.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-037-ST04-AS-BK  
Lab ID: 1402167-2

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 07-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3  
QCBatchID: AS140215-3-1  
Run ID: AS140215-3UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 5.05E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	0E+00 +/- 4.2E-16	8.8E-16		U
15117-96-1	U-235	0E+00 +/- 4.2E-16	6.4E-16		U
7440-61-1	U-238	5.9E-16 +/- 5.6E-16	7.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-038-ST05-AS-BK

Lab ID: 1402167-3

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 07-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.00E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	0E+00 +/- 2.7E-16	5.4E-16		U
15117-96-1	U-235	0E+00 +/- 2E-16	4.3E-16		U
7440-61-1	U-238	1.4E-16 +/- 2.2E-16	3.7E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-039-ST06-AS-BK

Lab ID: 1402167-4

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 07-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.30E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2E-16 +/- 3.7E-16	6.4E-16		U
15117-96-1	U-235	-5E-17 +/- 2.3E-16	4.4E-16		U
7440-61-1	U-238	1.6E-16 +/- 2E-16	3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-040-ST07-AS-BK

Lab ID: 1402167-5

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 07-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3  
QC Batch ID: AS140215-3-1  
Run ID: AS140215-3UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 5.30E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	4.1E-16 +/- 4.1E-16	6.3E-16		U
15117-96-1	U-235	4E-17 +/- 2.3E-16	4.8E-16		U
7440-61-1	U-238	4.9E-16 +/- 3.2E-16	3.5E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-041-ST08-AS-BK

Lab ID: 1402167-6

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 07-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.30E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.5E-16 +/- 4E-16	6.8E-16		U
15117-96-1	U-235	-4E-17 +/- 3E-16	6.2E-16		U
7440-61-1	U-238	1.8E-16 +/- 2.5E-16	4.2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-042-ST09-AS-BK

Lab ID: 1402167-7

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 07-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.30E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1E-16 +/- 3.1E-16	5.7E-16		U
15117-96-1	U-235	1.2E-16 +/- 1.9E-16	2.8E-16		U
7440-61-1	U-238	2.3E-16 +/- 2.7E-16	4.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-043-ST10-AS-BK

Lab ID: 1402167-8

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 07-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.30E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.3E-16 +/- 2.5E-16	3.9E-16		U
15117-96-1	U-235	1.5E-16 +/- 1.9E-16	2.8E-16		U
7440-61-1	U-238	1.3E-16 +/- 2.4E-16	4.2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-044-ST11-AS-BK

Lab ID: 1402167-9

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14

Date Collected: 07-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.30E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	6.4E-15 +/- 1.5E-15	8E-16		
15117-96-1	U-235	3.5E-16 +/- 3.1E-16	3.7E-16		U
7440-61-1	U-238	9E-17 +/- 2.7E-16	5.2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-014-ST03-AS-BK

Lab ID: 1402167-10

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 18-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.45E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.3E-16 +/- 3.4E-16	5.7E-16		U
15117-96-1	U-235	0E+00 +/- 1.9E-16	3.6E-16		U
7440-61-1	U-238	1E-16 +/- 2.4E-16	4.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-015-ST04-AS-BK

Lab ID: 1402167-11

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.55E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.5E-16 +/- 2.8E-16	4.9E-16		U
15117-96-1	U-235	3E-17 +/- 2.1E-16	4.1E-16		U
7440-61-1	U-238	2.3E-16 +/- 2.4E-16	3.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-016-ST05-AS- BK

Lab ID: 1402167-12

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.60E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	0E+00 +/- 1.8E-16	3.9E-16		U
15117-96-1	U-235	1.2E-16 +/- 1.9E-16	2.8E-16		U
7440-61-1	U-238	1E-16 +/- 2E-16	3.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-017-ST06-AS-BK

Lab ID: 1402167-13

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.65E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.2E-16 +/- 3.2E-16	5.7E-16		U
15117-96-1	U-235	1.4E-16 +/- 2.2E-16	3.7E-16		U
7440-61-1	U-238	1.2E-16 +/- 2E-16	3.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-018-ST07-AS-BK

Lab ID: 1402167-14

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.65E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.3E-16 +/- 2.4E-16	3.5E-16		U
15117-96-1	U-235	1.5E-16 +/- 1.9E-16	2.9E-16		U
7440-61-1	U-238	2E-16 +/- 1.9E-16	2.4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-019-ST08-AS-BK

Lab ID: 1402167-15

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.70E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.9E-16 +/- 2.4E-16	3.8E-16		U
15117-96-1	U-235	0E+00 +/- 1.8E-16	2.7E-16		U
7440-61-1	U-238	1.6E-16 +/- 1.7E-16	2.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-020-ST09-AS-BK

Lab ID: 1402167-16

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.75E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-3E-17 +/- 2.5E-16	5.2E-16		U
15117-96-1	U-235	-4E-17 +/- 1.9E-16	4.1E-16		U
7440-61-1	U-238	1.3E-16 +/- 2.1E-16	3.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-021-ST10-AS-BK

Lab ID: 1402167-17

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.75E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.3E-16 +/- 3.7E-16	6.7E-16		U
15117-96-1	U-235	-1E-16 +/- 2.4E-16	4.6E-16		U
7440-61-1	U-238	2.1E-16 +/- 2.3E-16	3.1E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC. greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-022-ST11-AS-BK

Lab ID: 1402167-18

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.85E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.61E-15 +/- 7.5E-16	5.1E-16		
15117-96-1	U-235	1.4E-16 +/- 2.3E-16	3.9E-16		U
7440-61-1	U-238	1.5E-16 +/- 1.9E-16	2.8E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-012-ST01-AS-BK

Lab ID: 1402167-19

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.80E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-7E-17 +/- 6.7E-16	1.31E-15		U
15117-96-1	U-235	-2.4E-16 +/- 5.3E-16	1.19E-15		U
7440-61-1	U-238	7E-17 +/- 4E-16	8.1E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402167

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-013-ST02-AS-BK

Lab ID: 1402167-20

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 05-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-3

QCBatchID: AS140215-3-1

Run ID: AS140215-3UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.80E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.1E-16 +/- 2.5E-16	3.4E-16		U
15117-96-1	U-235	7E-17 +/- 1.6E-16	2.4E-16		U
7440-61-1	U-238	0E+00 +/- 1.8E-16	3.7E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UAS1402167-1



## Section 5

# RAW DATA

**5**

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Thursday, February 20, 2014

PAI Work Order: 1402167

Analytical SOP: PAI 714

12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402167-1 SMP	U-232 Tracer	2/7/2014 4:05:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	47800000 ml 47800000 ml	AlphaSpec2 9a	AS140215-3UR Spectrum #1	2/18/2014 1:50 PM	714.000 35.000	31.42% 1000	1000 48.1%	2.14E-14 3.6E-15	9E-16 NA	uCi/ml As Received	NA NA	
1402167-1 SMP	U-234 Trg. Analyte	2/7/2014 4:05:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	47800000 ml 47800000 ml	AlphaSpec2 9a	AS140215-3UR Spectrum #1	2/18/2014 1:50 PM	1.000 8.000	31.42% 1000	1000 48.1%	6E-17 5.1E-16	9.9E-16 NA	uCi/ml As Received	NA NA	U
1402167-1 SMP	U-235 Trg. Analyte	2/7/2014 4:05:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	47800000 ml 47800000 ml	AlphaSpec2 9a	AS140215-3UR Spectrum #1	2/18/2014 1:50 PM	0.000 4.000	31.42% 1000	1000 48.1%	0E+00 4.1E-16	8.8E-16 NA	uCi/ml As Received	NA NA	U
1402167-1 SMP	U-238 Trg. Analyte	2/7/2014 4:05:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	47800000 ml 47800000 ml	AlphaSpec2 9a	AS140215-3UR Spectrum #1	2/18/2014 1:50 PM	5.000 4.000	31.42% 1000	1000 48.1%	3.1E-16 4.5E-16	7.5E-16 NA	uCi/ml As Received	NA NA	U
1402167-2 SMP	U-232 Tracer	2/7/2014 3:54:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	50500000 ml 50500000 ml	AlphaSpec2 10b	AS140215-3UR Spectrum #1	2/18/2014 1:50 PM	573.000 28.000	31.19% 1000	1000 38.9%	1.64E-14 2.8E-15	8E-16 NA	uCi/ml As Received	NA NA	
1402167-2 SMP	U-234 Trg. Analyte	2/7/2014 3:54:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	50500000 ml 50500000 ml	AlphaSpec2 10b	AS140215-3UR Spectrum #1	2/18/2014 1:50 PM	0.000 4.000	31.19% 1000	1000 38.9%	0E+00 4.2E-16	8.8E-16 NA	uCi/ml As Received	NA NA	U
1402167-2 SMP	U-235 Trg. Analyte	2/7/2014 3:54:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	50500000 ml 50500000 ml	AlphaSpec2 10b	AS140215-3UR Spectrum #1	2/18/2014 1:50 PM	0.000 3.000	31.19% 1000	1000 38.9%	0E+00 5.6E-16	6.4E-16 NA	uCi/ml As Received	NA NA	U
1402167-2 SMP	U-238 Trg. Analyte	2/7/2014 3:54:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	50500000 ml 50500000 ml	AlphaSpec2 10b	AS140215-3UR Spectrum #1	2/18/2014 1:50 PM	8.000 3.000	31.19% 1000	1000 38.9%	5.9E-16 5.6E-16	7.9E-16 NA	uCi/ml As Received	NA NA	U
1402167-3 SMP	U-232 Tracer	2/7/2014 3:51:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60000000 ml 60000000 ml	AlphaSpec2 29	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	1037.000 33.000	27.70% 1000	1000 79.2%	2.81E-14 4.5E-15	8E-16 NA	uCi/ml As Received	NA NA	
1402167-3 SMP	U-234 Trg. Analyte	2/7/2014 3:51:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60000000 ml 60000000 ml	AlphaSpec2 29	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	0.000 8.000	27.70% 1000	1000 79.2%	0E+00 2.7E-16	5.4E-16 NA	uCi/ml As Received	NA NA	U
1402167-3 SMP	U-235 Trg. Analyte	2/7/2014 3:51:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60000000 ml 60000000 ml	AlphaSpec2 29	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	0.000 3.000	27.70% 1000	1000 79.2%	0E+00 2E-16	4.3E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UAS1402167-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'.

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Thursday, February 20, 2014

PAI Work Order: 1402167

Analytical SOP: PAI 714

12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402167-3 SMP	U-238 Trg. Analyte	2/7/2014 3:51:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60000000 ml 60000000 ml	AlphaSpec2 29	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	4.000 3.000	27.70% 1000	1000 79.2%	1.4E-16 2.2E-16	3.7E-16 NA	uCi/ml As Received	NA NA	U
1402167-4 SMP	U-232 Tracer	2/7/2014 3:46:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 30	AS140215-3UR Spectrum #1	2/18/2014 1:51 PM	999.000 23.000	28.09% 1000	1000 75.2%	3.02E-14 4.9E-15	8E-16 NA	uCi/ml As Received	NA NA	
1402167-4 SMP	U-234 Trg. Analyte	2/7/2014 3:46:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 30	AS140215-3UR Spectrum #1	2/18/2014 1:51 PM	5.000 8.000	28.09% 1000	1000 75.2%	2E-16 3.7E-16	6.4E-16 NA	uCi/ml As Received	NA NA	U
1402167-4 SMP	U-235 Trg. Analyte	2/7/2014 3:46:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 30	AS140215-3UR Spectrum #1	2/18/2014 1:51 PM	-1.000 2.000	28.09% 1000	1000 75.2%	-5E-17 2.3E-16	4.4E-16 NA	uCi/ml As Received	NA NA	U
1402167-4 SMP	U-238 Trg. Analyte	2/7/2014 3:46:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 30	AS140215-3UR Spectrum #1	2/18/2014 1:51 PM	4.000 1.000	28.09% 1000	1000 75.2%	1.6E-16 2E-16	3E-16 NA	uCi/ml As Received	NA NA	U
1402167-5 SMP	U-232 Tracer	2/7/2014 3:43:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 31	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	1070.000 33.000	29.21% 1000	1000 77.5%	3.11E-14 5E-15	9E-16 NA	uCi/ml As Received	NA NA	
1402167-5 SMP	U-234 Trg. Analyte	2/7/2014 3:43:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 31	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	11.000 9.000	29.21% 1000	1000 77.5%	4.1E-16 4.1E-16	6.3E-16 NA	uCi/ml As Received	NA NA	U
1402167-5 SMP	U-235 Trg. Analyte	2/7/2014 3:43:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 31	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	1.000 3.000	29.21% 1000	1000 77.5%	4E-17 2.3E-16	4.8E-16 NA	uCi/ml As Received	NA NA	U
1402167-5 SMP	U-238 Trg. Analyte	2/7/2014 3:43:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 31	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	13.000 2.000	29.21% 1000	1000 77.5%	4.9E-16 3.2E-16	3.5E-16 NA	uCi/ml As Received	NA NA	LT
1402167-6 SMP	U-232 Tracer	2/7/2014 3:38:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 32	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	1148.000 16.000	29.03% 1000	1000 83.6%	3.36E-14 5.4E-15	6E-16 NA	uCi/ml As Received	NA NA	
1402167-6 SMP	U-234 Trg. Analyte	2/7/2014 3:38:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 32	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	7.000 13.000	29.03% 1000	1000 83.6%	2.5E-16 4E-16	6.8E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UAS1402167-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'.

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Thursday, February 20, 2014

PAI Work Order: 1402167

Analytical SOP: PAI 714

12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402167-6 SMP	U-235 Trg. Analyte	2/7/2014 3:38:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 32	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	-1.000 7.000	29.03% 1000	1000 83.6%	-4E-17 3E-16	6.2E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-6 SMP	U-238 Trg. Analyte	2/7/2014 3:38:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 32	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	5.000 4.000	29.03% 1000	1000 83.6%	1.8E-16 2.5E-16	4.2E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-7 SMP	U-232 Tracer	2/7/2014 3:33:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 43	AS140215-3UR Spectrum #1	2/18/2014 1:51 PM	1229.000 47.000	32.34% 1000	1000 80.4%	3.23E-14 5.2E-15	9E-16 NA	uCi/ml As Received	NA NA	NA NA
1402167-7 SMP	U-234 Trg. Analyte	2/7/2014 3:33:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 43	AS140215-3UR Spectrum #1	2/18/2014 1:51 PM	3.000 10.000	32.34% 1000	1000 80.4%	1E-16 3.1E-16	5.7E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-7 SMP	U-235 Trg. Analyte	2/7/2014 3:33:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 43	AS140215-3UR Spectrum #1	2/18/2014 1:51 PM	3.000 1.000	32.34% 1000	1000 80.4%	1.2E-16 1.9E-16	2.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-7 SMP	U-238 Trg. Analyte	2/7/2014 3:33:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 43	AS140215-3UR Spectrum #1	2/18/2014 1:51 PM	7.000 5.000	32.34% 1000	1000 80.4%	2.3E-16 2.7E-16	4.3E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-8 SMP	U-232 Tracer	2/7/2014 3:30:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 45	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	1243.000 29.000	31.65% 1000	1000 83.1%	3.34E-14 5.3E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
1402167-8 SMP	U-234 Trg. Analyte	2/7/2014 3:30:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 45	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	7.000 4.000	31.65% 1000	1000 83.1%	2.3E-16 2.5E-16	3.9E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-8 SMP	U-235 Trg. Analyte	2/7/2014 3:30:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 45	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	4.000 1.000	31.65% 1000	1000 83.1%	1.5E-16 1.9E-16	2.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-8 SMP	U-238 Trg. Analyte	2/7/2014 3:30:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 45	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	4.000 5.000	31.65% 1000	1000 83.1%	1.3E-16 2.4E-16	4.2E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-9 SMP	U-232 Tracer	2/7/2014 3:25:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 46	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	936.000 18.000	30.58% 1000	1000 64.7%	2.6E-14 4.2E-15	6E-16 NA	uCi/ml As Received	NA NA	NA NA

**Comments:**

**Data Package ID: UAS1402167-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'.

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Thursday, February 20, 2014

PAI Work Order: 1402167

Analytical SOP: PAI 714

12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402167-9 SMP	U-234 Trg. Analyte	2/7/2014 3:25:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 46	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	149.000 11.000	30.58% 1000	6.4E-15 64.7%	8E-16 1.5E-15	uCi/ml As Received	NA NA		
1402167-9 SMP	U-235 Trg. Analyte	2/7/2014 3:25:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 46	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	7.000 1.000	30.58% 1000	3.5E-16 64.7%	3.7E-16 3.1E-16	uCi/ml As Received	NA NA		U
1402167-9 SMP	U-238 Trg. Analyte	2/7/2014 3:25:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	53000000 ml 53000000 ml	AlphaSpec2 46	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	2.000 4.000	30.58% 1000	9E-17 64.7%	5.2E-16 2.7E-16	uCi/ml As Received	NA NA		U
1402167-10 SMP	U-232 Tracer	2/5/2014 4:36:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	64500000 ml 64500000 ml	AlphaSpec2 47	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	1007.000 26.000	30.42% 1000	2.31E-14 70.0%	6E-16 3.7E-15	uCi/ml As Received	NA NA		
1402167-10 SMP	U-234 Trg. Analyte	2/5/2014 4:36:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	64500000 ml 64500000 ml	AlphaSpec2 47	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	7.000 10.000	30.42% 1000	2.3E-16 70.0%	5.7E-16 3.4E-16	uCi/ml As Received	NA NA		U
1402167-10 SMP	U-235 Trg. Analyte	2/5/2014 4:36:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	64500000 ml 64500000 ml	AlphaSpec2 47	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	0.000 2.000	30.42% 1000	0E+00 70.0%	3.6E-16 1.9E-16	uCi/ml As Received	NA NA		U
1402167-10 SMP	U-238 Trg. Analyte	2/5/2014 4:36:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	64500000 ml 64500000 ml	AlphaSpec2 47	AS140215-3UR Spectrum #1	2/18/2014 1:52 PM	3.000 5.000	30.42% 1000	1E-16 70.0%	4.3E-16 2.4E-16	uCi/ml As Received	NA NA		U
1402167-11 SMP	U-232 Tracer	2/5/2014 4:24:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	65500000 ml 65500000 ml	AlphaSpec2 9a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	1108.000 28.000	31.42% 1000	2.42E-14 74.6%	6E-16 3.9E-15	uCi/ml As Received	NA NA		
1402167-11 SMP	U-234 Trg. Analyte	2/5/2014 4:24:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	65500000 ml 65500000 ml	AlphaSpec2 9a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	5.000 9.000	31.42% 1000	1.5E-16 74.6%	4.9E-16 2.8E-16	uCi/ml As Received	NA NA		U
1402167-11 SMP	U-235 Trg. Analyte	2/5/2014 4:24:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	65500000 ml 65500000 ml	AlphaSpec2 9a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	1.000 4.000	31.42% 1000	3E-17 74.6%	4.1E-16 2.1E-16	uCi/ml As Received	NA NA		U
1402167-11 SMP	U-238 Trg. Analyte	2/5/2014 4:24:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	65500000 ml 65500000 ml	AlphaSpec2 9a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	8.000 4.000	31.42% 1000	2.3E-16 74.6%	3.5E-16 2.4E-16	uCi/ml As Received	NA NA		U

**Comments:**

**Data Package ID: UAS1402167-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Thursday, February 20, 2014

PAI Work Order: 1402167

Analytical SOP: PAI 714

12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC BatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402167-12 SMP	U-232 Tracer	2/5/2014 4:21:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66000000 ml 66000000 ml	AlphaSpec2 10b	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	987.014 27.993	31.19% 1000	1000 66.9%	2.16E-14 3.5E-15	6E-16 NA	uCi/ml As Received	NA NA	
1402167-12 SMP	U-234 Trg. Analyte	2/5/2014 4:21:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66000000 ml 66000000 ml	AlphaSpec2 10b	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	0.000 4.000	31.19% 1000	1000 66.9%	0E+00 1.8E-16	3.9E-16 NA	uCi/ml As Received	NA NA	U
1402167-12 SMP	U-235 Trg. Analyte	2/5/2014 4:21:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66000000 ml 66000000 ml	AlphaSpec2 10b	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	3.000 1.000	31.19% 1000	1000 66.9%	1.2E-16 1.9E-16	2.8E-16 NA	uCi/ml As Received	NA NA	U
1402167-12 SMP	U-238 Trg. Analyte	2/5/2014 4:21:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66000000 ml 66000000 ml	AlphaSpec2 10b	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	3.000 3.000	31.19% 1000	1000 66.9%	1E-16 2E-16	3.5E-16 NA	uCi/ml As Received	NA NA	U
1402167-13 SMP	U-232 Tracer	2/5/2014 4:17:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 11a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	1099.000 26.000	30.43% 1000	1000 76.4%	2.45E-14 3.9E-15	6E-16 NA	uCi/ml As Received	NA NA	
1402167-13 SMP	U-234 Trg. Analyte	2/5/2014 4:17:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 11a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	4.000 13.000	30.43% 1000	1000 76.4%	1.2E-16 3.2E-16	5.7E-16 NA	uCi/ml As Received	NA NA	U
1402167-13 SMP	U-235 Trg. Analyte	2/5/2014 4:17:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 11a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	4.000 3.000	30.43% 1000	1000 76.4%	1.4E-16 2.2E-16	3.7E-16 NA	uCi/ml As Received	NA NA	U
1402167-13 SMP	U-238 Trg. Analyte	2/5/2014 4:17:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 11a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	4.000 4.000	30.43% 1000	1000 76.4%	1.2E-16 2E-16	3.5E-16 NA	uCi/ml As Received	NA NA	U
1402167-14 SMP	U-232 Tracer	2/5/2014 4:14:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 12a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	973.000 33.000	30.32% 1000	1000 67.9%	2.17E-14 3.5E-15	7E-16 NA	uCi/ml As Received	NA NA	
1402167-14 SMP	U-234 Trg. Analyte	2/5/2014 4:14:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 12a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	7.000 3.000	30.32% 1000	1000 67.9%	2.3E-16 2.4E-16	3.5E-16 NA	uCi/ml As Received	NA NA	U
1402167-14 SMP	U-235 Trg. Analyte	2/5/2014 4:14:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 12a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	4.000 1.000	30.32% 1000	1000 67.9%	1.5E-16 1.9E-16	2.9E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID:** UAS1402167-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
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- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
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- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402167

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Thursday, February 20, 2014  
12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402167-14 SMP	U-238 Trg. Analyte	2/5/2014 4:14:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 12a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	6.000 1.000	30.32% 1000	1000 67.9%	2E-16 1.9E-16	2.4E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-15 SMP	U-232 Tracer	2/5/2014 4:12:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 16a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	1001.000 14.000	29.83% 1000	1000 71.0%	2.26E-14 3.6E-15	5E-16 NA	uCi/ml As Received	NA NA	NA NA
1402167-15 SMP	U-234 Trg. Analyte	2/5/2014 4:12:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 16a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	6.000 4.000	29.83% 1000	1000 71.0%	1.9E-16 2.4E-16	3.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-15 SMP	U-235 Trg. Analyte	2/5/2014 4:12:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 16a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	0.000 1.000	29.83% 1000	1000 71.0%	0E+00 1.8E-16	2.7E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-15 SMP	U-238 Trg. Analyte	2/5/2014 4:12:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 16a	AS140215-3UR Spectrum #1	2/19/2014 2:55 PM	5.000 1.000	29.83% 1000	1000 71.0%	1.6E-16 1.7E-16	2.3E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-16 SMP	U-232 Tracer	2/5/2014 4:08:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67500000 ml 67500000 ml	AlphaSpec2 29	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	967.000 33.000	27.70% 1000	1000 73.8%	2.33E-14 3.8E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
1402167-16 SMP	U-234 Trg. Analyte	2/5/2014 4:08:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67500000 ml 67500000 ml	AlphaSpec2 29	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	-1.000 8.000	27.70% 1000	1000 73.8%	-3E-17 2.5E-16	5.2E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-16 SMP	U-235 Trg. Analyte	2/5/2014 4:08:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67500000 ml 67500000 ml	AlphaSpec2 29	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	-1.000 3.000	27.70% 1000	1000 73.8%	-4E-17 1.9E-16	4.1E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-16 SMP	U-238 Trg. Analyte	2/5/2014 4:08:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67500000 ml 67500000 ml	AlphaSpec2 29	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	4.000 3.000	27.70% 1000	1000 73.8%	1.3E-16 2.1E-16	3.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-17 SMP	U-232 Tracer	2/5/2014 4:03:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67500000 ml 67500000 ml	AlphaSpec2 30	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	746.000 23.000	28.09% 1000	1000 56.2%	1.77E-14 2.9E-15	6E-16 NA	uCi/ml As Received	NA NA	NA NA
1402167-17 SMP	U-234 Trg. Analyte	2/5/2014 4:03:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67500000 ml 67500000 ml	AlphaSpec2 30	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	3.000 8.000	28.09% 1000	1000 56.2%	1.3E-16 3.7E-16	6.7E-16 NA	uCi/ml As Received	NA NA	NA U

**Comments:**

**Data Package ID: UAS1402167-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'.

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
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**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
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- TPU - Total Propagated Uncertainty
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- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

51 128

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **ALS Environmental -- FC**

Prep SOP: PAI 778

Reported on: Thursday, February 20, 2014

PAI Work Order: 1402167

Analytical SOP: PAI 714

12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402167-17 SMP	U-235 Trg. Analyte	2/5/2014 4:03:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67500000 ml 67500000 ml	AlphaSpec2 30	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	-2.000 2.000	28.09% 1000	1000 56.2%	-1E-16 2.4E-16	4.6E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-17 SMP	U-238 Trg. Analyte	2/5/2014 4:03:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	67500000 ml 67500000 ml	AlphaSpec2 30	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	5.000 1.000	28.09% 1000	1000 56.2%	2.1E-16 2.3E-16	3.1E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-18 SMP	U-232 Tracer	2/5/2014 4:01:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68500000 ml 68500000 ml	AlphaSpec2 31	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	1014.000 33.000	29.21% 1000	1000 73.4%	2.28E-14 3.7E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
1402167-18 SMP	U-234 Trg. Analyte	2/5/2014 4:01:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68500000 ml 68500000 ml	AlphaSpec2 31	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	85.000 9.000	29.21% 1000	1000 73.4%	2.61E-15 7.5E-16	5.1E-16 NA	uCi/ml As Received	NA NA	NA NA
1402167-18 SMP	U-235 Trg. Analyte	2/5/2014 4:01:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68500000 ml 68500000 ml	AlphaSpec2 31	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	4.000 3.000	29.21% 1000	1000 73.4%	1.4E-16 2.3E-16	3.9E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-18 SMP	U-238 Trg. Analyte	2/5/2014 4:01:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68500000 ml 68500000 ml	AlphaSpec2 31	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	5.000 2.000	29.21% 1000	1000 73.4%	1.5E-16 1.9E-16	2.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-19 SMP	U-232 Tracer	2/5/2014 3:27:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68000000 ml 68000000 ml	AlphaSpec2 32	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	465.000 16.000	29.03% 1000	1000 33.9%	1.06E-14 1.9E-15	5E-16 NA	uCi/ml As Received	NA NA	NA NA
1402167-19 SMP	U-234 Trg. Analyte	2/5/2014 3:27:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68000000 ml 68000000 ml	AlphaSpec2 32	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	-1.000 13.000	29.03% 1000	1000 33.9%	-7E-17 6.7E-16	1.31E-15 NA	uCi/ml As Received	NA NA	NA U
1402167-19 SMP	U-235 Trg. Analyte	2/5/2014 3:27:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68000000 ml 68000000 ml	AlphaSpec2 32	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	-3.000 7.000	29.03% 1000	1000 33.9%	-2.4E-16 5.3E-16	1.19E-15 NA	uCi/ml As Received	NA NA	NA U
1402167-19 SMP	U-238 Trg. Analyte	2/5/2014 3:27:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68000000 ml 68000000 ml	AlphaSpec2 32	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	1.000 4.000	29.03% 1000	1000 33.9%	7E-17 4E-16	8.1E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-20 SMP	U-232 Tracer	2/5/2014 3:23:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68000000 ml 68000000 ml	AlphaSpec2 45	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	1117.000 29.000	31.65% 1000	1000 74.6%	2.34E-14 3.8E-15	6E-16 NA	uCi/ml As Received	NA NA	NA NA

**Comments:**

**Data Package ID: UAS1402167-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
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- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **ALS Environmental -- FC**  
 PAI Work Order: 1402167

Prep SOP: PAI 778  
 Analytical SOP: PAI 714

Reported on: Thursday, February 20, 2014  
 12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402167-20 SMP	U-234 Trg. Analyte	2/5/2014 3:23:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68000000 ml 68000000 ml	AlphaSpec2 45	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	11.000 4.000	31.65% 1000	1000 74.6%	3.1E-16 2.5E-16	3.4E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-20 SMP	U-235 Trg. Analyte	2/5/2014 3:23:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68000000 ml 68000000 ml	AlphaSpec2 45	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	2.000 1.000	31.65% 1000	1000 74.6%	7E-17 1.6E-16	2.4E-16 NA	uCi/ml As Received	NA NA	NA U
1402167-20 SMP	U-238 Trg. Analyte	2/5/2014 3:23:00 PM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	68000000 ml 68000000 ml	AlphaSpec2 45	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	0.000 5.000	31.65% 1000	1000 74.6%	0E+00 1.8E-16	3.7E-16 NA	uCi/ml As Received	NA NA	NA U
AS140215-3M MB	U-232 Tracer	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 46	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	785.000 18.000	30.58% 1000	1000 54.3%	1.91E-14 3.2E-15	5E-16 NA	uCi/ml As Received	NA NA	NA NA
AS140215-3M MB	U-234 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 46	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	4.000 11.000	30.58% 1000	1000 54.3%	1.8E-16 4.6E-16	8.1E-16 NA	uCi/ml As Received	NA NA	NA U
AS140215-3M MB	U-235 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 46	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	1.000 1.000	30.58% 1000	1000 54.3%	5E-17 2.6E-16	3.9E-16 NA	uCi/ml As Received	NA NA	NA U
AS140215-3M MB	U-238 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 46	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	3.000 4.000	30.58% 1000	1000 54.3%	1.3E-16 3E-16	5.4E-16 NA	uCi/ml As Received	NA NA	NA U
AS140215-3P MB	U-232 Tracer	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 47	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	463.000 29.000	30.42% 1000	1000 32.2%	1.13E-14 2E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
AS140215-3P MB	U-234 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 47	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	-4.000 10.000	30.42% 1000	1000 32.2%	-3E-16 6.1E-16	1.32E-15 NA	uCi/ml As Received	NA NA	NA U
AS140215-3P MB	U-235 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 47	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	1.000 2.000	30.42% 1000	1000 32.2%	9E-17 4.4E-16	8.3E-16 NA	uCi/ml As Received	NA NA	NA U
AS140215-3P MB	U-238 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 47	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	-1.000 5.000	30.42% 1000	1000 32.2%	-8E-17 4.6E-16	1E-15 NA	uCi/ml As Received	NA NA	NA U

**Comments:**

**Data Package ID: UAS1402167-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Thursday, February 20, 2014

PAI Work Order: 1402167

Analytical SOP: PAI 714

12:13:10 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
AS140215-3 LCS	U-232 Tracer	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 25	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	642.000 34.000	29.18% 1000	1000 46.5%	1.64E-14 2.8E-15	8E-16 NA	uCi/ml As Received	NA NA	
AS140215-3 LCS	U-234 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 25	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	635.000 13.000	29.18% 1000	1000 46.5%	3.48E-14 6.5E-15	1.1E-15 NA	uCi/ml As Received	NA NA	95.4 P
AS140215-3 LCS	U-238 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 25	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	719.000 5.000	29.18% 1000	1000 46.5%	3.94E-14 7.3E-15	7E-16 NA	uCi/ml As Received	NA NA	104 P
AS140215-3 LCSD	U-232 Tracer	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 26	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	947.000 35.000	30.73% 1000	1000 65.2%	2.29E-14 3.7E-15	7E-16 NA	uCi/ml As Received	NA NA	
AS140215-3 LCSD	U-234 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 26	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	874.000 34.000	30.73% 1000	1000 65.2%	3.24E-14 5.8E-15	1.1E-15 NA	uCi/ml As Received	0.27 NA	89.0 P
AS140215-3 LCSD	U-238 Trg. Analyte	2/15/2014 8:25:38 AM	AS140215-3 AS140215-3-1	NA NA	NA NA	FILTER NA	60600000 ml 60600000 ml	AlphaSpec2 26	AS140215-3UR Spectrum #1	2/19/2014 2:58 PM	1004.000 16.000	30.73% 1000	1000 65.2%	3.73E-14 6.5E-15	8E-16 NA	uCi/ml As Received	0.21 NA	98.5 P

**Comments:**

**Data Package ID: UAS1402167-1**

**Qualifiers/Flags:**

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- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402167-1  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 9a  
Batch Name: UAS140215-3\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

### Acquisition

Acquisition Start Date: 2/18/2014 1:50:20PM  
Live Time: 1,000.00 min.  
Real Time: 1,021.50 min.  
Dead Time: 2.10 %

### Calibration

Bkgd Info: Sample: B14021009; Det: 9a; Spectrum #1; Feb-10-2014 13:24

Calibration Date: 2/10/2014 10:20:24AM

Efficiency Calibration: C14021009

Efficiency: 31.42% +/- 0.21% TPU(2 sigma)

Energy Calibration: C14021009

Energy Cal: Gain = 10.0569 keV / Ch

Offset = 2,995.13 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

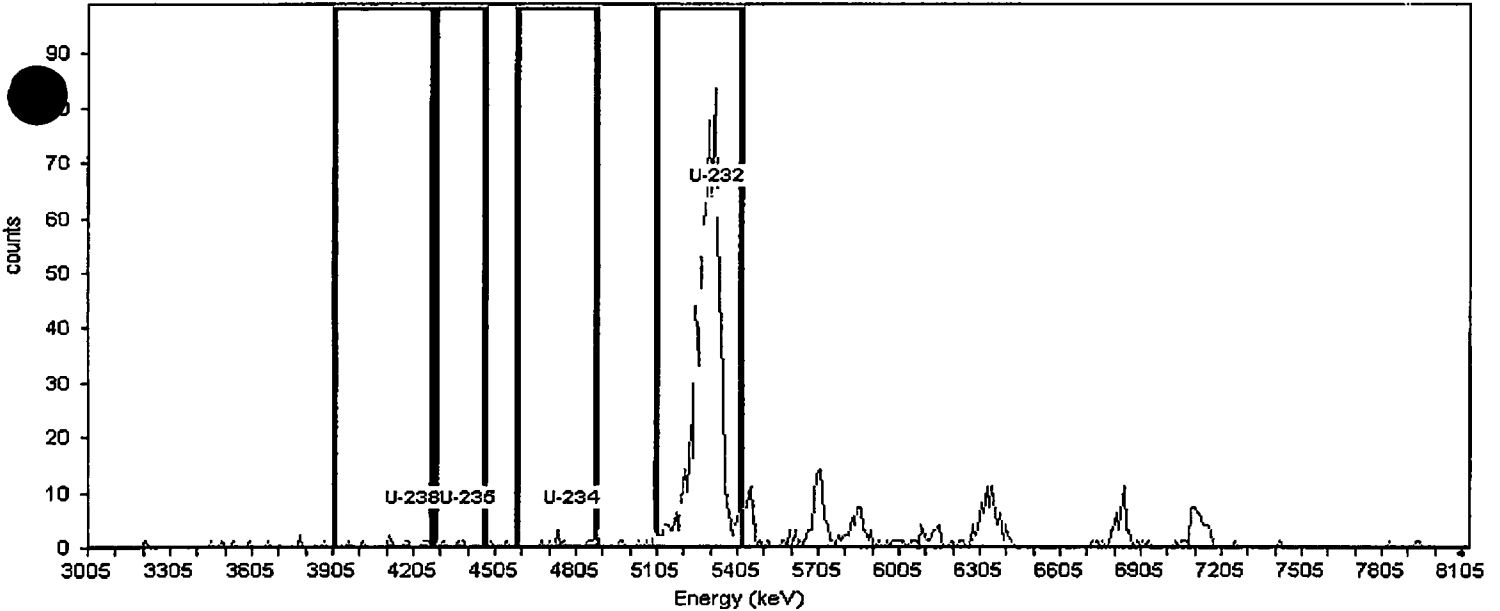
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 47.93%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4191.9	3910.3	4272.4	21.1	100.2	9.00	4.00	5.00	3.0E-002	4.3E-002	2.8E-002	7.2E-002
U-235	4393.0	4282.4	4463.4	.0	99.7	4.00	4.00	0.00	0.0E+000	3.4E-002	2.8E-002	7.2E-002
U-234	4775.2	4584.1	4875.8	.6	100.0	9.00	8.00	1.00	6.0E-003	4.9E-002	3.9E-002	9.5E-002
U-232	5318.3	5107.1	5418.9	87.9	100.1	749.00	35.00	714.00	2.1E+000	1.7E-001	8.5E-002	1.9E-001

Recorded By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

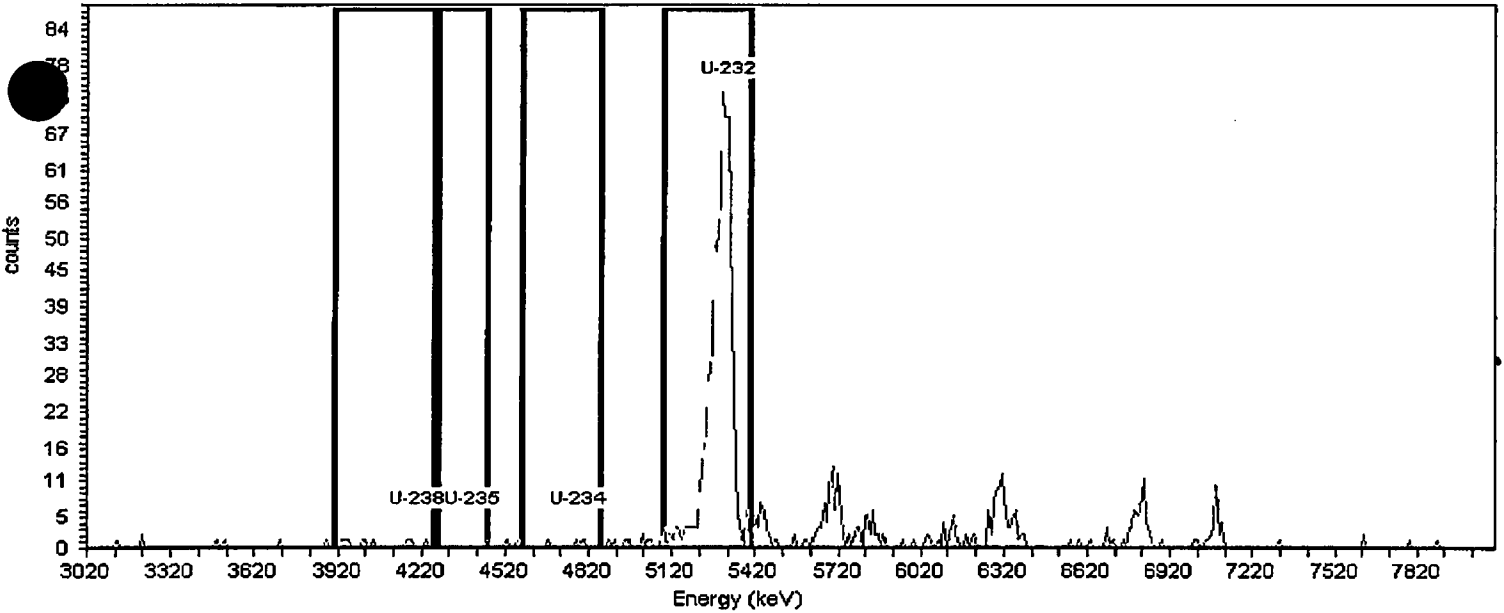
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-2  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 10b  
 Batch Name: UAS140215-3\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/18/2014 1:50:16PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,021.50 min.  
 Dead Time: 2.10 %

**Calibration**  
 Bkgd Info: Sample: B14021010; Det: 10b; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:21:35AM  
 Efficiency Calibration: C14021010  
 Efficiency: 31.19% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021010  
 Energy Cal: Gain = 9.9575 keV / Ch  
 Offset = 3,010.51 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 38.76%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4185.5	3906.7	4265.2	.0	100.2	11.00	3.00	8.00	5.9E-002	5.6E-002	3.0E-002	8.0E-002
U-235	4384.6	4275.1	4454.3	14.7	99.7	1.00	1.00	0.00	0.0E+000	2.1E-002	1.7E-002	5.5E-002
U-234	4763.0	4573.8	4862.6	143.5	100.0	4.00	4.00	0.00	0.0E+000	4.2E-002	3.5E-002	8.9E-002
U-232	5300.7	5091.6	5400.3	74.1	100.1	601.00	28.00	573.00	1.7E+000	1.5E-001	9.5E-002	2.1E-001

Reported By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

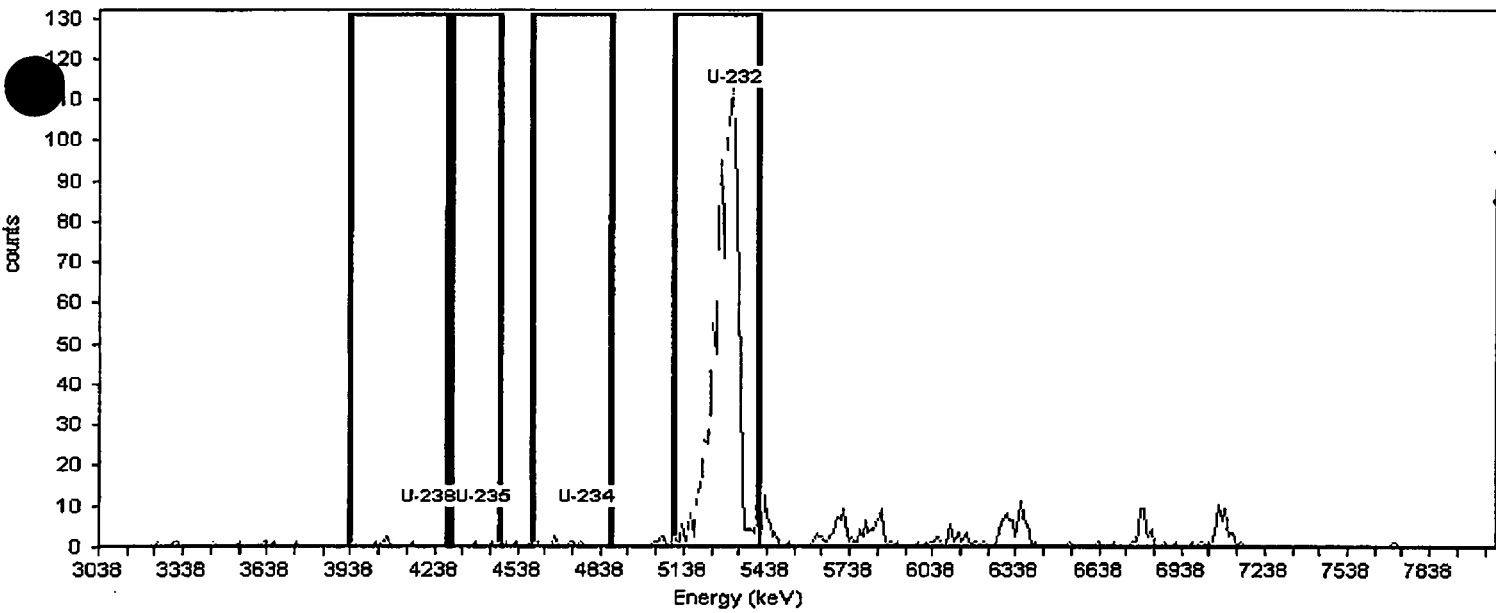
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-3  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 29  
 Batch Name: UAS140215-3\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/18/2014 1:52:05PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021029; Det: 29; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:04:22PM  
 Efficiency Calibration: C14021029  
 Efficiency: 27.70% +/- 0.12% TPU(2 sigma)  
 Energy Calibration: C14021029  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 78.98%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4204.0	3927.4	4283.1	137.2	100.2	7.00	3.00	4.00	1.6E-002	2.6E-002	1.7E-002	4.4E-002
U-235	4401.7	4293.0	4470.8	12.9	99.7	3.00	3.00	0.00	0.0E+000	2.0E-002	1.7E-002	4.4E-002
U-234	4777.1	4589.4	4876.0	23.5	100.0	8.00	8.00	0.00	0.0E+000	3.3E-002	2.7E-002	6.5E-002
U-232	5310.7	5103.2	5409.5	86.0	100.1	1,070.00	33.00	1,037.00	3.5E+000	2.2E-001	5.7E-002	1.3E-001

Reported By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402167-4  
Spectrum #1 Analysis #1

Sample Size : 0.50

**Acquisition**

Detector: 30  
Batch Name: UAS140215-3\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/18/2014 1:51:59PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

**Calibration**

Bkgd Info: Sample: B14021030; Det: 30; Spectrum #1; Feb-10-2014 13:27

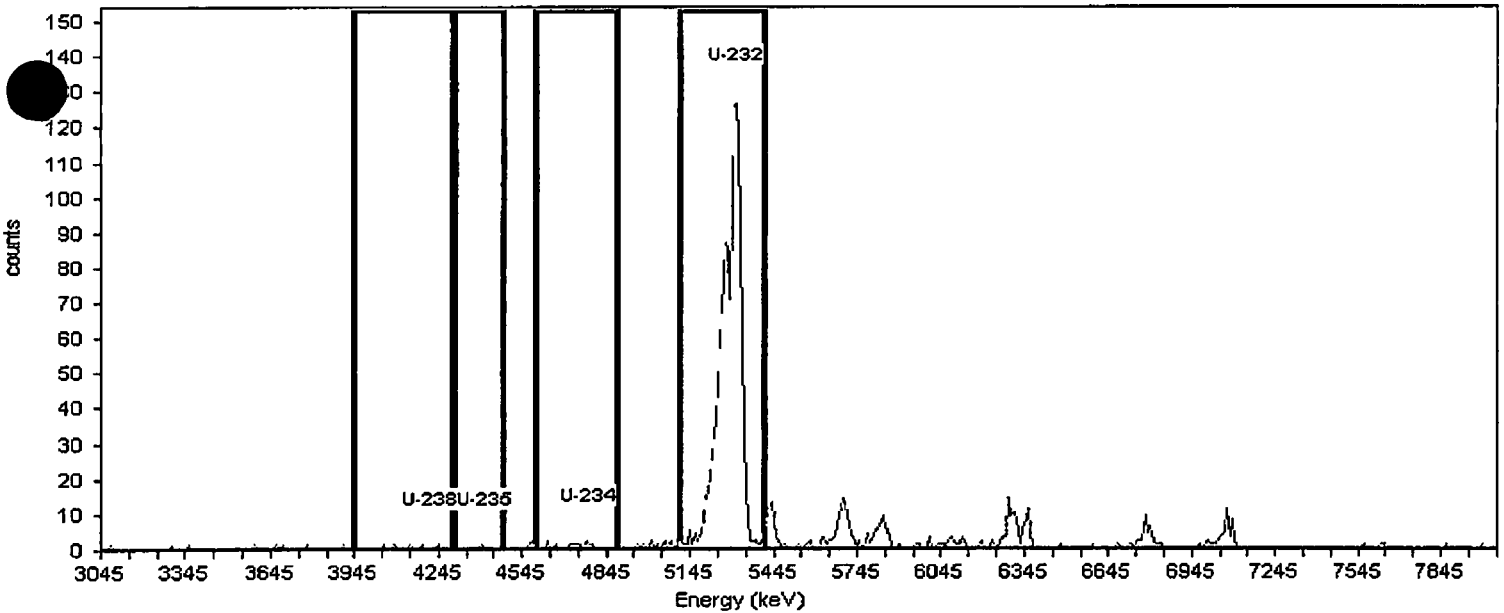
Calibration Date: 2/10/2014 12:04:44PM  
Efficiency Calibration: C14021030  
Efficiency: 28.09% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021030  
Energy Cal: Gain = 9.8047 keV / Ch  
Offset = 3,036.00 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**


Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 75.03%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	12.4	100.2	5.00	1.00	4.00	1.7E-002	2.1E-002	9.9E-003	3.1E-002
U-235	4408.7	4300.8	4477.3	24.0	99.7	1.00	2.00	-1.00	0.0E+000	1.5E-002	1.4E-002	4.0E-002
U-234	4781.3	4595.0	4879.3	164.5	100.0	13.00	8.00	5.00	2.1E-002	3.9E-002	2.8E-002	6.8E-002
U-232	5310.7	5104.8	5408.8	71.2	100.1	1,022.00	23.00	999.00	3.3E+000	2.2E-001	4.9E-002	1.1E-001

Requested By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

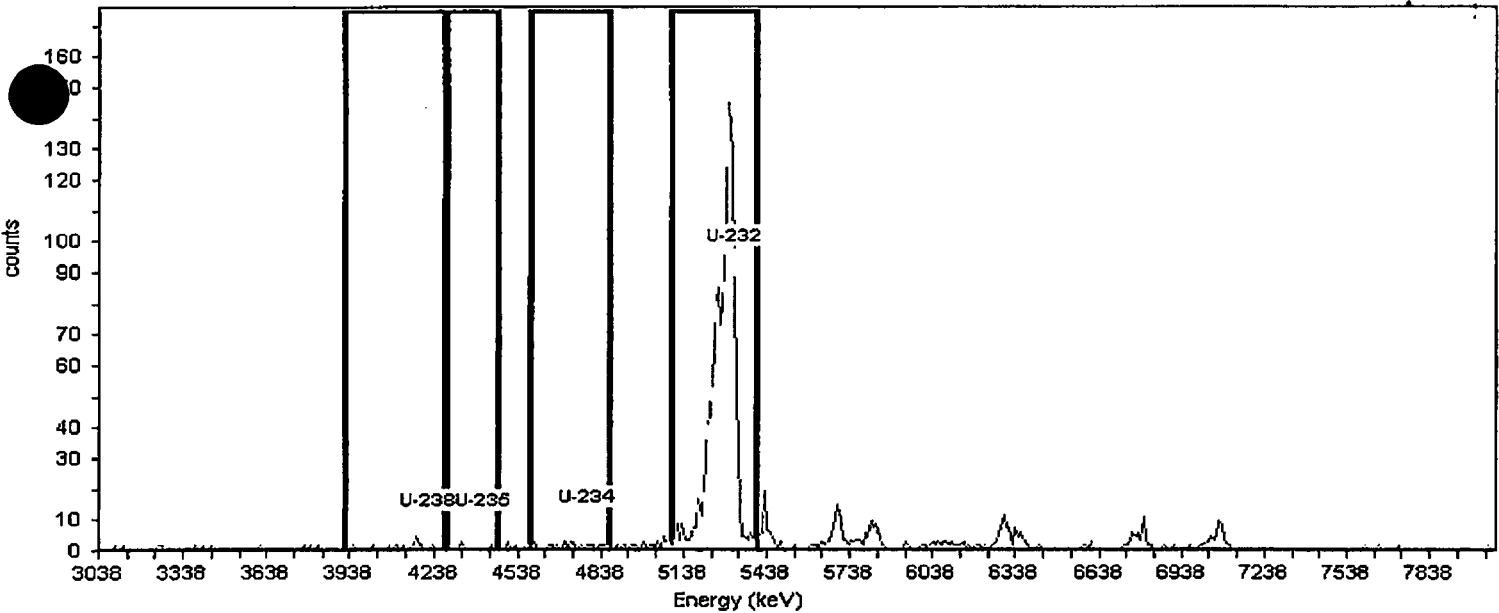
## Alpha-Spectroscopy Analysis Report

Sample ID: 1402167-5  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 31  
 Batch Name: UAS140215-3\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/18/2014 1:52:00PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021031; Det: 31; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:05:06PM  
 Efficiency Calibration: C14021031  
 Efficiency: 29.21% +/- 0.18% TPU(2 sigma)  
 Energy Calibration: C14021031  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 77.28%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4194.2	3917.5	4273.2	63.8	100.2	15.00	2.00	13.00	5.2E-002	3.3E-002	1.3E-002	3.7E-002
U-235	4391.8	4283.1	4461.0	23.6	99.7	4.00	3.00	1.00	4.0E-003	2.1E-002	1.6E-002	4.3E-002
U-234	4767.3	4579.5	4866.1	.0	100.0	20.00	9.00	11.00	4.4E-002	4.3E-002	2.8E-002	6.6E-002
U-232	5300.8	5093.3	5399.6	78.7	100.1	1,103.00	33.00	1,070.00	3.4E+000	2.2E-001	5.5E-002	1.2E-001

Reported By: *JP*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402167-6  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 32  
Batch Name: UAS140215-3\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

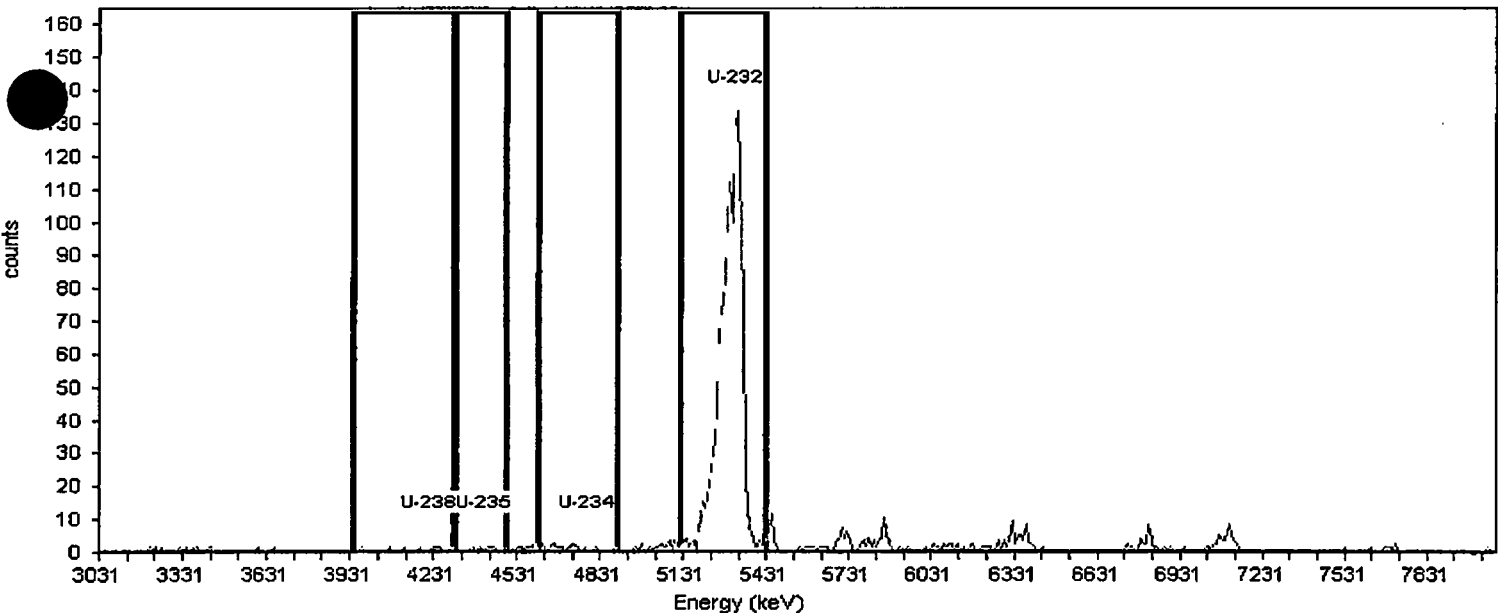
Acquisition Start Date: 2/18/2014 1:52:00PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

Bkgd Info: Sample: B14021032; Det: 32; Spectrum #1; Feb-10-2014 13:27  
Calibration Date: 2/10/2014 12:05:30PM  
Efficiency Calibration: C14021032  
Efficiency: 29.03% +/- 0.12% TPU(2 sigma)

Energy Calibration: C14021032  
Energy Cal: Gain = 9.9003 keV / Ch  
Offset = 3,021.28 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 83.43%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4219.2	3942.0	4298.4	20.8	100.2	9.00	4.00	5.00	1.9E-002	2.7E-002	1.7E-002	4.5E-002
U-235	4417.2	4308.3	4486.5	25.1	99.7	6.00	7.00	-1.00	0.0E+000	2.7E-002	2.3E-002	5.6E-002
U-234	4793.4	4605.3	4892.4	.0	100.0	20.00	13.00	7.00	2.6E-002	4.3E-002	3.1E-002	7.2E-002
U-232	5328.0	5120.1	5427.0	85.7	100.1	1,164.00	16.00	1,148.00	3.7E+000	2.2E-001	3.6E-002	8.2E-002

Recorded By: *[Signature]*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

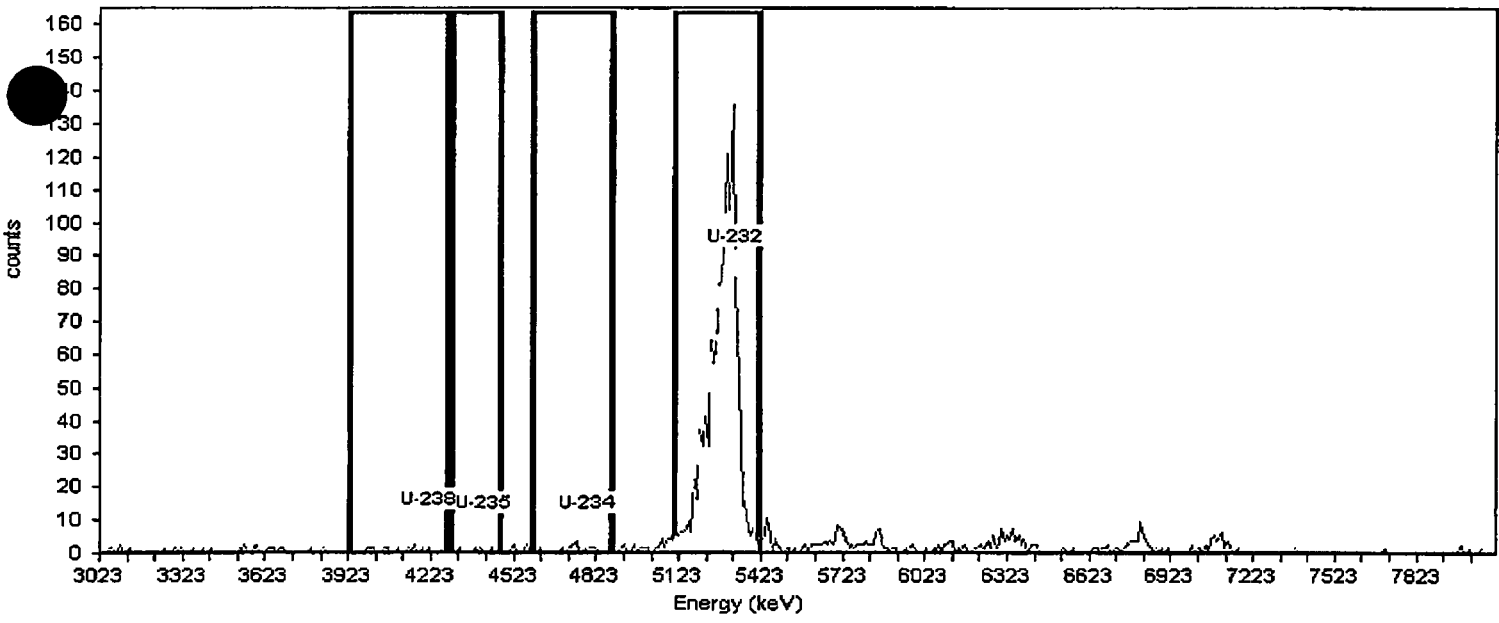
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-7  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 43  
 Batch Name: UAS140215-3\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/18/2014 1:51:59PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021043; Det: 43; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:46:17PM  
 Efficiency Calibration: C14021043  
 Efficiency: 32.34% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021043  
 Energy Cal: Gain = 9.9784 keV / Ch  
 Offset = 3,013.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 80.16%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4200.6	3921.3	4280.5	99.7	100.2	12.00	5.00	7.00	2.4E-002	2.9E-002	1.8E-002	4.5E-002
U-235	4400.2	4290.5	4470.1	103.0	99.7	4.00	1.00	3.00	1.0E-002	1.6E-002	8.1E-003	2.6E-002
U-234	4779.4	4589.8	4879.2	27.7	100.0	13.00	10.00	3.00	1.0E-002	3.3E-002	2.6E-002	6.1E-002
U-232	5318.2	5108.7	5418.0	99.6	100.1	1,276.00	47.00	1,229.00	3.5E+000	2.1E-001	5.7E-002	1.2E-001

Reported By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

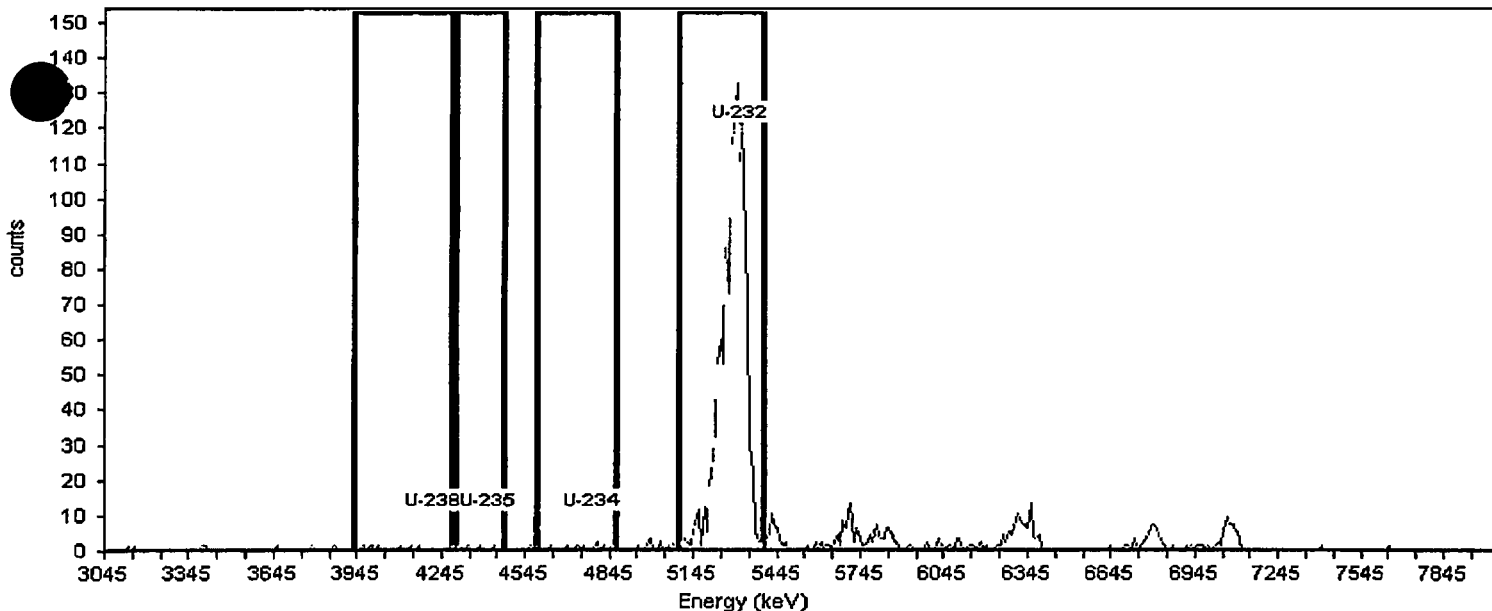
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-8  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 45  
 Batch Name: UAS140215-3\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/18/2014 1:52:01PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021045; Det: 45; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:46:47PM  
 Efficiency Calibration: C14021045  
 Efficiency: 31.65% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021045  
 Energy Cal: Gain = 9.8047 keV / Ch  
 Offset = 3,036.00 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 82.85%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4202.8	3928.2	4281.2	321.9	100.2	9.00	5.00	4.00	1.4E-002	2.6E-002	1.8E-002	4.5E-002
U-235	4398.9	4291.0	4467.5	.0	99.7	5.00	1.00	4.00	1.4E-002	1.7E-002	8.0E-003	2.5E-002
U-234	4771.4	4585.2	4869.5	77.9	100.0	11.00	4.00	7.00	2.4E-002	2.7E-002	1.6E-002	4.1E-002
U-232	5300.9	5095.0	5398.9	88.7	100.1	1,272.00	29.00	1,243.00	3.7E+000	2.1E-001	4.5E-002	9.9E-002

Reviewed By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

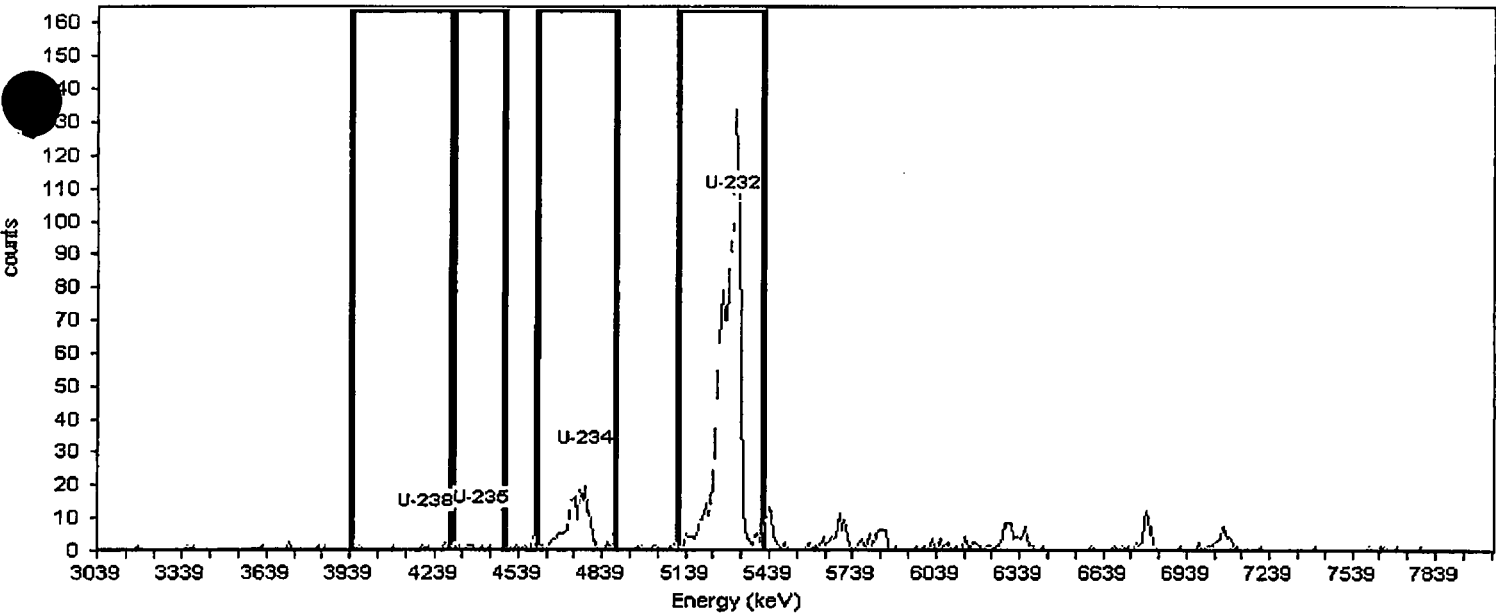
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-9  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 46  
 Batch Name: UAS140215-3\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/18/2014 1:52:01PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021046; Det: 46; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:47:15PM  
 Efficiency Calibration: C14021046  
 Efficiency: 30.58% +/- 0.16% TPU(2 sigma)  
 Energy Calibration: C14021046  
 Energy Cal: Gain = 9.8224 keV / Ch  
 Offset = 3,029.39 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 64.57%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.9	3942.9	4296.5	13.7	100.2	6.00	4.00	2.00	9.1E-003	2.9E-002	2.1E-002	5.5E-002
U-235	4414.4	4306.3	4483.1	75.4	99.7	8.00	1.00	7.00	3.2E-002	2.8E-002	1.1E-002	3.4E-002
U-234	4787.6	4601.0	4885.8	78.0	100.0	160.00	11.00	149.00	6.8E-001	1.4E-001	3.5E-002	8.3E-002
U-232	5318.0	5111.8	5416.2	79.9	100.1	954.00	18.00	936.00	2.9E+000	1.9E-001	4.7E-002	1.1E-001

Recorded By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

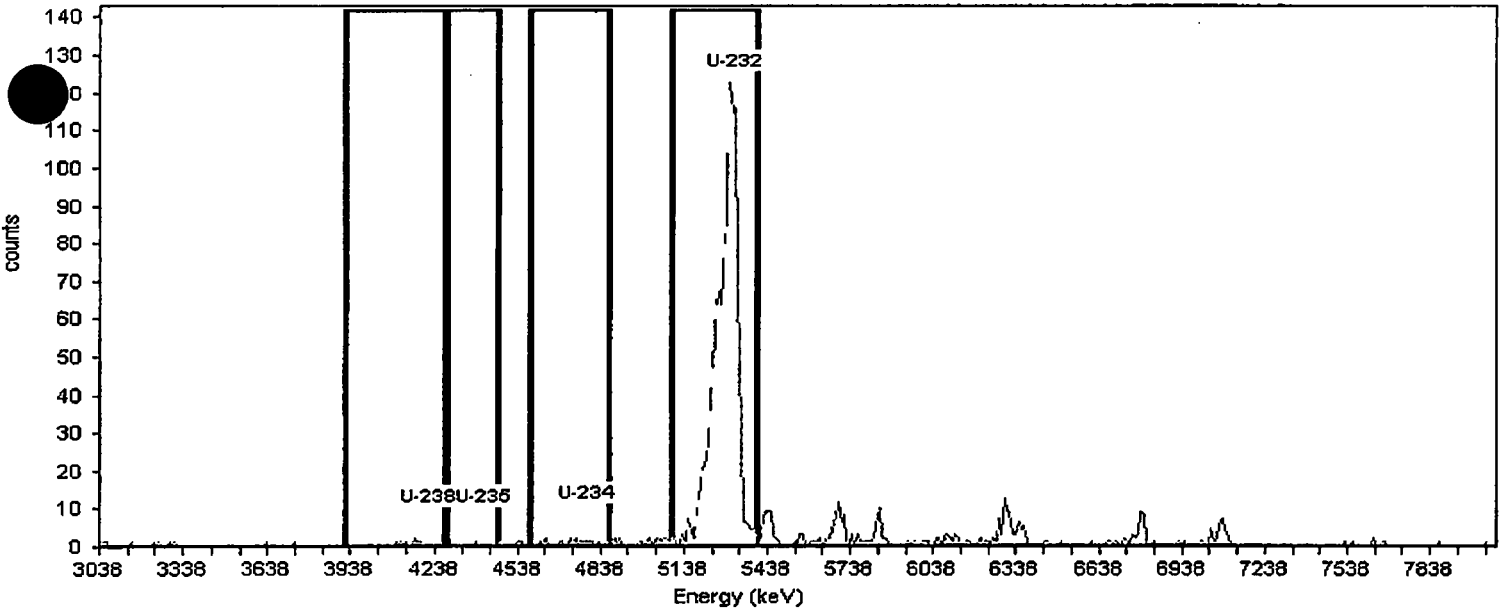
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-10  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 47  
 Batch Name: UAS140215-3\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/18/2014 1:52:02PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021047; Det: 47; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:47:41PM  
 Efficiency Calibration: C14021047  
 Efficiency: 30.42% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021047  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 69.82%



Nuclide Summary (ROI)												
Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4194.2	3917.5	4273.2	141.3	100.2	8.00	5.00	3.00	1.3E-002	3.1E-002	2.2E-002	5.5E-002
U-235	4391.8	4283.1	4461.0	13.4	99.7	2.00	2.00	0.00	0.0E+000	1.7E-002	1.4E-002	4.0E-002
U-234	4767.3	4579.5	4866.1	13.2	100.0	17.00	10.00	7.00	3.0E-002	4.4E-002	3.1E-002	7.4E-002
U-232	5300.8	5093.3	5399.6	80.4	100.1	1,033.00	26.00	1,007.00	3.1E+000	2.0E-001	5.2E-002	1.2E-001

Rechecked By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

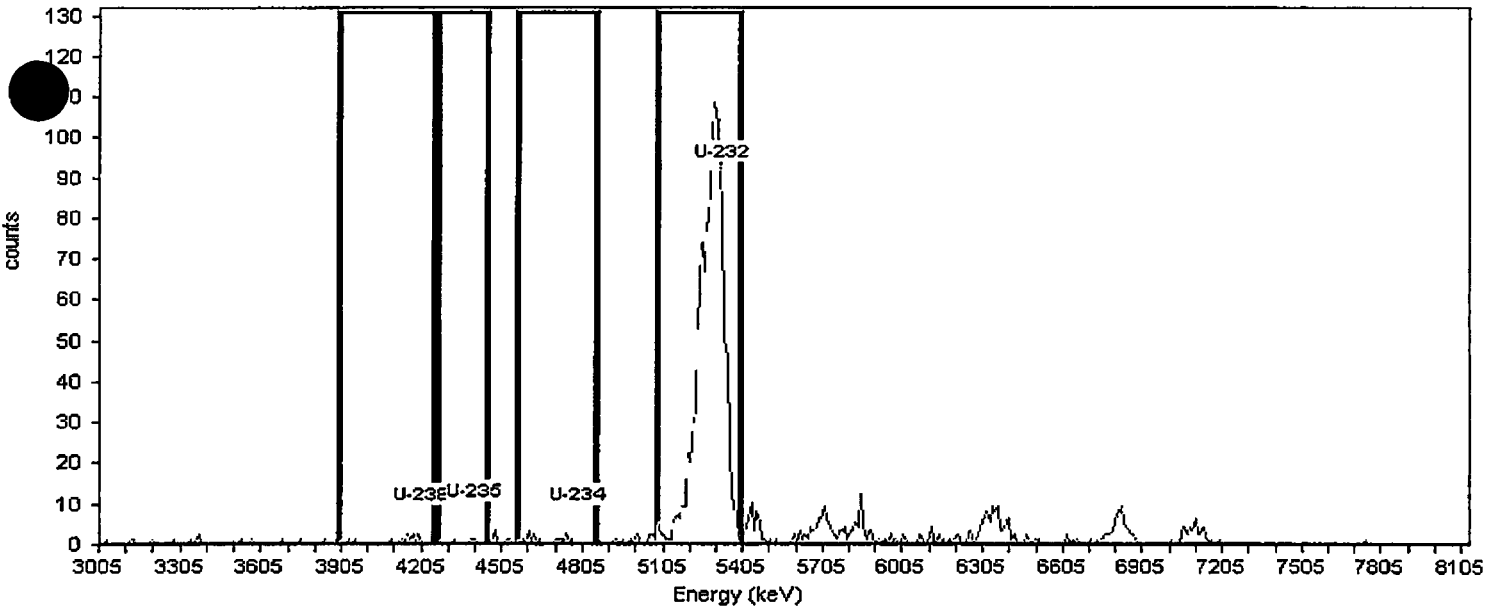
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-11  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 9a  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:55:22PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,010.68 min.  
 Dead Time: 1.06 %

**Calibration**  
 Bkgd Info: Sample: B14021009; Det: 9a; Spectrum #1; Feb-10-2014 13:24  
 Calibration Date: 2/10/2014 10:20:24AM  
 Efficiency Calibration: C14021009  
 Efficiency: 31.42% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021009  
 Energy Cal: Gain = 10.0569 keV / Ch  
 Offset = 2,995.13 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 74.39%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4171.8	3890.2	4252.2	136.9	100.2	12.00	4.00	8.00	3.1E-002	3.1E-002	1.8E-002	4.6E-002
U-235	4372.9	4262.3	4443.3	.4	99.7	5.00	4.00	1.00	3.9E-003	2.3E-002	1.8E-002	4.6E-002
U-234	4755.1	4564.0	4855.7	20.4	100.0	14.00	9.00	5.00	1.9E-002	3.7E-002	2.7E-002	6.4E-002
U-232	5298.2	5087.0	5398.7	403.4	100.1	1,136.00	28.00	1,108.00	3.3E+000	2.0E-001	4.9E-002	1.1E-001

Recorded By: *OP*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

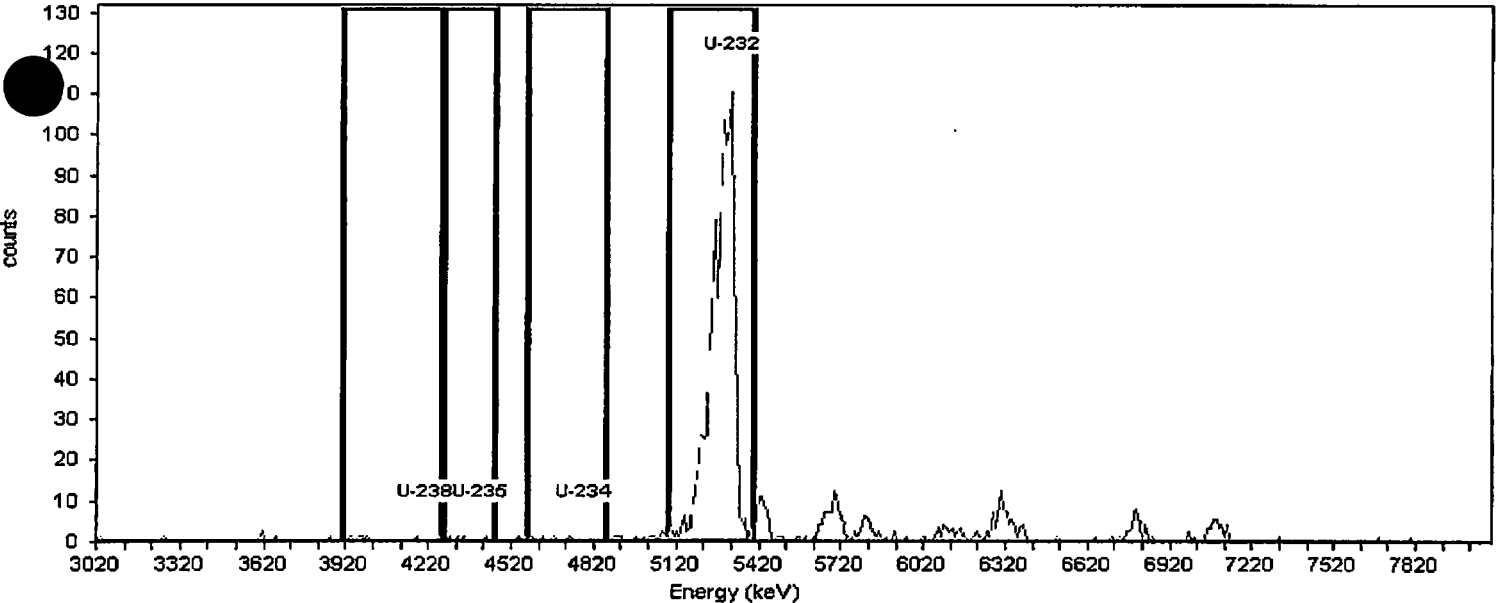
## Alpha-Spectroscopy Analysis Report

Sample: 1402167-12      Sample Size : 0.50  
Spectrum #1 Analysis #1

Acquisition  
Detector: 10b      Acquisition Start Date: 2/19/2014 2:55:24PM  
Batch Name: UAS140215-3\_B      Live Time: 1,000.00 min.  
Nuclide Library: Uranium Default      Real Time: 1,010.68 min.  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default      Dead Time: 1.06 %  
ROI Set: Uranium Default

Calibration  
Bkgd Info: Sample: B14021010; Det: 10b; Spectrum #1; Feb-10-2014 13:23  
Calibration Date: 2/10/2014 10:21:35AM      Energy Calibration: C14021010  
Efficiency Calibration: C14021010      Energy Cal: Gain = 9.9575 keV / Ch  
Efficiency: 31.19% +/- 0.15% TPU(2 sigma)      Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Tracer  
Tracer Name: 914.4095.46\_U-232      Tracer Nuclide: U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM      Tracer Recovery: 66.76%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4185.6	3906.7	4265.2	13.6	100.2	6.00	3.00	3.00	1.3E-002	2.6E-002	1.7E-002	4.6E-002
U-235	4384.7	4275.2	4454.4	.0	99.7	4.00	1.00	3.00	1.3E-002	1.9E-002	1.0E-002	3.2E-002
U-234	4763.1	4573.9	4862.7	.0	100.0	4.00	4.00	0.00	0.0E+000	2.4E-002	2.0E-002	5.2E-002
U-232	5300.8	5091.7	5400.4	90.7	100.1	1,015.01	27.99	987.01	3.0E+000	1.9E-001	5.5E-002	1.2E-001

Reported By: *JR* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

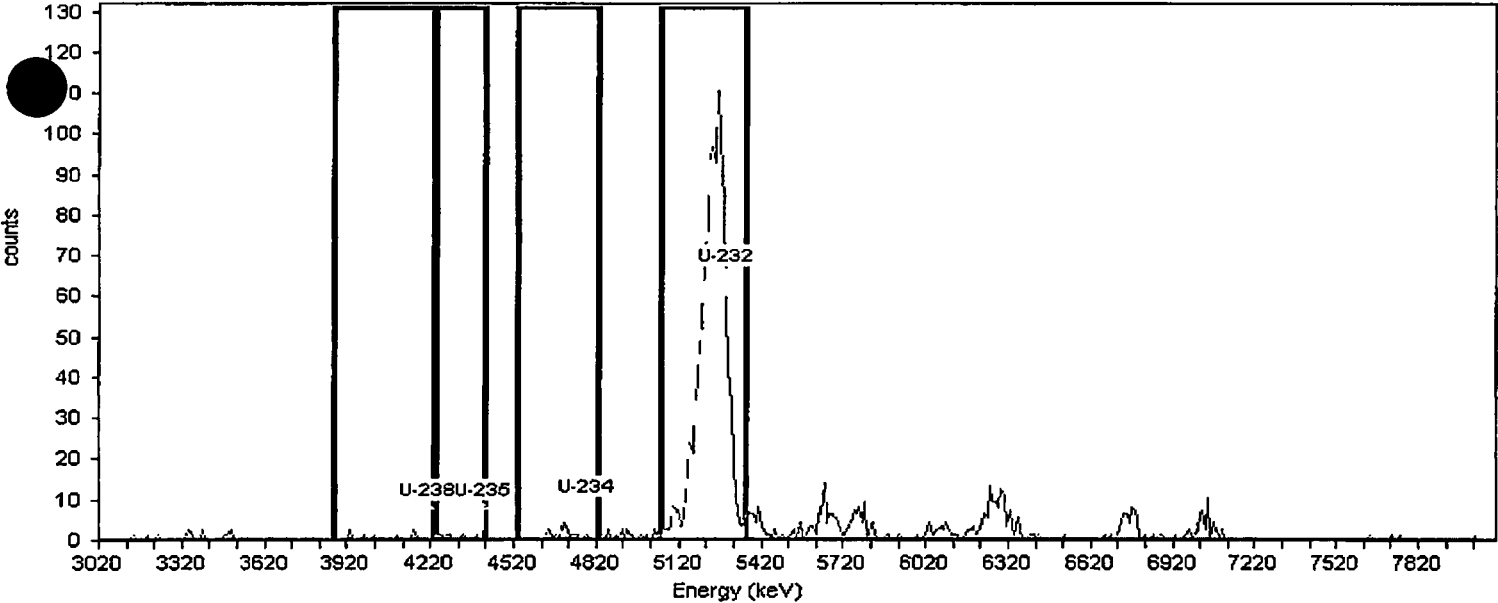
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-13  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 11a  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute Interactive ROI Analysis  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:55:20PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,010.68 min.  
 Dead Time: 1.06 %

**Calibration**  
 Bkgd Info: Sample: B14021011; Det: 11a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:23:50AM  
 Efficiency Calibration: C14021011  
 Efficiency: 30.43% +/- 0.16% TPU(2 sigma)  
 Energy Calibration: C14021011  
 Energy Cal: Gain = 9.9575 keV / Ch  
 Offset = 3,010.51 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 76.18%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4205.4	3866.9	4225.3	275.7	100.2	8.00	4.00	4.00	1.6E-002	2.7E-002	1.8E-002	4.7E-002
U-235	4404.6	4235.3	4414.5	.0	99.7	7.00	3.00	4.00	1.6E-002	2.5E-002	1.6E-002	4.2E-002
U-234	4782.9	4534.0	4822.8	72.1	100.0	17.00	13.00	4.00	1.6E-002	4.3E-002	3.3E-002	7.6E-002
U-232	5290.8	5051.8	5360.5	94.9	100.1	1,125.00	26.00	1,099.00	3.4E+000	2.1E-001	4.8E-002	1.1E-001

Recorded By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

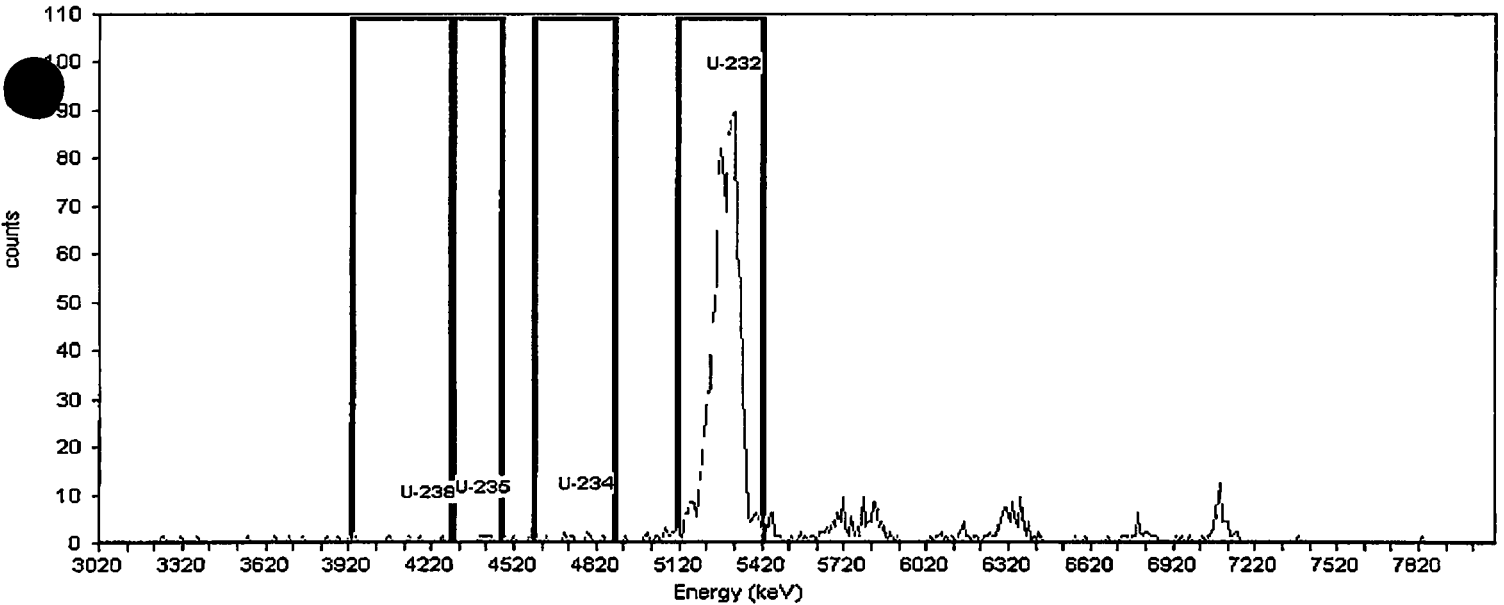
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-14  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 12a  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:55:21PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,010.68 min.  
 Dead Time: 1.06 %

**Calibration**  
 Bkgd Info: Sample: B14021012; Det: 12a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:25:15AM  
 Efficiency Calibration: C14021012  
 Efficiency: 30.32% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021012  
 Energy Cal: Gain = 9.9575 keV / Ch  
 Offset = 3,010.51 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 67.69%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4205.4	3926.6	4285.1	330.8	100.2	7.00	1.00	6.00	2.6E-002	2.5E-002	1.0E-002	3.2E-002
U-235	4404.6	4295.0	4474.3	48.0	99.7	5.00	1.00	4.00	1.8E-002	2.2E-002	1.0E-002	3.2E-002
U-234	4782.9	4593.7	4882.5	104.1	100.0	10.00	3.00	7.00	3.1E-002	3.2E-002	1.8E-002	4.7E-002
U-232	5320.6	5111.5	5420.2	98.3	100.1	1,006.00	33.00	973.00	3.0E+000	2.0E-001	6.1E-002	1.3E-001

Reported By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402167-15  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 16a  
Batch Name: UAS140215-3\_B  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

### Acquisition

Acquisition Start Date: 2/19/2014 2:55:23PM  
Live Time: 1,000.00 min.  
Real Time: 1,010.68 min.  
Dead Time: 1.06 %

### Calibration

Bkgd Info: Sample: B14021016; Det: 16a; Spectrum #1; Feb-10-2014 13:23

Calibration Date: 2/10/2014 10:57:03AM

Efficiency Calibration: C14021016

Efficiency: 29.83% +/- 0.12% TPU(2 sigma)

Energy Calibration: C14021016

Energy Cal: Gain = 9.8597 keV / Ch

Offset = 3,025.63 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

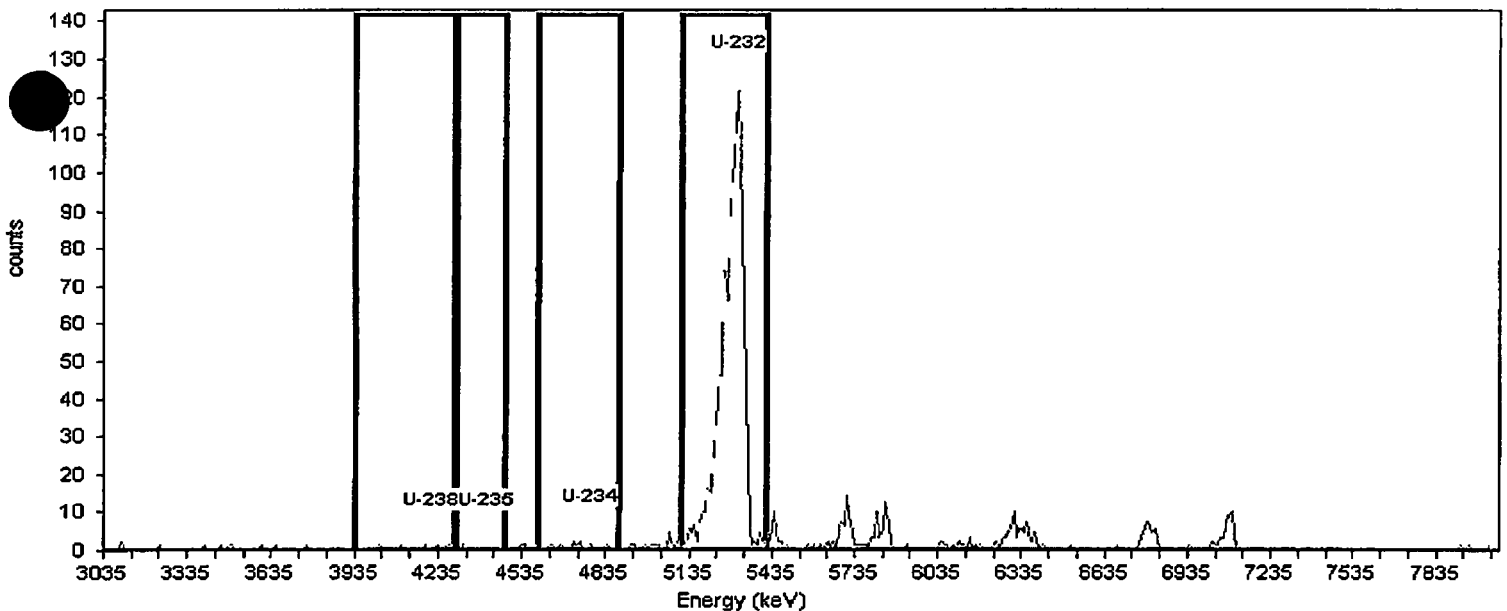
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 70.79%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.8	3932.7	4287.7	20.1	100.2	6.00	1.00	5.00	2.1E-002	2.3E-002	9.9E-003	3.1E-002
U-235	4406.0	4297.5	4475.0	27.0	99.7	1.00	1.00	0.00	0.0E+000	1.2E-002	1.0E-002	3.1E-002
U-234	4780.7	4593.3	4879.3	108.5	100.0	10.00	4.00	6.00	2.6E-002	3.2E-002	2.0E-002	5.1E-002
U-232	5313.1	5106.0	5411.7	75.8	100.1	1,015.00	14.00	1,001.00	3.1E+000	2.0E-001	3.8E-002	8.9E-002

Reported By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

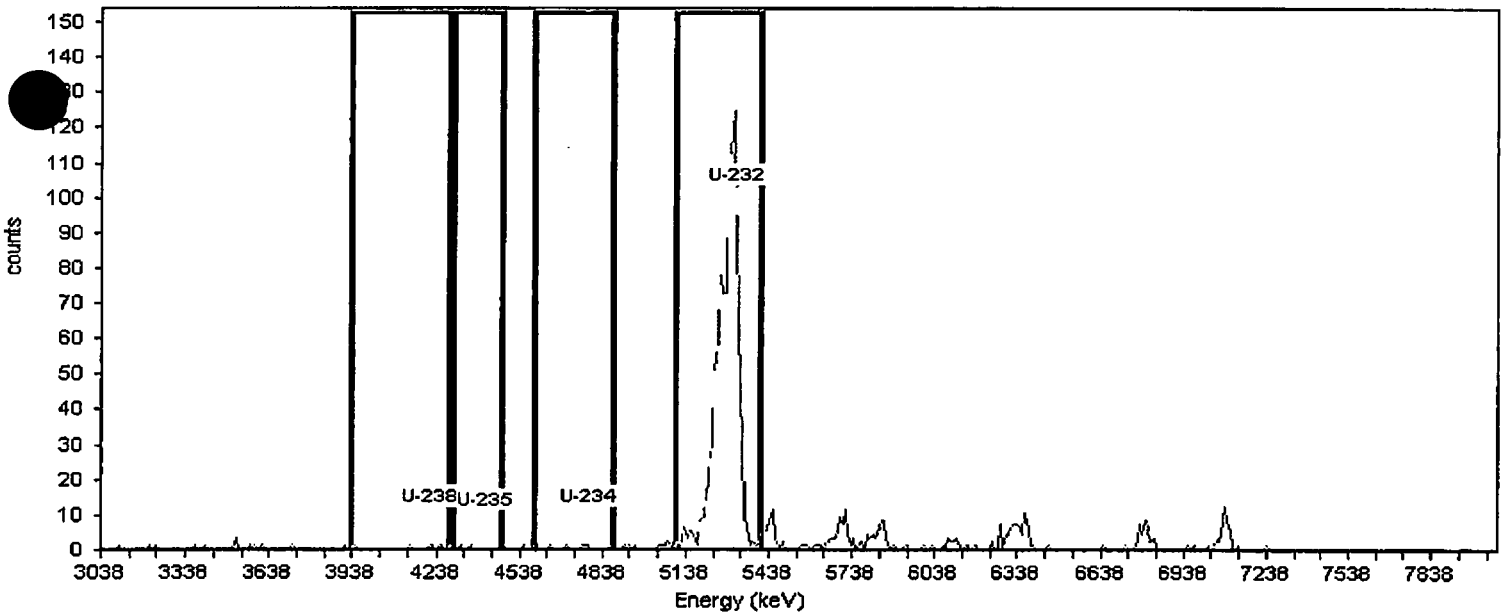
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-16  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 29  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:00PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021029; Det: 29; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:04:22PM  
 Efficiency Calibration: C14021029  
 Efficiency: 27.70% +/- 0.12% TPU(2 sigma)  
 Energy Calibration: C14021029  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 73.65%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4204.0	3927.4	4283.1	14.9	100.2	7.00	3.00	4.00	1.8E-002	2.8E-002	1.8E-002	4.7E-002
U-235	4401.7	4293.0	4470.8	.4	99.7	2.00	3.00	-1.00	0.0E+000	2.0E-002	1.8E-002	4.8E-002
U-234	4777.1	4589.4	4876.0	106.4	100.0	7.00	8.00	-1.00	0.0E+000	3.4E-002	2.9E-002	7.0E-002
U-232	5310.7	5103.2	5409.5	81.1	100.1	1,000.00	33.00	967.00	3.3E+000	2.2E-001	6.1E-002	1.3E-001

Reported By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

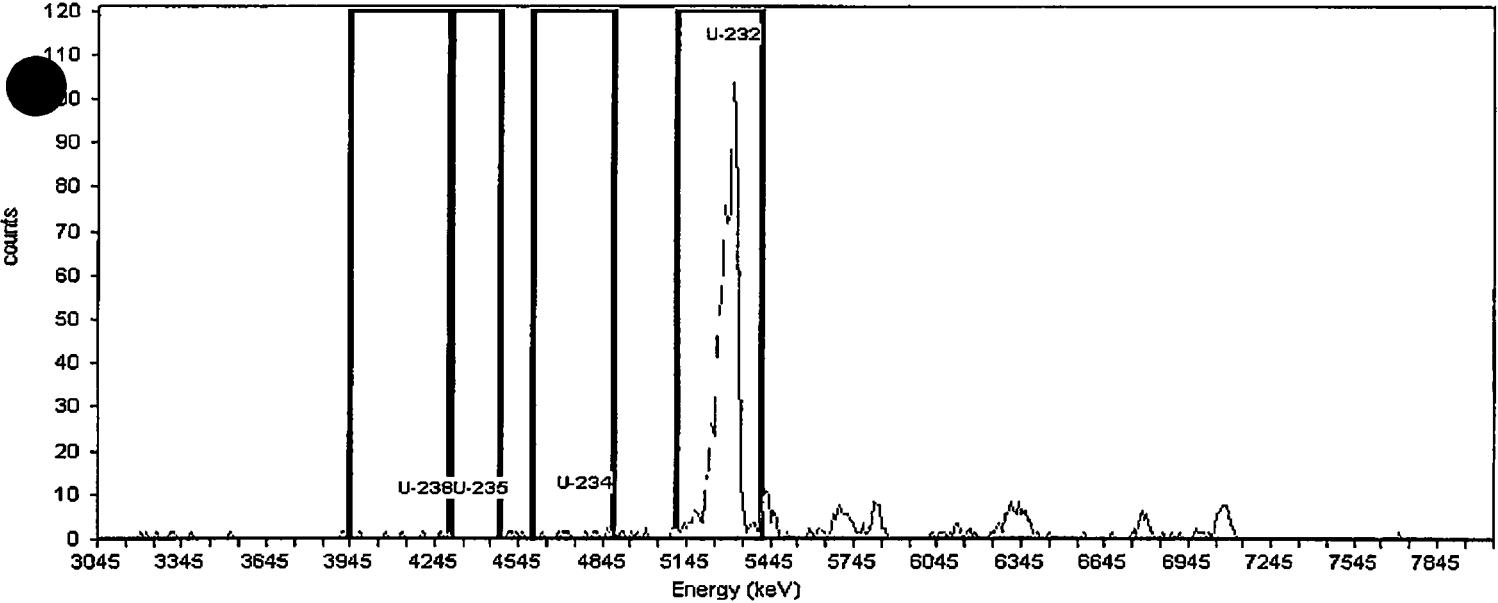
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-17  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 30  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:01PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021030; Det: 30; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:04:44PM  
 Efficiency Calibration: C14021030  
 Efficiency: 28.09% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021030  
 Energy Cal: Gain = 9.8047 keV / Ch  
 Offset = 3,036.00 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 56.03%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	28.0	100.2	6.00	1.00	5.00	2.9E-002	3.0E-002	1.3E-002	4.2E-002
U-235	4408.7	4300.8	4477.3	.0	99.7	0.00	2.00	-2.00	0.0E+000	2.0E-002	1.9E-002	5.3E-002
U-234	4781.3	4595.0	4879.3	18.9	100.0	11.00	8.00	3.00	1.7E-002	5.0E-002	3.8E-002	9.1E-002
U-232	5310.7	5104.8	5408.8	69.8	100.1	769.00	23.00	746.00	2.5E+000	1.9E-001	6.6E-002	1.5E-001

Reviewed By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

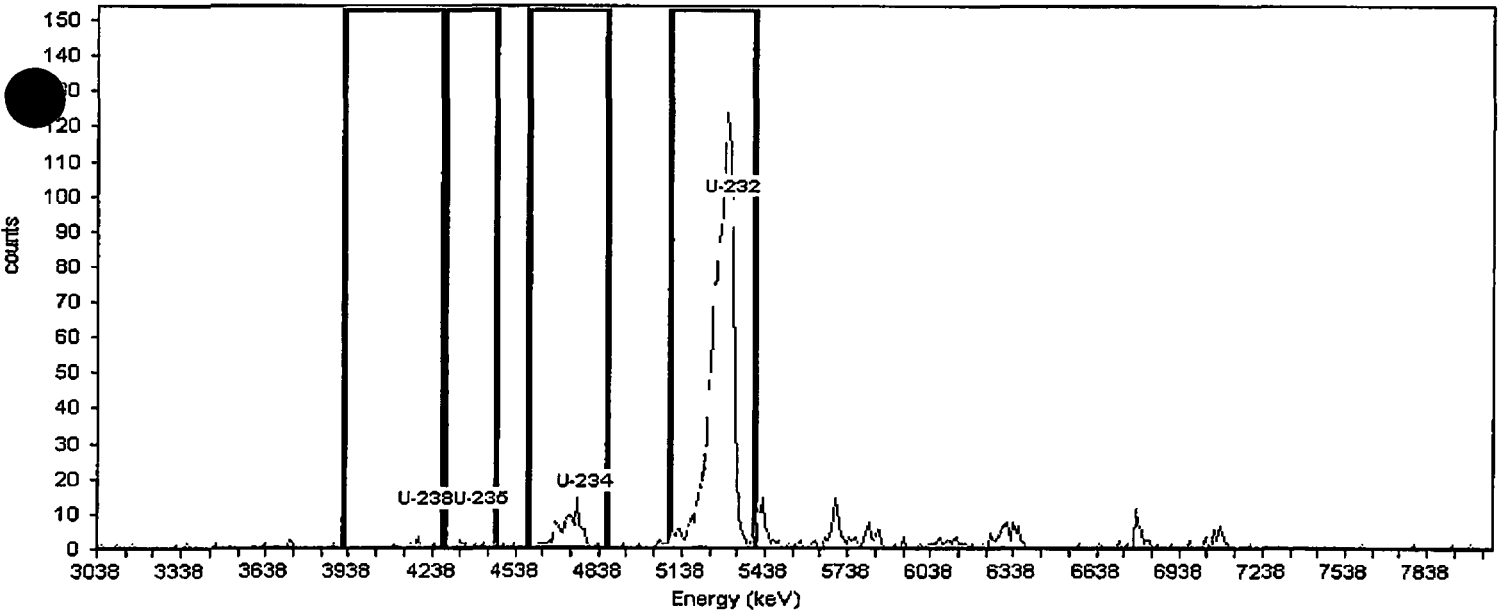
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-18  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 31  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:01PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021031; Det: 31; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:05:06PM  
 Efficiency Calibration: C14021031  
 Efficiency: 29.21% +/- 0.18% TPU(2 sigma)  
 Energy Calibration: C14021031  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 73.24%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4194.2	3917.5	4273.2	98.9	100.2	7.00	2.00	5.00	2.1E-002	2.5E-002	1.4E-002	3.9E-002
U-235	4391.8	4283.1	4461.0	26.2	99.7	7.00	3.00	4.00	1.7E-002	2.7E-002	1.7E-002	4.5E-002
U-234	4767.3	4579.5	4866.1	99.8	100.0	94.00	9.00	85.00	3.6E-001	9.6E-002	2.9E-002	7.0E-002
U-232	5300.8	5093.3	5399.6	81.0	100.1	1,047.00	33.00	1,014.00	3.2E+000	2.1E-001	5.8E-002	1.3E-001

Recorded By: *JP*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

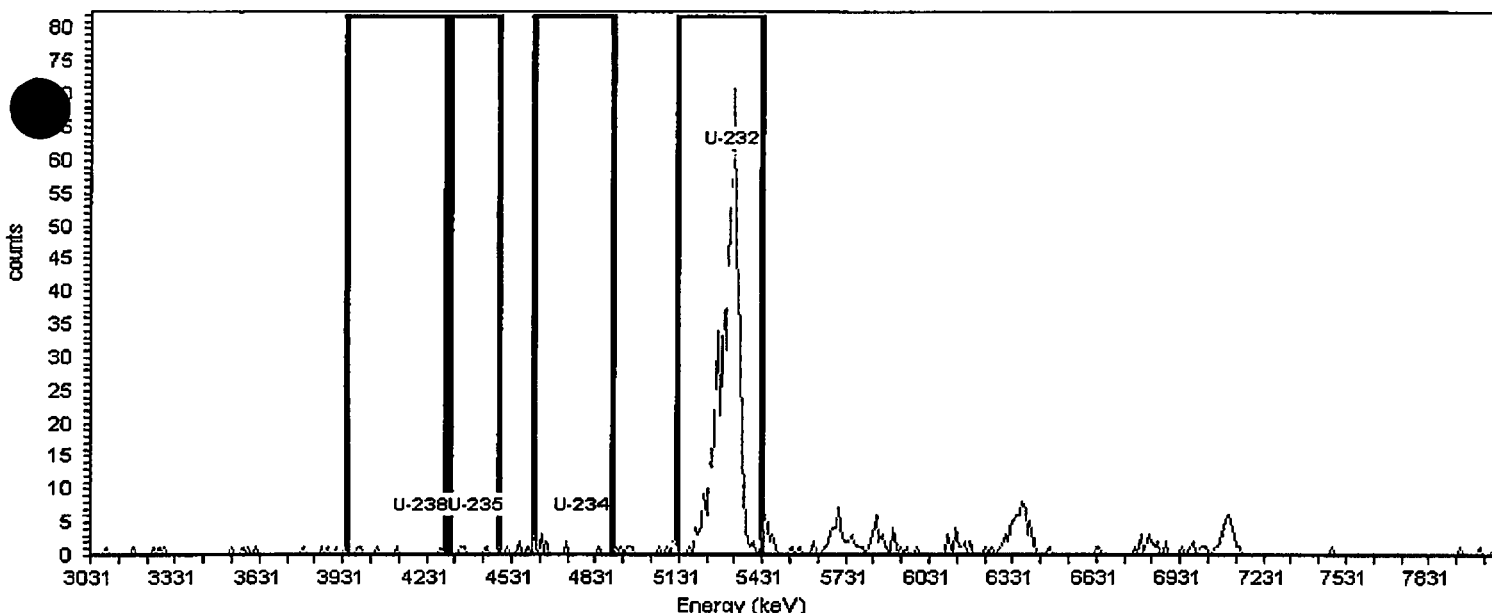
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-19  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 32  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:02PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021032; Det: 32; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:05:30PM  
 Efficiency Calibration: C14021032  
 Efficiency: 29.03% +/- 0.12% TPU(2 sigma)  
 Energy Calibration: C14021032  
 Energy Cal: Gain = 9.9003 keV / Ch  
 Offset = 3,021.28 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 33.79%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4219.2	3942.0	4298.4	13.6	100.2	5.00	4.00	1.00	9.2E-003	5.5E-002	4.3E-002	1.1E-001
U-235	4417.2	4308.3	4486.5	23.1	99.7	4.00	7.00	-3.00	0.0E+000	6.1E-002	5.7E-002	1.4E-001
U-234	4793.4	4605.3	4892.4	52.3	100.0	12.00	13.00	-1.00	0.0E+000	9.2E-002	7.7E-002	1.8E-001
U-232	5328.0	5120.1	5427.0	54.5	100.1	481.00	16.00	465.00	1.5E+000	1.4E-001	8.9E-002	2.0E-001

Reported By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

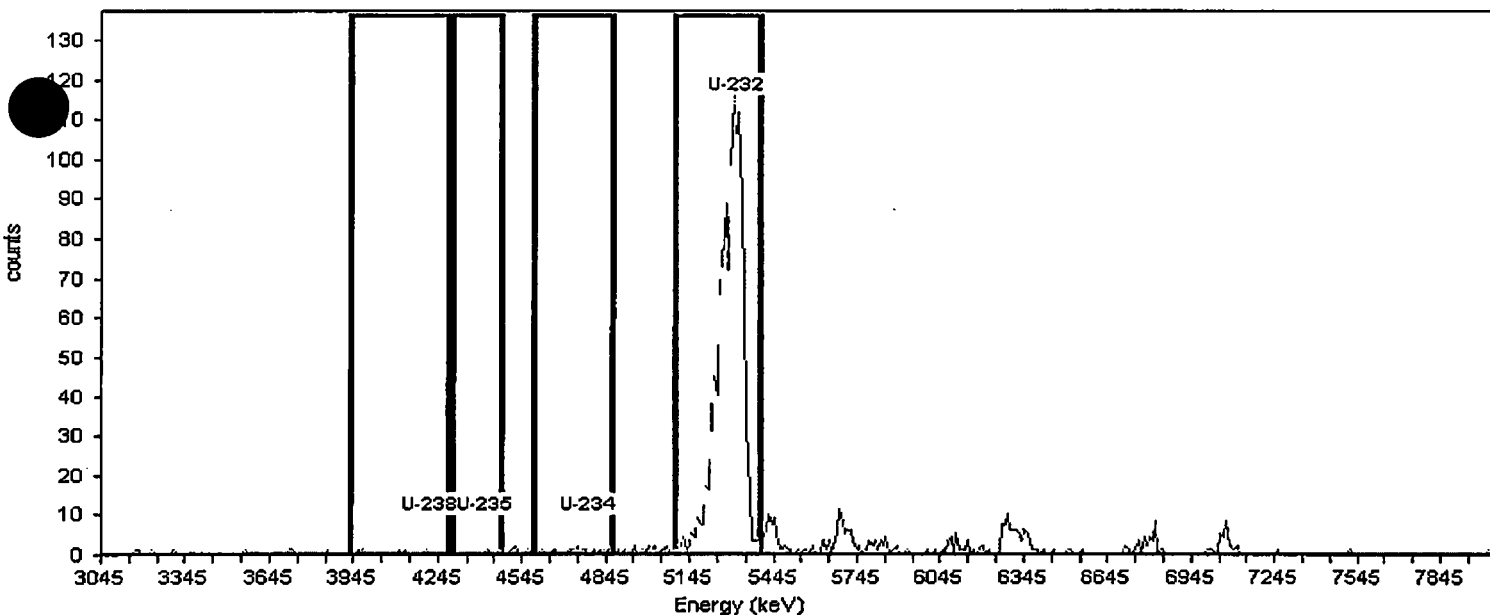
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402167-20  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 45  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:02PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021045; Det: 45; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:46:47PM  
 Efficiency Calibration: C14021045  
 Efficiency: 31.65% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021045  
 Energy Cal: Gain = 9.8047 keV / Ch  
 Offset = 3,036.00 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 74.45%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4202.8	3928.2	4281.2	40.7	100.2	5.00	5.00	0.00	0.0E+000	2.4E-002	2.0E-002	5.0E-002
U-235	4398.9	4291.0	4467.5	19.6	99.7	3.00	1.00	2.00	7.7E-003	1.5E-002	8.9E-003	2.8E-002
U-234	4771.4	4585.2	4869.5	15.6	100.0	15.00	4.00	11.00	4.2E-002	3.4E-002	1.8E-002	4.6E-002
U-232	5300.9	5095.0	5398.9	91.5	100.1	1,146.00	29.00	1,117.00	3.3E+000	2.0E-001	5.0E-002	1.1E-001

Recorded By: *OP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

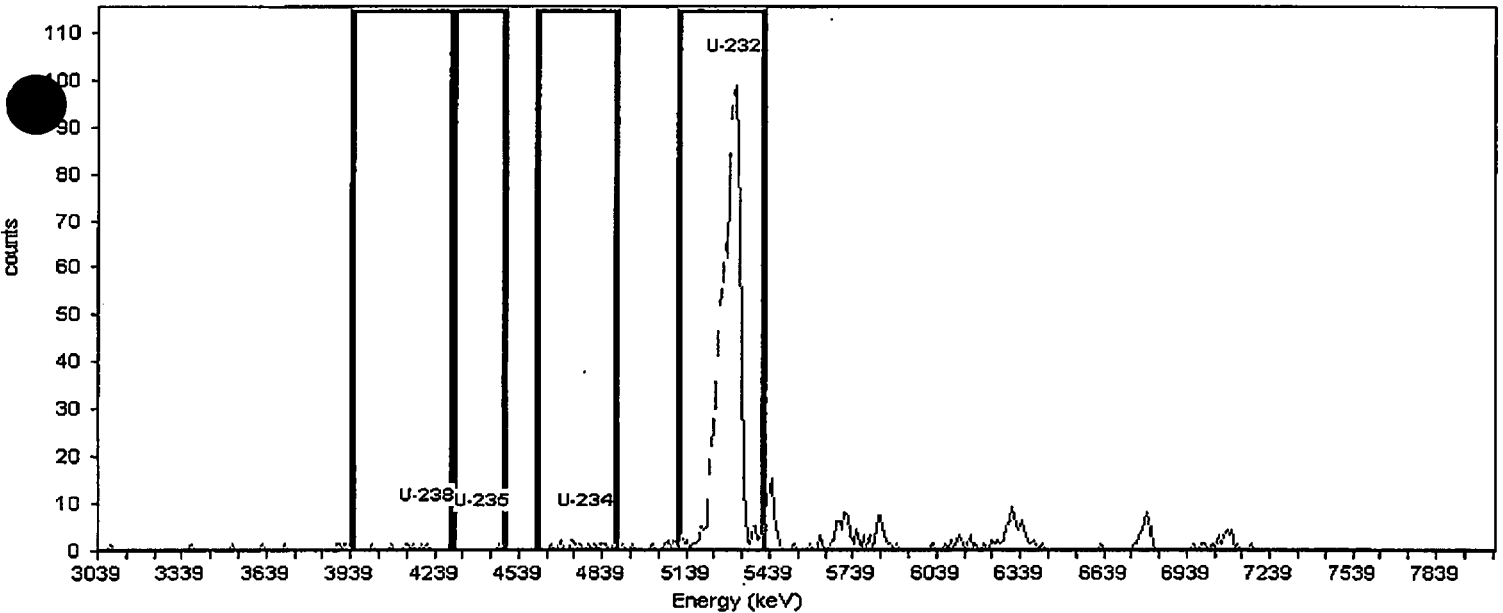
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-3MMB  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 46  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:03PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021046; Det: 46; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:47:15PM  
 Efficiency Calibration: C14021046  
 Efficiency: 30.58% +/- 0.16% TPU(2 sigma)  
 Energy Calibration: C14021046  
 Energy Cal: Gain = 9.8224 keV / Ch  
 Offset = 3,029.39 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 54.15%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.9	3942.9	4296.5	107.0	100.2	7.00	4.00	3.00	1.6E-002	3.6E-002	2.5E-002	6.5E-002
U-235	4414.4	4306.3	4483.1	13.3	99.7	2.00	1.00	1.00	5.5E-003	1.9E-002	1.3E-002	4.0E-002
U-234	4787.6	4601.0	4885.8	22.8	100.0	15.00	11.00	4.00	2.2E-002	5.6E-002	4.2E-002	9.9E-002
U-232	5318.0	5111.8	5416.2	75.3	100.1	803.00	18.00	785.00	2.4E+000	1.8E-001	5.6E-002	1.3E-001

Recorded By: *JP*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

*JA*

# ALS Laboratory Group - Fort Collins

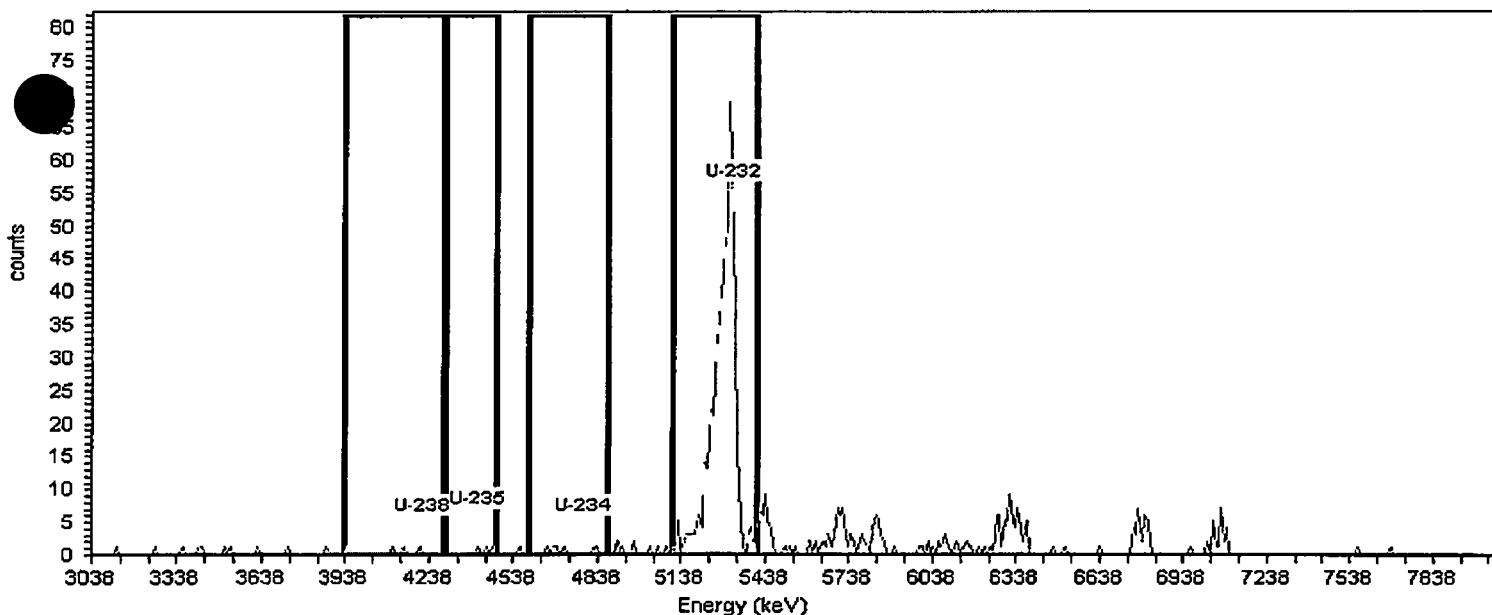
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-3PMB  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 47  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:03PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021047; Det: 47; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:47:41PM  
 Efficiency Calibration: C14021047  
 Efficiency: 30.42% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021047  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 32.10%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4204.0	3927.4	4283.1	.0	100.2	4.00	5.00	-1.00	0.0E+000	5.5E-002	4.8E-002	1.2E-001
U-235	4401.7	4293.0	4470.8	17.4	99.7	3.00	2.00	1.00	9.3E-003	4.1E-002	3.0E-002	8.6E-002
U-234	4777.1	4589.4	4876.0	180.6	100.0	6.00	10.00	-4.00	0.0E+000	7.4E-002	6.8E-002	1.6E-001
U-232	5310.7	5103.2	5409.5	68.9	100.1	492.00	29.00	463.00	1.4E+000	1.4E-001	1.2E-001	2.7E-001

Reported By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

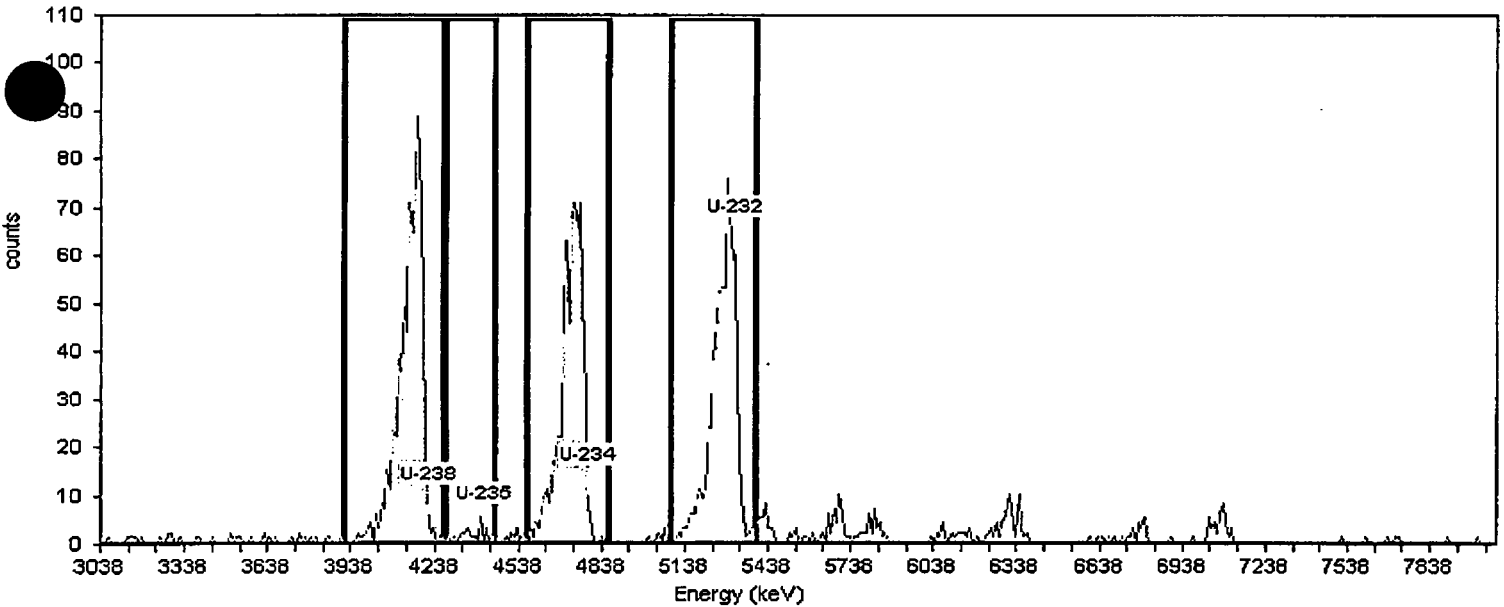
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-3LCS  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 25  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:04PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021025; Det: 25; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:03:30PM  
 Efficiency Calibration: C14021025  
 Efficiency: 29.18% +/- 0.20% TPU(2 sigma)  
 Energy Calibration: C14021025  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 46.42%



Nuclide Summary (ROI)												
Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4184.3	3907.6	4263.3	86.0	100.2	724.00	5.00	719.00	4.8E+000	7.2E-001	3.5E-002	8.7E-002
U-235	4381.9	4273.2	4451.1	90.6	99.7	24.00	5.00	19.00	1.3E-001	7.4E-002	3.5E-002	8.7E-002
U-234	4757.4	4569.6	4856.2	81.1	100.0	648.00	13.00	635.00	4.2E+000	6.5E-001	5.6E-002	1.3E-001
U-232	5291.0	5083.5	5389.8	88.7	100.1	676.00	34.00	642.00	2.1E+000	1.7E-001	9.3E-002	2.1E-001

Recorded By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

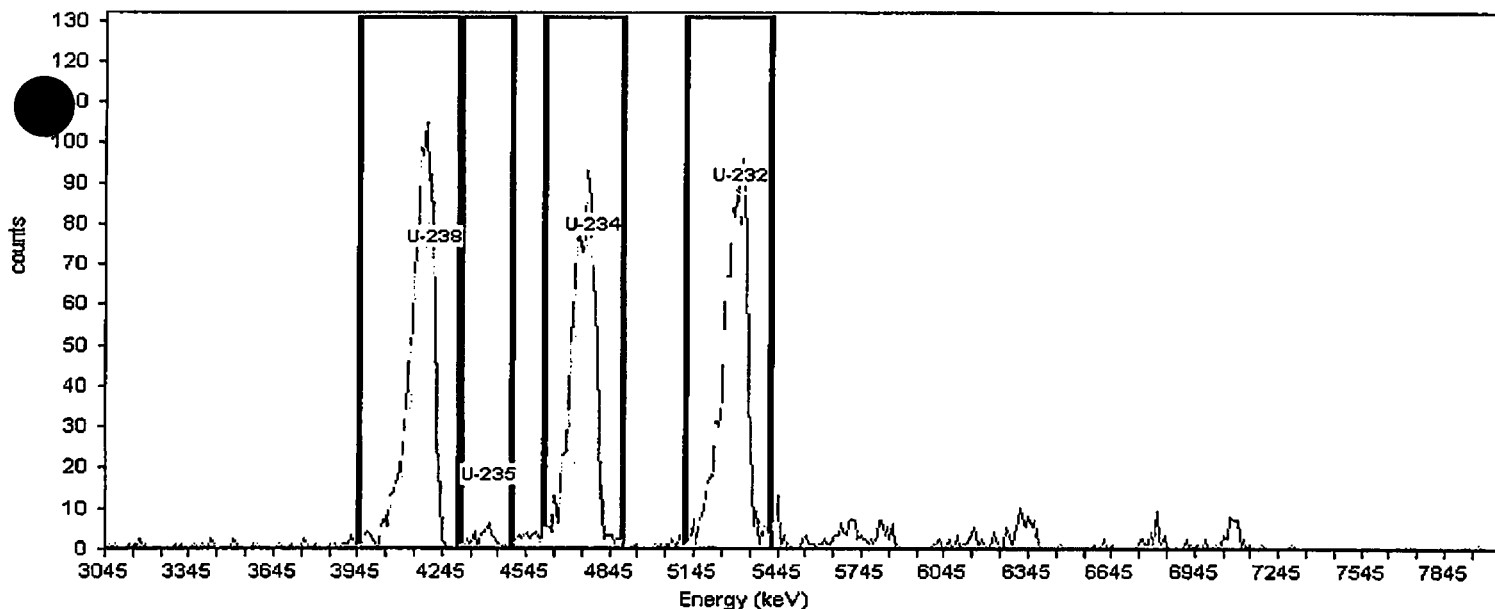
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-3LCSD  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 26  
 Batch Name: UAS140215-3\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/19/2014 2:58:00PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021026; Det: 26; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:04:02PM  
 Efficiency Calibration: C14021026  
 Efficiency: 30.73% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021026  
 Energy Cal: Gain = 9.8047 keV / Ch  
 Offset = 3,036.00 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 65.00%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4222.4	3947.8	4300.8	88.4	100.2	1,020.00	16.00	1,004.00	4.5E+000	6.2E-001	4.2E-002	9.6E-002
U-235	4418.5	4310.6	4487.1	75.2	99.7	35.00	7.00	28.00	1.3E-001	6.1E-002	2.8E-002	6.8E-002
U-234	4791.1	4604.8	4889.1	93.3	100.0	908.00	34.00	874.00	3.9E+000	5.5E-001	6.1E-002	1.3E-001
U-232	5320.5	5114.6	5418.6	93.1	100.1	982.00	35.00	947.00	2.9E+000	1.9E-001	6.4E-002	1.4E-001

Revised By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

ALS

Alpha Spectrometer Instrument Run Log

Date: 2/17/14 / 2/18/14

SOP 714; FORM 746r8.xls (10/2/07)

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
32	TAS140204-2.A	1402007-33	Th/F	300	JP
43		-34			
45		AS140204-2.MB			
46		PMB			
47		LCS			
81		LCS			
82	TAS140204-L.A	1402007-1	Th/F	300	JP
83		-2			
84		-3			
85		-4			
86		-5			
87		-6			
88		-7			
89		-8			
90		-9			
91		-10			
92		-11			
93		-12			
94		-13			
95		-14			
9	TAS140204-L.B	1402007-15	Th/F	300	JP
10		-16			
11		-17			
12		-18			

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
13	TAS140204-L.B	1402007-19	Th/F	300	JP
14		-20			
16		AS140204-1.MB			
29		PMB			
30		LCS			
31		LCS			
11	VAS140217-8-A	1401356-1	Vr/W	1000	JP
12		-10			
13		1401381-14			
14		1402062-6			
16		1402140-9			
25		AS140217-8.MB			
26		LCS			
9	VAS140215-3.A	1402167-1	Vr/F	1000	JP
10		-2			
29		-3			
30		-4			
31		-5			
32		-6			
43		-7			
45		-8			
46		-9			
47		-10			

h11112  
h118112

JP 2/18/14

Notes:

Reviewed by: JP  
 Date: 2/18/14

ALS

Alpha Spectrometer Instrument Run Log

Date: 2/19/14

SOP 714; FORM 746r8.xls (10/2/07)

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
54	AAS140204-1-B	AS140204-1LCS	Am F	300	JP
55		LCS			
56	AAS140204-2-A	1402007-21	Am F	300	JP
65		-22			
67		-23			
68		-24			
69		-25			
70		-26			
71		-27			
72		-28			
73		-29			
74		-30			
75		-31			
76		-32			
77		-33			
78		-34			
79		AS140204-2MMB			
80		PMB			
1	AAS140204-2-B	AS140204-2LCS	Am F	300	JP
2		LCS			
13	VAS140212-2-B	1402032-1	Ur F	720	JP
14		-3			
9	VAS140215-3-B	1402167-11	Ur F	1000	JP
10		-12			

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
11	VAS140215-3-B	1402167-13	Ur F	1000	JP
12		-14			
16		-15			
29		-16			
30		-17			
31		-18			
32		-19			
45		-20			
46		AS140215-3MMB			
47		PMB			
25		LCS			
26		LCS			
81	VAS140215-4-A	1402168-1	Ur F	1000	JP
82		-2			
83		-3			
84		-4			
85		-5			
86		-6			
87		-7			
88		-8			
89		-9			
90		-10			
91		-11			
92		-12			

Notes:

Reviewed by: JP  
Date: 2/19/14





## Section 6

# QUALITY ASSURANCE SUMMARY REPORTS

**6**



**No *NON-CONFORMANCE REPORTS* or *QUALITY ASSURANCE SUMMARY SHEETS* are included in this data package.**



## Section 7

# LABORATORY BENCH SHEETS

7

# Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AS140215-3

Prep Procedure: UIISO 1E-09 pCi/mL 1000 mL 1000 Mm

Analytical QASS / NCR? Y N NI

2/28

Prep Num	LabID	QC Type	Init Aliq	Fin Aliq	Units	Report Units	Cnt 1 File	Cnt 1 Ins/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Ins/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Ins/Det	Cnt 3 Pos Chk By	Notes
1	1402167-1	SMP	0.5	0.5	sample	uCi/ml	_21671	9	JP	_21671			_21671			A
1	1402167-2	SMP	0.5	0.5	sample	uCi/ml	_21672	10		_21672			_21672			
1	1402167-3	SMP	0.5	0.5	sample	uCi/ml	_21673	29		_21673			_21673			
1	1402167-4	SMP	0.5	0.5	sample	uCi/ml	_21674	30		_21674			_21674			
1	1402167-5	SMP	0.5	0.5	sample	uCi/ml	_21675	31		_21675			_21675			
1	1402167-6	SMP	0.5	0.5	sample	uCi/ml	_21676	32		_21676			_21676			
1	1402167-7	SMP	0.5	0.5	sample	uCi/ml	_21677	43		_21677			_21677			
1	1402167-8	SMP	0.5	0.5	sample	uCi/ml	_21678	45		_21678			_21678			
1	1402167-9	SMP	0.5	0.5	sample	uCi/ml	_21679	46		_21679			_21679			
1	1402167-10	SMP	0.5	0.5	sample	uCi/ml	_216710	47		_216710			_216710			
1	1402167-11	SMP	0.5	0.5	sample	uCi/ml	_216711	9	JP	_216711			_216711			B
1	1402167-12	SMP	0.5	0.5	sample	uCi/ml	_216712	10		_216712			_216712			
1	1402167-13	SMP	0.5	0.5	sample	uCi/ml	_216713	11		_216713			_216713			
1	1402167-14	SMP	0.5	0.5	sample	uCi/ml	_216714	12		_216714			_216714			
1	1402167-15	SMP	0.5	0.5	sample	uCi/ml	_216715	16		_216715			_216715			
1	1402167-16	SMP	0.5	0.5	sample	uCi/ml	_216716	29		_216716			_216716			
1	1402167-17	SMP	0.5	0.5	sample	uCi/ml	_216717	30		_216717			_216717			
1	1402167-18	SMP	0.5	0.5	sample	uCi/ml	_216718	31		_216718			_216718			
1	1402167-19	SMP	0.5	0.5	sample	uCi/ml	_216719	32		_216719			_216719			
1	1402167-20	SMP	0.5	0.5	sample	uCi/ml	_216720	45		_216720			_216720			
1	AS140215-3M	MB	0.5	0.5	sample	uCi/ml	_2153MB	46		_2153MB			_2153MB			
1	AS140215-3P	MB	0.5	0.5	sample	uCi/ml	_2153PB	47		_2153PB			_2153PB			
1	AS140215-3	LCS	0.5	0.5	sample	uCi/ml	_2153L	25		_2153L			_2153L			JP 2/21/14
1	AS140215-3	LCSD	0.5	0.5	sample	uCi/ml	_2153LD	26		_2153LD			_2153LD			JP 2/21/14

Tracer/Gamma Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016	

Spike Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016	
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016	

Prep Procedure: **UIISO**

Analytical QASS / NCR? Y

**N** *NA*  
Notes

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By
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S1 U-238 843.3610.100 20.357 DPM/ml 02/15/14 0.25 ml AW016

Sample Barcodes

1402167-1 AS140215-3PS1		1402167-2 AS140215-3PS2		1402167-3 AS140215-3PS3	
1402167-4 AS140215-3PS4		1402167-5 AS140215-3PS5		1402167-6 AS140215-3PS6	
1402167-7 AS140215-3PS7		1402167-8 AS140215-3PS8		1402167-9 AS140215-3PS9	
1402167-10 AS140215-3PS10		1402167-11 AS140215-3PS11		1402167-12 AS140215-3PS12	
1402167-13 AS140215-3PS13		1402167-14 AS140215-3PS14		1402167-15 AS140215-3PS15	
1402167-16 AS140215-3PS16		1402167-17 AS140215-3PS17		1402167-18 AS140215-3PS18	
1402167-19 AS140215-3PS19		1402167-20 AS140215-3PS20		AS140215-3MMB AS140215-3PS21	
AS140215-3PMB AS140215-3PS22		AS140215-3LCS AS140215-3PS23		AS140215-3LCSD AS140215-3PS24	

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Reporting Units

LabID:	TstGrpName:	RptUnits:
1402167-1	IsoU_PNV_Air Filter	uCi/ml
1402167-2	IsoU_PNV_Air Filter	uCi/ml
1402167-3	IsoU_PNV_Air Filter	uCi/ml
1402167-4	IsoU_PNV_Air Filter	uCi/ml
1402167-5	IsoU_PNV_Air Filter	uCi/ml
1402167-6	IsoU_PNV_Air Filter	uCi/ml
1402167-7	IsoU_PNV_Air Filter	uCi/ml
1402167-8	IsoU_PNV_Air Filter	uCi/ml
1402167-9	IsoU_PNV_Air Filter	uCi/ml
1402167-10	IsoU_PNV_Air Filter	uCi/ml
1402167-11	IsoU_PNV_Air Filter	uCi/ml
1402167-12	IsoU_PNV_Air Filter	uCi/ml
1402167-13	IsoU_PNV_Air Filter	uCi/ml
1402167-14	IsoU_PNV_Air Filter	uCi/ml
1402167-15	IsoU_PNV_Air Filter	uCi/ml
1402167-16	IsoU_PNV_Air Filter	uCi/ml
1402167-17	IsoU_PNV_Air Filter	uCi/ml
1402167-18	IsoU_PNV_Air Filter	uCi/ml
1402167-19	IsoU_PNV_Air Filter	uCi/ml
1402167-20	IsoU_PNV_Air Filter	uCi/ml

86 of 128

Prep Procedure: **UIISO**

Reviewed By: cas *cas*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  Y /  N Batch: *See Comments* Re-Prep? Y /  N Batch: *N/A* Prep QASS / NCR? Y /  N *N/A*

Prep SOP: PAI 778 Rev: 14  
 Prep SOP: NONE  
 Matrix Class: solid

Prep Analyst: Tandrae Elhart *TE*  
 Prep Date: 2/15/2014  
 Prep Dept: AP

Balance: 27  
 Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402167-1	SMP		0.5	0.5	As Received		<i>TE</i>	<i>2/18/14</i>	T1	
2	1	1402167-2	SMP		0.5	0.5	As Received				T1	
3	1	1402167-3	SMP		0.5	0.5	As Received				T1	
4	1	1402167-4	SMP		0.5	0.5	As Received				T1	
5	1	1402167-5	SMP		0.5	0.5	As Received				T1	
6	1	1402167-6	SMP		0.5	0.5	As Received				T1	
7	1	1402167-7	SMP		0.5	0.5	As Received				T1	
8	1	1402167-8	SMP		0.5	0.5	As Received				T1	
9	1	1402167-9	SMP		0.5	0.5	As Received				T1	
10	1	1402167-10	SMP		0.5	0.5	As Received				T1	
11	1	1402167-11	SMP		0.5	0.5	As Received				T1	
12	1	1402167-12	SMP		0.5	0.5	As Received				T1	
13	1	1402167-13	SMP		0.5	0.5	As Received				T1	
14	1	1402167-14	SMP		0.5	0.5	As Received				T1	
15	1	1402167-15	SMP		0.5	0.5	As Received				T1	
16	1	1402167-16	SMP		0.5	0.5	As Received				T1	
17	1	1402167-17	SMP		0.5	0.5	As Received				T1	
18	1	1402167-18	SMP		0.5	0.5	As Received				T1	
19	1	1402167-19	SMP		0.5	0.5	As Received				T1	
20	1	1402167-20	SMP		0.5	0.5	As Received				T1	
21	1	AS140215-3M	MB		0.5	0.5	As Received				T1	
22	1	AS140215-3P	MB		0.5	0.5	As Received				T1	
23	1	AS140215-3	LCS		0.5	0.5	As Received				S1,T1	
24	1	AS140215-3	LCSD		0.5	0.5	As Received				S1,T1	

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# Radiochemistry Worksheet

ALS Environmental -- FC

Prep Batch: AS140213-8

Prep Procedure: UIISO

Reviewed By: cas *cas*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  (Y)  (N) Batch: See comments Re-Prep?  (Y)  (N) Batch: NIA Prep QASS / NCR?  (Y)  (N) NIA

Prep SOP: PAI 778 Rev: 14 *2/11/14* Prep Analyst: Tandrae Elhart Balance: 27  
 Prep SOP: NONE Prep Date: 2/15/2014 Balance:  
 Matrix Class: solid Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
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**Comments**  
 Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffled at 600C. After muffling, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: Tandrae Elhart Date: 2/15/2014  
 Witnessed By: Emily R. Lyons Date: 2/15/2014

Trace/Carrier Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016

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Prep Procedure: **UIISO**

**Prep Batch Not Validated!!!**

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: \_\_\_\_\_ Re-Prep? Y / N Batch: \_\_\_\_\_ Prep QASS / NCR? Y / N \_\_\_\_\_

Prep SOP: PAI 778 Rev: 14

Prep SOP: NONE

Matrix Class: solid

Prep Analyst: Tabrae Elhart *TE*

Prep Date: 2/15/2014

Prep Dept: AP

Balance:

Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402167-1	SMP		0.5	0.5	As Received	<i>beaker ID</i>			T1	
2	1	1402167-2	SMP		0.5	0.5	As Received				T1	
3	1	1402167-3	SMP		0.5	0.5	As Received				T1	
4	1	1402167-4	SMP		0.5	0.5	As Received				T1	
5	1	1402167-5	SMP		0.5	0.5	As Received				T1	
6	1	1402167-6	SMP		0.5	0.5	As Received				T1	
7	1	1402167-7	SMP		0.5	0.5	As Received				T1	
8	1	1402167-8	SMP		0.5	0.5	As Received				T1	
9	1	1402167-9	SMP		0.5	0.5	As Received				T1	
10	1	1402167-10	SMP		0.5	0.5	As Received				T1	
11	1	1402167-11	SMP		0.5	0.5	As Received				T1	
12	1	1402167-12	SMP		0.5	0.5	As Received				T1	
13	1	1402167-13	SMP		0.5	0.5	As Received				T1	
14	1	1402167-14	SMP		0.5	0.5	As Received				T1	
15	1	1402167-15	SMP		0.5	0.5	As Received				T1	
16	1	1402167-16	SMP		0.5	0.5	As Received				T1	
17	1	1402167-17	SMP		0.5	0.5	As Received				T1	
18	1	1402167-18	SMP		0.5	0.5	As Received				T1	
19	1	1402167-19	SMP		0.5	0.5	As Received				T1	
20	1	1402167-20	SMP		0.5	0.5	As Received				T1	
21	1	AS140215-3M	MB		1	1	As Received	<i>464</i>			T1	
22	1	AS140215-3P	MB		1	1	As Received	<i>491</i>			T1	
23	1	AS140215-3	LCS		1	1	As Received	<i>493</i>			S1,T1	
24	1	AS140215-3	LCSD		1	1	As Received	<i>905</i>			S1,T1	

89 10 68

Prep Procedure: UIISO

Prep Batch Not Validated!!!

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: Re-Prep? Y / N Batch: Prep QASS / NCR? Y / N

Prep SOP: PAI 778 Rev: 14

Prep Analyst: Tamrae Elhart

Balance:

Prep SOP: NONE

Prep Date: 2/15/2014

Balance:

Matrix Class: solid

Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
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Comments

Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffled at 600C. After muffling, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: TE Date: 2/15/14

Witnessed By: GM Date: 2-15-14

Tracer/Carrier Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016	

Spike Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016	
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016	
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016	

10.29.14

Exp 6.20.14

## Sample Condition Form (Solids)

Analyst: 7C

Analysis Date: 2/15/14

Method: Prep

		Sample Condition (Visual Appearance of Analysis Aliquot at Time of Prep)		
Work Order	Sample ID	Dry/Wet/Moist	Texture	Remarks
1402167	1	dry	filter	1-half filter
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			
✓	20	✓	✓	

**1402167 Filter Weight Spreadsheet**

<b>Sample ID</b>	<b>Beaker ID</b>	<b>Beaker, Watch glass wt (g)</b>	<b>Beaker, Watch Glass, Filter Wt (g)</b>	<b>Beaker, Watch Glass, Ashed Filter Wt (g)</b>	<b>Net Filter Wt (g)</b>	<b>Net Ash Wt (g)</b>
1402167-1	202	54.6917	55.0725	54.6944	0.3808	0.0027
1402167-2	456	57.2456	57.6347	57.2458	0.3891	0.0002
1402167-3	209	57.5877	57.9785	57.5889	0.3908	0.0012
1402167-4	452	58.8333	59.2373	58.8357	0.404	0.0024
1402167-5	450	55.5945	55.9822	55.5992	0.3877	0.0047
1402167-6	463	57.0523	57.4656	57.0548	0.4133	0.0025
1402167-7	468	58.7509	59.1653	58.7537	0.4144	0.0028
1402167-8	206	56.1955	56.5797	56.1967	0.3842	0.0012
1402167-9	208	54.3164	54.7354	54.318	0.419	0.0016
1402167-10	459	56.6149	57.0517	56.6153	0.4368	0.0004
1402167-11	L46	54.9947	55.4141	54.9963	0.4194	0.0016
1402167-12	444	54.4715	54.8613	54.4717	0.3898	0.0002
1402167-13	LL13X	55.5252	55.9139	55.5263	0.3887	0.0011
1402167-14	L59	58.5514	58.9856	58.5553	0.4342	0.0039
1402167-15	461	54.9631	55.3521	54.9639	0.389	0.0008
1402167-16	469	58.0119	58.405	58.0134	0.3931	0.0015
1402167-17	204	56.162	56.5652	56.1627	0.4032	0.0007
1402167-18	200	56.241	56.6052	56.2427	0.3642	0.0017
1402167-19	443	56.8637	57.2702	56.864	0.4065	0.0003
1402167-20	440	55.1706	55.5556	55.1714	0.385	0.0008

Balance: 27

Note: Prior to aliquotting, the filters were cut in half. Only one half of the filter was placed into the weighed beaker, spiked/traced, and muffled. Following muffling, the beaker/filter was reweighed to determine ash weight.

Batch: AS140215-3

**U Solid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Conc. Hydrofluoric Acid	0000061467
Boric Acid	J23624
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MK BK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467

**U Liquid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MK BK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467



## Section 8

# STANDARDS TRACEABILITY DOCUMENTS

8

Prepare a working dilution of 843.3610.56

1. Density of 1M HNO<sub>3</sub>, lot # K16045  
 Mass of 100mL vol. flask: 68.2981g Balance # 12  
 Mass of flask & 100mL acid: 171.5705g Balance# 12  
 Net Mass: 103.2724g  
 Density: 1.0327g/mL

2. Mass of 843.3610.56 transferred:  
 Mass of open empty nalgene: 74.7438 Balance# 12  
 Mass of nalgene & standard: 82.4483 Balance# 12  
 Net mass of standard transferred: 7.7045g Balance# NA

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1003.9g Balance# 26  
 Mass of empty nalgene (from above): 74.7438 Balance# 12  
 Net mass of new dilution: 929.1562g Balance# NA

4. Final activity calculation:

(U-238):  $2377.34 \text{ dpm/g} \left( \frac{7.7045 \text{ g}}{929.1562 \text{ g}} \right) (1.0327 \text{ g/mL}) = 20.36 \text{ dpm/mL}$

(U-235):  $109.44 \text{ dpm/g} \left( \frac{7.7045 \text{ g}}{929.1562 \text{ g}} \right) (1.0327 \text{ g/mL}) = 0.9294 \text{ dpm/mL}$

(U-234):  $2289.91 \text{ dpm/g} \left( \frac{7.7045 \text{ g}}{929.1562 \text{ g}} \right) (1.0327 \text{ g/mL}) = 19.61 \text{ dpm/mL}$

Std ID: 843.3610.100

Description: U-238

Expiration: 8/4/2012

Activity: 20.36 dpm/mL

2s Uncertainty: 0.12 dpm/mL

Ref. Date: 8/1/1977 1997

Ref Time: N/A JP 7/19/11

Prep Date: 8/3/2011 Prep by: TE

Matrix/Comp. 1M HNO<sub>3</sub>

Half Life (y): 4.47E+09

Reverification Log		
Analysis Date	Initials	Expiration Date
7/11/12	JP	7/10/13
6/20/13	JP	6/20/2014

Continued on Page

Read and Understood By

TE

Signed

8/3/11

Date

Renee Hall

Signed

10/21/11

Date

Prepare an intermediate Dilution of RSO # 843

Diluent is (M)  $HNO_3$  lot # H31041  
from Pg. 54 this logbook (3610)  
 $\rho = 1.0283 \text{ g/ml}$

Mass of Parent Transferred

Mass of Open full Ampule + beaker	38.1504 g	12
Mass of Empty Ampule + beaker	32.9991 g	1
Net Mass transferred	5.1513 g	

Dilute to Final Volume

Mass of Open Empty 40 ml VOA	21.6337 g	12
Mass of Open full Vial	53.0961 g	1
Net mass of New Dilution	31.4624 g	

Final Activity (U-238)


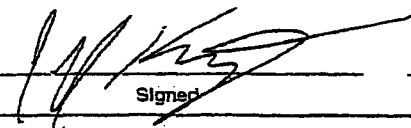
$$\left( \frac{247.0 \text{ Bq}}{\text{g}} \right) \left( \frac{60 \text{ dpm}}{\text{Bq}} \right) \left( \frac{5.1513 \text{ g}}{31.4624 \text{ g}} \right) = \frac{2382.5 \text{ dpm}}{2372.34 \text{ g}}$$

Final activity (U-238): 109.44 dpm/g  
(RSO: 843) = 11.14 Bq/g

Final activity (U-234): 2289.91 dpm/g  
(RSO: 843) = 233.1 Bq/g

Continued on Page

Read and Understood By


4/23/10

5/11/10

Signed \_\_\_\_\_ Date \_\_\_\_\_ Signed \_\_\_\_\_ Date \_\_\_\_\_





# National Institute of Standards & Technology Certificate

RSO #  
843  
rel 2-20-07

## Standard Reference Material 4321C Natural Uranium Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive uranium-238, uranium-235, and uranium-234 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. The solution, whose composition is specified in Table 1, is contained in a flame-sealed, 5 mL, NIST, borosilicate-glass ampoule (see Note 1)\*.

The certified massic activities for the uranium isotopes at a Reference Time of 1200 EST, 1 August 1997 are:

Uranium-238:  $(242.0 \pm 1.5) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-235:  $(11.14 \pm 0.07) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-234:  $(233.1 \pm 2.2) \text{ Bq}\cdot\text{g}^{-1}$

Additional physical, chemical, and radiological properties for the SRM, as well as details on the standardization method, are given in Table 1. Uncertainty intervals for certified quantities are expanded ( $k=2$ ) uncertainties calculated according to the ISO and NIST Guidelines (see Note 2). Table 2 contains a specification of the components that comprise the uncertainty analyses.

The certification of this SRM, within the measurement uncertainties specified, is valid for at least five (5) years after receipt. The solution matrix, in an unopened ampoule, is believed to be indefinitely homogeneous and stable, within its half-life-dependent, useful lifetime. NIST will monitor this material and will report any substantive changes in certification to the purchaser. Should any of the certified values change, purchasers of this SRM will be notified of the change by NIST.

This SRM may represent a radiological hazard and a chemical hazard. Consult the Material Safety Data Sheet (MSDS), enclosed with the SRM shipment, for details (see Note 1).

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dr. M.P. Unterwiesing, Acting Group Leader. The overall technical direction and physical measurements leading to certification were provided by Dr. L.L. Lucas of the Radioactivity Group. The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program.

Gaithersburg, Maryland 20899  
November 1997

Text revised and expiration date extended February 2007

Lisa R. Karam, Deputy Chief  
Ionizing Radiation Division

Robert L. Watters, Jr., Chief  
Measurement Services Division

Table 1. Properties of SRM 4321C

Certified values

Radionuclides	Natural Uranium (Mixture of $^{238}\text{U}$ , $^{235}\text{U}$ , and $^{234}\text{U}$ )
Reference time	1200 EST, 1 August 1997
Massic activities of the solution	$^{238}\text{U}$ : 242.0 Bq·g <sup>-1</sup> $^{235}\text{U}$ : 11.14 Bq·g <sup>-1</sup> $^{234}\text{U}$ : 233.1 Bq·g <sup>-1</sup>
Relative expanded uncertainties ( $k=2$ )	$^{238}\text{U}$ : 0.60% (see Note 2)* $^{235}\text{U}$ : 0.60% (see Note 2) $^{234}\text{U}$ : 0.96% (see Note 2)

Uncertified information

Source description	Liquid in flame-sealed, 5 mL NIST borosilicate ampoule (see Note 1)
Solution composition	1.0 mol·L <sup>-1</sup> HCl with 30 mg UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> per gram of solution
Solution density	(1.053 ± 0.001) g·mL <sup>-1</sup> at 21.4 °C (see Note 3)
Solution mass	(5.258 ± 0.002) g (see Note 3)
Mass fraction of uranium	(0.01960 ± 0.00010) g·g <sup>-1</sup> (see Note 3)
Photon-emitting impurities	None detected (see Note 4)
Half-lives used [1]	$^{238}\text{U}$ : (4.468 ± 0.003) × 10 <sup>8</sup> a $^{235}\text{U}$ : (7.038 ± 0.005) × 10 <sup>8</sup> a $^{234}\text{U}$ : (2.455 ± 0.006) × 10 <sup>5</sup> a
Calibration method (and instruments)	The certified massic activity for natural uranium was obtained by mass spectrometer, silicon surface-barrier detector, and 4πβ and scintillation (LS) counting systems.

\* See Note 5

Table 2. Uncertainty evaluation for the massic activity for SRM 4321C

	Uncertainty component	Assessment Type †	Relative standard uncertainty contribution on massic activity of Natural Uranium (%)
1	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for $^{238}\text{U}$	A	0.001
2	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for $^{235}\text{U}$	A	0.07
3	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for $^{234}\text{U}$	A	0.3
4	Half life of $^{238}\text{U}$ ; standard uncertainty of the half-life	A	0.07
5	Half life of $^{235}\text{U}$ ; standard uncertainty of the half-life	A	0.07
6	Half life of $^{234}\text{U}$ ; standard uncertainty of the half-life	A	0.24
7	Uranium mass fraction in SRM 960; from SRM960 certificate	B	0.003
8	Quantitative dissolution	B	0.25
9	Gravimetric (mass) measurements	B	0.10
10	Limit for photon-emitting impurities	B	0.10
	Relative combined standard uncertainty		
	$^{238}\text{U}$		0.30
	$^{235}\text{U}$		0.50
	$^{234}\text{U}$		0.48
	Relative expanded uncertainty ( $k = 2$ )		
	$^{238}\text{U}$		0.60
	$^{235}\text{U}$		0.60
	$^{234}\text{U}$		0.96

† = (A) denotes evaluation by statistical methods; (B) denotes evaluation by other methods.

## NOTES

Note 1. Refer to <http://physics.nist.gov/Divisions/Div846/srm.html> for the standardized ampoule dimensions and for assistance and instructions on how to properly open an ampoule. Information on additional storage and handling requirements is also included in the website.

Note 2. The uncertainties on certified values are expanded uncertainties,  $U = k u_c$ . The quantity  $u_c$  is the combined standard uncertainty calculated according to the ISO and NIST Guides (see references [2] and [3]). The combined standard uncertainty is multiplied by a coverage factor of  $k = 2$  and was chosen to obtain an approximate 95 % level of confidence.

Note 3. The stated uncertainty is two times the standard uncertainty. See reference [3].

Note 4. The estimated lower limits of detection for photon-emitting impurities, expressed as massic photon emission rates are:

1.4  $s^{-1} \cdot g^{-1}$  for 8 keV < E < 59 keV

1.1  $s^{-1} \cdot g^{-1}$  for 67 keV < E < 88 keV

0.5  $s^{-1} \cdot g^{-1}$  for 102 keV < E < 197 keV

0.3  $s^{-1} \cdot g^{-1}$  for 205 keV < E < 762 keV

0.2  $s^{-1} \cdot g^{-1}$  for 770 keV < E < 996 keV, and

0.1  $s^{-1} \cdot g^{-1}$  for 1006 keV < E < 1900 keV

provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of  $^{235}\text{U}$ ,  $^{238}\text{U}$ , or their progeny

Note 5. The stated uncertainty is the standard uncertainty. See reference [3].

## REFERENCES

- [1] Evaluated Nuclear Structure Data File (ENSDF), online database, National Nuclear Data Center, Brookhaven Laboratory (Upton, NY), August 2007. Refer to <http://www.nndc.bnl.gov/ensdf/>
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993 (corrected and reprinted, 1995). Available from Global Engineering Documents, 12 Inverness Way East, Englewood, CO 80112, U.S.A. Telephone 1-800-854-7179.
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.

TE 10/22/13

Prepare a working dilution of 914.3610.62

1. Density of 1M HNO3, lot # 000045470  
 Mass of 100mL vol. flask: 66.4318g Balance # 12  
 Mass of flask & 100mL acid: 169.6212g Balance# 12  
 Net Mass: 103.1894g  
 Density: 1.0319 g/mL

2. Mass of 914.3610.62 transferred:  
 Mass of open empty nalgene: 75.4800g Balance# 12  
 Mass of nalgene & standard: 78.3581g Balance# 12  
 Net mass of standard transferred: 2.8781g Balance# NA

TE 10/22/13

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1173.7g Balance# 26  
 Mass of empty nalgene (from above): 75.4800g Balance# 12  
 Net mass of new dilution: 1098.22g Balance# NA

4. Final activity calculation:

$$7261.8 \text{ dpm/g} \left( \frac{2.8781 \text{ g}}{1098.22 \text{ g}} \right) (1.0319 \text{ g/mL}) = 19.64 \text{ dpm/mL}$$

TE 10/22/13

JP 11/5/13

Std ID: 914.4095.46

Description: U-232

Expiration: 10/29/2014

Activity: 19.64 dpm/mL

2s Uncertainty: 0.96 dpm/mL

Ref. Date: 5/27/2010

Ref Time: N/A

Prep Date: 10/22/2013 Prep by: TE

Matrix/Comp. 1M HNO3

Half Life (y): 6.89E+01

JP 11/5/13

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 11/5/13

Continued on Page

7 Eht 10/22/13  
Signed Date

[Signature]  
Read and Understood By Signed

11/05/13  
101 of 128  
Date

Prepare an Intermediate dilution of RCO # 914

Diluent is  $1M HNO_3$  Act lot # J11044

Mass of parent transferred		bal #
Mass of Open Full Ampule + Beaker	38.0670 g	12
Mass of Empty Ampule + Beaker	32.9311 g	12
Net mass transferred	5.1379 g	


Dilute to final Mass

Mass of Vial, Std, + Diluent	58.6556 g	12
Mass of Vial	21.5781 g	12
Net Mass of New dilution	37.0574 g	

Final Activity

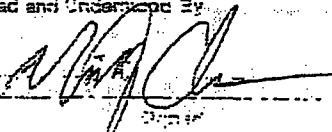
$$\left(4.552 \times 10^5 \text{ Bq}\right) \left(\frac{60 \text{ dm}}{1 \text{ Bq}}\right) \left(\frac{5.1379 \text{ g}}{5.21457 \text{ g}}\right) \left(\frac{1}{37.0574 \text{ g}}\right) = 7261.8 \text{ Bq}$$

Continued on Page

  
Signed

6/4/10

Read and Understood By

  
Date

06-17-2010  
Date



**Eckert & Ziegler**  
Analytics

*Rec  
6-1-10  
R50# 914*

1380 Seaboard Industrial Blvd.  
Atlanta, Georgia 30318  
Tel 404-352-8677  
Fax 404-352-2837  
www.analyticsinc.com

**CERTIFICATE OF CALIBRATION**  
Standard Radionuclide Source

82306-307

U-232 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins  
P.O. No.: 13626 04-28-10, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.18, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			$\alpha$	$\beta$	U	
U-232	2.617E+04	4.852E+03	0.5	2.4	4.9	05/27/2010

\*Uncertainty: U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1287, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%. 5.21450 g 1M HNO3 solution, carrier free.

Source Prepared by: *W. Mao*  
W, Mao, Radiochemist

QA Approved: *J. D. McCorvey*  
J. D. McCorvey, QA Manager Alternate

Date: 5/27/10

ANA Form 003 Rev. --

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office  
24937 Avenue Tibbitts Valencia, California 91355

Laboratory  
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318



## Section 9

# **ADDITIONAL SUPPORTING DOCUMENTATION**





## **Alpha Spectroscopy**

# **Quality Control Data**

# **Weekly Background, Energy, and Efficiency Calibrations**

# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402167

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Thursday, February 20, 2014  
12:13:10 PM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402167-1 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	9a	C14021009	2/10/2014	31.42	Pass	29.48	30.00	32.06	32.58
					B14021009	2/10/2014	0.3920	Pass	0.0000	0.0498	0.4998	0.7500
					C14021009	2/10/2014	5569.7	Pass	5496.0	5506.0	5586.0	5596.0
1402167-2 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	10b	C14021010	2/10/2014	31.19	Pass	29.79	30.31	32.41	32.93
					B14021010	2/10/2014	0.3040	Pass	0.0000	0.0498	0.4998	0.7500
					C14021010	2/10/2014	5559.6	Pass	5486.2	5496.2	5576.2	5586.2
1402167-3 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	29	C14021029	2/10/2014	27.70	Warning	27.50	27.99	29.92	30.40
					B14021029	2/10/2014	0.3910	Pass	0.0000	0.0500	0.5000	0.7500
					C14021029	2/10/2014	5557.7	Pass	5486.0	5496.0	5576.0	5586.0
1402167-4 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	30	C14021030	2/10/2014	28.09	Pass	26.99	27.46	29.36	29.83
					B14021030	2/10/2014	0.4190	Pass	0.0000	0.0500	0.5000	0.7500
					C14021030	2/10/2014	5546.0	Pass	5514.0	5524.0	5604.0	5614.0
1402167-5 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	31	C14021031	2/10/2014	29.21	Pass	28.09	28.58	30.56	31.05
					B14021031	2/10/2014	0.3950	Pass	0.0000	0.0500	0.5000	0.7500
					C14021031	2/10/2014	5557.7	Pass	5496.0	5506.0	5586.0	5596.0
1402167-6 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	32	C14021032	2/10/2014	29.03	Pass	27.66	28.16	30.08	30.58
					B14021032	2/10/2014	0.3190	Pass	0.0000	0.0500	0.5000	0.7500
					C14021032	2/10/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
1402167-7 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	43	C14021043	2/10/2014	32.34	Pass	30.49	31.03	33.15	33.69
					B14021043	2/10/2014	0.4360	Pass	0.0000	0.0498	0.4998	0.7500
					C14021043	2/10/2014	5567.7	Pass	5496.0	5506.0	5586.0	5596.0
1402167-8 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	45	C14021045	2/10/2014	31.65	Pass	30.63	31.18	33.30	33.85
					B14021045	2/10/2014	0.4130	Pass	0.0000	0.0498	0.4998	0.7500
					C14021045	2/10/2014	5546.0	Pass	5496.0	5506.0	5586.0	5596.0
1402167-9 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	46	C14021046	2/10/2014	30.58	Pass	29.63	30.16	32.22	32.75
					B14021046	2/10/2014	0.3270	Pass	0.0000	0.0498	0.4998	0.7500
					C14021046	2/10/2014	5543.9	Pass	5505.8	5515.8	5595.8	5605.8

Data Package ID: UAS1402167-1

106 Date Printed: Friday, February 21, 2014	Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
		Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
CI - The Analysis Date exceeds the Calibration Date by more than 14 days.					

# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402167

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Thursday, February 20, 2014  
12:13:10 PM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402167-10 Spectrum #1 2/18/2014	SMP	AS140215-3 AS140215-3UR	UIISO	47	C14021047	2/10/2014	30.42	Warning	30.32	30.87	32.97	33.52
					B14021047	2/10/2014	0.3520	Pass	0.0000	0.0498	0.4998	0.7500
					C14021047	2/10/2014	5557.7	Pass	5507.7	5517.7	5597.7	5607.7
1402167-11 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	9a	C14021009	2/10/2014	31.42	Pass	29.48	30.00	32.06	32.58
					B14021009	2/10/2014	0.3920	Pass	0.0000	0.0498	0.4998	0.7500
					C14021009	2/10/2014	5569.7	Pass	5496.0	5506.0	5586.0	5596.0
1402167-12 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	10b	C14021010	2/10/2014	31.19	Pass	29.79	30.31	32.41	32.93
					B14021010	2/10/2014	0.3040	Pass	0.0000	0.0498	0.4998	0.7500
					C14021010	2/10/2014	5559.6	Pass	5486.2	5496.2	5576.2	5586.2
1402167-13 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	11a	C14021011	2/10/2014	30.43	Pass	29.69	30.21	32.29	32.81
					B14021011	2/10/2014	0.4130	Pass	0.0000	0.0498	0.4998	0.7500
					C14021011	2/10/2014	5559.6	Pass	5497.0	5507.0	5587.0	5597.0
1402167-14 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	12a	C14021012	2/10/2014	30.32	Pass	29.29	29.80	31.86	32.37
					B14021012	2/10/2014	0.3430	Pass	0.0000	0.0498	0.4998	0.7500
					C14021012	2/10/2014	5559.6	Pass	5507.7	5517.7	5597.7	5607.7
1402167-15 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	16a	C14021016	2/10/2014	29.83	Pass	27.91	28.41	30.35	30.85
					B14021016	2/10/2014	0.3160	Pass	0.0000	0.0498	0.4998	0.7500
					C14021016	2/10/2014	5549.7	Pass	5497.9	5507.9	5587.9	5597.9
1402167-16 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	29	C14021029	2/10/2014	27.70	Warning	27.50	27.99	29.92	30.40
					B14021029	2/10/2014	0.3910	Pass	0.0000	0.0500	0.5000	0.7500
					C14021029	2/10/2014	5557.7	Pass	5486.0	5496.0	5576.0	5586.0
1402167-17 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	30	C14021030	2/10/2014	28.09	Pass	26.99	27.46	29.36	29.83
					B14021030	2/10/2014	0.4190	Pass	0.0000	0.0500	0.5000	0.7500
					C14021030	2/10/2014	5546.0	Pass	5514.0	5524.0	5604.0	5614.0
1402167-18 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	31	C14021031	2/10/2014	29.21	Pass	28.09	28.58	30.56	31.05
					B14021031	2/10/2014	0.3950	Pass	0.0000	0.0500	0.5000	0.7500
					C14021031	2/10/2014	5557.7	Pass	5496.0	5506.0	5586.0	5596.0

Data Package ID: UAS1402167-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
CI - The Analysis Date exceeds the Calibration Date by more than 14 days.				

# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402167

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Thursday, February 20, 2014  
12:13:10 PM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402167-19 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	32	C14021032	2/10/2014	29.03	Pass	27.66	28.16	30.08	30.58
					B14021032	2/10/2014	0.3190	Pass	0.0000	0.0500	0.5000	0.7500
					C14021032	2/10/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
1402167-20 Spectrum #1 2/19/2014	SMP	AS140215-3 AS140215-3UR	UIISO	45	C14021045	2/10/2014	31.65	Pass	30.63	31.18	33.30	33.85
					B14021045	2/10/2014	0.4130	Pass	0.0000	0.0498	0.4998	0.7500
					C14021045	2/10/2014	5546.0	Pass	5496.0	5506.0	5586.0	5596.0
AS140215-3M Spectrum #1 2/19/2014	MB	AS140215-3 AS140215-3UR	UIISO	46	C14021046	2/10/2014	30.58	Pass	29.63	30.16	32.22	32.75
					B14021046	2/10/2014	0.3270	Pass	0.0000	0.0498	0.4998	0.7500
					C14021046	2/10/2014	5543.9	Pass	5505.8	5515.8	5595.8	5605.8
AS140215-3P Spectrum #1 2/19/2014	MB	AS140215-3 AS140215-3UR	UIISO	47	C14021047	2/10/2014	30.42	Warning	30.32	30.87	32.97	33.52
					B14021047	2/10/2014	0.3520	Pass	0.0000	0.0498	0.4998	0.7500
					C14021047	2/10/2014	5557.7	Pass	5507.7	5517.7	5597.7	5607.7
AS140215-3 Spectrum #1 2/19/2014	LCS	AS140215-3 AS140215-3UR	UIISO	25	C14021025	2/10/2014	29.18	Pass	26.95	27.42	29.32	29.79
					B14021025	2/10/2014	0.4650	Pass	0.0000	0.0500	0.5000	0.7500
					C14021025	2/10/2014	5557.7	Pass	5496.0	5506.0	5586.0	5596.0
AS140215-3 Spectrum #1 2/19/2014	LCSD	AS140215-3 AS140215-3UR	UIISO	26	C14021026	2/10/2014	30.73	Pass	29.40	29.92	31.98	32.50
					B14021026	2/10/2014	0.4800	Pass	0.0000	0.0498	0.4998	0.7500
					C14021026	2/10/2014	5546.0	Pass	5496.0	5506.0	5586.0	5596.0

Data Package ID: UAS1402167-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
				CI - The Analysis Date exceeds the Calibration Date by more than 14 days.

# Alpha Spec Calibration Source Re-Certification

Recalibration performed by Isotope Products Laboratories

**Primary Certified Source**

Source PA ID: 190  
 Planchet Label: 9  
 Recalibrated on: 10/15/2013  
 Received by ALS on: 10/18/2013

Values from certificate	
Source ID:	92MX223027
Total Activity:	3745.2 dpm
Ref. Date:	10/15/2013

Nuclide	Act (Bq)	Act (dpm)	Half-Life (yrs)	Decay Corrected
U-234:	49.54	2972.4	2.48E+05	2972.40 dpm
U-235:	1.09	65.58	7.04E+08	65.58 dpm
Am-241:	11.79	707.4	432.17	707.38 dpm
TOTAL				3745.36 dpm

**Efficiency Determination for Detector:**

13

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Total cpm	Known dpm	Detector efficiency
92MX223027	190	97-19-103-06	10/21/13	7688	32739	1135	2100		1187.43	3745.36	31.70%

**Sources 1 through 8 activity determination**

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Detector Efficiency	Am-241 dpm	U-234 dpm	U-235 dpm	Combined dpm
92MX2203026	182	97-19-103-01	10/21/13	13543	81484	2689	2100		31.70%	1220.49	7343.29	242.33	8806.10
92MX2203028	183	97-19-103-02	10/21/13	15830	158715	4155	2100		31.70%	1428.59	14123.06	374.45	15924.09
92MX2203024	184	97-19-103-03	10/21/13	71784	74298	2052	2100		31.70%	6467.33	6895.69	164.92	13347.94
92MX2203021	185	97-19-103-04	10/21/13	22944	62381	2198	2100		31.70%	2067.70	5621.74	186.08	7887.52
92MX2203025	186	97-19-103-05	10/21/13	103302	124917	3425	2100		31.70%	9309.51	11257.44	349.86	20875.61
92MX2203022	187	97-19-103-06	10/21/13	78934	84490	2349	2100		31.70%	7113.48	7814.19	211.69	14939.36
92MX2203023	188	97-19-103-07	10/21/13	48085	71762	1847	2100		31.70%	4153.15	6467.15	189.45	10786.75
92MX2203029	189	97-19-103-08	10/21/13	34624	218016	6721	2100		31.70%	3120.29	19647.47	605.69	23373.45

**Efficiency Verification**

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	Count dur (s)	Total cpm	Known dpm	Detector efficiency	FPD	FLAG
92MX223027	190	97-19-103-06	10/21/13	7807	32933	1155	2100	1197.00	3745.36	31.96%	-0.80%	PASS

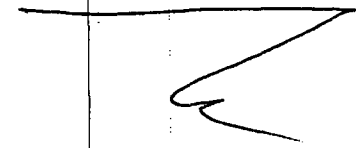
**Sources 1 through 8 activity re-verification**

Source Serial#	PA ID	Sequential #	Combined Observed dpm	Combined Certified dpm*	Percent Difference %	Within 5% of Certified value?
92MX2203026	182	97-19-103-01	8806.10	8855.90	-0.56%	Yes
92MX2203028	183	97-19-103-02	15924.09	15999.04	-0.47%	Yes
92MX2203024	184	97-19-103-03	13347.94	13533.39	-1.37%	Yes
92MX2203021	185	97-19-103-04	7887.52	8170.91	-3.47%	Yes
92MX2203025	186	97-19-103-05	20875.61	21020.88	-0.69%	Yes
92MX2203022	187	97-19-103-06	14939.36	15319.53	-2.48%	Yes
92MX2203023	188	97-19-103-07	10786.75	10744.16	0.40%	Yes
92MX2203029	189	97-19-103-08	23373.45	23608.79	-1.00%	Yes

**Data from certificates**

Reference Date	U-234 (Bq)	U-234 (dpm)	U-235 (Bq)	U-235 (dpm)	Am-241 (Bq)	Am-241 (dpm)
5/1/2003	24.10	7446.00	2.43	145.74	21.43	1285.80
5/1/2003	39.30	14358.00	4.20	252.00	23.55	1413.00
5/1/2003	19.40	7164.00	1.93	115.68	106.00	6360.00
4/1/2003	01.00	6060.00	1.26	75.84	34.50	2070.00
4/1/2003	03.00	12180.00	3.41	204.72	148.40	8784.00
4/1/2003	32.90	7974.00	3.17	189.96	121.30	7278.00
4/1/2003	07.10	6426.00	0.93	55.54	72.26	4335.60
5/1/2003	34.80	20088.00	6.55	393.18	53.02	3181.20

New Expiration Date => 10/21/2014  
 JP 10/22/13





**Eckert & Ziegler**

**Isotope Products**

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010

Fax 661-257-8303

#190  
Received 10/18/13

# CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide:</b> U-234	<b>Customer:</b> ALS LABORATORY
<b>Radionuclide:</b> U-235	<b>P.O. No.:</b> FC 35957/R5576
<b>Radionuclide:</b> Am-241	<b>Catalog No.:</b> *SOURCE-RECAL-STD
<b>Half-life (U-234):</b> (2.454 ± 0.006)E+05 years	<b>Reference Date:</b> 15-Oct-13 12:00 PST
<b>Half-life (U-235):</b> (7.037 ± 0.011)E+08 years	<b>Source No.:</b> 92MIX223027
<b>Half-life (Am-241):</b> 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234:	1.339	nCi,	49.54	Bq	Am-241:	0.3187	nCi,	11.79	Bq
U-235:	0.02954	nCi,	1.093	Bq	Total Activity:	1.687	nCi,	62.42	Bq

**Physical Description:**

- A. Capsule type: Disk (22 mm OD x 0.79 mm THK)
- B. Nature of active deposit: Electrodeposited and diffusion bonded oxide
- C. Active diameter/volume: 19 mm
- D. Backing: Stainless steel
- E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in May 2001.

**Uncertainty of Measurement:**

- |   |         |
|---|---------|
| A. Type A (random) uncertainty:                   | ± 0.5 % |
| B. Type B (systematic) uncertainty:               | ± 3.0 % |
| C. Uncertainty in aliquot weighing:               | ± 0.0 % |
| D. Total uncertainty at the 99% confidence level: | ± 3.0 % |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 1893 α/min in 2π on 20-Sep-13.

*Donald James Van Dalsen*  
Quality Control

2-OCT-13  
Date

IPL Ref. No.: 987-28

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**

24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory 110 of 128**

1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13

$\alpha$  1

New Exp Date  
=> 10/21/2014

PAI 187  
Recalibrated 4-15-03  
JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203026
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**Contained Radioactivity:**

U-234: 3.354 nCi (124.1 Bq) U-235: 0.06566 nCi (2.429 Bq)	Am-241: 0.5793 nCi (21.43 Bq) <b>Total Activity:</b> 3.999 nCi (148.0 Bq)
--	--

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4483  $\alpha$ /min in  $2\pi$  on 11 Apr 03.

*Daniel James Van Dalsem*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED



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An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
22 New Exp Date  
 => 10/21/2014  
 PAI 183  
 Recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234	<b>Customer:</b> PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b> U-235	<b>P.O. No.:</b> EW040203/R2193
<b>Radionuclide C:</b> Am-241	<b>Catalog No.:</b> MISC-STD
<b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years	<b>Reference Date:</b> 1-May-03 12:00 PST
<b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years	<b>Source No.:</b> 92MIX2203028
<b>Half Life (Am-241):</b> 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234: 6.467 nCi (239.3 Bq)	Am-241: 0.6366 nCi (23.55 Bq)
U-235: 0.1135 nCi (4.200 Bq)	Total Activity: 7.217 nCi (267.1 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radiopurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 8091 α/min in 2π on 11 Apr 03.

*Daniel James Van Dalsen*  
 Quality Control

*15-Apr-03*  
 Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
 24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
 1800 North Keystone Street Burbank, California 91504





**Isotope Products  
Laboratories**

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24937 Avenue Tibbitts  
Valencia, California 91355

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Fax 661•257•8303

$\alpha 3$

Re-Calibrated 10/21/13  
New Exp Date  
=> 10/21/2014

PAT I.D 184  
recalibrated 4-15-03  
JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203024
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**Contained Radioactivity:**

U-234: 3.227 nCi (119.4 Bq)	Am-241: 2.866 nCi (106.0 Bq)
U-235: 0.05205 nCi (1.926 Bq)	Total Activity: 6.145 nCi (227.3 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.6%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 6889  $\alpha$ /min in 2 $\pi$  on 11 Apr 03.

*Daniel James Van Dolson*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13  
New Exp Date  
α4 ⇒ 10/21/2014

PAI ID: 00188  
rec'd from recalibration  
3-28-03 TP 10/22/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

Radionuclide A: U-234	Customer: PARAGON ANALYTICS, INC.
Radionuclide B: U-235	P.O. No.: EW030603/R2155
Radionuclide C: Am-241	Catalog No.: MISC-STD
Half Life (U-234): (2.454 ± 0.006)E+05 years	Reference Date: 1-Apr-03 12:00 PST
Half Life (U-235): (7.037 ± 0.011)E+08 years	Source No.: 92MIX2203021
Half Life (Am-241): 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234: 2.731 nCi (101.0 Bq)	Am-241: 0.9325 nCi (34.50 Bq)
U-235: 0.03416 nCi (1.264 Bq)	Total Activity: 3.698 nCi (136.8 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4145 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsen  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED



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Ke-Calibrated 10/21/13  
 [x5] New Exp Date  
 => 10/21/2014  
 PAI ID 00186  
 specification  
 received 186  
 3-28-03  
 JP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203025
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**Contained Radioactivity:**

U-234: 5.486 nCi (203.0 Bq)	Am-241: 3.958 nCi (146.4 Bq)
U-235: 0.09221 nCi (3.412 Bq)	Total Activity: 9.536 nCi (352.8 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 10690 α/min in 2π on 18 Mar 03.

*Daniel Jameson Dalsam*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
1800 North Keystone Street Burbank, California 91504



**Isotope Products  
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Re-Calibrated 10/21/13  
New Exp Date  
α6 ⇒ 10/21/2014  
PAID 00187  
Rec'd for recalibration  
3-28-03 JP 10/22/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b>	U-234	<b>Customer:</b>	PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b>	U-235	<b>P.O. No.:</b>	EW030603/R2155
<b>Radionuclide C:</b>	Am-241	<b>Catalog No.:</b>	MISC-STD
<b>Half Life (U-234):</b>	(2.454 ± 0.006)E+05 years	<b>Reference Date:</b>	1-Apr-03 12:00 PST
<b>Half Life (U-235):</b>	(7.037 ± 0.011)E+08 years	<b>Source No.:</b>	92MIX2203022
<b>Half Life (Am-241):</b>	432.17 ± 0.66 years		

**Contained Radioactivity:**

U-234:	3.592 nCi (132.9 Bq)	Am-241:	3.279 nCi (121.3 Bq)
U-235:	0.08556 nCi (3.166 Bq)	Total Activity:	6.957 nCi (257.4 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 7799 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13  
α 7 New Exp Date  
 ⇒ 10/21/2014  
 PA ID 188  
 rec'd for recalibration  
 3-28-03 TP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

Radionuclide A:	U-234	Customer:	PARAGON ANALYTICS, INC.
Radionuclide B:	U-235	P.O. No.:	EW030603/R2155
Radionuclide C:	Am-241	Catalog No.:	MISC-STD
Half Life (U-234):	(2.454 ± 0.006)E+05 years	Reference Date:	1-Apr-03 12:00 PST
Half Life (U-235):	(7.037 ± 0.011)E+08 years	Source No.:	92MIX2203023
Half Life (Am-241):	432.17 ± 0.66 years		

**Contained Radioactivity:**

U-234:	2.895 nCi (107.1 Bq)	Am-241:	1.953 nCi (72.26 Bq)
U-235:	0.02502 nCi (0.9257 Bq)	Total Activity:	4.873 nCi (180.3 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 5463 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsem*  
Quality Control

*19-Mar-03*  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED



**Isotope Products  
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Re-Calibrated 10/21/13  
 28 New Exp Date  
 => 10/21/2014  
 PAI ID 189  
 recd 4-21-03  
 recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203029
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**Contained Radioactivity:**

U-234: 9.048 nCi (334.8 Bq) U-235: 0.1771 nCi (6.553 Bq)	Am-241: 1.433 nCi (53.02 Bq) <b>Total Activity:</b> 10.66 nCi (394.4 Bq)
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**Physical description:**

A. Capsule type:	Disk (22 mm, OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radiopurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.5%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.0%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 11950 α/min in 2π on 11 Apr 03.

*Daniel James Van Dalsem*  
 Quality Control

15-Apr-03  
 Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
 24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
 1800 North Keystone Street Burbank, California 91504

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 10:15:08AM  
Calibration Type: Efficiency

Energy Calibration: SOURCE 190\_10.21.13 (#9)  
Description:

Source Info

Certificate ID: A9 RSO#190  
Prepared by: IPL

Certification Date: 10/15/2013 10:00:00AM

Description:

Acquisition

Detector: 13a, SN:  
Acquisition Start Date: 10/21/2013 8:31:19AM

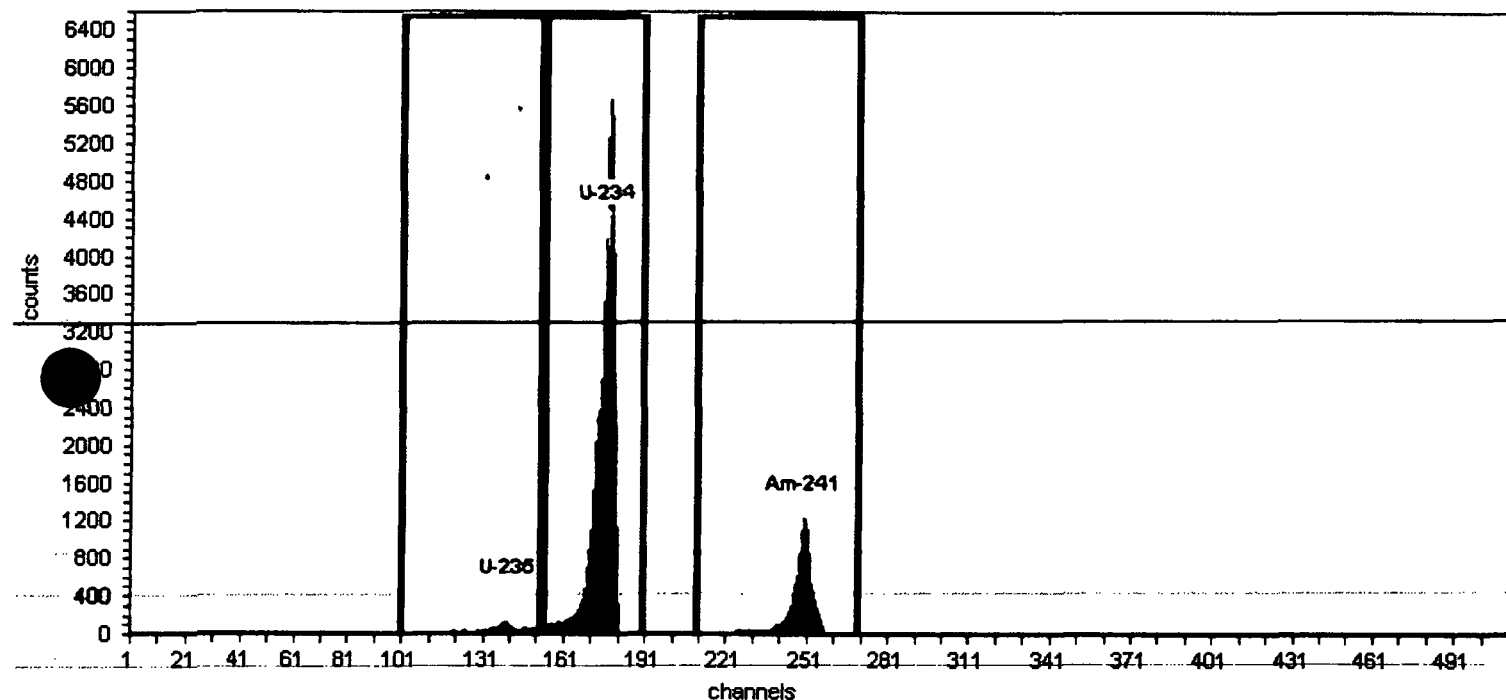
Energy Calibration Equation:  
Gain = 9.9575 keV / Ch

Live Time: 35.00 min.  
Real Time: 35.01 min.

Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 190\_10.21.13 (

Efficiency: 31.46% +/- 0.32% TPU(2 sigma)



Method: Interactive ROI  
Algorithm: Linear

Initial Calibration: Yes  
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,135.00	32.43
U-234	176	4.78	153	190	32,739.00	935.40
Am-241	249	5.49	210	270	7,686.00	219.60

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 182\_10.21.13 (#1)

Description:

Analysis Date: 10/21/2013 10:15:34AM

Calibration Type: Efficiency

Source Info

Certificate ID: A1 RSO#182

Prepared by: IPL

Description:

Certification Date: 5/1/2003 12:00:24PM

Acquisition

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 9:09:15AM

Live Time: 35.00 min.

Real Time: 35.03 min.

Efficiency Calibration Name: SOURCE 182\_10.21.13 (

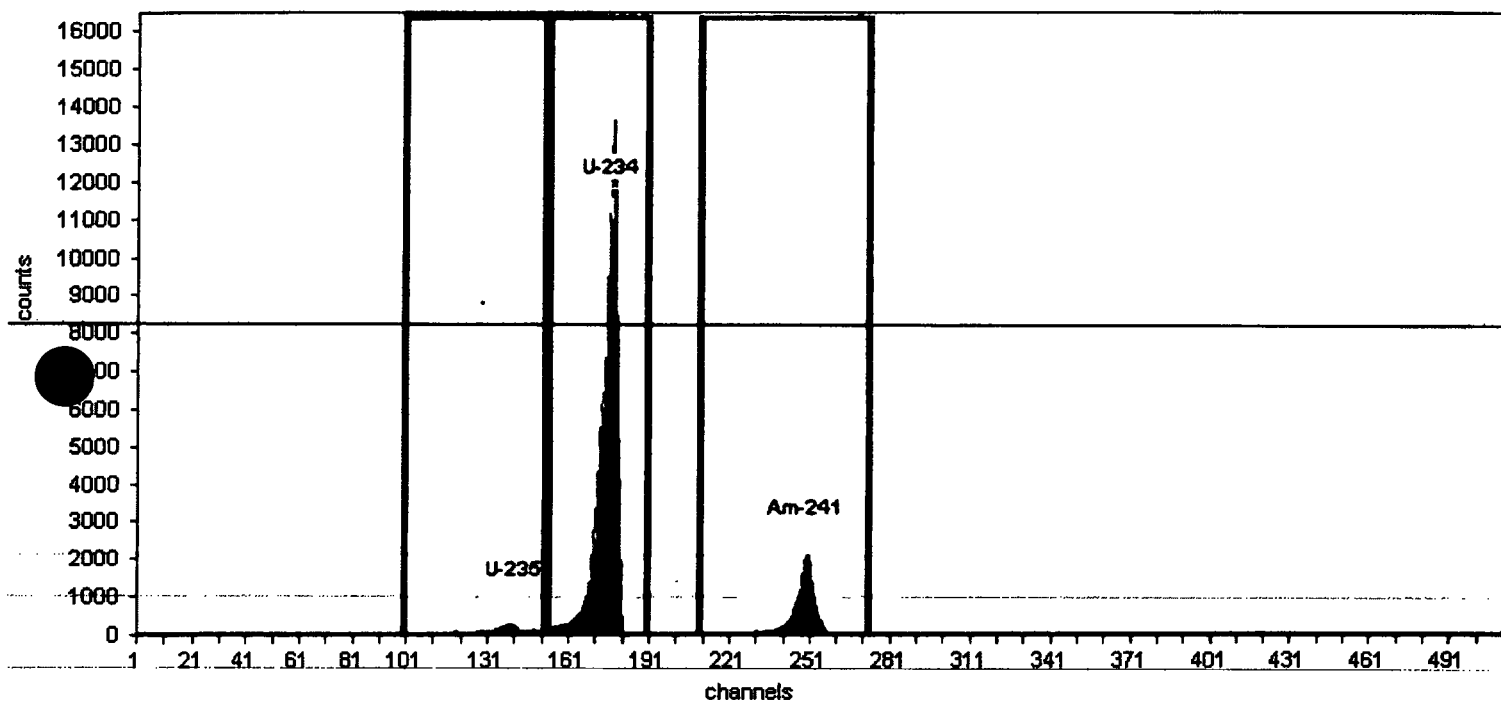
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 31.17% +/- 0.20% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,689.00	76.83
U-234	176	4.78	153	190	81,484.00	2,328.11
Am-241	249	5.49	210	273	13,543.00	386.94

JP 10/21/13



Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 10:39:26AM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 183\_10.21.13 (#2)  
Description:

Source Info

Certificate ID: A2 RSO#183  
Prepared by: IPL  
Description:

Certification Date: 5/1/2003 12:00:00PM

Acquisition

Detector: 13a , SN:  
Acquisition Start Date: 10/21/2013 9:48:00AM

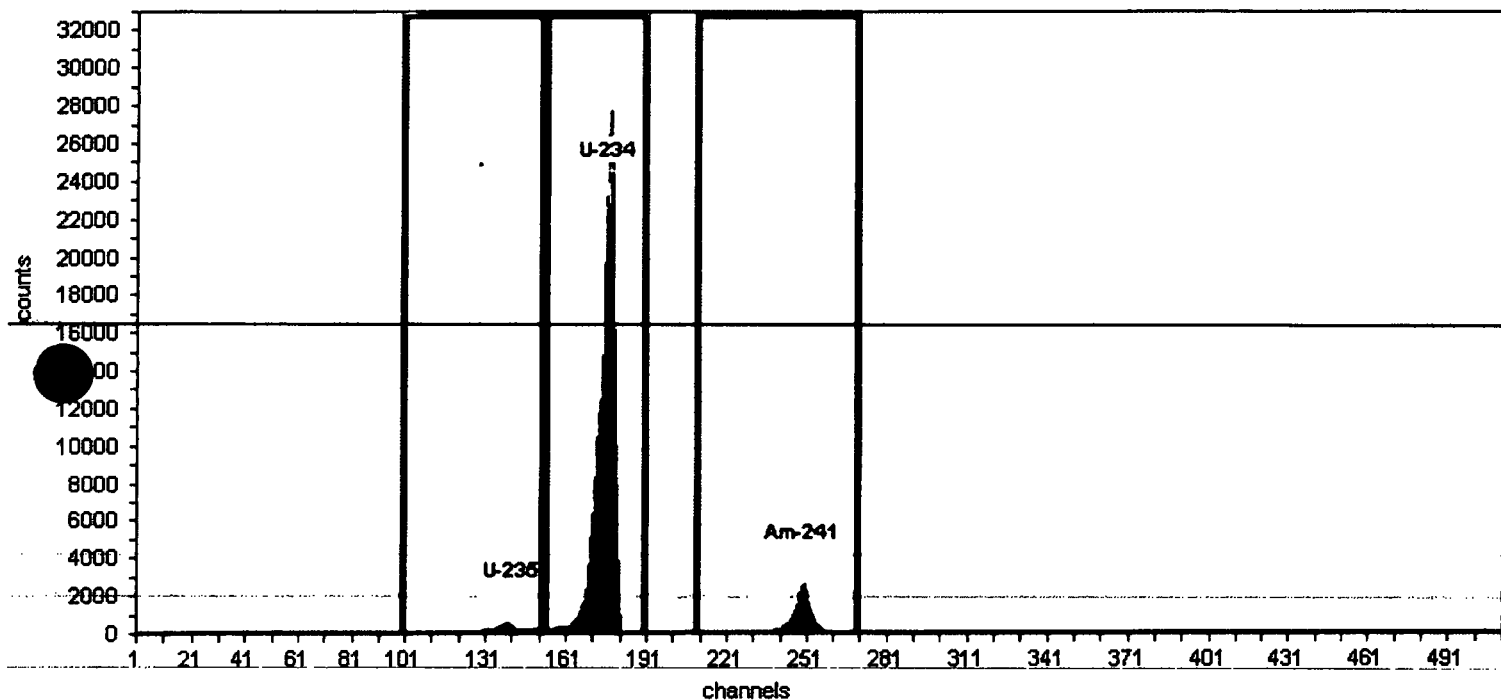
Energy Calibration Equation:  
Gain = 9.9575 keV / Ch

Live Time: 35.00 min.  
Real Time: 35.06 min.

Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 183\_10.21.13 (

Efficiency: 31.40% +/- 0.15% TPU(2 sigma)



Method: Interactive ROI  
Algorithm: Linear

Initial Calibration: Yes  
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	4,155.00	118.71
U-234	176	4.78	153	190	156,715.00	4,477.57
Am-241	249	5.49	210	270	15,830.00	452.29

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 184\_10.21.13 (#3)

Description:

Analysis Date: 10/21/2013 11:08:15AM

Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A3 RSO#184

Prepared by: IPL

Description:

Certification Date: 5/1/2003 12:00:00PM

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 10:30:47AM

Live Time: 35.00 min.

Real Time: 35.05 min.

Efficiency Calibration Name: SOURCE 184\_10.21.13 (

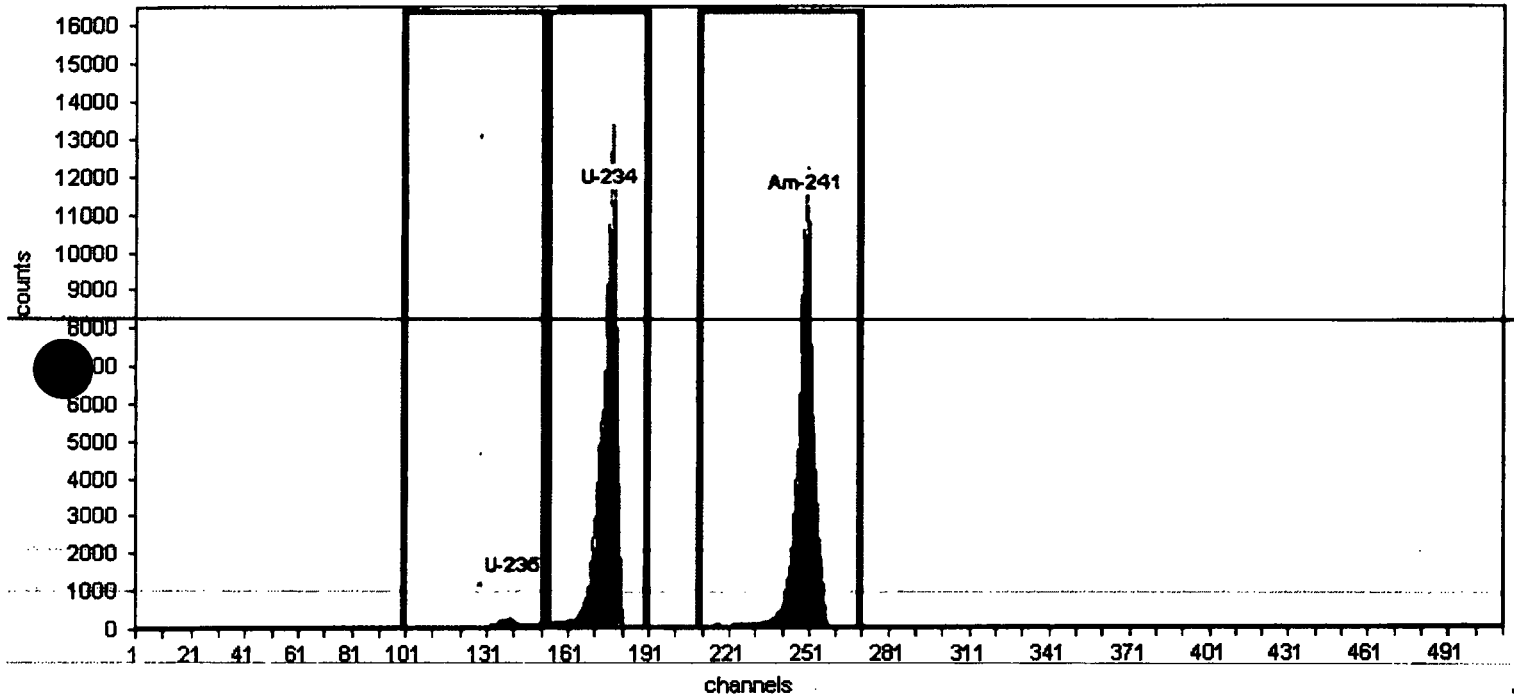
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 31.06% +/- 0.16% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,052.00	58.63
U-234	176	4.78	153	190	74,298.00	2,122.80
Am-241	249	5.49	210	270	71,764.00	2,050.40

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 185\_10.21.13 (#4)

Description:

Analysis Date: 10/21/2013 11:44:23AM

Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A4 RSO#185

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 11:08:08AM

Live Time: 35.00 min.

Real Time: 35.03 min.

Efficiency Calibration Name: SOURCE 185\_10.21.13 (

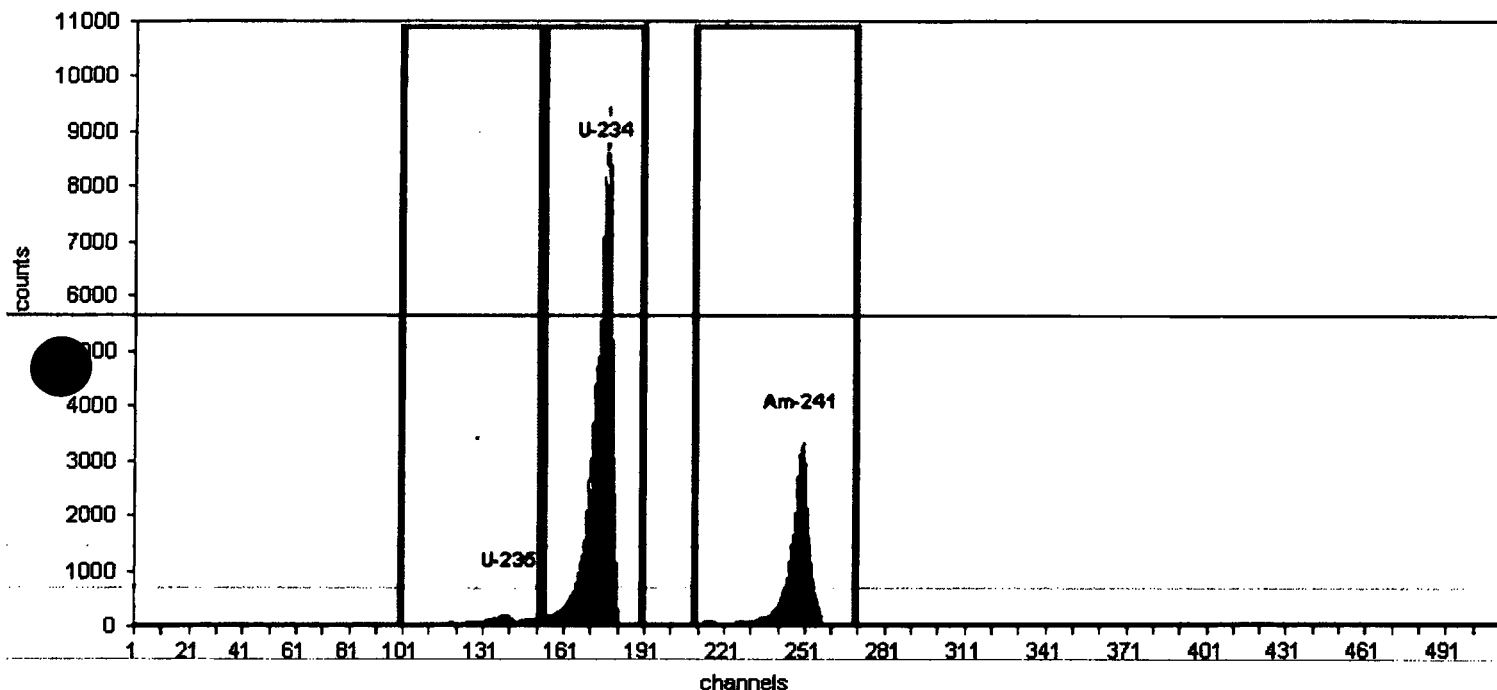
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 30.07% +/- 0.21% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,198.00	62.80
U-234	176	4.78	153	190	62,381.00	1,782.31
Am-241	249	5.49	210	270	22,944.00	655.54

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 12:20:40PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 186\_10.21.13 (#5)

Description:

Source Info

Certificate ID: A5 RSO#186

Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 11:45:31AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

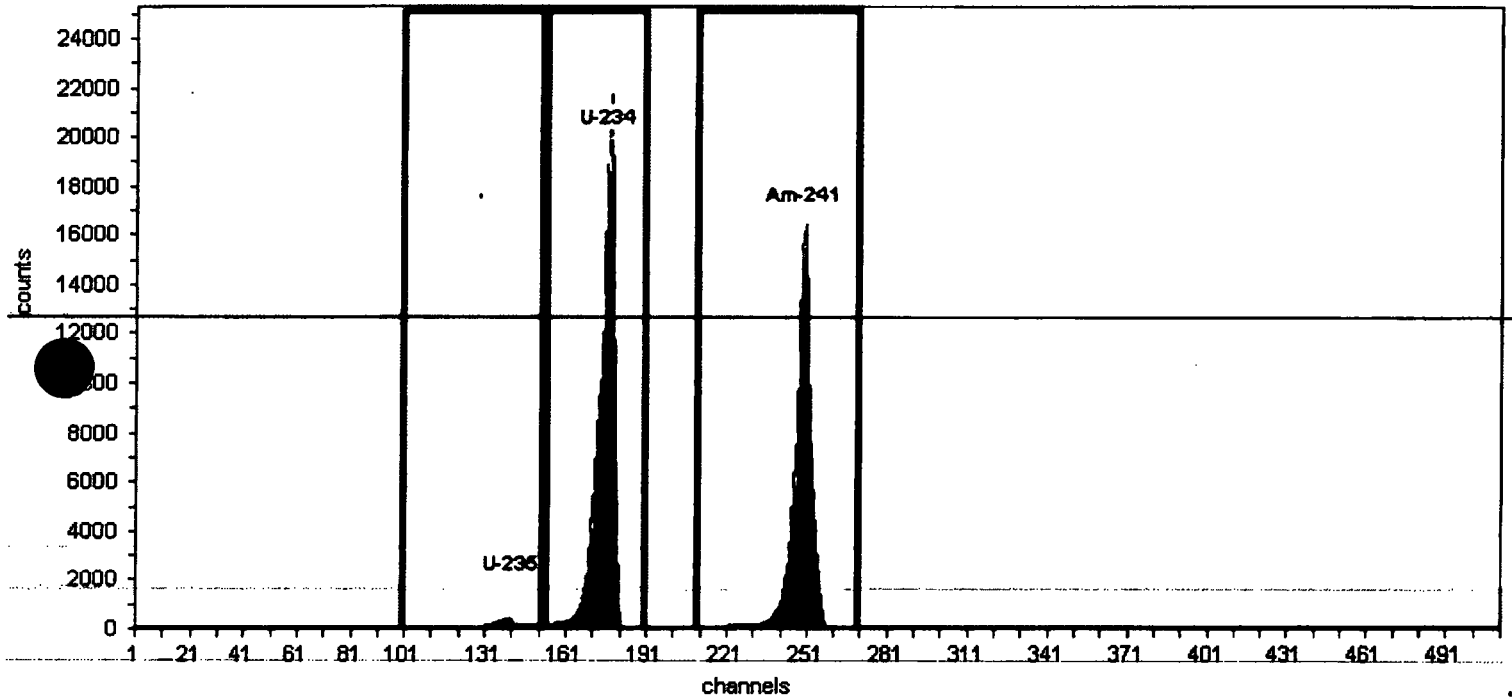
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Live Time: 35.00 min.

Real Time: 35.08 min.

Efficiency: 31.20% +/- 0.13% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 186\_10.21.13 (



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	3,425.00	97.86
U-234	176	4.78	153	190	124,917.00	3,569.06
Am-241	249	5.49	210	270	103,302.00	2,951.49

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 12:56:51PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 187\_10.21.13 (#6)  
Description:

Source Info

Certificate ID: A6 RSO#187  
Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

Acquisition

Detector: 13a , SN:

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch

Acquisition Start Date: 10/21/2013 12:21:22PM

Offset = 3,010.51 keV

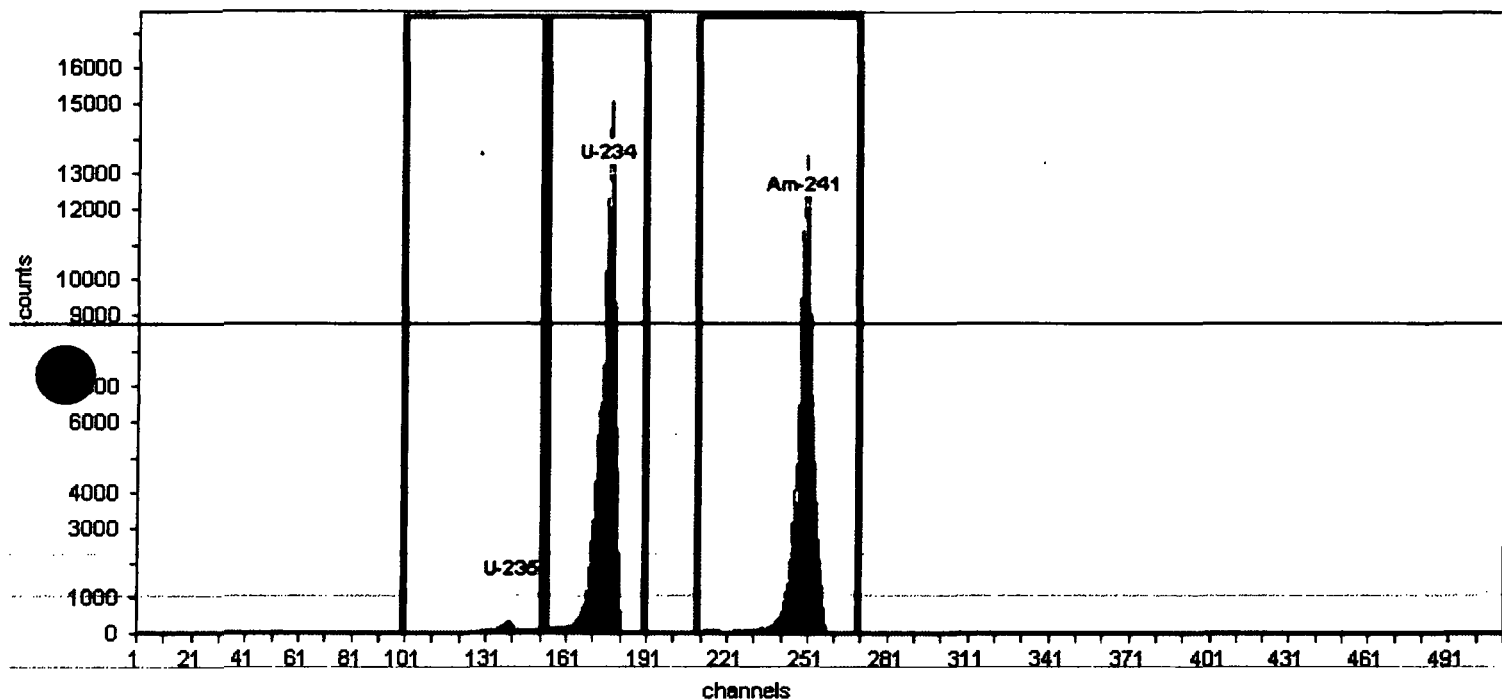
Live Time: 35.00 min.

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Real Time: 35.06 min.

Efficiency: 30.89% +/- 0.15% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 187\_10.21.13 (



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,349.00	67.11
U-234	176	4.78	153	190	84,490.00	2,414.00
Am-241	249	5.49	210	270	78,934.00	2,255.26

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 188\_10.21.13 (#7)  
Description:

Analysis Date: 10/21/2013 1:32:57PM  
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A7 RSO#188  
Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

Acquisition

Detector: 13a , SN:  
Acquisition Start Date: 10/21/2013 12:57:17PM

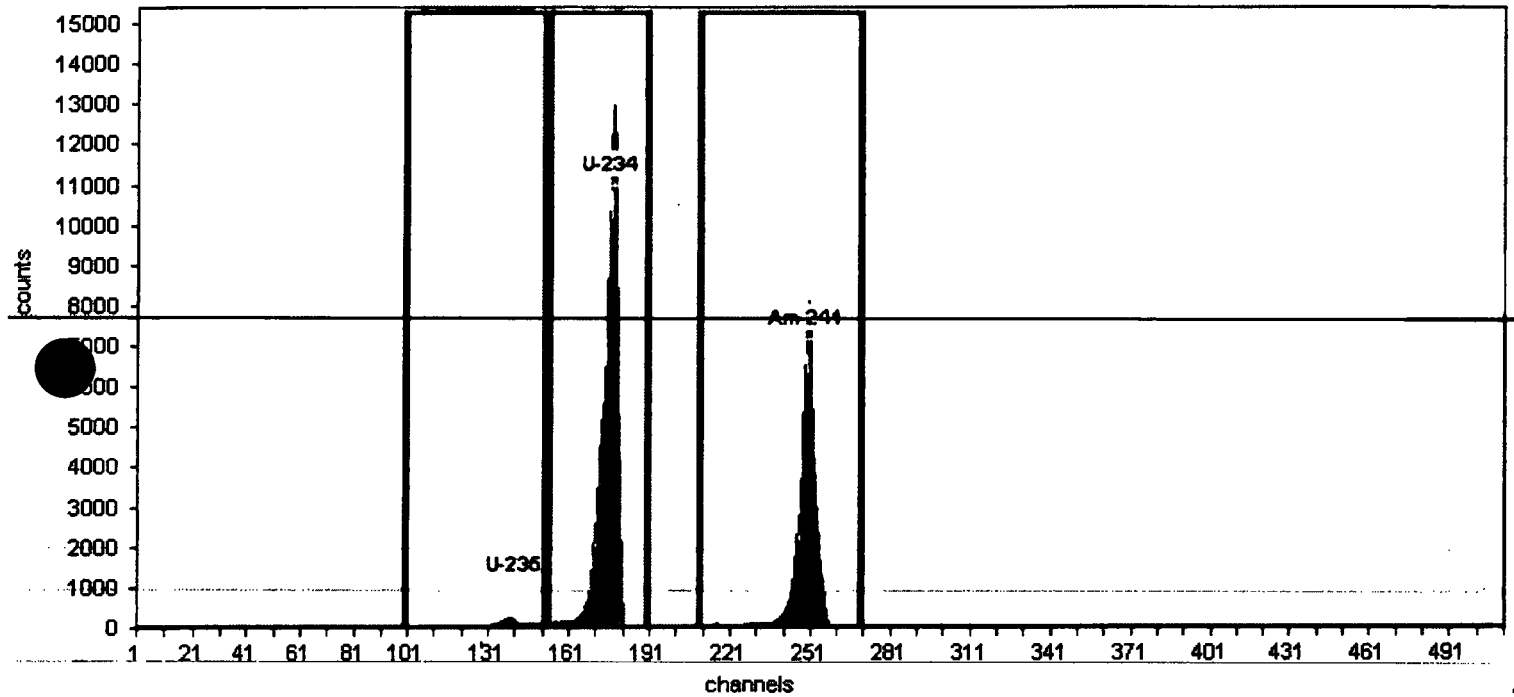
Energy Calibration Equation:  
Gain = 9.9575 keV / Ch

Live Time: 35.00 min.  
Real Time: 35.04 min.

Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 188\_10.21.13 (

Efficiency: 31.50% +/- 0.19% TPU(2 sigma)



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,847.00	52.77
U-234	176	4.78	153	190	71,762.00	2,050.34
Am-241	249	5.49	210	270	46,085.00	1,316.71

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 2:09:42PM

Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 189\_10.21.13 (#8)

Description:

**Source Info**

Certification Date: 4/1/2003 12:00:00PM

Certificate ID: A8 RSO#189

Prepared by: IPL

Description:

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 1:34:04PM

Live Time: 35.00 min.

Real Time: 35.09 min.

Energy Calibration Equation:

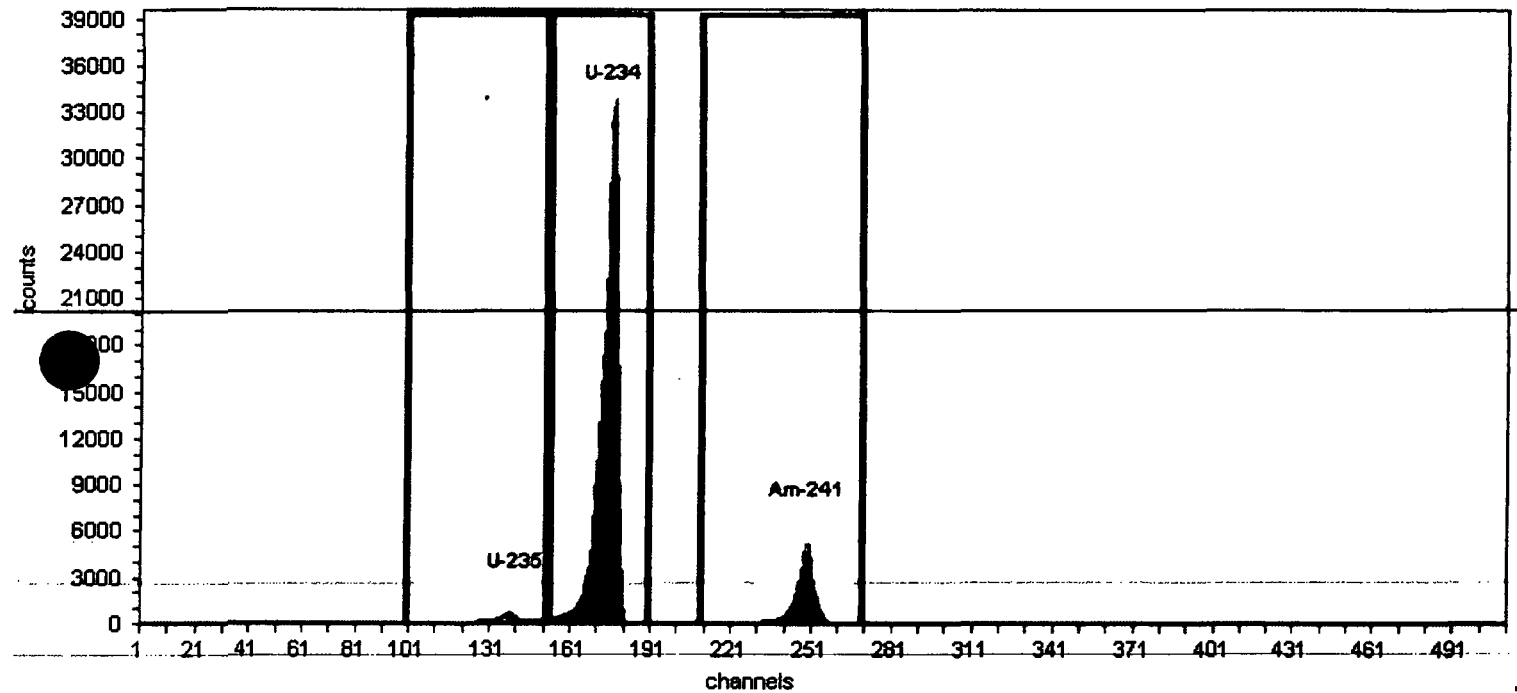
Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 189\_10.21.13 (

Efficiency: 31.23% +/- 0.12% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	6,721.00	192.03
U-234	176	4.78	153	190	218,016.00	6,229.03
Am-241	249	5.49	210	270	34,624.00	989.26

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 2:45:56PM

Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 190A\_10.21.13 (#9)

Description:

Source Info

Certification Date: 10/15/2013 10:00:00AM

Certificate ID: A9 RSO#190

Prepared by: IPL

Description:

Acquisition

Detector: 13a, SN:

Energy Calibration Equation:

Acquisition Start Date: 10/21/2013 2:10:16PM

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

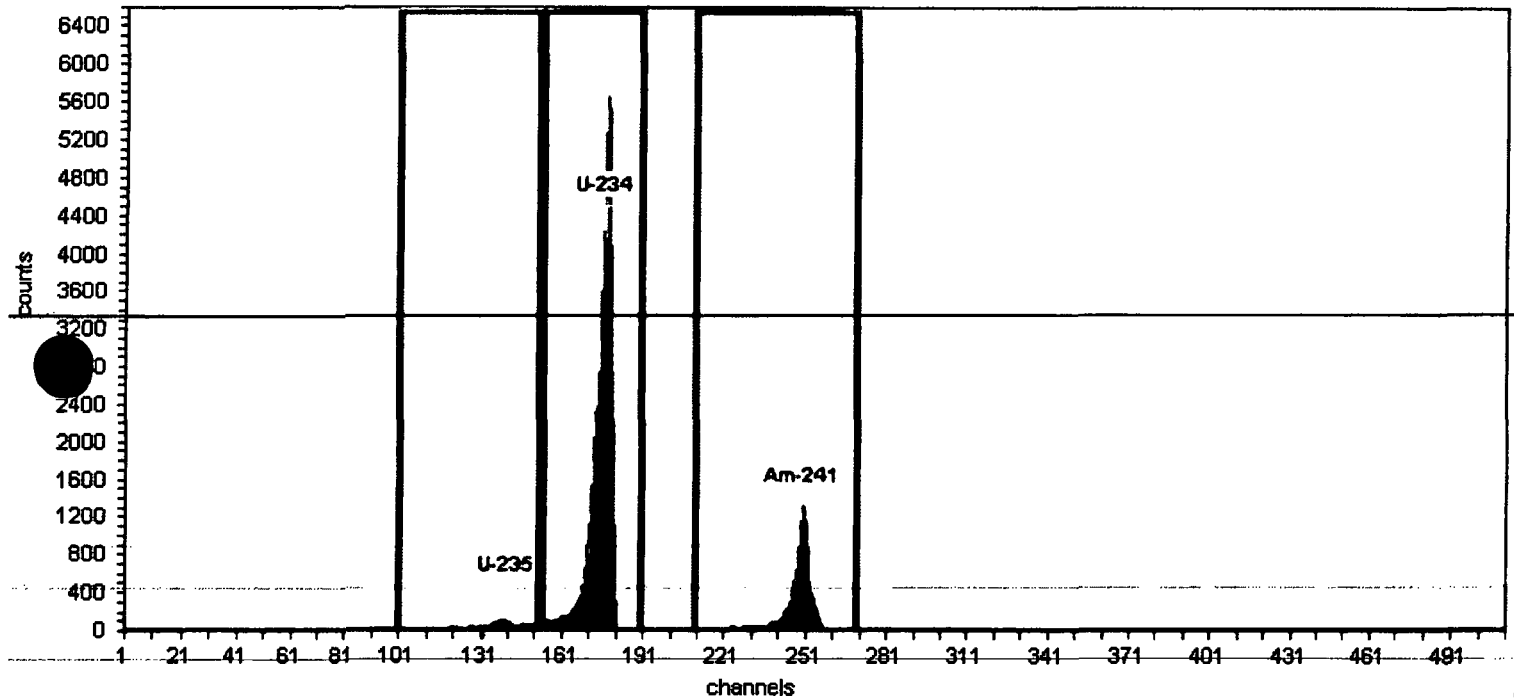
Offset = 3,010.51 keV

Real Time: 35.01 min.

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 190A\_10.21.13

Efficiency: 31.69% +/- 0.32% TPU(2 sigma)



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,155.00	33.00
U-234	176	4.78	153	190	32,933.00	940.94
Am-241	249	5.49	210	270	7,807.00	223.06

JP 10/21/13



Case Narrative -1402168

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## Isotopic Uranium Case Narrative

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### **Cabrera Services, Inc** **Schofield Barracks – 08-3123.00**

Work Order Number: 1402168

1. This report consists of the analytical results and supporting documentation for 20 filter samples received by ALS on 2/14/2014.
2. These samples were prepared according to the current revisions of SOP 773 and SOP 778.
3. The samples were analyzed for the presence of isotopic uranium according to the current revision of SOP 714. The analyses were completed on 2/20/2014.
4. The isotopic analysis results for these samples are reported on an 'As Received' basis in units of  $\mu\text{Ci/mL}$ .
5. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate.
6. This analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to emission energies between those of U-234 and U-238. A potential limitation of this method is that measurable amounts of U-234 in the sample may cause a small amount of characteristic activity in the U-235 region of interest due to poorly resolved alpha activity at the boundary between the two regions. To minimize the potential for a high bias in the U-235 analytical results, the U-235 region of interest has been narrowed and limited to a lower energy region. An 85.1% abundance correction has been made to the final U-235 results.
7. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.



The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Crystal Shaeffer  
Crystal Shaeffer  
Radiochemistry Primary Data Reviewer

2/24/14  
Date

[Signature]  
Radiochemistry Final Data Reviewer

02/24/14  
Date



## Section 1

# CHAIN OF CUSTODY

# ALS Environmental -- FC

## Sample Number(s) Cross-Reference Table

**OrderNum:** 1402168

**Client Name:** Cabrera Services, Inc.

**Client Project Name:** Schofield Barracks

**Client Project Number:** 08-3123.00

**Client PO Number:** 12-3541

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SBHF14-047-ST03-AS-BK	1402168-1		FILTER	08-Feb-14	16:28
SBHF14-048-ST04-AS-BK	1402168-2		FILTER	08-Feb-14	16:21
SBHF14-049-ST05-AS-BK	1402168-3		FILTER	08-Feb-14	16:14
SBHF14-050-ST06-AS-BK	1402168-4		FILTER	08-Feb-14	16:07
SBHF14-051-ST07-AS-BK	1402168-5		FILTER	08-Feb-14	16:04
SBHF14-052-ST08-AS-BK	1402168-6		FILTER	08-Feb-14	16:01
SBHF14-053-ST09-AS-BK	1402168-7		FILTER	08-Feb-14	15:56
SBHF14-054-ST10-AS-BK	1402168-8		FILTER	08-Feb-14	15:53
SBHF14-055-ST11-AS-BK	1402168-9		FILTER	08-Feb-14	15:49
SBHF14-045-ST01-AS-BK	1402168-10		FILTER	08-Feb-14	20:25
SBHF14-046-ST02-AS-BK	1402168-11		FILTER	08-Feb-14	20:28
SBHF14-025-ST03-AS- HF	1402168-12		FILTER	06-Feb-14	17:19
SBHF14-026-ST04-AS-HF	1402168-13		FILTER	06-Feb-14	17:07
SBHF14-027-ST05-AS-HF	1402168-14		FILTER	06-Feb-14	17:03
SBHF14-028-ST06-AS-HF	1402168-15		FILTER	06-Feb-14	16:58
SBHF14-029-ST07-AS-HF	1402168-16		FILTER	06-Feb-14	16:56
SBHF14-030-ST08-AS-HF	1402168-17		FILTER	06-Feb-14	16:51
SBHF14-031-ST09-AS-HF	1402168-18		FILTER	06-Feb-14	16:44
SBHF14-032-ST10-AS-HF	1402168-19		FILTER	06-Feb-14	16:38
SBHF14-033-ST11-AS-HF	1402168-20		FILTER	06-Feb-14	16:33



# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

## Chain-of-Custody

Form 202B

WORKORDER # TBD

140208

PROJECT NAME	Schofield Barracks	SAMPLER	Stephan Owe	DATE	2/8/2014	PAGE	1 of 1
PROJECT No.	08-3123.00	SITE ID	Schofield Barracks	TURNAROUND	30 days	DISPOSAL	(By Lab) or Return to Client
Task	310	EDD FORMAT	n/a				
COMPANY NAME	Cabrera Services	PURCHASE ORDER	12-3541				
SEND REPORT TO	Mike Winters	BILL TO COMPANY	Cabrera Services				
ADDRESS	2318 Bolger Ave	INVOICE ATTN TO	Accounts Payable				
CITY / STATE / ZIP	Spring Hill, FL 34809	ADDRESS	473 Silver Lane				
PHONE	352-610-2150	CITY / STATE / ZIP	East Hartford, CT 06108				
FAX	n/a	PHONE	860-569-0095				
E-MAIL	mwint@cabreraseservices.com	FAX	n/a				
		E-MAIL	n/a				

Lab ID	Field ID	Matrix	Sample Date	Sart Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec												
1	SBHF14-047-ST03-AS-BK	F	2/8/2014	11:25	16:28	303	10	X												
2	SBHF14-048-ST04-AS-BK	F	2/8/2014	11:11	16:21	310	10	X												
3	SBHF14-049-ST05-AS-BK	F	2/8/2014	10:35	16:14	339	10	X												
4	SBHF14-050-ST06-AS-BK	F	2/8/2014	11:03	16:07	304	10	X												
5	SBHF14-051-ST07-AS-BK	F	2/8/2014	11:01	16:04	303	10	X												
6	SBHF14-052-ST08-AS-BK	F	2/8/2014	10:59	16:01	302	10	X												
7	SBHF14-053-ST09-AS-BK	F	2/8/2014	10:54	15:56	302	10	X												
8	SBHF14-054-ST10-AS-BK	F	2/8/2014	10:51	15:53	302	10	X												
9	SBHF14-055-ST11-AS-BK	F	2/8/2014	10:47	15:49	302	10	X												

\*Time Zone (Circle): EST CST MST **HAST** Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

Comments:

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/ml

MDC is 1E-15 uCi/ml; see previously provided work plan for other MQC's

Bag of blank unused filters included for QC sample purposes

Preserve half of each sample for re-analysis/follow up testing

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5036

QC PACKAGE (check below)	
<input type="checkbox"/>	LEVEL II (Standard QC)
<input type="checkbox"/>	LEVEL III (Std QC + forms)
<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)

SIGNATURE	PRINTED NAME	DATE	TIME
	Stephan Owe	2/8/2014	16:30
	Pat Horkman	2/8/2014	16:31
	Pat Horkman	2/12/14	1500
	C Trumble	2-14-14	1005



**ALS Laboratory Group**

225 Commerce Drive, Fort Collins, Colorado 80524  
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**Chain-of-Custody**

Form 20278

WORKORDER # TBD

1402108

SAMPLER	Jon A Cote	DATE	2/8/2014	PAGE	1 of 1
PROJECT NAME	Schofield Barracks	TURNAROUND	30 days	DISPOSAL	(By Lab) or Return to Client
PROJECT No.	08-3123.00	EDD FORMAT	n/a		
Task	310	PURCHASE ORDER	12-3541		
COMPANY NAME	Cabrera Services	BILL TO COMPANY	Cabrera Services		
SEND REPORT TO	Mike Winters	INVOICE ATTN TO	Accounts Payable		
ADDRESS	2318 Bolger Ave	ADDRESS	473 Silver Lane		
CITY / STATE / ZIP	Spring Hill, FL 34609	CITY / STATE / ZIP	East Hartford, CT 06108		
PHONE	352-610-2150	PHONE	860-569-0095		
FAX	n/a	FAX	n/a		
E-MAIL	mwinters@cabreraservices.com	E-MAIL	n/a		

Lab ID	Field ID	Matrix	Sample Date	Sart Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	isotopic Uranium by Alpha Spec											
10	SBHF14-045-ST01-AS-BK	F	2/8/2014	10:25	20:25	600	10	X											
11	SBHF14-046-ST02-AS-BK	F	2/8/2014	10:28	20:28	600	10	X											

\*Time Zone (Circle): EST CST MST HAST Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

Comments:

Volumes provided in  $\text{m}^3$ ; results requested in units of  $\mu\text{Ci}/\text{ml}$   
 MDC is 1E-15  $\mu\text{Ci}/\text{ml}$ ; see previously provided work plan for other MQC's  
 Bag of blank unused filters included for QC sample purposes  
 Preserve half of each sample for re-analysis/follow up testing

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

QC PACKAGE (check below)	
<input type="checkbox"/>	LEVEL II (Standard QC)
<input type="checkbox"/>	LEVEL III (Std QC + forms)
<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>[Signature]</i>	Jon A Cote	2/9/2014	9:00
RECEIVED BY	<i>[Signature]</i>	Pat Horkman	2/9/2014	9:01
RELINQUISHED BY	<i>[Signature]</i>	Pat Horkman	2-12-14	1500
RECEIVED BY	<i>[Signature]</i>	C Trimble	2-14-14	1005
RELINQUISHED BY				
RECEIVED BY				

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# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

# Chain-of-Custody

WORKORDER # TBD

14028

Form 202/8

SAMPLER	Stephan Owe	DATE	2/6/2014	PAGE	1 of 1
PROJECT NAME	Schofield Barracks	SITE ID	Schofield Barracks	TURNAROUND	30 days
PROJECT No.	08-3123.00	EDD FORMAT	n/a	DISPOSAL	(By Lab) or Return to Client
Task	310	PURCHASE ORDER	12-3541		
COMPANY NAME	Cabrera Services	BILL TO COMPANY	Cabrera Services		
SEND REPORT TO	Mike Winters	INVOICE ATTN TO	Accounts Payable		
ADDRESS	2318 Bolger Ave	ADDRESS	473 Silver Lane		
CITY / STATE / ZIP	Spring Hill, FL 34609	CITY / STATE / ZIP	East Hartford, CT 06108		
PHONE	352-810-2150	PHONE	860-569-0095		
FAX	n/a	FAX	n/a		
E-MAIL	mwinters@cabreraseservices.com	E-MAIL	n/a		

Lab ID	Field ID	Matrix	Sample Date	Sart Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotopic Uranium by Alpha Spec												
12	SBHF14-025-ST03-AS-HF	F	2/6/2014	10:44	17:19	395	10	X												
13	SBHF14-026-ST04-AS-HF	F	2/6/2014	9:53	17:07	434	10	X												
14	SBHF14-027-ST05-AS-HF	F	2/6/2014	10:33	17:03	390	10	X												
15	SBHF14-028-ST06-AS-HF	F	2/6/2014	10:27	16:58	391	10	X												
16	SBHF14-029-ST07-AS-HF	F	2/6/2014	10:23	16:56	393	10	X												
17	SBHF14-030-ST08-AS-HF	F	2/6/2014	10:19	16:51	392	10	X												
18	SBHF14-031-ST09-AS-HF	F	2/6/2014	10:15	16:44	389	10	X												
19	SBHF14-032-ST10-AS-HF	F	2/6/2014	10:10	16:36	388	10	X												
20	SBHF14-033-ST11-AS-HF	F	2/6/2014	10:06	16:33	387	10	X												

\*Time Zone (Circle): EST CST MST **HAST** Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

Comments:

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/ml  
 MDC is 1E-15 uCi/ml; see previously provided work plan for other MQO's  
 Bag of blank unused filters included for QC sample purposes  
 Preserve half of each sample for re-analysis/follow up testing

QC PACKAGE (check below)	
<input type="checkbox"/>	LEVEL II (Standard QC)
<input type="checkbox"/>	LEVEL III (Std QC + forms)
<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)
<input type="checkbox"/>	

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>[Signature]</i>	Stephan Owe	2/6/2014	16:30
RECEIVED BY	<i>[Signature]</i>	Pat Horkman	2/6/2014	16:31
RELINQUISHED BY	<i>[Signature]</i>	PAT HORKMAN	2/12/14	1500
RECEIVED BY	<i>[Signature]</i>	C Trumble	2-14-14	1805
RELINQUISHED BY				
RECEIVED BY				





ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: CABRERA

Workorder No: 1402168

Project Manager: LS

Initials: CDT Date: 2-14-14

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	<input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	<input checked="" type="radio"/> NO
Cooler #: <u>1</u>			
Temperature (°C): <u>Amb</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: <u>11</u>			
Background µR/hr reading: <u>11</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES <input type="radio"/> NO <input type="radio"/> NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

If applicable, was the client contacted? YES / NO / NA Contact: MS Date/Time: \_\_\_\_\_

Project Manager Signature / Date: LS 2/14/14

From: (800) 324-5699  
Pat Hartman (no Cash/Gamma)  
CABRERA SERVICES  
1554 Lyman Road (Bldg 3004)  
Schofield Barracks, HI 96857

Origin ID: HMLA



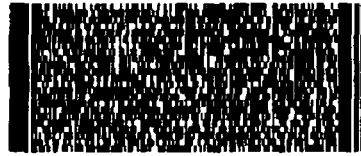
Ship Date: 12FEB14  
ActWgt: 1.0 LB  
CAD: 1053104000NET3480  
Dim: 12 X 12 X 12 IN

1402168

SHIP TO: (878) 498-1511  
BILL BENDER  
Lance Steere  
ALS Laboratories  
225 COMMERCE DR  
FORT COLLINS, CO 80524



Ref # 00-3020.04 Task 021  
Invoice #  
PO # A/S to ALS  
Dept #



TRK# 7978 9055 5057  
E291

FRI - 14 FEB 10:30A  
PRIORITY OVERNIGHT

XH FTCA 11-0

80524  
CO-US  
DEN



522616827 #220

After printing this label:

1. Use the 'Print' button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.

Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on [fedex.com](http://fedex.com). FedEx will not be responsible for any claim in excess of \$100 per package, whether the result of loss, damage, delay, non-delivery, misdelivery, or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim. Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental, consequential, or special is limited to the greater of \$100 or the authorized declared value. Recovery cannot exceed actual documented loss. Maximum for items of extraordinary value is \$1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our Service Guide. Written claims must be filed within strict time limits, see current FedEx Service Guide.



Section 2

2

# **SAMPLE RESULTS SUMMARY**

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402168

**Page:** 1 of 7  
**Reported on:** Monday, February 24, 2014  
 9:51:09 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402168-1	SBHF14-047-ST03-AS-BK	Sample	U-234	3.1E-16 +/- 2.4E-16	1.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-1	SBHF14-047-ST03-AS-BK	Sample	U-235	0E+00 +/- 2.6E-16	3.8E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-1	SBHF14-047-ST03-AS-BK	Sample	U-238	1.8E-16 +/- 2.2E-16	3.3E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-2	SBHF14-048-ST04-AS-BK	Sample	U-234	3.5E-16 +/- 2.4E-16	1.1E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-2	SBHF14-048-ST04-AS-BK	Sample	U-235	5E-17 +/- 2.3E-16	1.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-2	SBHF14-048-ST04-AS-BK	Sample	U-238	1.2E-16 +/- 2.1E-16	3.6E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-3	SBHF14-049-ST05-AS-BK	Sample	U-234	2.1E-16 +/- 2.8E-16	4.5E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-3	SBHF14-049-ST05-AS-BK	Sample	U-235	8E-17 +/- 2E-16	1.1E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-3	SBHF14-049-ST05-AS-BK	Sample	U-238	1.4E-16 +/- 2E-16	3.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U

**Comments:**

**Data Package ID:** UR1402168-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

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**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402168

**Page:** 2 of 7  
**Reported on:** Monday, February 24, 2014  
 9:51:09 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402168-4	SBHF 14-050-ST06-AS-BK	Sample	U-234	5E-16 +/- 2.9E-16	1.1E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-4	SBHF 14-050-ST06-AS-BK	Sample	U-235	-9E-17 +/- 2.2E-16	4.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-4	SBHF 14-050-ST06-AS-BK	Sample	U-238	1.9E-16 +/- 1.9E-16	1.1E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	LT
1402168-5	SBHF 14-051-ST07-AS-BK	Sample	U-234	2.1E-16 +/- 2.6E-16	1.4E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-5	SBHF 14-051-ST07-AS-BK	Sample	U-235	2.5E-16 +/- 3.1E-16	1.7E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-5	SBHF 14-051-ST07-AS-BK	Sample	U-238	2.7E-16 +/- 2.6E-16	1.4E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	LT
1402168-6	SBHF 14-052-ST08-AS-BK	Sample	U-234	2.6E-16 +/- 2.5E-16	3.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-6	SBHF 14-052-ST08-AS-BK	Sample	U-235	0E+00 +/- 2.5E-16	4.8E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-6	SBHF 14-052-ST08-AS-BK	Sample	U-238	2.6E-16 +/- 2.2E-16	1.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	LT

**Comments:**

**Data Package ID:** UR1402168-1

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**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402168

**Page:** 3 of 7  
**Reported on:** Monday, February 24, 2014  
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Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402168-7	SBHF14-053-ST09-AS-BK	Sample	U-234	4.8E-16 +/- 2.9E-16	1.1E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-7	SBHF14-053-ST09-AS-BK	Sample	U-235	1.4E-16 +/- 2.3E-16	3.5E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-7	SBHF14-053-ST09-AS-BK	Sample	U-238	1.6E-16 +/- 2E-16	2.9E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-8	SBHF14-054-ST10-AS-BK	Sample	U-234	2.1E-16 +/- 2.2E-16	3.1E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-8	SBHF14-054-ST10-AS-BK	Sample	U-235	1.5E-16 +/- 2.4E-16	3.6E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-8	SBHF14-054-ST10-AS-BK	Sample	U-238	4E-17 +/- 2.2E-16	4.5E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-9	SBHF14-055-ST11-AS-BK	Sample	U-234	3.7E-15 +/- 1E-15	5E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-9	SBHF14-055-ST11-AS-BK	Sample	U-235	3.6E-16 +/- 2.8E-16	1.4E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-9	SBHF14-055-ST11-AS-BK	Sample	U-238	2.6E-16 +/- 2.2E-16	1.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	LT

**Comments:**

**Data Package ID:** UR1402168-1

**Qualifiers/Flags:**

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# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

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**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402168

**Page:** 4 of 7  
**Reported on:** Monday, February 24, 2014  
 9:51:09 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402168-10	SBHF14-045-ST01-AS-BK	Sample	U-234	1.9E-16 +/- 1.4E-16	7E-17	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-10	SBHF14-045-ST01-AS-BK	Sample	U-235	8E-17 +/- 1.4E-16	8E-17	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-10	SBHF14-045-ST01-AS-BK	Sample	U-238	2E-17 +/- 1.2E-16	2.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-11	SBHF14-046-ST02-AS-BK	Sample	U-234	3.2E-16 +/- 2.1E-16	9E-17	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-11	SBHF14-046-ST02-AS-BK	Sample	U-235	7E-17 +/- 1.8E-16	3.5E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-11	SBHF14-046-ST02-AS-BK	Sample	U-238	1.6E-16 +/- 1.7E-16	2.3E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-12	SBHF14-025-ST03-AS- HF	Sample	U-234	3E-16 +/- 2E-16	9E-17	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-12	SBHF14-025-ST03-AS- HF	Sample	U-235	0E+00 +/- 1.9E-16	1E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-12	SBHF14-025-ST03-AS- HF	Sample	U-238	3E-17 +/- 1.7E-16	3.5E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U

**Comments:**

**Data Package ID:** UR1402168-1

**Qualifiers/Flags:**

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# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
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**PAI Work Order:** 1402168

**Page:** 5 of 7  
**Reported on:** Monday, February 24, 2014  
 9:51:09 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402168-13	SBHF14-026-ST04-AS-HF	Sample	U-234	2.7E-16 +/- 2E-16	2.2E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	
1402168-13	SBHF14-026-ST04-AS-HF	Sample	U-235	4E-17 +/- 1.7E-16	2.6E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-13	SBHF14-026-ST04-AS-HF	Sample	U-238	1.5E-16 +/- 2.2E-16	3.6E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-14	SBHF14-027-ST05-AS-HF	Sample	U-234	2.2E-16 +/- 2.6E-16	4.1E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-14	SBHF14-027-ST05-AS-HF	Sample	U-235	0E+00 +/- 1.8E-16	3.9E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-14	SBHF14-027-ST05-AS-HF	Sample	U-238	0E+00 +/- 1.5E-16	3.3E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-15	SBHF14-028-ST06-AS-HF	Sample	U-234	2.2E-16 +/- 2.3E-16	3.4E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-15	SBHF14-028-ST06-AS-HF	Sample	U-235	1.8E-16 +/- 2E-16	2.7E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U
1402168-15	SBHF14-028-ST06-AS-HF	Sample	U-238	1.9E-16 +/- 1.8E-16	2.3E-16	uCi/ml	FILTER	AS140215-4	2/19/2014	U

**Comments:**

**Data Package ID:** UR1402168-1

**Qualifiers/Flags:**

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**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402168

**Page:** 6 of 7  
**Reported on:** Monday, February 24, 2014  
 9:51:09 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402168-16	SBHF 14-029-ST07-AS-HF	Sample	U-234	-4E-17 +/- 3.2E-16	6.5E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-16	SBHF 14-029-ST07-AS-HF	Sample	U-235	0E+00 +/- 2.7E-16	5.8E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-16	SBHF 14-029-ST07-AS-HF	Sample	U-238	8E-17 +/- 2.6E-16	4.9E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-17	SBHF 14-030-ST08-AS-HF	Sample	U-234	2.6E-16 +/- 2.9E-16	4.4E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-17	SBHF 14-030-ST08-AS-HF	Sample	U-235	2.2E-16 +/- 2.3E-16	3.2E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-17	SBHF 14-030-ST08-AS-HF	Sample	U-238	2.6E-16 +/- 2.7E-16	4E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-18	SBHF 14-031-ST09-AS-HF	Sample	U-234	9E-17 +/- 4.6E-16	8.4E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-18	SBHF 14-031-ST09-AS-HF	Sample	U-235	-5E-17 +/- 2.6E-16	5.7E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-18	SBHF 14-031-ST09-AS-HF	Sample	U-238	4E-17 +/- 2.7E-16	5.4E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U

**Comments:**

**Data Package ID:** UR1402168-1

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**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402168

**Page:** 7 of 7  
**Reported on:** Monday, February 24, 2014  
 9:51:09 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402168-19	SBHF14-032-ST10-AS-HF	Sample	U-234	1.18E-15 +/- 4.5E-16	3.4E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	
1402168-19	SBHF14-032-ST10-AS-HF	Sample	U-235	1.1E-16 +/- 1.8E-16	2.7E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-19	SBHF14-032-ST10-AS-HF	Sample	U-238	2.2E-16 +/- 1.9E-16	2.3E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-20	SBHF14-033-ST11-AS-HF	Sample	U-234	4.4E-15 +/- 1.1E-15	8E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	
1402168-20	SBHF14-033-ST11-AS-HF	Sample	U-235	-4E-17 +/- 2.6E-16	5.5E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U
1402168-20	SBHF14-033-ST11-AS-HF	Sample	U-238	-9E-17 +/- 2.4E-16	5.2E-16	uCi/ml	FILTER	AS140215-4	2/20/2014	U

**Comments:**

**Data Package ID:** UR1402168-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit



## Section 3

# QC RESULTS SUMMARY



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-4MMB

Sample Matrix: FILTER

Prep Batch: AS140215-4

Final Aliquot: 53300000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-4-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-4UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 20-Feb-14

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-5E-17 +/- 4.9E-16	9.5E-16		U
15117-96-1	U-235	0E+00 +/- 2.7E-16	1.5E-16		U
7440-61-1	U-238	9E-17 +/- 3E-16	5.7E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-4PMB

Sample Matrix: FILTER

Prep Batch: AS140215-4

Final Aliquot: 53300000 ml

Prep SOP: PAI 778 Rev 14

QC Batch ID: AS140215-4-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-4UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 20-Feb-14

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	4.1E-16 +/- 4.6E-16	7E-16		U
15117-96-1	U-235	7E-17 +/- 3.4E-16	5.1E-16		U
7440-61-1	U-238	4.1E-16 +/- 3.6E-16	4.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-4LCS	Sample Matrix: FILTER Prep SOP: PAI 778 Rev 14 Date Collected: 15-Feb-14 Date Prepared: 15-Feb-14 Date Analyzed: 20-Feb-14	Prep Batch: AS140215-4 QCBatchID: AS140215-4-1 Run ID: AS140215-4UR Count Time: 1000 minutes	Final Aliquot: 53300000 ml Result Units: uCi/ml File Name: Spectrum #1
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CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	3.81E-14 +/- 6.8E-15	9E-16	4.140E-14	91.9	82 - 122	P
7440-61-1	U-238	4.2E-14 +/- 7.5E-15	6E-16	4.300E-14	97.8	82 - 122	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
L - LCS Recovery below lower control limit.  
H - LCS Recovery above upper control limit.  
P - LCS Recovery within control limits.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Minimum Detectable Concentration

Data Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-4LCSD	Sample Matrix: FILTER Prep SOP: PAI 778 Rev 14 Date Collected: 15-Feb-14 Date Prepared: 15-Feb-14 Date Analyzed: 20-Feb-14	Prep Batch: AS140215-4 QCBatchID: AS140215-4-1 Run ID: AS140215-4UR Count Time: 1000 minutes	Final Aliquot: 53300000 ml Result Units: uCi/ml File Name: Spectrum #1
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CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	4.11E-14 +/- 7.1E-15	1.1E-15	4.140E-14	99.2	82 - 122	P
7440-61-1	U-238	4.4E-14 +/- 7.5E-15	8E-16	4.300E-14	102	82 - 122	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
L - LCS Recovery below lower control limit.  
H - LCS Recovery above upper control limit.  
P - LCS Recovery within control limits.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Minimum Detectable Concentration

Data Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Duplicate Sample Results (DER)

Lab Name: ALS Environmental – FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> <b>Lab ID:</b> AS140215-4LCSD	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 15-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 20-Feb-14	<b>Prep Batch:</b> AS140215-4 <b>QCBatchID:</b> AS140215-4-1 <b>Run ID:</b> AS140215-4UR <b>Count Time:</b> 1000 minutes	<b>Final Aliquot:</b> 53300000 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
---	---	---	---

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
13966-29-5	U-234	3.81E-14 +/- 6.8E-15	9E-16	P	4.11E-14 +/- 7.1E-15	1.1E-15	P	0.308	2.13
7440-61-1	U-238	4.2E-14 +/- 7.5E-15	6E-16	P	4.4E-14 +/- 7.5E-15	8E-16	P	0.185	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Package ID: UR1402168-1





## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-047-ST03-AS-BK

Lab ID: 1402168-1

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 08-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.29E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.1E-16 +/- 2.4E-16	1.2E-16		
15117-96-1	U-235	0E+00 +/- 2.6E-16	3.8E-16		U
7440-61-1	U-238	1.8E-16 +/- 2.2E-16	3.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12  
Sample Results

Lab Name: ALS Environmental -- FC  
Work Order Number: 1402168  
Client Name: Cabrera Services, Inc.  
ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> SBHF14-048-ST04-AS-BK <b>Lab ID:</b> 1402168-2	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 08-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 19-Feb-14	<b>Prep Batch:</b> AS140215-4 <b>QCBatchID:</b> AS140215-4-1 <b>Run ID:</b> AS140215-4UR <b>Count Time:</b> 1000 minutes <b>Report Basis:</b> As Received	<b>Final Aliquot:</b> 4.39E+07 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.5E-16 +/- 2.4E-16	1.1E-16		
15117-96-1	U-235	5E-17 +/- 2.3E-16	1.2E-16		U
7440-61-1	U-238	1.2E-16 +/- 2.1E-16	3.6E-16	1E-15	U

## Comments:

### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12  
Sample Results

Lab Name: ALS Environmental – FC  
Work Order Number: 1402168  
Client Name: Cabrera Services, Inc.  
ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-049-ST05-AS-BK Lab ID: 1402168-3	Sample Matrix: FILTER Prep SOP: PAI 778 Rev 14 Date Collected: 08-Feb-14 Date Prepared: 15-Feb-14 Date Analyzed: 19-Feb-14	Prep Batch: AS140215-4 QCBatchID: AS140215-4-1 Run ID: AS140215-4UR Count Time: 1000 minutes Report Basis: As Received	Final Aliquot: 4.80E+07 ml Prep Basis: As Received Moisture(%): NA Result Units: uCi/ml File Name: Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.1E-16 +/- 2.8E-16	4.5E-16		U
15117-96-1	U-235	8E-17 +/- 2E-16	1.1E-16		U
7440-61-1	U-238	1.4E-16 +/- 2E-16	3.2E-16	1E-15	U

## Comments:

### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-050-ST06-AS-BK

Lab ID: 1402168-4

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 08-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.30E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	5E-16 +/- 2.9E-16	1.1E-16		
15117-96-1	U-235	-9E-17 +/- 2.2E-16	4.2E-16		U
7440-61-1	U-238	1.9E-16 +/- 1.9E-16	1.1E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-051-ST07-AS-BK  
Lab ID: 1402168-5

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 08-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4  
QCBatchID: AS140215-4-1  
Run ID: AS140215-4UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 4.30E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.1E-16 +/- 2.6E-16	1.4E-16		
15117-96-1	U-235	2.5E-16 +/- 3.1E-16	1.7E-16		
7440-61-1	U-238	2.7E-16 +/- 2.6E-16	1.4E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-052-ST08-AS-BK

Lab ID: 1402168-6

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 08-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.30E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.6E-16 +/- 2.5E-16	3.2E-16		U
15117-96-1	U-235	0E+00 +/- 2.5E-16	4.8E-16		U
7440-61-1	U-238	2.6E-16 +/- 2.2E-16	1.2E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-053-ST09-AS-BK

Lab ID: 1402168-7

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 08-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.30E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	4.8E-16 +/- 2.9E-16	1.1E-16		
15117-96-1	U-235	1.4E-16 +/- 2.3E-16	3.5E-16		U
7440-61-1	U-238	1.6E-16 +/- 2E-16	2.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12  
Sample Results

Lab Name: ALS Environmental -- FC  
Work Order Number: 1402168  
Client Name: Cabrera Services, Inc.  
ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-054-ST10-AS-BK Lab ID: 1402168-8	Sample Matrix: FILTER Prep SOP: PAI 778 Rev 14 Date Collected: 08-Feb-14 Date Prepared: 15-Feb-14 Date Analyzed: 19-Feb-14	Prep Batch: AS140215-4 QCBatchID: AS140215-4-1 Run ID: AS140215-4UR Count Time: 1000 minutes Report Basis: As Received	Final Aliquot: 4.30E+07 ml Prep Basis: As Received Moisture(%): NA Result Units: uCi/ml File Name: Spectrum #1
--	--	--	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.1E-16 +/- 2.2E-16	3.1E-16		U
15117-96-1	U-235	1.5E-16 +/- 2.4E-16	3.6E-16		U
7440-61-1	U-238	4E-17 +/- 2.2E-16	4.5E-16	1E-15	U

## Comments:

### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BQL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12  
Sample Results

Lab Name: ALS Environmental -- FC  
Work Order Number: 1402168  
Client Name: Cabrera Services, Inc.  
ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> SBHF14-055-ST11-AS-BK <b>Lab ID:</b> 1402168-9	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 08-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 19-Feb-14	<b>Prep Batch:</b> AS140215-4 <b>QC Batch ID:</b> AS140215-4-1 <b>Run ID:</b> AS140215-4UR <b>Count Time:</b> 1000 minutes <b>Report Basis:</b> As Received	<b>Final Aliquot:</b> 4.30E+07 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.7E-15 +/- 1E-15	5E-16		
15117-96-1	U-235	3.6E-16 +/- 2.8E-16	1.4E-16		
7440-61-1	U-238	2.6E-16 +/- 2.2E-16	1.2E-16	1E-15	LT

## Comments:

### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-045-ST01-AS-BK

Lab ID: 1402168-10

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 08-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 8.50E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.9E-16 +/- 1.4E-16	7E-17		
15117-96-1	U-235	8E-17 +/- 1.4E-16	8E-17		
7440-61-1	U-238	2E-17 +/- 1.2E-16	2.2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-046-ST02-AS-BK  
Lab ID: 1402168-11

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 08-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4  
QCBatchID: AS140215-4-1  
Run ID: AS140215-4UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 8.50E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.2E-16 +/- 2.1E-16	9E-17		
15117-96-1	U-235	7E-17 +/- 1.8E-16	3.5E-16		U
7440-61-1	U-238	1.6E-16 +/- 1.7E-16	2.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-025-ST03-AS- HF  
Lab ID: 1402168-12

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 06-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4  
QCBatchID: AS140215-4-1  
Run ID: AS140215-4UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 5.60E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3E-16 +/- 2E-16	9E-17		
15117-96-1	U-235	0E+00 +/- 1.9E-16	1E-16		U
7440-61-1	U-238	3E-17 +/- 1.7E-16	3.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> SBHF14-026-ST04-AS-HF <b>Lab ID:</b> 1402168-13	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 06-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 19-Feb-14	<b>Prep Batch:</b> AS140215-4 <b>QCBatchID:</b> AS140215-4-1 <b>Run ID:</b> AS140215-4UR <b>Count Time:</b> 1000 minutes <b>Report Basis:</b> As Received	<b>Final Aliquot:</b> 6.15E+07 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.7E-16 +/- 2E-16	2.2E-16		
15117-96-1	U-235	4E-17 +/- 1.7E-16	2.6E-16		U
7440-61-1	U-238	1.5E-16 +/- 2.2E-16	3.6E-16	1E-15	U

### Comments:

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-027-ST05-AS-HF  
Lab ID: 1402168-14

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 06-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4  
QCBatchID: AS140215-4-1  
Run ID: AS140215-4UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 5.50E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.2E-16 +/- 2.6E-16	4.1E-16		U
15117-96-1	U-235	0E+00 +/- 1.8E-16	3.9E-16		U
7440-61-1	U-238	0E+00 +/- 1.5E-16	3.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-028-ST06-AS-HF  
Lab ID: 1402168-15

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 06-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 19-Feb-14

Prep Batch: AS140215-4  
QCBatchID: AS140215-4-1  
Run ID: AS140215-4UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 5.55E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.2E-16 +/- 2.3E-16	3.4E-16		U
15117-96-1	U-235	1.8E-16 +/- 2E-16	2.7E-16		U
7440-61-1	U-238	1.9E-16 +/- 1.8E-16	2.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402168-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-029-ST07-AS-HF  
Lab ID: 1402168-16

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 06-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 20-Feb-14

Prep Batch: AS140215-4  
QCBatchID: AS140215-4-1  
Run ID: AS140215-4UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 5.55E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	-4E-17 +/- 3.2E-16	6.5E-16		U
15117-96-1	U-235	0E+00 +/- 2.7E-16	5.8E-16		U
7440-61-1	U-238	8E-17 +/- 2.6E-16	4.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-030-ST08-AS-HF

Lab ID: 1402168-17

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 06-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.55E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.6E-16 +/- 2.9E-16	4.4E-16		U
15117-96-1	U-235	2.2E-16 +/- 2.3E-16	3.2E-16		U
7440-61-1	U-238	2.6E-16 +/- 2.7E-16	4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-031-ST09-AS-HF

Lab ID: 1402168-18

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 06-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.50E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	9E-17 +/- 4.6E-16	8.4E-16		U
15117-96-1	U-235	-5E-17 +/- 2.6E-16	5.7E-16		U
7440-61-1	U-238	4E-17 +/- 2.7E-16	5.4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-032-ST10-AS-HF

Lab ID: 1402168-19

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 06-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.50E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.18E-15 +/- 4.5E-16	3.4E-16		
15117-96-1	U-235	1.1E-16 +/- 1.8E-16	2.7E-16		U
7440-61-1	U-238	2.2E-16 +/- 1.9E-16	2.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402168

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-033-ST11-AS-HF

Lab ID: 1402168-20

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 06-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-4

QCBatchID: AS140215-4-1

Run ID: AS140215-4UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.50E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	4.4E-15 +/- 1.1E-15	8E-16		
15117-96-1	U-235	-4E-17 +/- 2.6E-16	5.5E-16		U
7440-61-1	U-238	-9E-17 +/- 2.4E-16	5.2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402168-1



## Section 5

# RAW DATA

**5**

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402168-1 SMP	U-232 Tracer	2/8/2014 4:28:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	42900000 ml 42900000 ml	AlphaSpec2 81	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1121.000 2.000	30.83% 1000	1000 76.9%	3.82E-14 6.1E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402168-1 SMP	U-234 Trg. Analyte	2/8/2014 4:28:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	42900000 ml 42900000 ml	AlphaSpec2 81	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	7.000 0.000	30.83% 1000	1000 76.9%	3.1E-16 2.4E-16	1.2E-16 NA	uCi/ml As Received	NA NA	
1402168-1 SMP	U-235 Trg. Analyte	2/8/2014 4:28:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	42900000 ml 42900000 ml	AlphaSpec2 81	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	0.000 1.000	30.83% 1000	1000 76.9%	0E+00 2.6E-16	3.8E-16 NA	uCi/ml As Received	NA NA	U
1402168-1 SMP	U-238 Trg. Analyte	2/8/2014 4:28:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	42900000 ml 42900000 ml	AlphaSpec2 81	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	4.000 1.000	30.83% 1000	1000 76.9%	1.8E-16 2.2E-16	3.3E-16 NA	uCi/ml As Received	NA NA	U
1402168-2 SMP	U-232 Tracer	2/8/2014 4:21:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 82	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1242.000 2.000	30.65% 1000	1000 85.7%	4.16E-14 6.6E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402168-2 SMP	U-234 Trg. Analyte	2/8/2014 4:21:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 82	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	9.000 0.000	30.65% 1000	1000 85.7%	3.5E-16 2.4E-16	1.1E-16 NA	uCi/ml As Received	NA NA	
1402168-2 SMP	U-235 Trg. Analyte	2/8/2014 4:21:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 82	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1.000 0.000	30.65% 1000	1000 85.7%	5E-17 2.3E-16	1.2E-16 NA	uCi/ml As Received	NA NA	U
1402168-2 SMP	U-238 Trg. Analyte	2/8/2014 4:21:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 82	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	3.000 2.000	30.65% 1000	1000 85.7%	1.2E-16 2.1E-16	3.6E-16 NA	uCi/ml As Received	NA NA	U
1402168-3 SMP	U-232 Tracer	2/8/2014 4:14:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	48000000 ml 48000000 ml	AlphaSpec2 83	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1280.000 1.000	31.20% 1000	1000 86.8%	3.85E-14 6.1E-15	2E-16 NA	uCi/ml As Received	NA NA	
1402168-3 SMP	U-234 Trg. Analyte	2/8/2014 4:14:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	48000000 ml 48000000 ml	AlphaSpec2 83	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	6.000 5.000	31.20% 1000	1000 86.8%	2.1E-16 2.8E-16	4.5E-16 NA	uCi/ml As Received	NA NA	U
1402168-3 SMP	U-235 Trg. Analyte	2/8/2014 4:14:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	48000000 ml 48000000 ml	AlphaSpec2 83	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	2.000 0.000	31.20% 1000	1000 86.8%	8E-17 2E-16	1.1E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402168-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402168-3 SMP	U-238 Trg. Analyte	2/8/2014 4:14:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	48000000 ml 48000000 ml	AlphaSpec2 83	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	4.000 2.000	31.20% 1000	1000 86.8%	1.4E-16 2E-16	3.2E-16 NA	uCi/ml As Received	NA NA	U
1402168-4 SMP	U-232 Tracer	2/8/2014 4:07:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 84	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1276.000 2.000	30.40% 1000	1000 88.8%	4.4E-14 7E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402168-4 SMP	U-234 Trg. Analyte	2/8/2014 4:07:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 84	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	13.000 0.000	30.40% 1000	1000 88.8%	5E-16 2.9E-16	1.1E-16 NA	uCi/ml As Received	NA NA	
1402168-4 SMP	U-235 Trg. Analyte	2/8/2014 4:07:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 84	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	-2.000 2.000	30.40% 1000	1000 88.8%	-9E-17 2.2E-16	4.2E-16 NA	uCi/ml As Received	NA NA	U
1402168-4 SMP	U-238 Trg. Analyte	2/8/2014 4:07:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 84	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	5.000 0.000	30.40% 1000	1000 88.8%	1.9E-16 1.9E-16	1.1E-16 NA	uCi/ml As Received	NA NA	LT
1402168-5 SMP	U-232 Tracer	2/8/2014 4:04:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 85	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	933.000 1.000	30.11% 1000	1000 65.5%	3.25E-14 5.3E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402168-5 SMP	U-234 Trg. Analyte	2/8/2014 4:04:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 85	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	4.000 0.000	30.11% 1000	1000 65.5%	2.1E-16 2.6E-16	1.4E-16 NA	uCi/ml As Received	NA NA	
1402168-5 SMP	U-235 Trg. Analyte	2/8/2014 4:04:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 85	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	4.000 0.000	30.11% 1000	1000 65.5%	2.5E-16 3.1E-16	1.7E-16 NA	uCi/ml As Received	NA NA	
1402168-5 SMP	U-238 Trg. Analyte	2/8/2014 4:04:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 85	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	5.000 0.000	30.11% 1000	1000 65.5%	2.7E-16 2.6E-16	1.4E-16 NA	uCi/ml As Received	NA NA	LT
1402168-6 SMP	U-232 Tracer	2/8/2014 4:01:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 86	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1125.000 3.000	30.61% 1000	1000 77.7%	3.85E-14 6.2E-15	4E-16 NA	uCi/ml As Received	NA NA	
1402168-6 SMP	U-234 Trg. Analyte	2/8/2014 4:01:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 86	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	6.000 1.000	30.61% 1000	1000 77.7%	2.6E-16 2.5E-16	3.2E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402168-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR - Tracer
- TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

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128



# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	Spk. Recov Flags
1402168-6 SMP	U-235 Trg. Analyte	2/8/2014 4:01:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 86	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	0.000 2.000	30.61% 1000	1000 77.7%	0E+00 2.5E-16	4.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-6 SMP	U-238 Trg. Analyte	2/8/2014 4:01:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 86	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	6.000 0.000	30.61% 1000	1000 77.7%	2.6E-16 2.2E-16	1.2E-16 NA	uCi/ml As Received	NA NA	NA LT
1402168-7 SMP	U-232 Tracer	2/8/2014 3:56:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 87	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1241.000 2.000	31.55% 1000	1000 83.2%	4.12E-14 6.5E-15	3E-16 NA	uCi/ml As Received	NA NA	NA NA
1402168-7 SMP	U-234 Trg. Analyte	2/8/2014 3:56:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 87	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	12.000 0.000	31.55% 1000	1000 83.2%	4.8E-16 2.9E-16	1.1E-16 NA	uCi/ml As Received	NA NA	NA NA
1402168-7 SMP	U-235 Trg. Analyte	2/8/2014 3:56:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 87	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	3.000 1.000	31.55% 1000	1000 83.2%	1.4E-16 2.3E-16	3.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-7 SMP	U-238 Trg. Analyte	2/8/2014 3:56:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 87	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	4.000 1.000	31.55% 1000	1000 83.2%	1.6E-16 2E-16	2.9E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-8 SMP	U-232 Tracer	2/8/2014 3:53:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 88	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1188.000 4.000	30.79% 1000	1000 81.6%	4.04E-14 6.4E-15	4E-16 NA	uCi/ml As Received	NA NA	NA NA
1402168-8 SMP	U-234 Trg. Analyte	2/8/2014 3:53:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 88	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	5.000 1.000	30.79% 1000	1000 81.6%	2.1E-16 2.2E-16	3.1E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-8 SMP	U-235 Trg. Analyte	2/8/2014 3:53:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 88	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	3.000 1.000	30.79% 1000	1000 81.6%	1.5E-16 2.4E-16	3.6E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-8 SMP	U-238 Trg. Analyte	2/8/2014 3:53:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 88	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1.000 3.000	30.79% 1000	1000 81.6%	4E-17 2.2E-16	4.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-9 SMP	U-232 Tracer	2/8/2014 3:49:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 89	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1136.000 7.000	31.24% 1000	1000 76.9%	3.81E-14 6.1E-15	5E-16 NA	uCi/ml As Received	NA NA	NA NA

**Comments:**

**Data Package ID:** UR1402168-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402168-9 SMP	U-234 Trg. Analyte	2/8/2014 3:49:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 89	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	86.000 3.000	31.24% 1000	1000 76.9%	3.7E-15 1E-15	5E-16 NA	uCi/ml As Received	NA NA	
1402168-9 SMP	U-235 Trg. Analyte	2/8/2014 3:49:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 89	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	7.000 0.000	31.24% 1000	1000 76.9%	3.6E-16 2.8E-16	1.4E-16 NA	uCi/ml As Received	NA NA	
1402168-9 SMP	U-238 Trg. Analyte	2/8/2014 3:49:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	43000000 ml 43000000 ml	AlphaSpec2 89	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	6.000 0.000	31.24% 1000	1000 76.9%	2.6E-16 2.2E-16	1.2E-16 NA	uCi/ml As Received	NA NA	LT
1402168-10 SMP	U-232 Tracer	2/8/2014 8:25:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	85000000 ml 85000000 ml	AlphaSpec2 90	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1042.000 5.000	30.90% 1000	1000 71.3%	1.79E-14 2.9E-15	2E-16 NA	uCi/ml As Received	NA NA	
1402168-10 SMP	U-234 Trg. Analyte	2/8/2014 8:25:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	85000000 ml 85000000 ml	AlphaSpec2 90	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	8.000 0.000	30.90% 1000	1000 71.3%	1.9E-16 1.4E-16	7E-17 NA	uCi/ml As Received	NA NA	
1402168-10 SMP	U-235 Trg. Analyte	2/8/2014 8:25:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	85000000 ml 85000000 ml	AlphaSpec2 90	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	3.000 0.000	30.90% 1000	1000 71.3%	8E-17 1.4E-16	8E-17 NA	uCi/ml As Received	NA NA	
1402168-10 SMP	U-238 Trg. Analyte	2/8/2014 8:25:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	85000000 ml 85000000 ml	AlphaSpec2 90	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1.000 2.000	30.90% 1000	1000 71.3%	2E-17 1.2E-16	2.2E-16 NA	uCi/ml As Received	NA NA	U
1402168-11 SMP	U-232 Tracer	2/8/2014 8:28:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	85000000 ml 85000000 ml	AlphaSpec2 91	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	789.000 4.000	30.35% 1000	1000 55.0%	1.38E-14 2.3E-15	2E-16 NA	uCi/ml As Received	NA NA	
1402168-11 SMP	U-234 Trg. Analyte	2/8/2014 8:28:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	85000000 ml 85000000 ml	AlphaSpec2 91	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	10.000 0.000	30.35% 1000	1000 55.0%	3.2E-16 2.1E-16	9E-17 NA	uCi/ml As Received	NA NA	
1402168-11 SMP	U-235 Trg. Analyte	2/8/2014 8:28:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	85000000 ml 85000000 ml	AlphaSpec2 91	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	2.000 2.000	30.35% 1000	1000 55.0%	7E-17 1.8E-16	3.5E-16 NA	uCi/ml As Received	NA NA	U
1402168-11 SMP	U-238 Trg. Analyte	2/8/2014 8:28:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	85000000 ml 85000000 ml	AlphaSpec2 91	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	5.000 1.000	30.35% 1000	1000 55.0%	1.6E-16 1.7E-16	2.3E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402168-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
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- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **ALS Environmental – FC**

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402168-12 SMP	U-232 Tracer	2/6/2014 5:19:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 92	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1157.000 1.000	31.14% 1000	1000 78.6%	2.99E-14 4.8E-15	2E-16 NA	uCi/ml As Received	NA NA	
1402168-12 SMP	U-234 Trg. Analyte	2/6/2014 5:19:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 92	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	9.000 0.000	31.14% 1000	1000 78.6%	3E-16 2E-16	9E-17 NA	uCi/ml As Received	NA NA	
1402168-12 SMP	U-235 Trg. Analyte	2/6/2014 5:19:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 92	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	0.000 0.000	31.14% 1000	1000 78.6%	0E+00 1.9E-16	1E-16 NA	uCi/ml As Received	NA NA	U
1402168-12 SMP	U-238 Trg. Analyte	2/6/2014 5:19:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	56000000 ml 56000000 ml	AlphaSpec2 92	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1.000 3.000	31.14% 1000	1000 78.6%	3E-17 1.7E-16	3.5E-16 NA	uCi/ml As Received	NA NA	U
1402168-13 SMP	U-232 Tracer	2/6/2014 5:07:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	61500000 ml 61500000 ml	AlphaSpec2 93	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1163.000 7.000	32.05% 1000	1000 76.7%	2.66E-14 4.2E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402168-13 SMP	U-234 Trg. Analyte	2/6/2014 5:07:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	61500000 ml 61500000 ml	AlphaSpec2 93	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	9.000 1.000	32.05% 1000	1000 76.7%	2.7E-16 2E-16	2.2E-16 NA	uCi/ml As Received	NA NA	
1402168-13 SMP	U-235 Trg. Analyte	2/6/2014 5:07:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	61500000 ml 61500000 ml	AlphaSpec2 93	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1.000 1.000	32.05% 1000	1000 76.7%	4E-17 1.7E-16	2.6E-16 NA	uCi/ml As Received	NA NA	U
1402168-13 SMP	U-238 Trg. Analyte	2/6/2014 5:07:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	61500000 ml 61500000 ml	AlphaSpec2 93	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	5.000 4.000	32.05% 1000	1000 76.7%	1.5E-16 2.2E-16	3.6E-16 NA	uCi/ml As Received	NA NA	U
1402168-14 SMP	U-232 Tracer	2/6/2014 5:03:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 94	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1251.000 2.000	32.10% 1000	1000 82.4%	3.19E-14 5.1E-15	2E-16 NA	uCi/ml As Received	NA NA	
1402168-14 SMP	U-234 Trg. Analyte	2/6/2014 5:03:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 94	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	7.000 5.000	32.10% 1000	1000 82.4%	2.2E-16 2.6E-16	4.1E-16 NA	uCi/ml As Received	NA NA	U
1402168-14 SMP	U-235 Trg. Analyte	2/6/2014 5:03:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 94	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	0.000 3.000	32.10% 1000	1000 82.4%	0E+00 1.8E-16	3.9E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402168-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC  
PAI Work Order: 1402168

Prep SOP: PAI 778  
Analytical SOP: PAI 714

Reported on: Friday, February 21, 2014  
10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402168-14 SMP	U-238 Trg. Analyte	2/6/2014 5:03:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 94	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	0.000 3.000	32.10% 1000	1000 82.4%	0E+00 1.5E-16	3.3E-16 NA	uCi/ml As Received	NA NA	U
1402168-15 SMP	U-232 Tracer	2/6/2014 4:58:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 95	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	1223.000 3.000	32.13% 1000	1000 80.5%	3.09E-14 4.9E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402168-15 SMP	U-234 Trg. Analyte	2/6/2014 4:58:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 95	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	7.000 3.000	32.13% 1000	1000 80.5%	2.2E-16 2.3E-16	3.4E-16 NA	uCi/ml As Received	NA NA	U
1402168-15 SMP	U-235 Trg. Analyte	2/6/2014 4:58:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 95	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	5.000 1.000	32.13% 1000	1000 80.5%	1.8E-16 2E-16	2.7E-16 NA	uCi/ml As Received	NA NA	U
1402168-15 SMP	U-238 Trg. Analyte	2/6/2014 4:58:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 95	AS140215-4UR Spectrum #1	2/19/2014 2:59 PM	6.000 1.000	32.13% 1000	1000 80.5%	1.9E-16 1.8E-16	2.3E-16 NA	uCi/ml As Received	NA NA	U
1402168-16 SMP	U-232 Tracer	2/6/2014 4:56:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 9a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	933.000 35.000	31.42% 1000	1000 62.8%	2.41E-14 3.9E-15	8E-16 NA	uCi/ml As Received	NA NA	
1402168-16 SMP	U-234 Trg. Analyte	2/6/2014 4:56:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 9a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	-1.000 8.000	31.42% 1000	1000 62.8%	-4E-17 3.2E-16	6.5E-16 NA	uCi/ml As Received	NA NA	U
1402168-16 SMP	U-235 Trg. Analyte	2/6/2014 4:56:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 9a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	0.000 4.000	31.42% 1000	1000 62.8%	0E+00 2.7E-16	5.8E-16 NA	uCi/ml As Received	NA NA	U
1402168-16 SMP	U-238 Trg. Analyte	2/6/2014 4:56:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 9a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	2.000 4.000	31.42% 1000	1000 62.8%	8E-17 2.6E-16	4.9E-16 NA	uCi/ml As Received	NA NA	U
1402168-17 SMP	U-232 Tracer	2/6/2014 4:51:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 10b	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	1040.000 33.000	31.19% 1000	1000 70.5%	2.71E-14 4.4E-15	8E-16 NA	uCi/ml As Received	NA NA	
1402168-17 SMP	U-234 Trg. Analyte	2/6/2014 4:51:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 10b	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	7.000 4.000	31.19% 1000	1000 70.5%	2.6E-16 2.9E-16	4.4E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402168-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

128

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402168-17 SMP	U-235 Trg. Analyte	2/6/2014 4:51:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 10b	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	5.000 1.000	31.19% 1000	1000 70.5%	2.2E-16 2.3E-16	3.2E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-17 SMP	U-238 Trg. Analyte	2/6/2014 4:51:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55500000 ml 55500000 ml	AlphaSpec2 10b	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	7.000 3.000	31.19% 1000	1000 70.5%	2.6E-16 2.7E-16	4E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-18 SMP	U-232 Tracer	2/6/2014 4:44:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 11a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	865.000 22.000	30.43% 1000	1000 60.1%	2.33E-14 3.8E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
1402168-18 SMP	U-234 Trg. Analyte	2/6/2014 4:44:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 11a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	2.000 12.000	30.43% 1000	1000 60.1%	9E-17 4.6E-16	8.4E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-18 SMP	U-235 Trg. Analyte	2/6/2014 4:44:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 11a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	-1.000 3.000	30.43% 1000	1000 60.1%	-5E-17 2.6E-16	5.7E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-18 SMP	U-238 Trg. Analyte	2/6/2014 4:44:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 11a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	1.000 4.000	30.43% 1000	1000 60.1%	4E-17 2.7E-16	5.4E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-19 SMP	U-232 Tracer	2/6/2014 4:38:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 12a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	1243.000 28.000	30.32% 1000	1000 86.7%	3.36E-14 5.3E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
1402168-19 SMP	U-234 Trg. Analyte	2/6/2014 4:38:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 12a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	38.000 3.000	30.32% 1000	1000 86.7%	1.18E-15 4.5E-16	3.4E-16 NA	uCi/ml As Received	NA NA	NA NA
1402168-19 SMP	U-235 Trg. Analyte	2/6/2014 4:38:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 12a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	3.000 1.000	30.32% 1000	1000 86.7%	1.1E-16 1.8E-16	2.7E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-19 SMP	U-238 Trg. Analyte	2/6/2014 4:38:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 12a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	7.000 1.000	30.32% 1000	1000 86.7%	2.2E-16 1.9E-16	2.3E-16 NA	uCi/ml As Received	NA NA	NA U
1402168-20 SMP	U-232 Tracer	2/6/2014 4:33:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 13a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	1249.000 24.000	30.84% 1000	1000 85.6%	3.32E-14 5.3E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA

**Comments:**

**Data Package ID: UR1402168-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR - Tracer
- TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

20140228

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	6Spk. Recov Flags
1402168-20 SMP	U-234 Trg. Analyte	2/6/2014 4:33:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 13a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	141.000 27.000	30.84% 1000	1000 85.6%	4.4E-15 1.1E-15	8E-16 NA	uCi/ml As Received	NA NA	
1402168-20 SMP	U-235 Trg. Analyte	2/6/2014 4:33:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 13a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	-1.000 7.000	30.84% 1000	1000 85.6%	-4E-17 2.6E-16	5.5E-16 NA	uCi/ml As Received	NA NA	U
1402168-20 SMP	U-238 Trg. Analyte	2/6/2014 4:33:00 PM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	55000000 ml 55000000 ml	AlphaSpec2 13a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	-3.000 9.000	30.84% 1000	1000 85.6%	-9E-17 2.4E-16	5.2E-16 NA	uCi/ml As Received	NA NA	U
AS140215-4M MB	U-232 Tracer	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 14a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	842.000 19.000	28.44% 1000	1000 62.6%	2.5E-14 4.1E-15	7E-16 NA	uCi/ml As Received	NA NA	
AS140215-4M MB	U-234 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 14a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	-1.000 14.000	28.44% 1000	1000 62.6%	-5E-17 4.9E-16	9.5E-16 NA	uCi/ml As Received	NA NA	U
AS140215-4M MB	U-235 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 14a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	0.000 0.000	28.44% 1000	1000 62.6%	0E+00 2.7E-16	1.5E-16 NA	uCi/ml As Received	NA NA	U
AS140215-4M MB	U-238 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 14a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	2.000 4.000	28.44% 1000	1000 62.6%	9E-17 3E-16	5.7E-16 NA	uCi/ml As Received	NA NA	U
AS140215-4P MB	U-232 Tracer	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 16a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	681.000 16.000	29.83% 1000	1000 48.3%	1.93E-14 3.2E-15	6E-16 NA	uCi/ml As Received	NA NA	
AS140215-4P MB	U-234 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 16a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	7.000 4.000	29.83% 1000	1000 48.3%	4.1E-16 4.6E-16	7E-16 NA	uCi/ml As Received	NA NA	U
AS140215-4P MB	U-235 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 16a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	1.000 1.000	29.83% 1000	1000 48.3%	7E-17 3.4E-16	5.1E-16 NA	uCi/ml As Received	NA NA	U
AS140215-4P MB	U-238 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 16a	AS140215-4UR Spectrum #1	2/20/2014 2:19 PM	7.000 1.000	29.83% 1000	1000 48.3%	4.1E-16 3.6E-16	4.3E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402168-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
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- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	Spk. Recov Flags
AS140215-4 LCS	U-232 Tracer	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 25	AS140215-4UR Spectrum #1	2/20/2014 2:21 PM	854.000 34.000	29.18% 1000	1000 61.9%	2.47E-14 4.1E-15	9E-16 NA	uCi/ml As Received	NA NA	
AS140215-4 LCS	U-234 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 25	AS140215-4UR Spectrum #1	2/20/2014 2:21 PM	814.000 13.000	29.18% 1000	1000 61.9%	3.81E-14 6.8E-15	9E-16 NA	uCi/ml As Received	NA NA	91.9 P
AS140215-4 LCS	U-238 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 25	AS140215-4UR Spectrum #1	2/20/2014 2:21 PM	899.000 5.000	29.18% 1000	1000 61.9%	4.2E-14 7.5E-15	6E-16 NA	uCi/ml As Received	NA NA	97.8 P
AS140215-4 LCSD	U-232 Tracer	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 26	AS140215-4UR Spectrum #1	2/20/2014 2:21 PM	1109.000 35.000	30.73% 1000	1000 76.3%	3.05E-14 4.9E-15	8E-16 NA	uCi/ml As Received	NA NA	
AS140215-4 LCSD	U-234 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 26	AS140215-4UR Spectrum #1	2/20/2014 2:21 PM	1141.000 34.000	30.73% 1000	1000 76.3%	4.11E-14 7.1E-15	1.1E-15 NA	uCi/ml As Received	0.31 NA	99.2 P
AS140215-4 LCSD	U-238 Trg. Analyte	2/15/2014 8:31:17 AM	AS140215-4 AS140215-4-1	NA NA	NA NA	FILTER NA	53300000 ml 53300000 ml	AlphaSpec2 26	AS140215-4UR Spectrum #1	2/20/2014 2:21 PM	1222.000 16.000	30.73% 1000	1000 76.3%	4.4E-14 7.5E-15	8E-16 NA	uCi/ml As Received	0.19 NA	102 P

**Comments:**

**Data Package ID: UR1402168-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

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# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-1  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 81  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021881; Det: 81; Spectrum #1; 2/18/2014 10:34:49 AM

Calibration Date: 2/18/2014 10:14:53AM

Efficiency Calibration: C14021881

Efficiency: 30.83% +/- 0.20% TPU(2 sigma)

Energy Calibration: C14021881

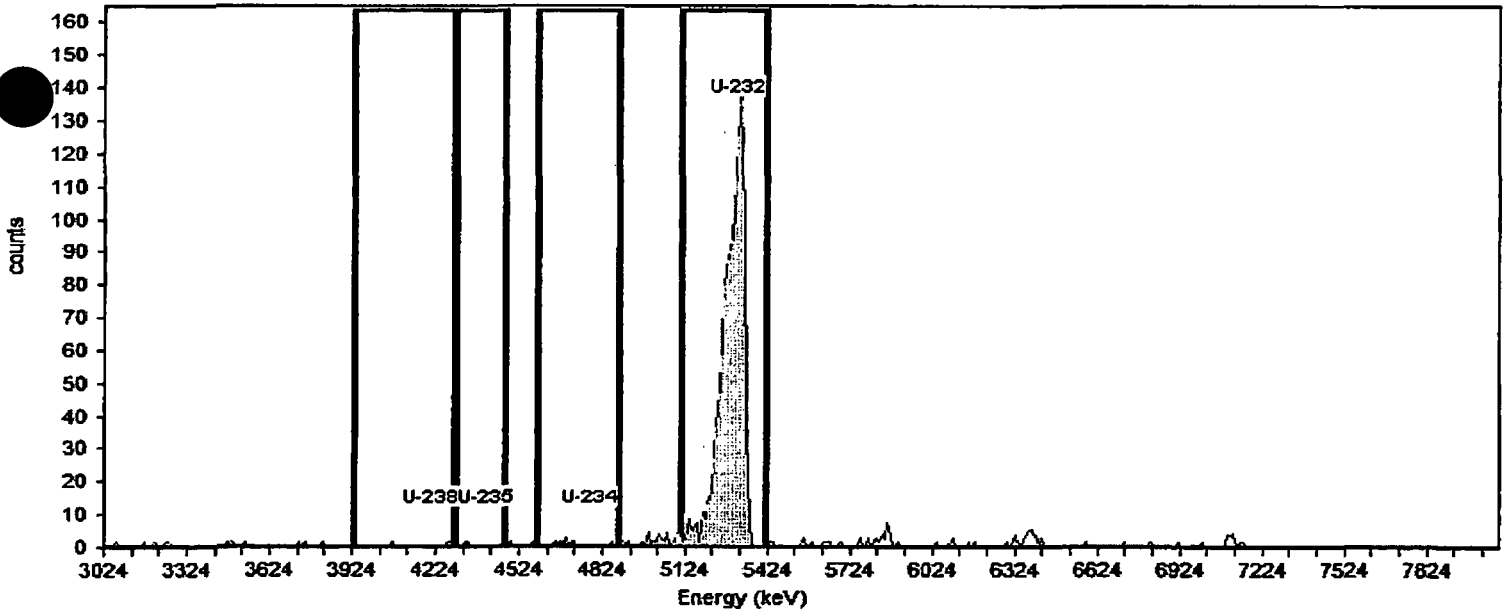
Energy Cal: Gain = 9.9176 keV / Ch  
Offset = 3,014.71 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 76.70%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4204.8	3927.1	4284.2	225.6	100.2	5.00	1.00	4.00	1.5E-002	9.4E-003	8.8E-003	2.8E-002
U-235	4403.2	4294.1	4472.6	24.3	80.9	1.00	1.00	0.00	0.0E+000	6.7E-003	1.1E-002	3.5E-002
U-234	4780.0	4591.6	4879.2	189.8	100.0	7.00	0.00	7.00	2.7E-002	1.1E-002	0.0E+000	1.0E-002
U-232	5315.6	5107.3	5414.8	80.9	100.1	1,123.00	2.00	1,121.00	3.4E+000	1.0E-001	1.3E-002	3.7E-002

Reviewed By:  

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-2  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 82  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.09 min.  
Dead Time: 0.01 %

### Calibration

Bkgd Info: Sample: B14021882; Det: 82; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:11AM

Efficiency Calibration: C14021882

Efficiency: 30.65% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021882

Energy Cal: Gain = 9.9003 keV / Ch

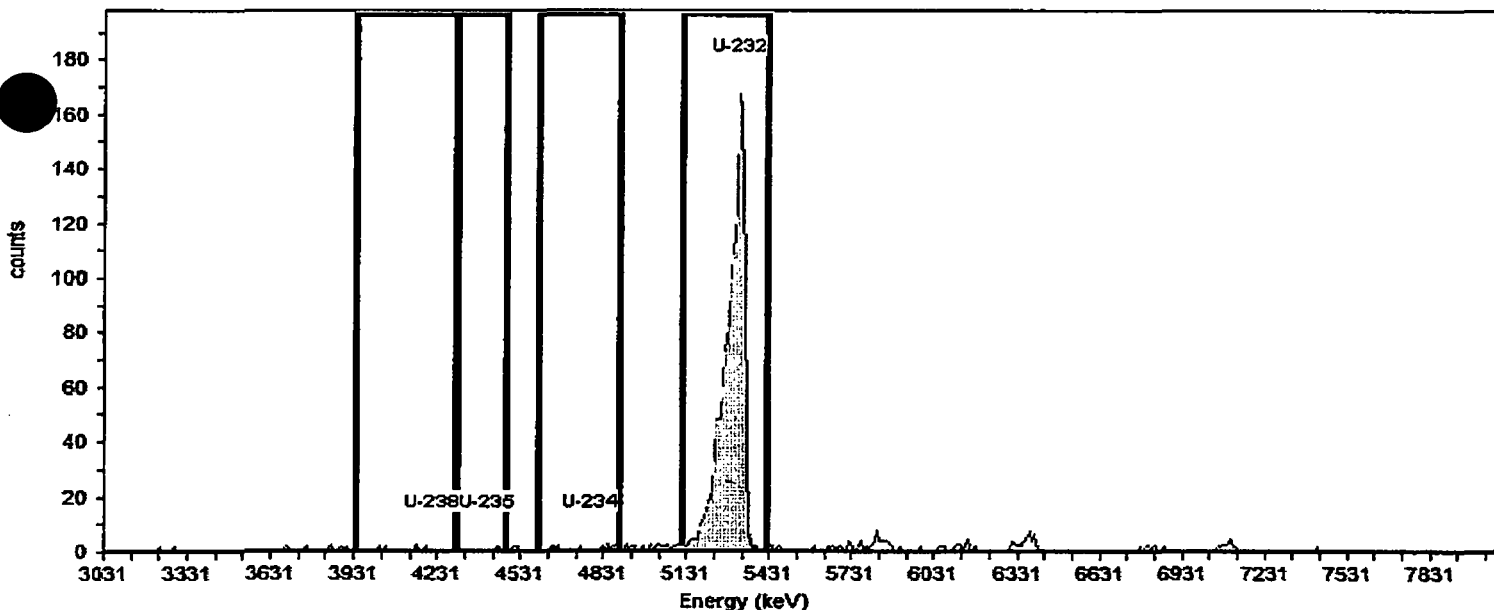
Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 85.50%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	183.4	100.2	5.00	2.00	3.00	1.0E-002	9.1E-003	1.1E-002	3.2E-002
U-235	4407.3	4298.4	4476.6	24.0	80.9	1.00	0.00	1.00	4.3E-003	6.0E-003	0.0E+000	1.2E-002
U-234	4783.5	4595.4	4882.5	66.1	100.0	9.00	0.00	9.00	3.1E-002	1.1E-002	0.0E+000	9.3E-003
U-232	5318.1	5110.2	5417.1	63.8	100.1	1,244.00	2.00	1,242.00	3.8E+000	1.1E-001	1.2E-002	3.3E-002

Reviewed By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-3  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 83  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021883; Det: 83; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:30AM

Efficiency Calibration: C14021883

Efficiency: 31.20% +/- 0.16% TPU(2 sigma)

Energy Calibration: C14021883

Energy Cal: Gain = 9.8810 keV / Ch

Offset = 3,028.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

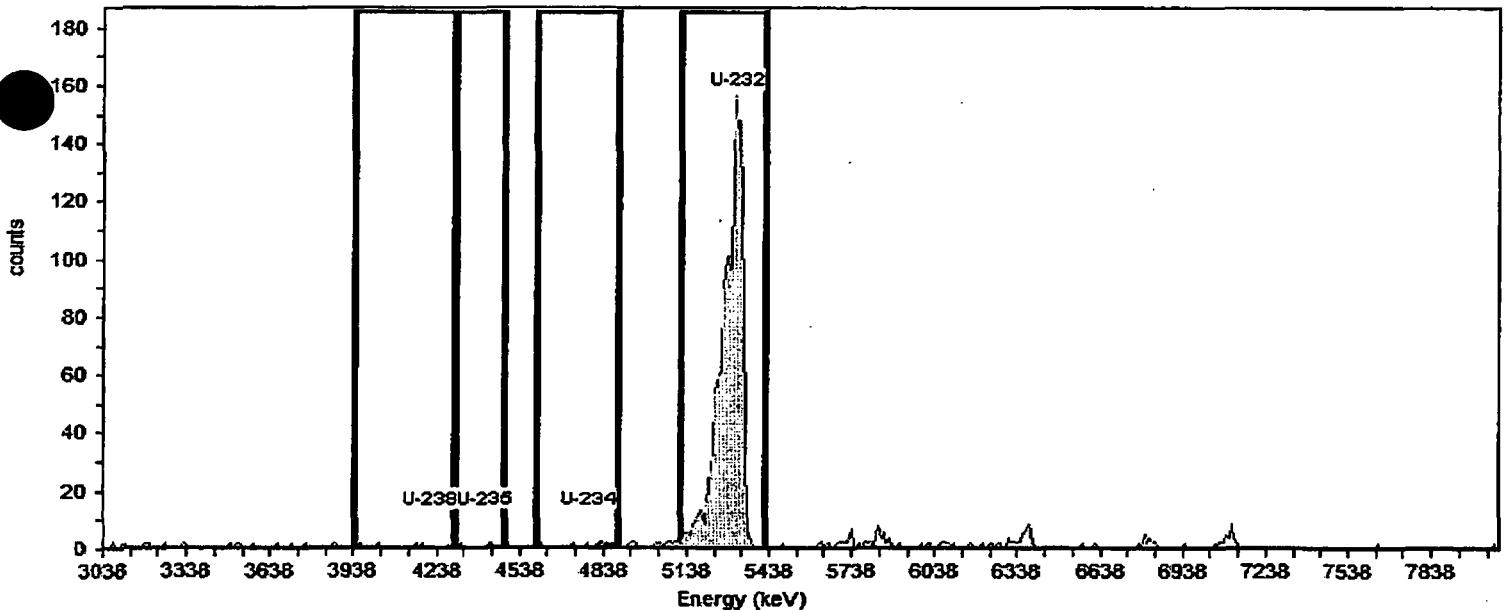
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 86.54%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	13.6	100.2	6.00	2.00	4.00	1.3E-002	9.4E-003	1.1E-002	3.1E-002
U-235	4411.5	4302.9	4480.7	27.0	80.9	2.00	0.00	2.00	8.2E-003	7.2E-003	0.0E+000	1.1E-002
U-234	4787.0	4599.3	4885.8	114.9	100.0	11.00	5.00	6.00	2.0E-002	1.3E-002	1.7E-002	4.4E-002
U-232	5320.6	5113.1	5419.4	74.1	100.1	1,281.00	1.00	1,280.00	3.8E+000	1.1E-001	8.0E-003	2.5E-002

Reviewed By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-4  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 84  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.00 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021884; Det: 84; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:49AM

Energy Calibration: C14021884

Efficiency Calibration: C14021884

Energy Cal: Gain = 9.9003 keV / Ch

Efficiency: 30.40% +/- 0.21% TPU(2 sigma)

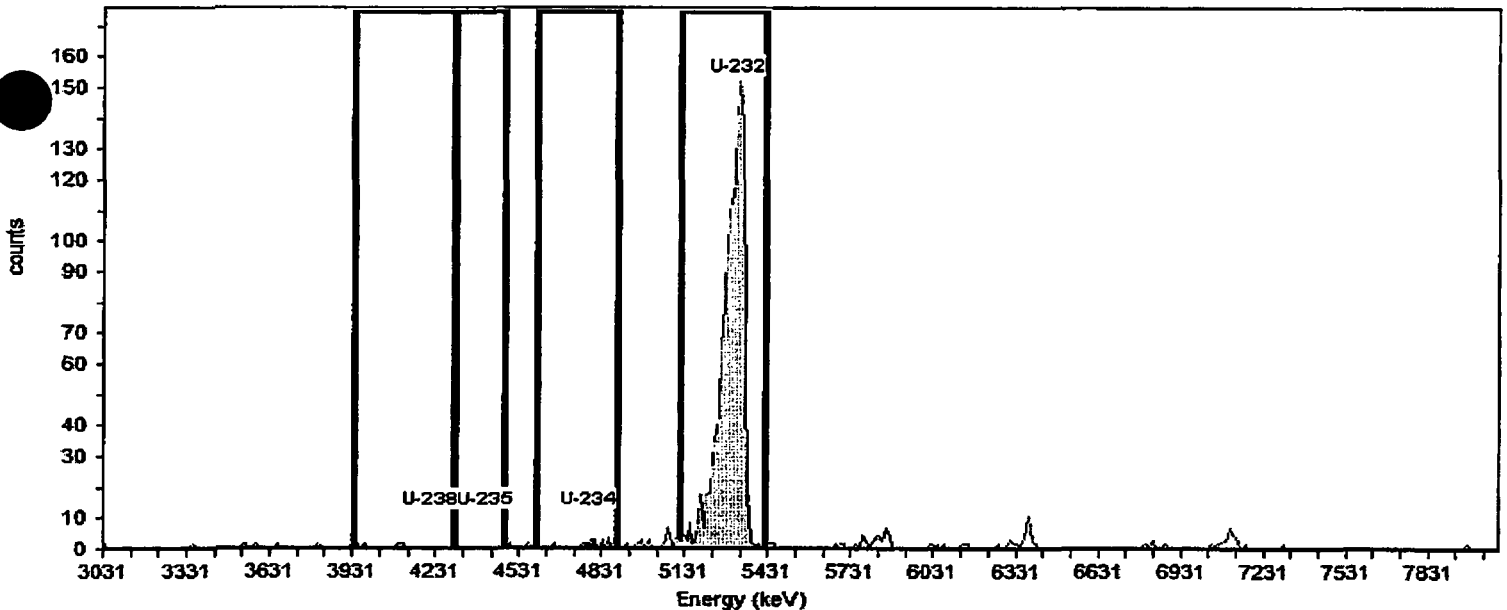
Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 88.53%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	191.6	100.2	5.00	0.00	5.00	1.7E-002	8.2E-003	0.0E+000	9.0E-003
U-235	4407.3	4298.4	4476.6	.0	80.9	0.00	2.00	-2.00	-8.3E-003	7.2E-003	1.4E-002	3.8E-002
U-234	4783.5	4595.4	4882.5	23.0	100.0	13.00	0.00	13.00	4.3E-002	1.3E-002	0.0E+000	9.1E-003
U-232	5318.1	5110.2	5417.1	77.6	100.1	1,278.00	2.00	1,276.00	3.9E+000	1.1E-001	1.1E-002	3.2E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-5  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 85  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.02 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021885; Det: 85; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:16:07AM

Efficiency Calibration: C14021885

Efficiency: 30.11% +/- 0.13% TPU(2 sigma)

Energy Calibration: C14021885

Energy Cal: Gain = 9.8224 keV / Ch

Offset = 3,029.39 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

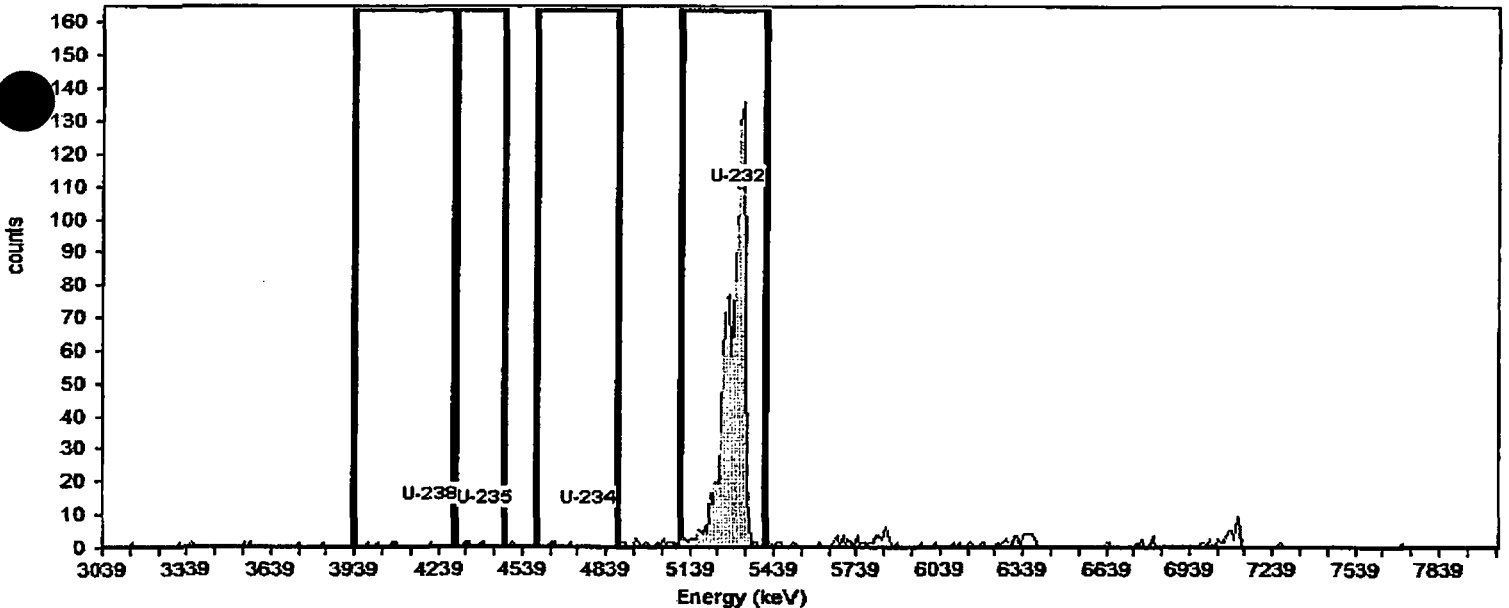
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 65.37%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.1	3933.1	4286.7	125.5	100.2	5.00	0.00	5.00	2.3E-002	1.1E-002	0.0E+000	1.2E-002
U-235	4404.5	4296.5	4473.3	.0	80.9	4.00	0.00	4.00	2.3E-002	1.3E-002	0.0E+000	1.5E-002
U-234	4777.8	4591.2	4876.0	232.4	100.0	4.00	0.00	4.00	1.8E-002	1.0E-002	0.0E+000	1.2E-002
U-232	5308.2	5101.9	5406.4	76.1	100.1	934.00	1.00	933.00	2.9E+000	9.5E-002	1.1E-002	3.5E-002

Reviewed By:  

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

Print Date: 2/20/2014

AlphaVision v5.3

Custom Report Iteration: 05/21/09

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# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-6  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 86  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.00 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021886; Det: 86; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:16:26AM

Efficiency Calibration: C14021886

Efficiency: 30.61% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021886

Energy Cal: Gain = 9.8047 keV / Ch

Offset = 3,036.00 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

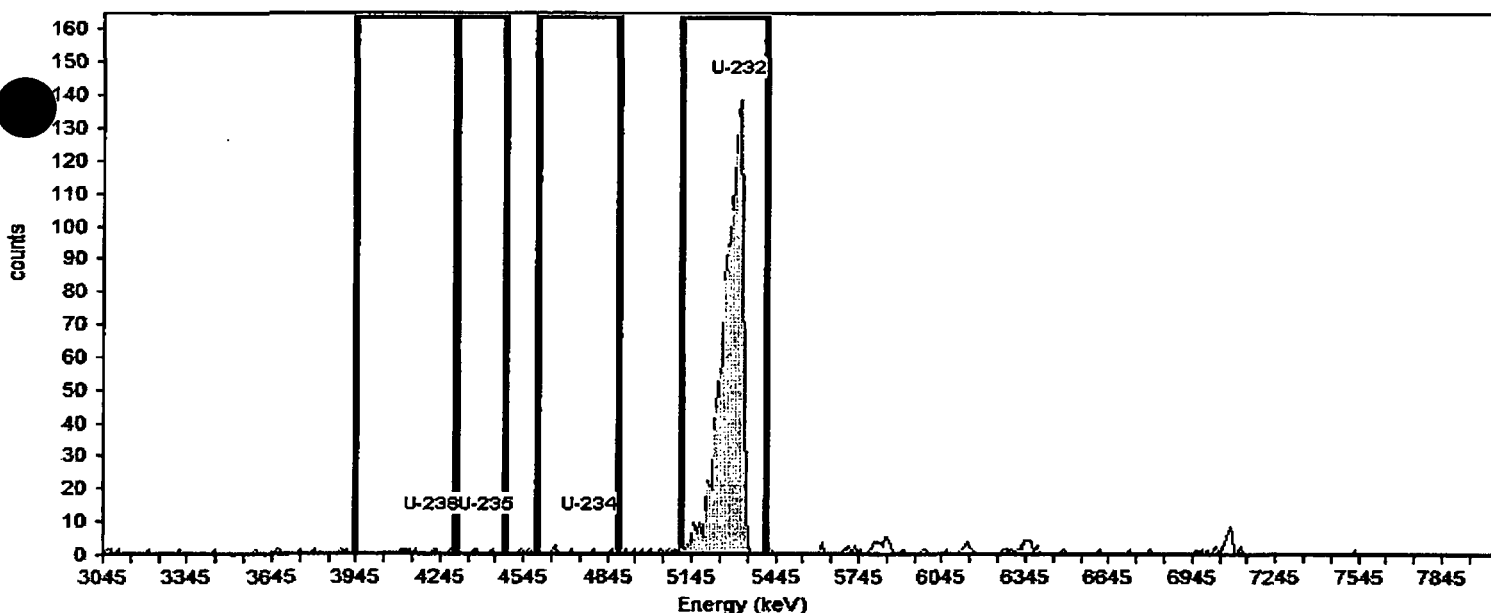
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 77.52%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	13.9	100.2	6.00	0.00	6.00	2.3E-002	1.0E-002	0.0E+000	1.0E-002
U-235	4408.7	4300.8	4477.3	24.0	80.9	2.00	2.00	0.00	0.0E+000	9.4E-003	1.5E-002	4.4E-002
U-234	4781.2	4595.0	4879.3	228.5	100.0	7.00	1.00	6.00	2.3E-002	1.1E-002	8.8E-003	2.8E-002
U-232	5310.7	5104.8	5408.8	72.8	100.1	1,128.00	3.00	1,125.00	3.4E+000	1.0E-001	1.6E-002	4.2E-002

Reviewed By: \_\_\_\_\_

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-7  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 87  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.02 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021887; Det: 87; Spectrum #1; 2/18/2014 10:34:51 AM

Calibration Date: 2/18/2014 10:16:46AM

Efficiency Calibration: C14021887

Efficiency: 31.55% +/- 0.19% TPU(2 sigma)

Energy Calibration: C14021887

Energy Cal: Gain = 9.7851 keV / Ch

Offset = 3,042.97 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

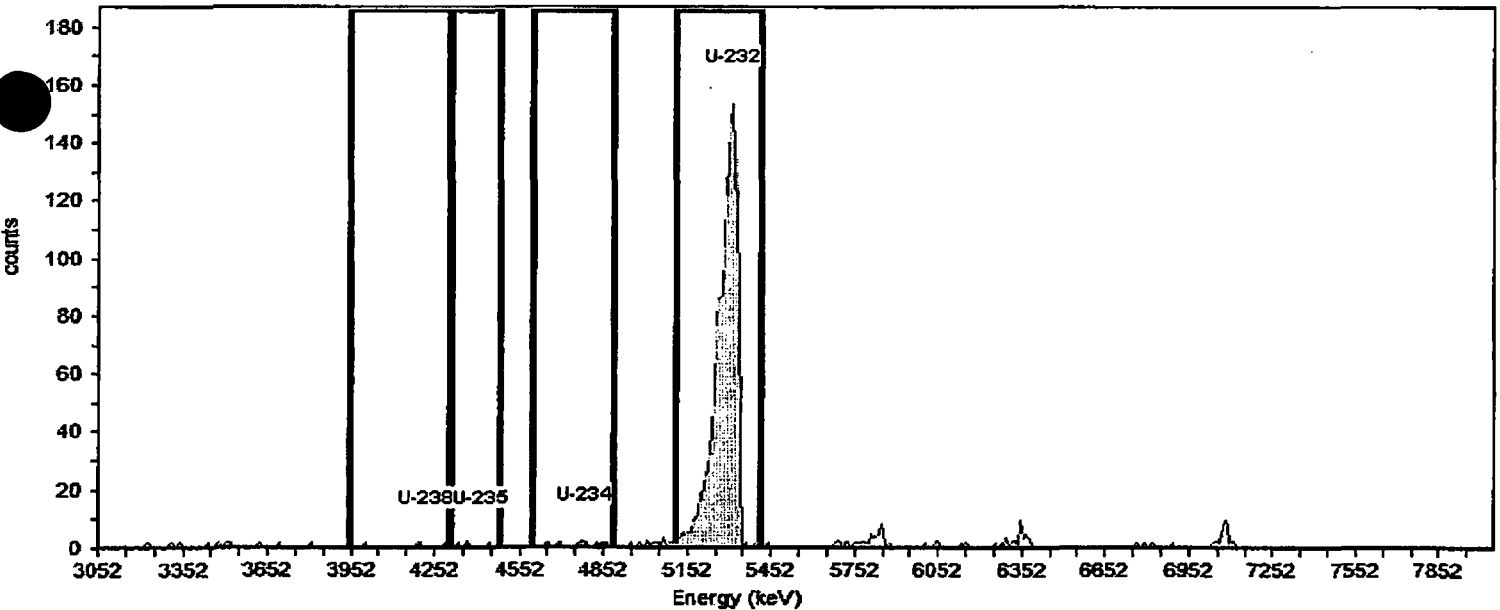
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 82.97%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.2	3943.2	4295.5	13.5	100.2	5.00	1.00	4.00	1.4E-002	8.4E-003	8.0E-003	2.5E-002
U-235	4412.9	4305.2	4481.4	46.8	80.9	4.00	1.00	3.00	1.3E-002	9.5E-003	9.9E-003	3.1E-002
U-234	4784.7	4598.8	4882.6	180.0	100.0	12.00	0.00	12.00	4.1E-002	1.3E-002	0.0E+000	9.3E-003
U-232	5313.1	5107.6	5411.0	78.0	100.1	1,243.00	2.00	1,241.00	3.7E+000	1.0E-001	1.2E-002	3.3E-002

Reviewed By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

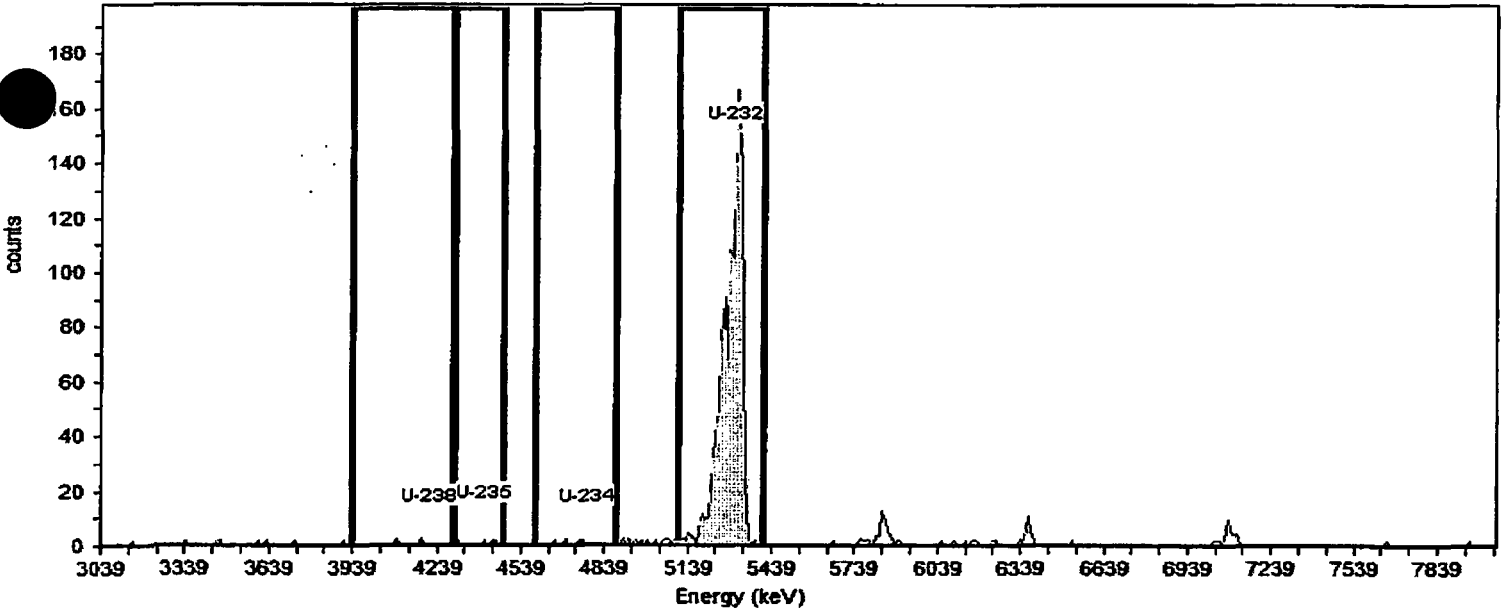
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402168-8      Sample Size : 0.50  
 Spectrum #1      Analysis #1

**Acquisition**  
 Detector: 88      Acquisition Start Date: 2/19/2014 2:59:37PM  
 Batch Name: UAS140215-4\_A      Live Time: 1,000.00 min.  
 Nuclide Library: Uranium      Real Time: 1,000.02 min.  
 Analysis Method: ROI Analysis, Set Name = Uranium Default      Dead Time: 0.00 %  
 ROI Set: Uranium Default

**Calibration**  
 Bkgd Info: Sample: B14021888; Det: 88; Spectrum #1; 2/18/2014 10:34:51 AM  
 Calibration Date: 2/18/2014 10:17:09AM      Energy Calibration: C14021888  
 Efficiency Calibration: C14021888      Energy Cal: Gain = 9.8224 keV / Ch  
 Efficiency: 30.79% +/- 0.12% TPU(2 sigma)      Offset = 3,029.39 keV  
    Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232      Tracer Nuclide: U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM      Tracer Recovery: 81.39%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.1	3933.1	4286.7	58.6	100.2	4.00	3.00	1.00	3.6E-003	9.5E-003	1.4E-002	3.9E-002
U-235	4404.5	4296.5	4473.3	146.4	80.9	4.00	1.00	3.00	1.3E-002	1.0E-002	1.0E-002	3.3E-002
U-234	4777.8	4591.2	4876.0	180.5	100.0	6.00	1.00	5.00	1.8E-002	9.6E-003	8.4E-003	2.6E-002
U-232	5308.2	5101.9	5406.4	67.5	100.1	1,192.00	4.00	1,188.00	3.6E+000	1.1E-001	1.7E-002	4.5E-002

Reviewed By: \_\_\_\_\_

*JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-9  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 89  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021889; Det: 89; Spectrum #1; 2/18/2014 10:35:40 AM

Calibration Date: 2/18/2014 10:21:39AM

Efficiency Calibration: C14021889

Efficiency: 31.24% +/- 0.20% TPU(2 sigma)

Energy Calibration: C14021889

Energy Cal: Gain = 9.9003 keV / Ch

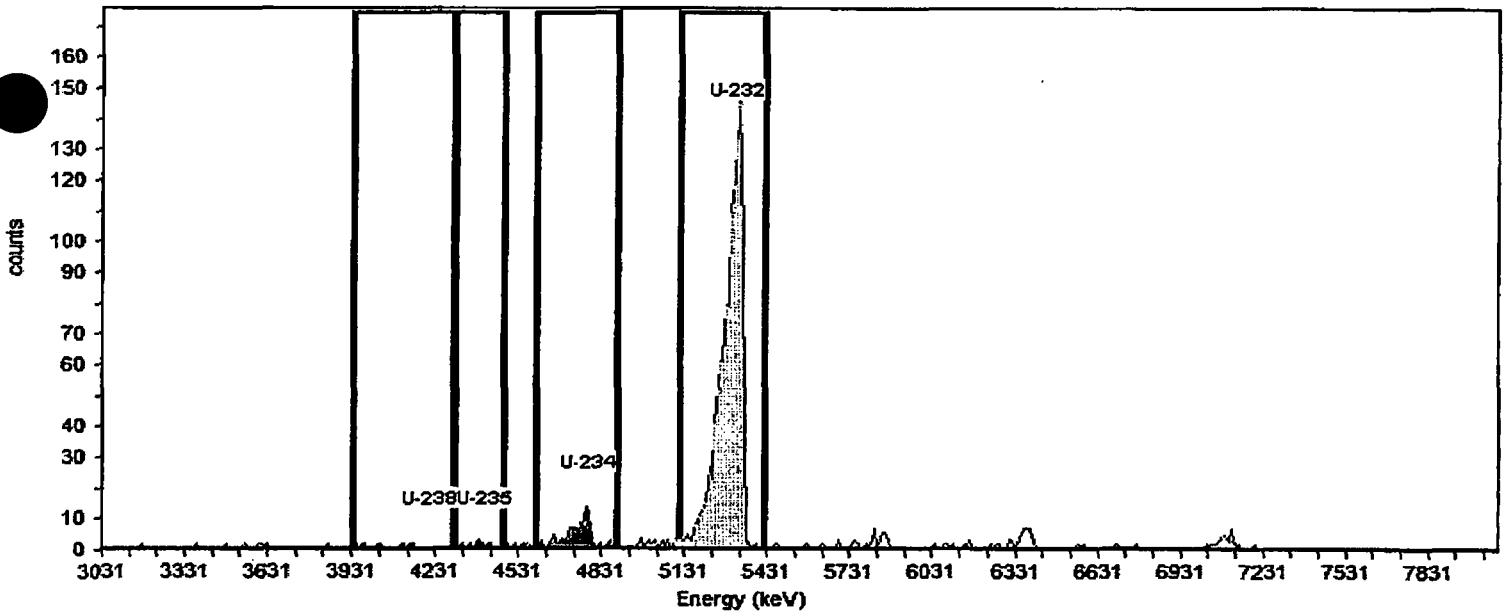
Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 76.70%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	234.9	100.2	6.00	0.00	6.00	2.3E-002	1.0E-002	0.0E+000	1.0E-002
U-235	4407.3	4298.4	4476.6	24.5	80.9	7.00	0.00	7.00	3.3E-002	1.3E-002	0.0E+000	1.3E-002
U-234	4783.5	4595.4	4882.5	72.4	100.0	89.00	3.00	86.00	3.2E-001	4.1E-002	1.5E-002	4.0E-002
U-232	5318.1	5110.2	5417.1	65.1	100.1	1,143.00	7.00	1,136.00	3.4E+000	1.0E-001	2.4E-002	5.8E-002

Prepared By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-10  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 90  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021890; Det: 90; Spectrum #1; 2/18/2014 10:35:40 AM

Calibration Date: 2/18/2014 10:21:56AM

Efficiency Calibration: C14021890

Efficiency: 30.90% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021890

Energy Cal: Gain = 9.9003 keV / Ch

Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

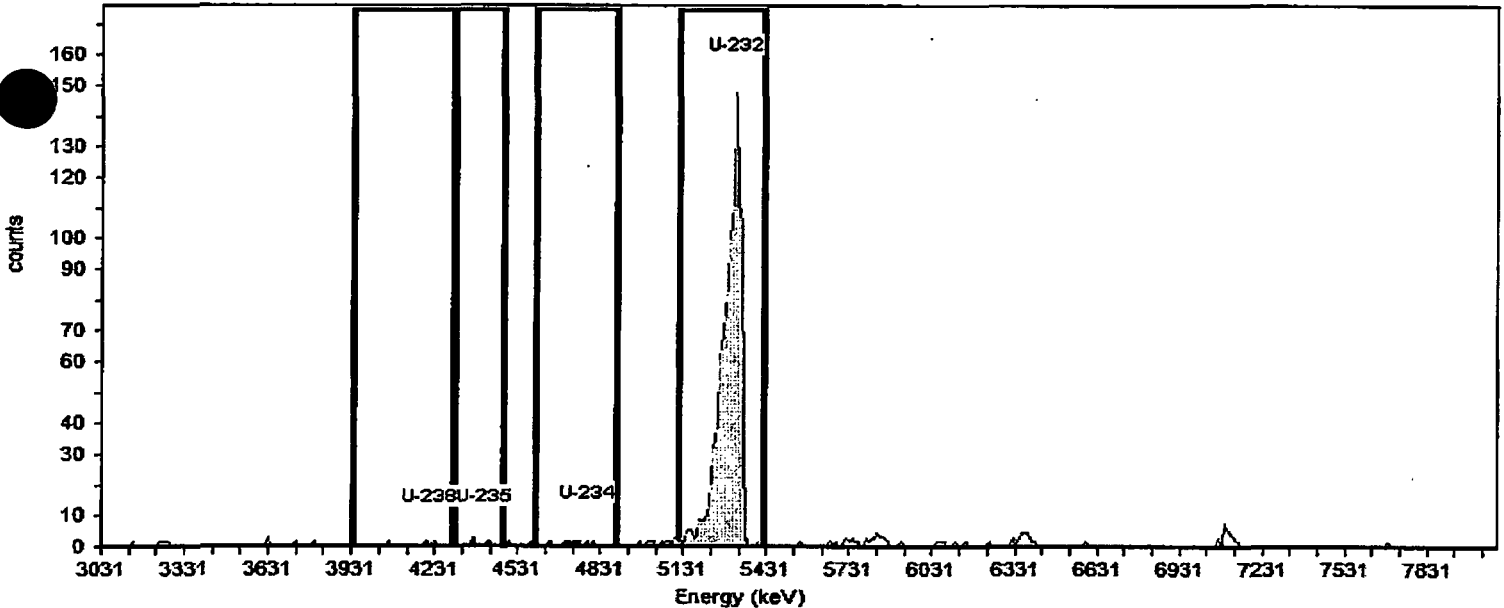
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 71.13%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	195.6	100.2	3.00	2.00	1.00	4.1E-003	9.1E-003	1.3E-002	3.8E-002
U-235	4407.3	4298.4	4476.6	24.2	80.9	3.00	0.00	3.00	1.5E-002	1.0E-002	0.0E+000	1.4E-002
U-234	4783.5	4595.4	4882.5	56.6	100.0	8.00	0.00	8.00	3.3E-002	1.2E-002	0.0E+000	1.1E-002
U-232	5318.1	5110.2	5417.1	75.1	100.1	1,047.00	5.00	1,042.00	3.1E+000	9.8E-002	2.2E-002	5.6E-002

Reviewed By: TP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-11  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 91  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021891; Det: 91; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:22:19AM

Efficiency Calibration: C14021891

Efficiency: 30.35% +/- 0.16% TPU(2 sigma)

Energy Calibration: C14021891

Energy Cal: Gain = 9.8810 keV / Ch

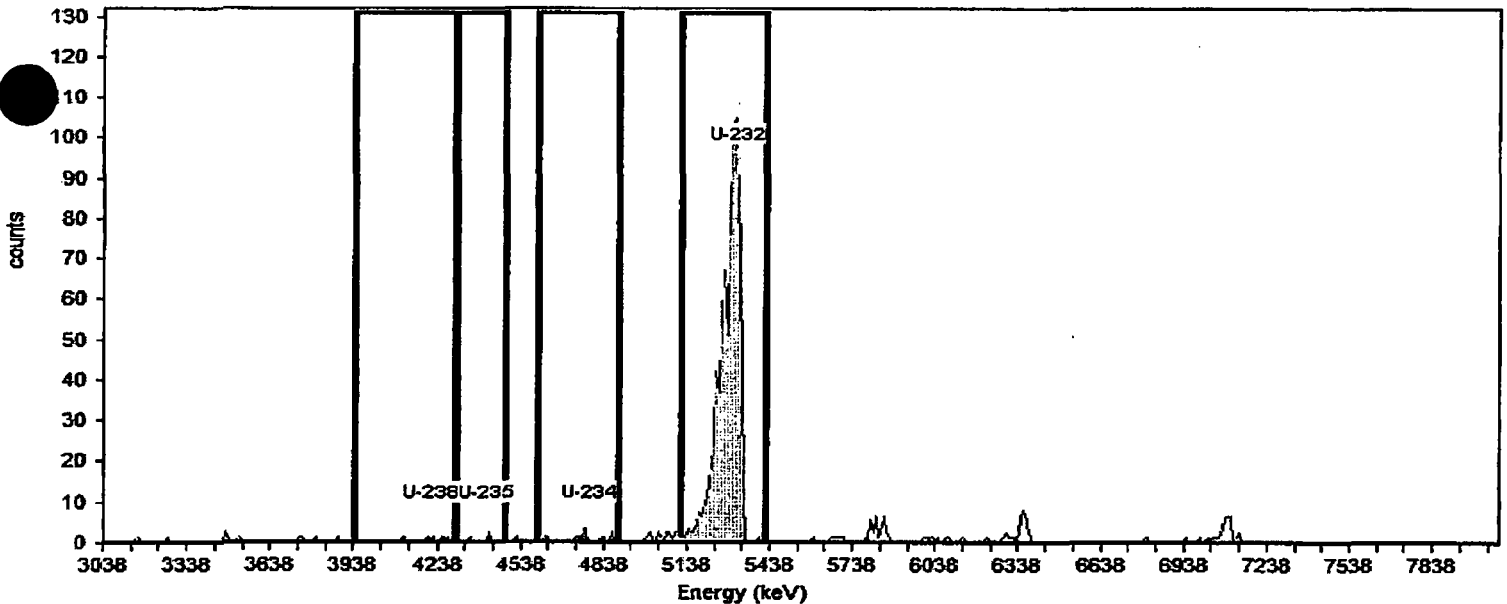
Offset = 3,028.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 54.85%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	33.6	100.2	6.00	1.00	5.00	2.7E-002	1.4E-002	1.3E-002	4.0E-002
U-235	4411.5	4302.9	4480.7	.0	80.9	4.00	2.00	2.00	1.3E-002	1.6E-002	2.2E-002	6.2E-002
U-234	4787.0	4599.3	4885.8	14.4	100.0	10.00	0.00	10.00	5.4E-002	1.8E-002	0.0E+000	1.5E-002
U-232	5320.6	5113.1	5419.4	72.0	100.1	793.00	4.00	789.00	2.4E+000	8.7E-002	2.6E-002	6.7E-002

Reviewed By:  

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-12  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 92  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.00 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021892; Det: 92; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:22:35AM

Efficiency Calibration: C14021892

Efficiency: 31.14% +/- 0.21% TPU(2 sigma)

Energy Calibration: C14021892

Energy Cal: Gain = 9.7851 keV / Ch

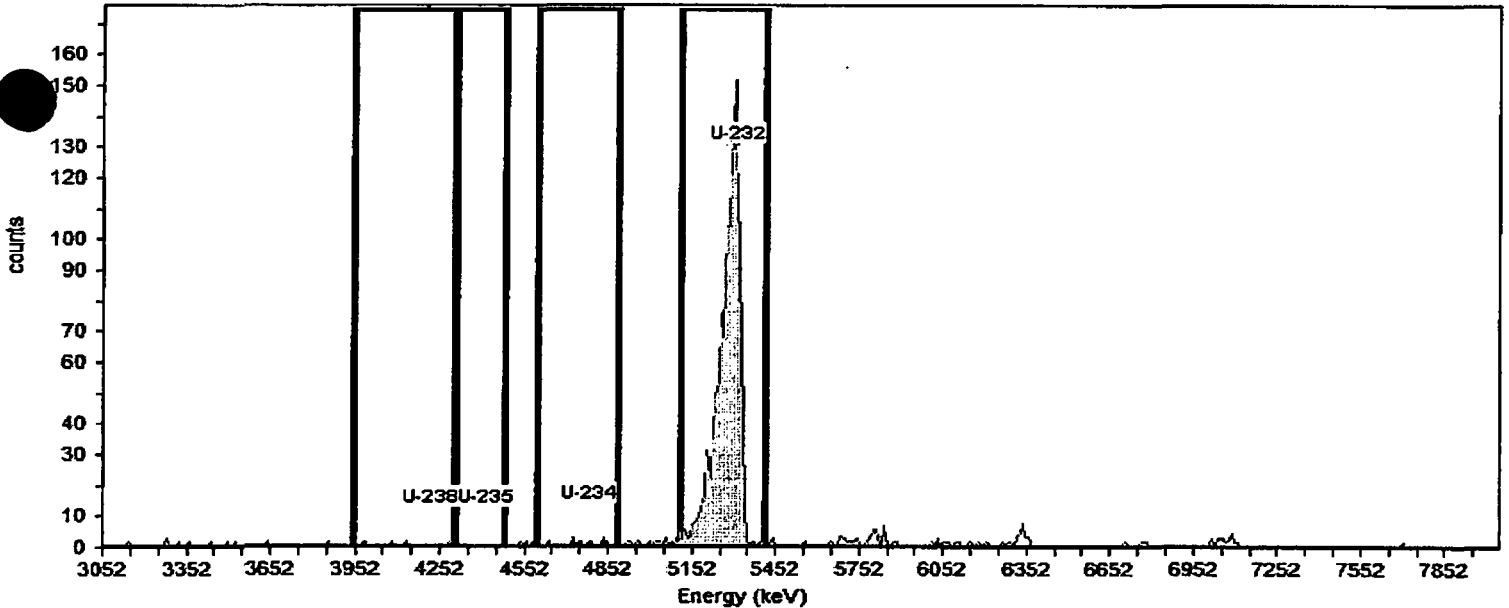
Offset = 3,042.97 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 78.38%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.2	3943.2	4295.5	13.5	100.2	4.00	3.00	1.00	3.7E-003	9.7E-003	1.5E-002	4.0E-002
U-235	4412.9	4305.2	4481.4	.0	80.9	0.00	0.00	0.00	0.0E+000	6.5E-003	0.0E+000	1.2E-002
U-234	4784.7	4598.8	4882.6	131.7	100.0	9.00	0.00	9.00	3.3E-002	1.2E-002	0.0E+000	1.0E-002
U-232	5313.1	5107.6	5411.0	68.9	100.1	1,158.00	1.00	1,157.00	3.5E+000	1.0E-001	8.9E-003	2.8E-002

Reviewed By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

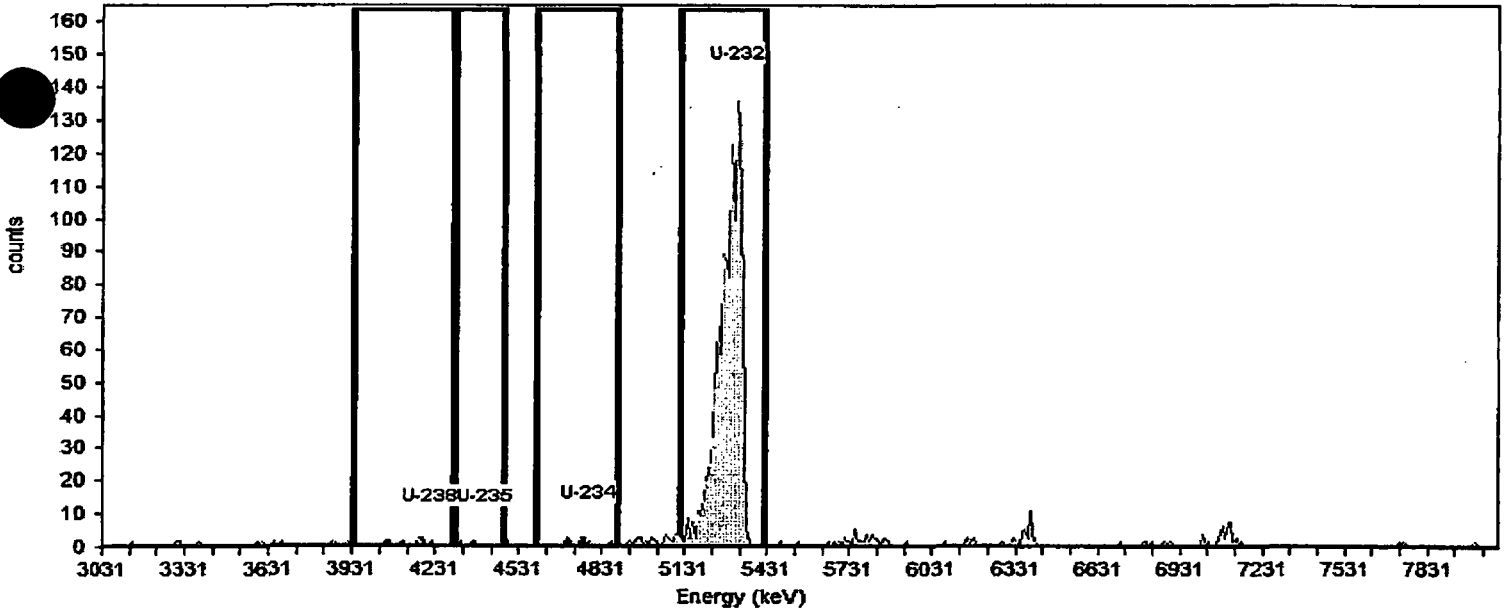
## Alpha-Spectroscopy Analysis Report

Sample: 1402168-13 Sample Size : 0.50  
Spectrum #1 Analysis #1

**Acquisition**  
Detector: 93 Acquisition Start Date: 2/19/2014 2:59:35PM  
Batch Name: UAS140215-4\_A Live Time: 1,000.00 min.  
Nuclide Library: Uranium Real Time: 1,000.01 min.  
Analysis Method: ROI Analysis, Set Name = Uranium Default Dead Time: 0.00 %  
ROI Set: Uranium Default

**Calibration**  
Bkgd Info: Sample: B14021893; Det: 93; Spectrum #1; 2/18/2014 10:35:41 AM  
Calibration Date: 2/18/2014 10:22:53AM Energy Calibration: C14021893  
Efficiency Calibration: C14021893 Energy Cal: Gain = 9.9003 keV / Ch  
Efficiency: 32.05% +/- 0.13% TPU(2 sigma) Offset = 3,021.28 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
Tracer Name: 914.4095.46\_U-232 Tracer Nuclide: U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM Tracer Recovery: 76.55%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	63.1	100.2	9.00	4.00	5.00	1.8E-002	1.3E-002	1.7E-002	4.4E-002
U-235	4407.3	4298.4	4476.6	27.2	80.9	2.00	1.00	1.00	4.5E-003	7.9E-003	1.1E-002	3.3E-002
U-234	4783.5	4595.4	4882.5	75.8	100.0	10.00	1.00	9.00	3.3E-002	1.2E-002	8.5E-003	2.7E-002
U-232	5318.1	5110.2	5417.1	86.3	100.1	1,170.00	7.00	1,163.00	3.4E+000	1.0E-001	2.3E-002	5.7E-002

Reviewed By:  

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-14  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 94  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.11 min.  
Dead Time: 0.01 %

### Calibration

Bkgd Info: Sample: B14021894; Det: 94; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:23:21AM

Efficiency Calibration: C14021894

Efficiency: 32.10% +/- 0.16% TPU(2 sigma)

Energy Calibration: C14021894

Energy Cal: Gain = 9.8810 keV / Ch

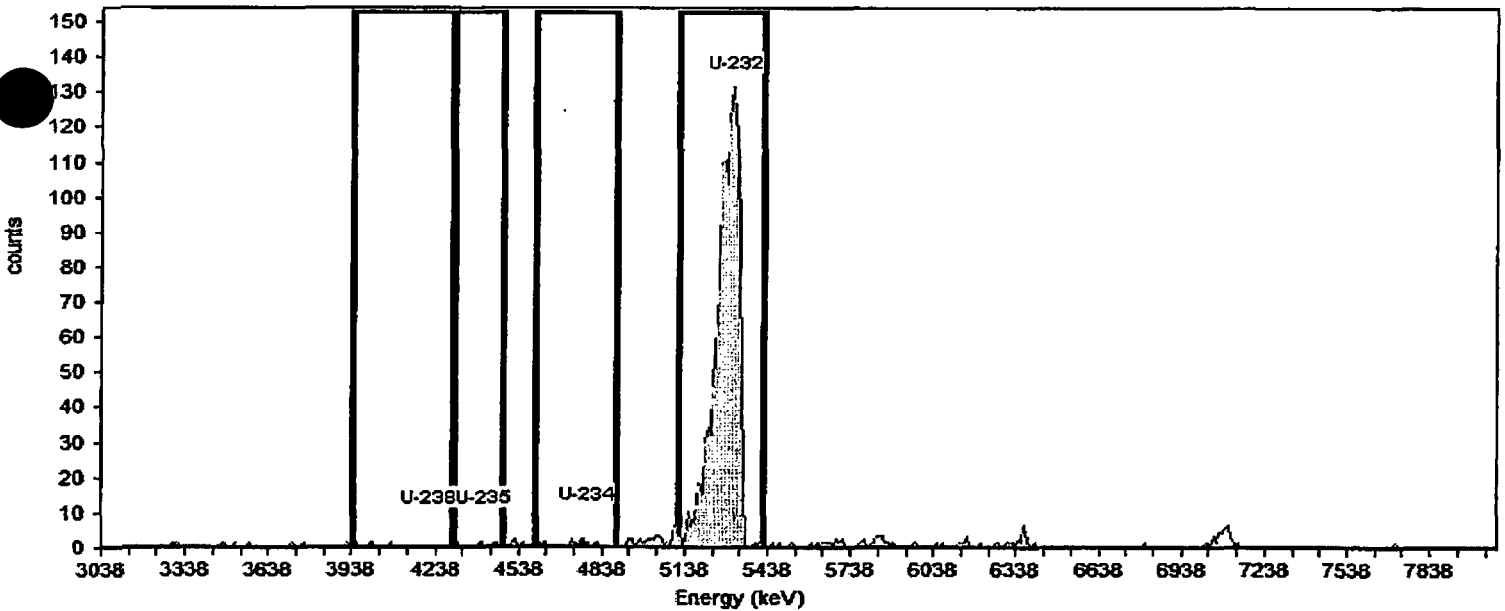
Offset = 3,028.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 82.21%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	22.5	100.2	3.00	3.00	0.00	0.0E+000	8.3E-003	1.4E-002	3.7E-002
U-235	4411.5	4302.9	4480.7	16.8	80.9	3.00	3.00	0.00	0.0E+000	1.0E-002	1.7E-002	4.5E-002
U-234	4787.0	4599.3	4885.8	65.2	100.0	12.00	5.00	7.00	2.4E-002	1.4E-002	1.8E-002	4.5E-002
U-232	5320.6	5113.1	5419.4	84.2	100.1	1,253.00	2.00	1,251.00	3.6E+000	1.0E-001	1.2E-002	3.3E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402168-15  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 95  
Batch Name: UAS140215-4\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/19/2014 2:59:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.02 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021895; Det: 95; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:23:39AM

Efficiency Calibration: C14021895

Efficiency: 32.13% +/- 0.19% TPU(2 sigma)

Energy Calibration: C14021895

Energy Cal: Gain = 9.9784 keV / Ch

Offset = 3,013.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

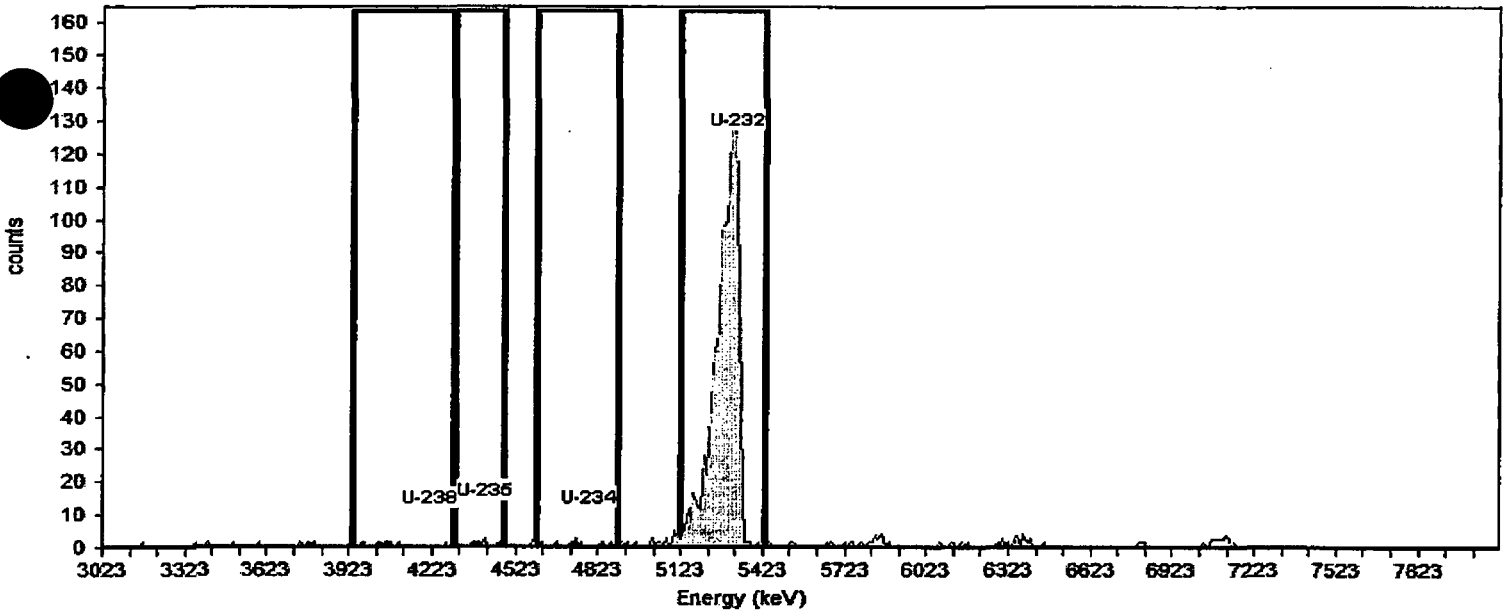
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 80.29%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4210.6	3931.2	4290.5	218.7	100.2	7.00	1.00	6.00	2.1E-002	9.9E-003	8.1E-003	2.6E-002
U-235	4410.2	4300.4	4480.0	97.5	80.9	6.00	1.00	5.00	2.2E-002	1.1E-002	1.0E-002	3.2E-002
U-234	4789.4	4599.8	4889.2	151.8	100.0	10.00	3.00	7.00	2.4E-002	1.3E-002	1.4E-002	3.8E-002
U-232	5328.2	5118.7	5428.0	82.1	100.1	1,226.00	3.00	1,223.00	3.6E+000	1.0E-001	1.5E-002	3.9E-002

Reviewed By:  

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

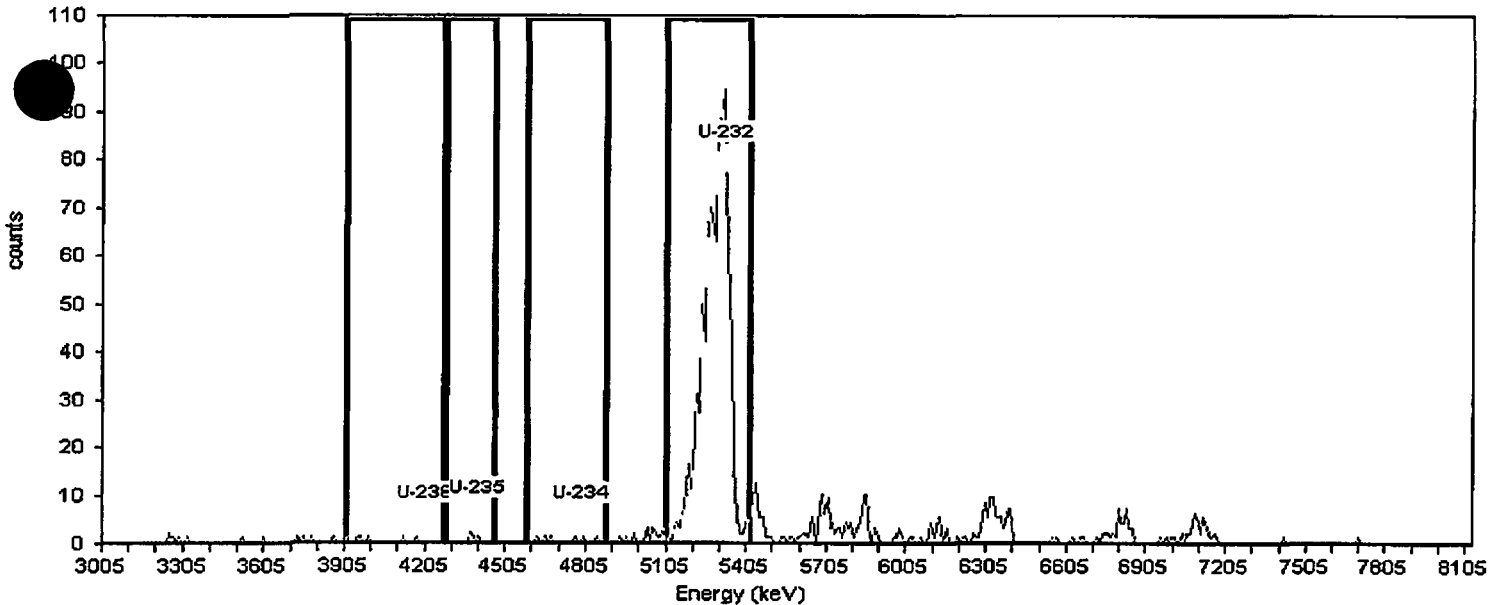
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402168-16  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 9a  
 Batch Name: UAS140215-4\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:19:29PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.93 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021009; Det: 9a; Spectrum #1; Feb-10-2014 13:24  
 Calibration Date: 2/10/2014 10:20:24AM  
 Efficiency Calibration: C14021009  
 Efficiency: 31.42% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021009  
 Energy Cal: Gain = 10.0569 keV / Ch  
 Offset = 2,995.13 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 62.64%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4191.9	3910.3	4272.4	57.9	100.2	6.00	4.00	2.00	9.1E-003	2.9E-002	2.1E-002	5.5E-002
U-235	4393.0	4282.4	4463.4	26.2	99.7	4.00	4.00	0.00	0.0E+000	2.6E-002	2.1E-002	5.5E-002
U-234	4775.2	4584.1	4875.8	13.1	100.0	7.00	8.00	-1.00	-4.6E-003	3.5E-002	3.0E-002	7.3E-002
U-232	5318.3	5107.1	5418.9	100.5	100.1	968.00	35.00	933.00	2.8E+000	1.9E-001	6.5E-002	1.4E-001

Reviewed By: JA JP

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

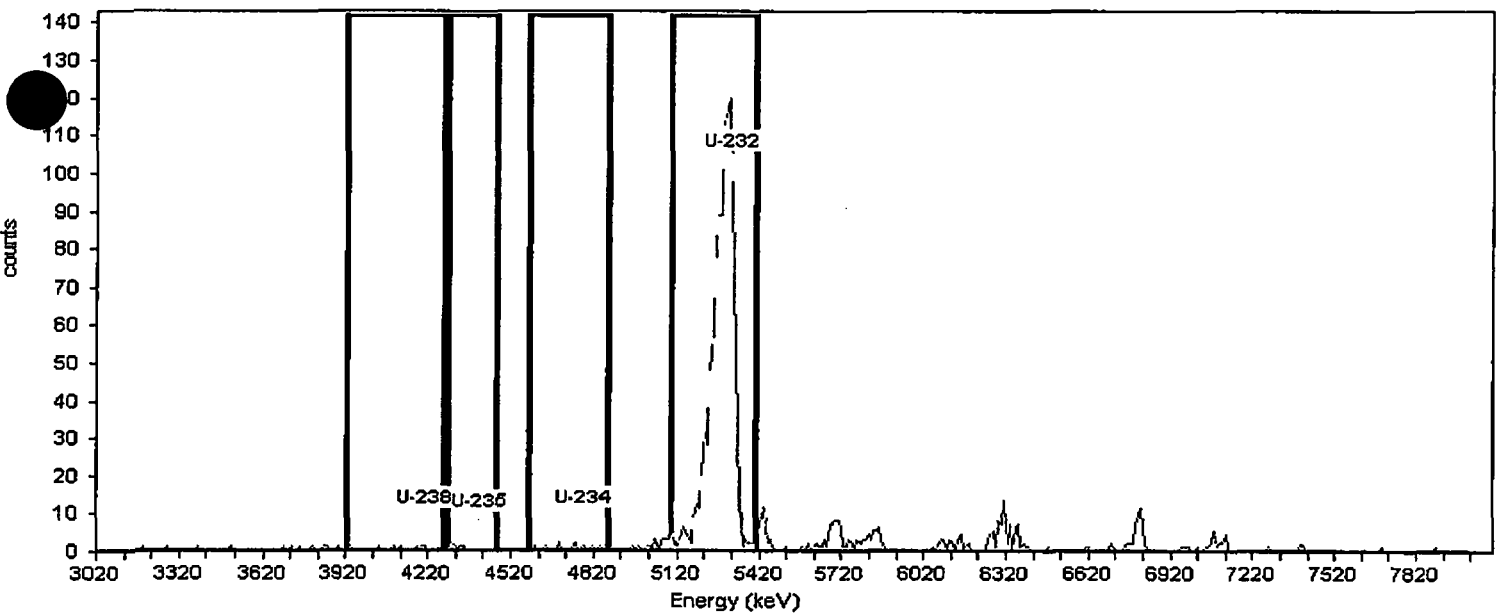
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample ID: 1402168-17  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 10b  
 Batch Name: UAS140215-4\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:19:24PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.93 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021010; Det: 10b; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:21:35AM  
 Efficiency Calibration: C14021010  
 Efficiency: 31.19% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021010  
 Energy Cal: Gain = 9.9575 keV / Ch  
 Offset = 3,010.51 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 70.35%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4195.4	3916.6	4275.1	13.3	100.2	10.00	3.00	7.00	2.9E-002	3.0E-002	1.7E-002	4.4E-002
U-235	4394.6	4285.1	4464.3	.0	99.7	6.00	1.00	5.00	2.1E-002	2.2E-002	9.6E-003	3.0E-002
U-234	4773.0	4583.8	4872.6	194.2	100.0	11.00	4.00	7.00	2.9E-002	3.2E-002	1.9E-002	4.9E-002
U-232	5310.7	5101.6	5410.3	82.3	100.1	1,073.00	33.00	1,040.00	3.1E+000	2.0E-001	5.7E-002	1.3E-001

Reviewed By: JA JP

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

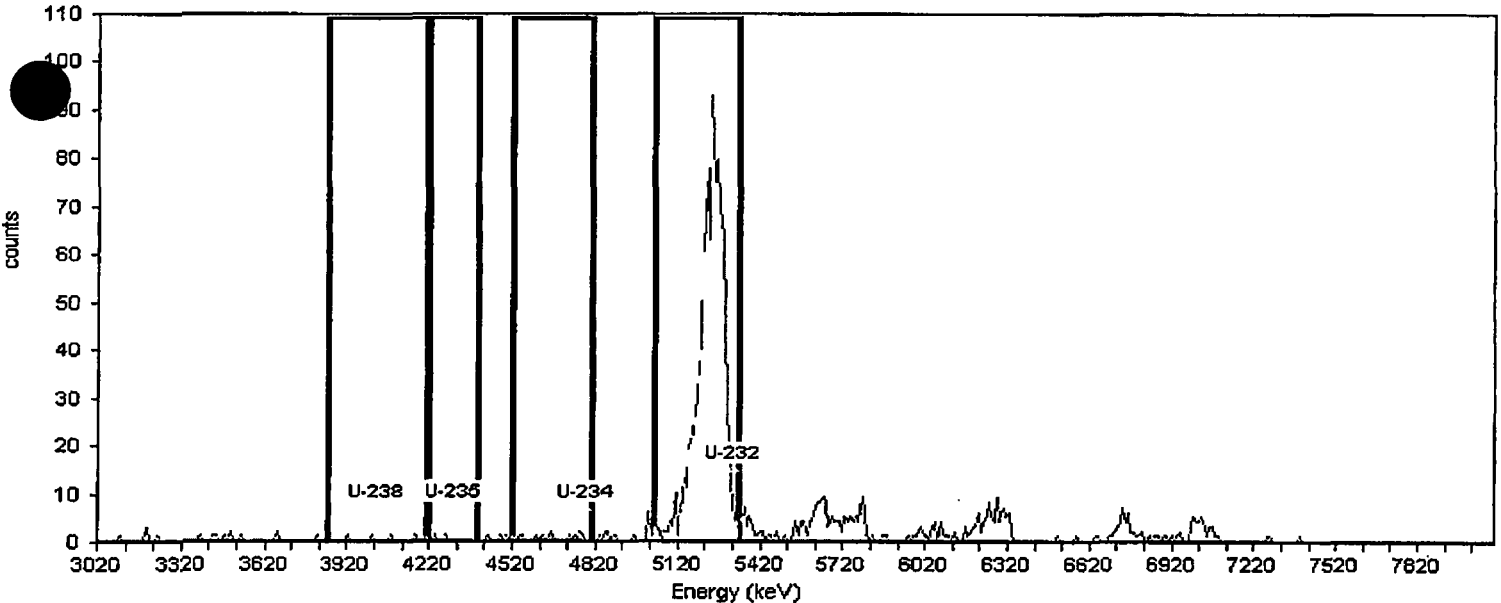
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402168-18  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 11a  
 Batch Name: UAS140215-4\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute Interactive ROI Analysis  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:19:25PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.93 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021011; Det: 11a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:23:50AM  
 Efficiency Calibration: C14021011  
 Efficiency: 30.43% +/- 0.16% TPU(2 sigma)  
 Energy Calibration: C14021011  
 Energy Cal: Gain = 9.9575 keV / Ch  
 Offset = 3,010.51 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 59.96%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4026.2	3846.9	4205.4	39.4	100.2	5.00	4.00	1.00	4.9E-003	3.0E-002	2.3E-002	5.9E-002
U-235	4305.0	4215.4	4394.6	26.8	99.7	2.00	3.00	-1.00	-5.0E-003	2.2E-002	2.0E-002	5.3E-002
U-234	4782.9	4514.1	4802.9	125.6	100.0	14.00	12.00	2.00	9.9E-003	5.0E-002	4.0E-002	9.3E-002
U-232	5320.6	5031.9	5340.6	93.2	100.1	887.00	22.00	865.00	2.7E+000	1.9E-001	5.6E-002	1.3E-001

Reviewed By: JA JP

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

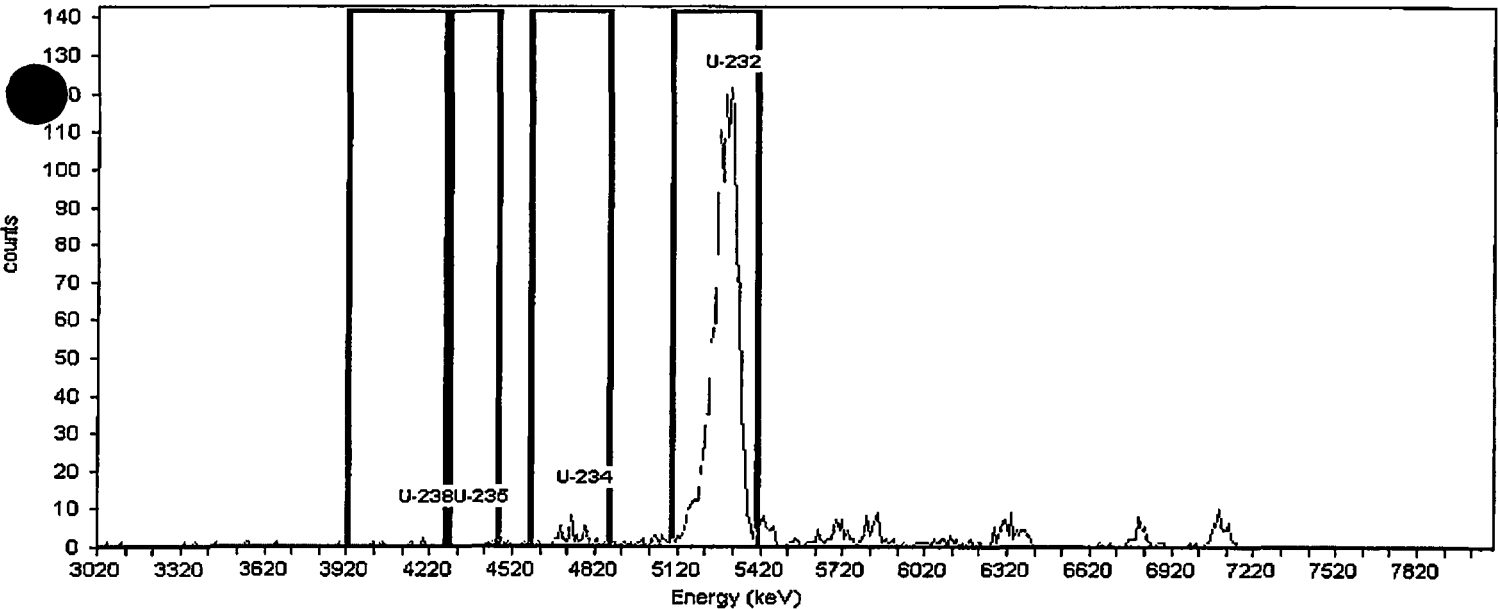
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402168-19  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 12a  
 Batch Name: UAS140215-4\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:19:26PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.93 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021012; Det: 12a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:25:15AM  
 Efficiency Calibration: C14021012  
 Efficiency: 30.32% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021012  
 Energy Cal: Gain = 9.9575 keV / Ch  
 Offset = 3,010.51 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 86.48%



Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4195.4	3916.6	4275.1	.4	100.2	8.00	1.00	7.00	2.4E-002	2.1E-002	8.0E-003	2.5E-002
U-235	4394.6	4285.1	4464.3	.8	99.7	4.00	1.00	3.00	1.0E-002	1.5E-002	8.0E-003	2.5E-002
U-234	4773.0	4583.8	4872.6	70.4	100.0	41.00	3.00	38.00	1.3E-001	4.8E-002	1.4E-002	3.7E-002
U-232	5310.7	5101.6	5410.3	90.3	100.1	1,271.00	28.00	1,243.00	3.8E+000	2.2E-001	4.4E-002	9.7E-002

Re: [Signature] By: [Signature]

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

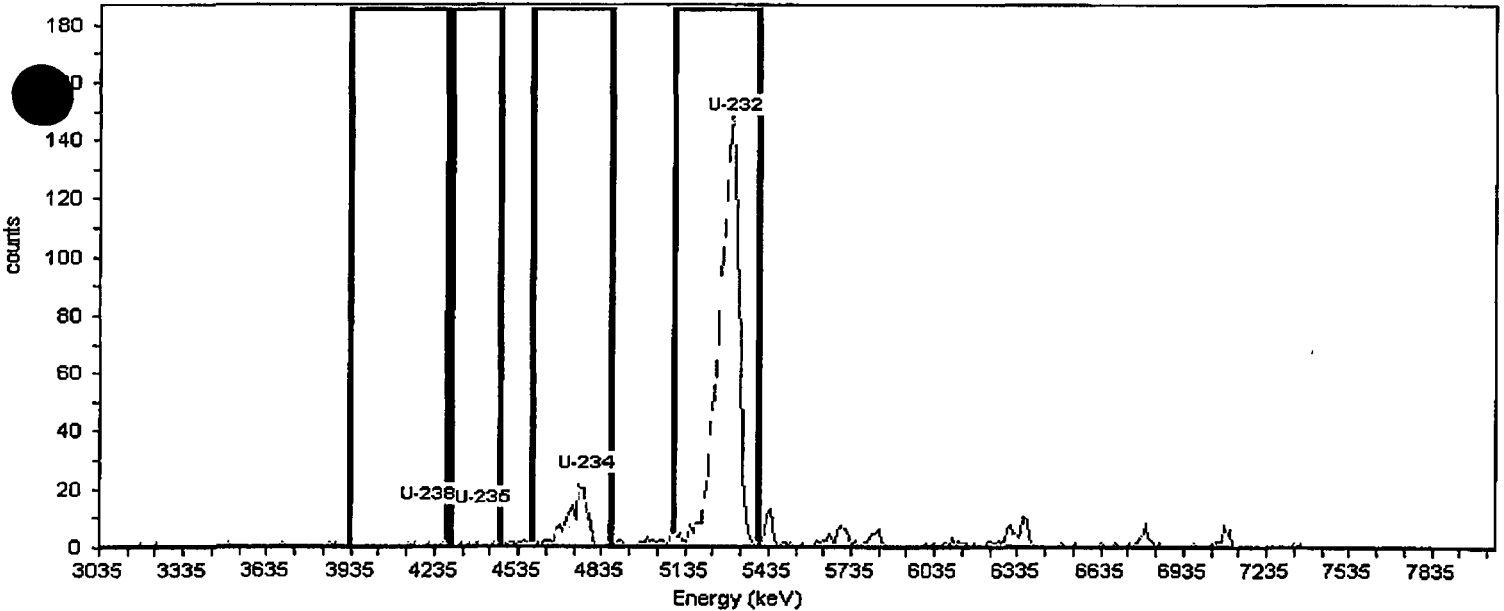
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402168-20  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 13a  
 Batch Name: UAS140215-4\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:19:27PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.93 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021013; Det: 13a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:51:21AM  
 Efficiency Calibration: C14021013  
 Efficiency: 30.84% +/- 0.13% TPU(2 sigma)  
 Energy Calibration: C14021013  
 Energy Cal: Gain = 9.8597 keV / Ch  
 Offset = 3,025.63 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 85.42%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4198.9	3922.9	4277.8	19.1	100.2	6.00	9.00	-3.00	-1.0E-002	2.6E-002	2.4E-002	5.7E-002
U-235	4396.1	4287.7	4465.2	15.6	99.7	6.00	7.00	-1.00	-3.4E-003	2.5E-002	2.1E-002	5.1E-002
U-234	4770.8	4583.5	4869.4	71.1	100.0	168.00	27.00	141.00	4.8E-001	1.1E-001	4.1E-002	9.2E-002
U-232	5303.2	5096.2	5401.8	76.4	100.1	1,273.00	24.00	1,249.00	3.8E+000	2.2E-001	4.0E-002	9.0E-002

Re By: JA JP

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

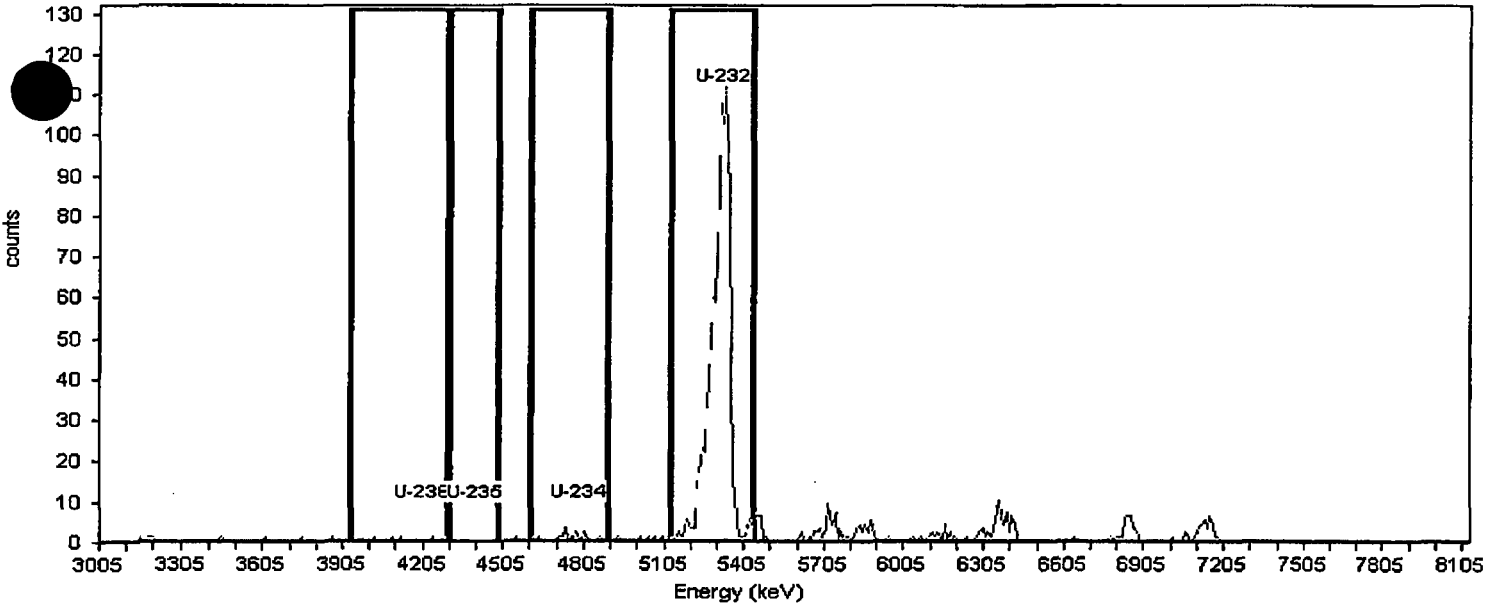
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-4MMB  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 14a  
 Batch Name: UAS140215-4\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:19:25PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.93 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021014; Det: 14a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:29:50AM  
 Efficiency Calibration: C14021014  
 Efficiency: 28.44% +/- 0.15% TPU(2 sigma)  
 Energy Calibration: C14021014  
 Energy Cal: Gain = 10.0569 keV / Ch  
 Offset = 2,995.13 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 62.47%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.0	3930.4	4292.5	39.8	100.2	6.00	4.00	2.00	1.0E-002	3.2E-002	2.4E-002	6.1E-002
U-235	4413.2	4302.5	4483.6	.0	99.7	0.00	0.00	0.00	0.0E+000	1.4E-002	0.0E+000	1.4E-002
U-234	4795.3	4604.2	4895.9	29.5	100.0	13.00	14.00	-1.00	-5.1E-003	5.3E-002	4.4E-002	1.0E-001
U-232	5338.4	5127.2	5439.0	66.9	100.1	861.00	19.00	842.00	2.8E+000	2.0E-001	5.3E-002	1.2E-001

Revised By: JA JP

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

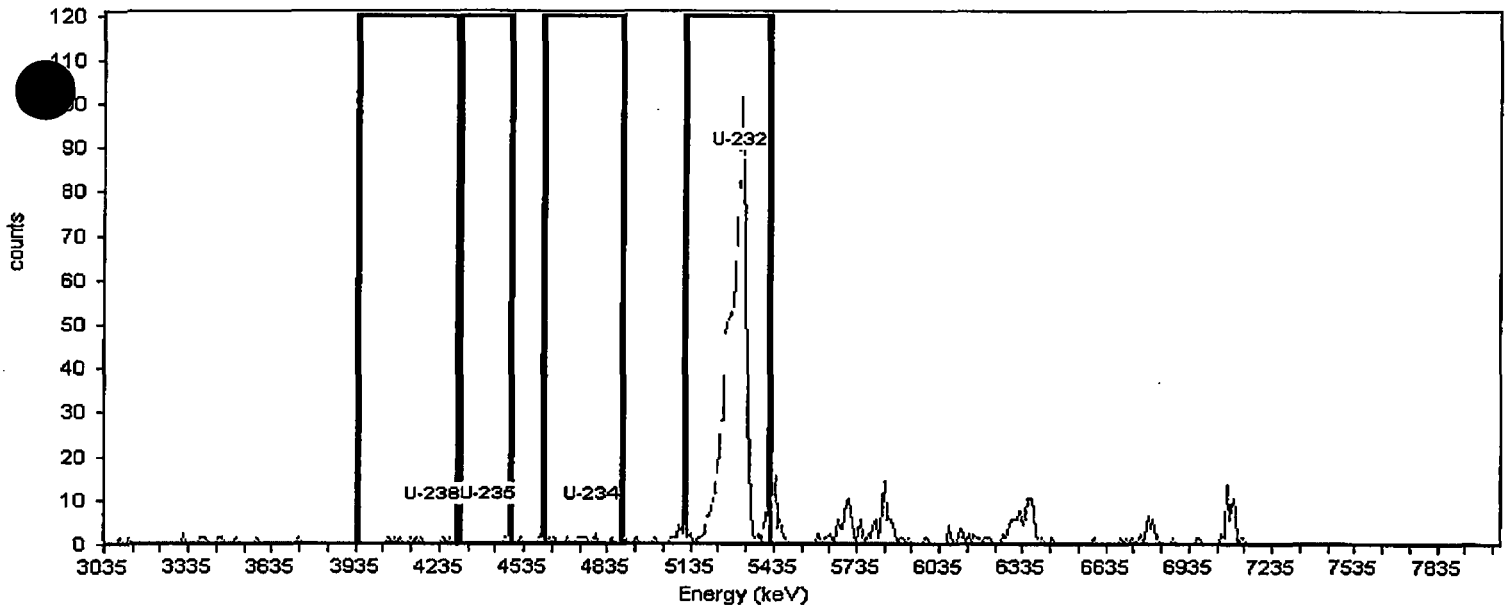
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-4PMB  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 16a  
 Batch Name: UAS140215-4\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:19:29PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.93 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021016; Det: 16a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:57:03AM  
 Efficiency Calibration: C14021016  
 Efficiency: 29.83% +/- 0.12% TPU(2 sigma)  
 Energy Calibration: C14021016  
 Energy Cal: Gain = 9.8597 keV / Ch  
 Offset = 3,025.63 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 48.16%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4218.7	3942.6	4297.5	32.9	100.2	8.00	1.00	7.00	4.4E-002	3.8E-002	1.5E-002	4.6E-002
U-235	4415.9	4307.4	4484.9	199.5	99.7	2.00	1.00	1.00	6.3E-003	2.2E-002	1.5E-002	4.6E-002
U-234	4790.5	4603.2	4889.1	156.7	100.0	11.00	4.00	7.00	4.4E-002	4.9E-002	2.9E-002	7.5E-002
U-232	5322.9	5115.9	5421.5	71.8	100.1	697.00	16.00	681.00	2.1E+000	1.7E-001	6.0E-002	1.4E-001

Recorded By: JA JP

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

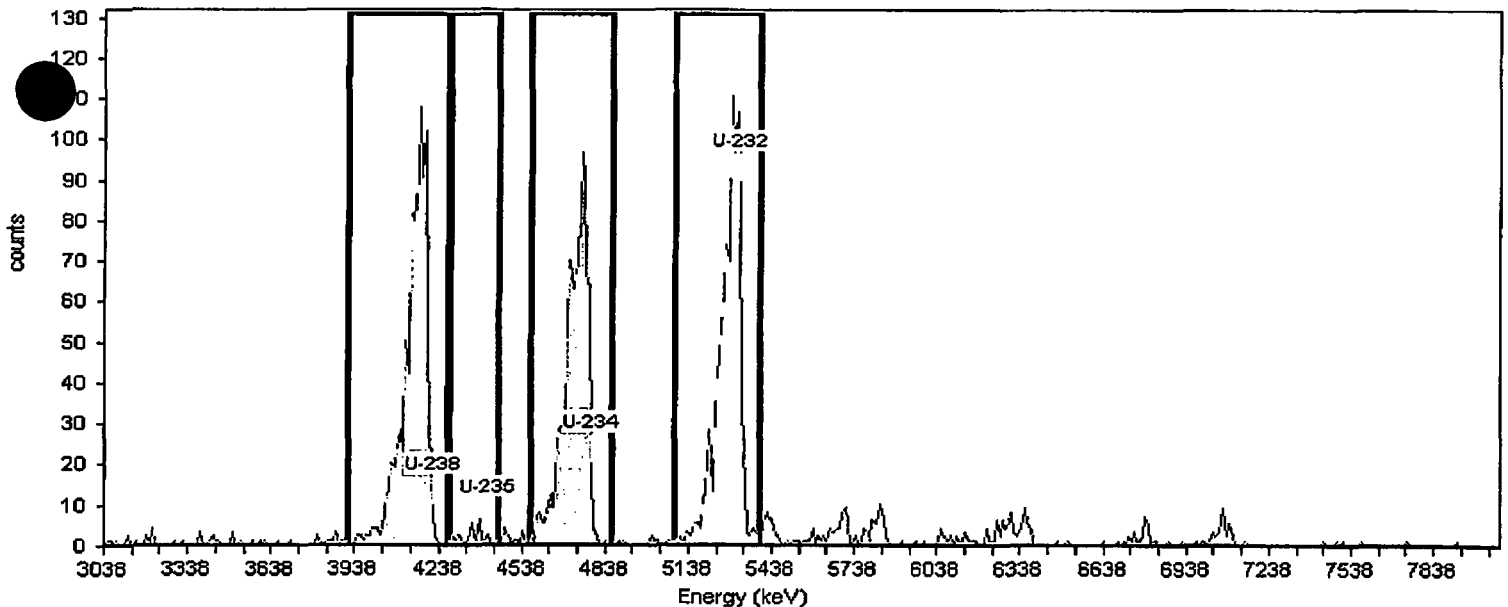
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-4LCS  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 25  
 Batch Name: UAS140215-4\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute Interactive ROI Analysis  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:21:43PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021025; Det: 25; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:03:30PM  
 Efficiency Calibration: C14021025  
 Efficiency: 29.18% +/- 0.20% TPU(2 sigma)  
 Energy Calibration: C14021025  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 61.75%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3907.6	4263.3	79.3	100.2	904.00	5.00	899.00	4.5E+000	6.3E-001	2.6E-002	6.5E-002
U-235	4411.5	4273.2	4451.1	103.4	99.7	29.00	5.00	24.00	1.2E-001	6.0E-002	2.6E-002	6.6E-002
U-234	4787.0	4569.6	4856.2	83.7	100.0	827.00	13.00	814.00	4.1E+000	5.8E-001	4.2E-002	9.7E-002
U-232	5320.6	5083.5	5389.8	73.4	100.1	888.00	34.00	854.00	2.7E+000	2.0E-001	7.0E-002	1.5E-001

Recorded By: *JA* *JP*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: AS140215-4LCSD  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 26  
Batch Name: UAS140215-4\_B  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:21:44PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

Bkgd Info: Sample: B14021026; Det: 26; Spectrum #1; Feb-10-2014 13:27

Calibration Date: 2/10/2014 12:04:02PM

Energy Calibration: C14021026

Efficiency Calibration: C14021026

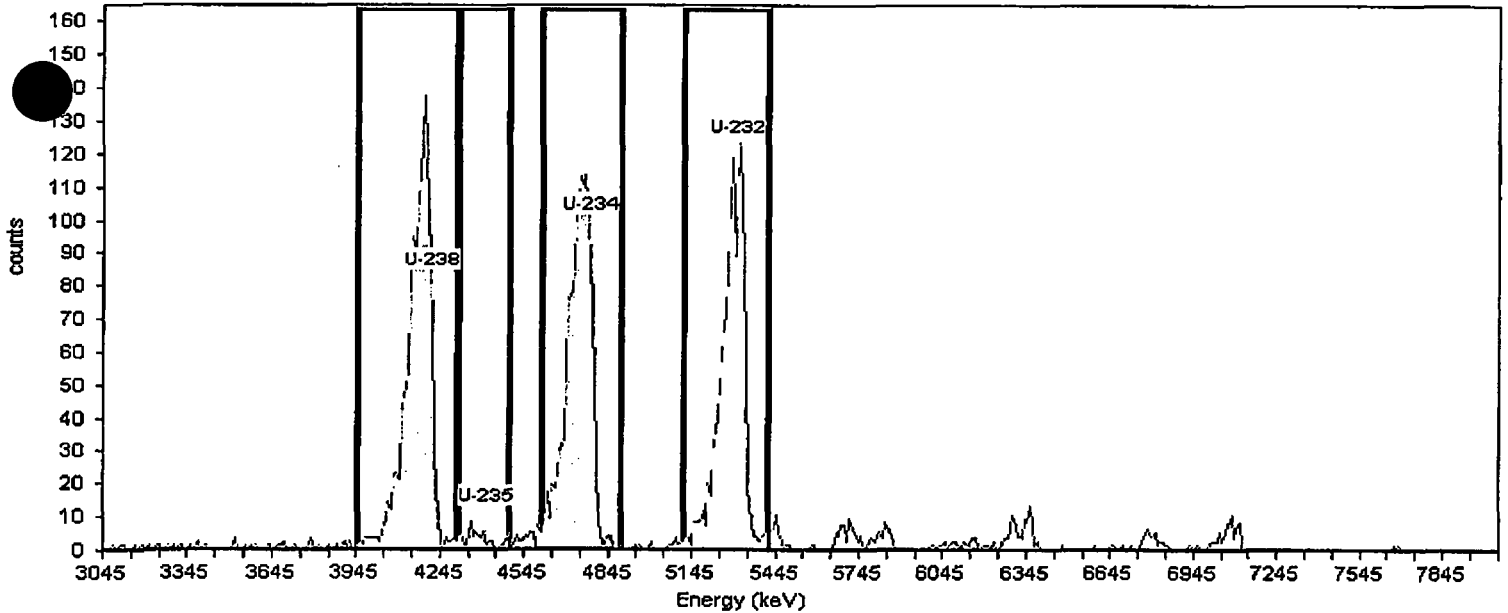
Energy Cal: Gain = 9.8047 keV / Ch  
Offset = 3,036.00 keV

Efficiency: 30.73% +/- 0.15% TPU(2 sigma)

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 76.12%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4222.4	3947.8	4300.8	90.8	100.2	1,238.00	16.00	1,222.00	4.7E+000	6.2E-001	3.6E-002	8.2E-002
U-235	4418.5	4310.6	4487.1	96.7	99.7	52.00	7.00	45.00	1.7E-001	6.3E-002	2.4E-002	5.8E-002
U-234	4791.1	4604.8	4889.1	95.4	100.0	1,175.00	34.00	1,141.00	4.4E+000	5.8E-001	5.2E-002	1.1E-001
U-232	5320.5	5114.6	5418.6	84.9	100.1	1,144.00	35.00	1,109.00	3.4E+000	2.1E-001	5.5E-002	1.2E-001

Recorded By: JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

ALS

Alpha Spectrometer Instrument Run Log

Date: 2/19/14

SOP 714; FORM 746r8.xls (10/2/07)

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
54	AAS140204-1-B	AS140204-1CS	Am F	300	JP
55		LCS1			
56	AAS140204-2-A	1402007-21	Am F	300	JP
65		-22			
67		-23			
68		-24			
69		-25			
70		-26			
71		-27			
72		-28			
73		-29			
74		-30			
75		-31			
76		-32			
77		-33			
78		-34			
79		AS140204-2MMB			
80		PMB			
1	AAS140204-2-B	AS140204-2LCS	Am F	300	JP
2		LCS1			
13	VAS140212-2-B	1402032-1	Ur F	720	JP
14		-3			
9	VAS140215-3-B	1402167-11	Ur F	1000	JP
10		-12			

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
11	VAS140215-3-B	1402167-13	Ur F	1000	JP
12		-14			
16		-15			
29		-16			
30		-17			
31		-18			
32		-19			
45		-20			
46		AS140215-3MMB			
47		PMB			
25		LCS			
26		LCS1			
81	VAS140215-4-A	1402168-1	Ur F	1000	JP
82		-2			
83		-3			
84		-4			
85		-5			
86		-6			
87		-7			
88		-8			
89		-9			
90		-10			
91		-11			
92		-12			

Notes:

Reviewed by: JP  
Date: 2/19/14



ALS

Alpha Spectrometer Instrument Run Log

SOP 714; FORM 748r8.xls (10/207)

Date: 2/19/14/2/20/14

2/20/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
43	VAS140215-4-A	1402168-13	U/F	1000	JP
94		-14			
95		-15			
9	VAS140215-6-A	1402102-1	U/S	360	JA
10		1402103-1			
11		1402104-1			
12		-10			
13		AS140215-6MB			
14	✓	-6LCS	✓	✓	✓
16	VAS140217-9-A	1402075-1	U/S	360	JA
25		-10			
26		AS140217-9MB			
29	✓	-9LCS	✓	✓	✓
30	VAS140217-L-A	1402222-1	Th/S	360	JA
31		-2			
32		-3			
43		-4			
45		-5			
46		-50			
47		-6			
81		-7			
82		-8			
83		-9			
84	✓	-10	✓	✓	✓

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
85	VAS140217-L-A	1402222-11	360		JA
86		-12			
87		-13			
88		-14			
89		-15			
90		-16			
91		-17			
92		-18			
93		-19			
94		-20			
95	✓	AS140217-1MB	✓	✓	✓
29	VAS140217-L-B	AS140217-1CS	Th/S	360	JA
9	VAS140215-4-B	1402168-16	U/F	1000	JA
10		-17			
11		-18			
12		-19			
13		-20			
14		AS140215-4MB			
16		-4PMB			
25		-4LCS			
26	✓	-4LSD	✓	✓	✓

2/20/14

Notes:

Reviewed by: Jm/A  
Date: 2/20/14



## Section 6

# QUALITY ASSURANCE SUMMARY REPORTS

**6**



**No *NON-CONFORMANCE REPORTS* or *QUALITY ASSURANCE SUMMARY SHEETS* are included in this data package.**



## Section 7

# LABORATORY BENCH SHEETS

7

# Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AS140214

Prep Procedure: **UIISO** **MDC => IE-09** **1 -> P -> Tower 3** **10 -> Any Tower** **1000/min** Analytical QASS / NCR? Y / **N** **NA**

128

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
1	1402168-1	SMP	0.5	0.5	sample	uCi/ml	_21681	81	JP	_21681			_21681			A
1	1402168-2	SMP	0.5	0.5	sample	uCi/ml	_21682	82		_21682			_21682			
1	1402168-3	SMP	0.5	0.5	sample	uCi/ml	_21683	83		_21683			_21683			
1	1402168-4	SMP	0.5	0.5	sample	uCi/ml	_21684	84		_21684			_21684			
1	1402168-5	SMP	0.5	0.5	sample	uCi/ml	_21685	85		_21685			_21685			
1	1402168-6	SMP	0.5	0.5	sample	uCi/ml	_21686	86		_21686			_21686			
1	1402168-7	SMP	0.5	0.5	sample	uCi/ml	_21687	87		_21687			_21687			
1	1402168-8	SMP	0.5	0.5	sample	uCi/ml	_21688	88		_21688			_21688			
1	1402168-9	SMP	0.5	0.5	sample	uCi/ml	_21689	89		_21689			_21689			
1	1402168-10	SMP	0.5	0.5	sample	uCi/ml	_216810	90		_216810			_216810			
1	1402168-11	SMP	0.5	0.5	sample	uCi/ml	_216811	91		_216811			_216811			
1	1402168-12	SMP	0.5	0.5	sample	uCi/ml	_216812	92		_216812			_216812			
1	1402168-13	SMP	0.5	0.5	sample	uCi/ml	_216813	93		_216813			_216813			
1	1402168-14	SMP	0.5	0.5	sample	uCi/ml	_216814	94		_216814			_216814			
1	1402168-15	SMP	0.5	0.5	sample	uCi/ml	_216815	95		_216815			_216815			
1	1402168-16	SMP	0.5	0.5	sample	uCi/ml	_216816	9 JA		_216816			_216816			B
1	1402168-17	SMP	0.5	0.5	sample	uCi/ml	_216817	10		_216817			_216817			
1	1402168-18	SMP	0.5	0.5	sample	uCi/ml	_216818	11		_216818			_216818			
1	1402168-19	SMP	0.5	0.5	sample	uCi/ml	_216819	12		_216819			_216819			
1	1402168-20	SMP	0.5	0.5	sample	uCi/ml	_216820	13		_216820			_216820			
1	AS140215-4M	MB	0.5	0.5	sample	uCi/ml	_2154MB	14		_2154MB			_2154MB			
1	AS140215-4P	MB	0.5	0.5	sample	uCi/ml	_2154PB	16		_2154PB			_2154PB			
1	AS140215-4	LCS	0.5	0.5	sample	uCi/ml	_2154L	25		_2154L			_2154L			JP 2/12/14
1	AS140215-4	LCSD	0.5	0.5	sample	uCi/ml	_2154LD	26		_2154LD			_2154LD			JP 2/12/14

Sample/Carrier Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016

Prep Procedure: UISO

Analytical QASS / NCR? Y / N *ONA*

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
							S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016	

Sample Barcodes

1402168-1 AS140215-4PS1		1402168-2 AS140215-4PS2		1402168-3 AS140215-4PS3	
1402168-4 AS140215-4PS4		1402168-5 AS140215-4PS5		1402168-6 AS140215-4PS6	
1402168-7 AS140215-4PS7		1402168-8 AS140215-4PS8		1402168-9 AS140215-4PS9	
1402168-10 AS140215-4PS10		1402168-11 AS140215-4PS11		1402168-12 AS140215-4PS12	
1402168-13 AS140215-4PS13		1402168-14 AS140215-4PS14		1402168-15 AS140215-4PS15	
1402168-16 AS140215-4PS16		1402168-17 AS140215-4PS17		1402168-18 AS140215-4PS18	
1402168-19 AS140215-4PS19		1402168-20 AS140215-4PS20		AS140215-4MMB AS140215-4PS21	
AS140215-4PMB AS140215-4PS22		AS140215-4LCS AS140215-4PS23		AS140215-4LCSD AS140215-4PS24	

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Reporting Units

LabID:	TstGrpName:	RptUnits:
1402168-1	IsoU_PNV_Air Filter	uCi/ml
1402168-2	IsoU_PNV_Air Filter	uCi/ml
1402168-3	IsoU_PNV_Air Filter	uCi/ml
1402168-4	IsoU_PNV_Air Filter	uCi/ml
1402168-5	IsoU_PNV_Air Filter	uCi/ml
1402168-6	IsoU_PNV_Air Filter	uCi/ml
1402168-7	IsoU_PNV_Air Filter	uCi/ml
1402168-8	IsoU_PNV_Air Filter	uCi/ml
1402168-9	IsoU_PNV_Air Filter	uCi/ml
1402168-10	IsoU_PNV_Air Filter	uCi/ml
1402168-11	IsoU_PNV_Air Filter	uCi/ml
1402168-12	IsoU_PNV_Air Filter	uCi/ml
1402168-13	IsoU_PNV_Air Filter	uCi/ml
1402168-14	IsoU_PNV_Air Filter	uCi/ml
1402168-15	IsoU_PNV_Air Filter	uCi/ml
1402168-16	IsoU_PNV_Air Filter	uCi/ml
1402168-17	IsoU_PNV_Air Filter	uCi/ml
1402168-18	IsoU_PNV_Air Filter	uCi/ml
1402168-19	IsoU_PNV_Air Filter	uCi/ml
1402168-20	IsoU_PNV_Air Filter	uCi/ml

Prep Procedure: **UIISO**

Reviewed By: cas *cas*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  Y /  N Batch: *See Comments* Re-Prep? Y /  N Batch: *N/A* Prep QASS / NCR? Y /  N *N/A*

Prep SOP: PAI 778 Rev: 14 Prep Analyst: Tamrae Elhart Balance: 27  
 Prep SOP: NONE Prep Date: 2/15/2014 Balance:  
 Matrix Class: solid Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq sample	Fin Aliq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402168-1	SMP		0.5	0.5	As Received		<i>cas</i>	<i>2/19/14</i>	T1	<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);"><i>cas 2/17/14</i></div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);"><i>cas 2/17/14</i></div> </div>
2	1	1402168-2	SMP		0.5	0.5	As Received				T1	
3	1	1402168-3	SMP		0.5	0.5	As Received				T1	
4	1	1402168-4	SMP		0.5	0.5	As Received				T1	
5	1	1402168-5	SMP		0.5	0.5	As Received				T1	
6	1	1402168-6	SMP		0.5	0.5	As Received				T1	
7	1	1402168-7	SMP		0.5	0.5	As Received				T1	
8	1	1402168-8	SMP		0.5	0.5	As Received				T1	
9	1	1402168-9	SMP		0.5	0.5	As Received				T1	
10	1	1402168-10	SMP		0.5	0.5	As Received				T1	
11	1	1402168-11	SMP		0.5	0.5	As Received				T1	
12	1	1402168-12	SMP		0.5	0.5	As Received				T1	
13	1	1402168-13	SMP		0.5	0.5	As Received				T1	
14	1	1402168-14	SMP		0.5	0.5	As Received				T1	
15	1	1402168-15	SMP		0.5	0.5	As Received				T1	
16	1	1402168-16	SMP		0.5	0.5	As Received				T1	
17	1	1402168-17	SMP		0.5	0.5	As Received				T1	
18	1	1402168-18	SMP		0.5	0.5	As Received				T1	
19	1	1402168-19	SMP		0.5	0.5	As Received				T1	
20	1	1402168-20	SMP		0.5	0.5	As Received				T1	
21	1	AS140215-4M	MB		0.5	0.5	As Received				T1	
22	1	AS140215-4P	MB		0.5	0.5	As Received				T1	
23	1	AS140215-4	LCS		0.5	0.5	As Received				S1,T1	
24	1	AS140215-4	LCSD		0.5	0.5	As Received				S1,T1	

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Prep Procedure: **UIISO**

Reviewed By: cas *cas*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  Y  N Batch: See comments Re-Prep?  Y  N Batch: N/A Prep QASS / NCR?  Y  N N/A

Prep SOP: PAI 778 Rev: 14 Prep Analyst: Tamrae Elhart Balance: 27  
 Prep SOP: NONE Prep Date: 2/15/2014 Balance:  
 Matrix Class: solid Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
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**Comments**  
 Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffled at 600C. After muffling, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: Tamrae Elhart Date: 2/15/2014  
 Witnessed By: Emily R. Lyons Date: 2/15/2014

Carrier Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016

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Prep Procedure: **UIISO**

**Prep Batch Not Validated!!!**

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N                      Batch:                      Re-Prep? Y / N                      Batch:                      Prep QASS / NCR? Y / N                     

Prep SOP: PAI 778 Rev: 14  
 Prep SOP: NONE  
 Matrix Class: solid

Prep Analyst: Tamrae Elhart *TE*  
 Prep Date: 2/15/2014  
 Prep Dept: AP

Balance:  
 Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402168-1	SMP		0.5	0.5	As Received	<i>beaker ID</i>			T1	
2	1	1402168-2	SMP		0.5	0.5	As Received				T1	
3	1	1402168-3	SMP		0.5	0.5	As Received				T1	
4	1	1402168-4	SMP		0.5	0.5	As Received				T1	
5	1	1402168-5	SMP		0.5	0.5	As Received				T1	
6	1	1402168-6	SMP		0.5	0.5	As Received				T1	
7	1	1402168-7	SMP		0.5	0.5	As Received				T1	
8	1	1402168-8	SMP		0.5	0.5	As Received				T1	
9	1	1402168-9	SMP		0.5	0.5	As Received				T1	
10	1	1402168-10	SMP		0.5	0.5	As Received				T1	
11	1	1402168-11	SMP		0.5	0.5	As Received				T1	
12	1	1402168-12	SMP		0.5	0.5	As Received				T1	
13	1	1402168-13	SMP		0.5	0.5	As Received				T1	
14	1	1402168-14	SMP		0.5	0.5	As Received				T1	
15	1	1402168-15	SMP		0.5	0.5	As Received				T1	
16	1	1402168-16	SMP		0.5	0.5	As Received				T1	
17	1	1402168-17	SMP		0.5	0.5	As Received				T1	
18	1	1402168-18	SMP		0.5	0.5	As Received				T1	
19	1	1402168-19	SMP		0.5	0.5	As Received				T1	
20	1	1402168-20	SMP		0.5	0.5	As Received				T1	
21	1	AS140215-4M	MB		1	1	As Received	<i>439</i>			T1	
22	1	AS140215-4P	MB		1	1	As Received	<i>481</i>			T1	
23	1	AS140215-4	LCS		1	1	As Received	<i>505</i>			S1,T1	
24	1	AS140215-4	LCSD		1	1	As Received	<i>501</i>			S1,T1	

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Prep Procedure: UISO

**Prep Batch Not Validated!!!**

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: \_\_\_\_\_ Re-Prep? Y / N Batch: \_\_\_\_\_ Prep QASS / NCR? Y / N \_\_\_\_\_

Prep SOP: PAI 778 Rev: 14  
 Prep SOP: NONE  
 Matrix Class: solid

Prep Analyst: Tandrae Eihart *TE*  
 Prep Date: 2/15/2014  
 Prep Dept: AP

Balance:  
 Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq sample	Fin Aliq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
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**Comments**  
 Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffed at 600C. After muffing, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: *TE* Date: *2/15/14*  
 Witnessed By: *EW* Date: *2.15.14*

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016

*10.29.14*

*Exp 6.20.14*

## Sample Condition Form (Solids)

Analyst: TE

Analysis Date: 2/15/14

Method: Prep

		Sample Condition (Visual Appearance of Analysis Aliquot at Time of Prep)		
Work Order	Sample ID	Dry/Wet/Moist	Texture	Remarks
1402168	1	dry	filter	1-half filter
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			
✓	20	✓	✓	✓

**1402168 Filter Weight Spreadsheet**

<b>Sample ID</b>	<b>Beaker ID</b>	<b>Beaker, Watch glass wt (g)</b>	<b>Beaker, Watch Glass, Filter Wt (g)</b>	<b>Beaker, Watch Glass, Ashed Filter Wt (g)</b>	<b>Net Filter Wt (g)</b>	<b>Net Ash Wt (g)</b>
1402168-1	L37	56.5577	56.9378	56.5607	0.3801	0.003
1402168-2	LL22X	53.6189	54.0047	53.6192	0.3858	0.0003
1402168-3	458	58.3584	58.7698	58.36	0.4114	0.0016
1402168-4	449	56.3484	56.7322	56.3508	0.3838	0.0024
1402168-5	454	53.4027	53.7884	53.4029	0.3857	0.0002
1402168-6	211	56.0464	56.4204	56.0477	0.374	0.0013
1402168-7	453	57.6932	58.0702	57.6943	0.377	0.0011
1402168-8	NONE	55.2774	55.6602	55.2781	0.3828	0.0007
1402168-9	LL23X	55.1819	55.5768	55.1827	0.3949	0.0008
1402168-10	L42	58.3234	58.6918	58.3241	0.3684	0.0007
1402168-11	205	57.8482	58.2311	57.8486	0.3829	0.0004
1402168-12	437	53.8429	54.2624	53.844	0.4195	0.0011
1402168-13	465	60.4844	60.9097	60.4865	0.4253	0.0021
1402168-14	446	54.9968	55.3825	54.998	0.3857	0.0012
1402168-15	L47	55.0753	55.4339	55.0771	0.3586	0.0018
1402168-16	LL14	54.0446	54.4348	54.0473	0.3902	0.0027
1402168-17	L53	56.3136	56.6972	56.3168	0.3836	0.0032
1402168-18	203	57.9085	58.3163	57.9086	0.4078	0.0001
1402168-19	467	54.9944	55.3525	54.9966	0.3581	0.0022
1402168-20	L36	55.9126	56.2961	55.9152	0.3835	0.0026

Balance: 27

Note: Prior to aliquotting, the filters were cut in half. Only one half of the filter was placed into the weighed beaker, spiked/traced, and muffled. Following muffling, the beaker/filter was reweighed to determine ash weight.

Batch: AS140215-4

**U Solid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Conc. Hydrofluoric Acid	0000061467
Boric Acid	J23624
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MKKBK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467

**U Liquid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MKKBK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467



## Section 8

# STANDARDS TRACEABILITY DOCUMENTS

8

Prepare a working dilution of 843.3610.56

1. Density of 1M HNO<sub>3</sub>, lot # K16045  
 Mass of 100mL vol. flask: 68.2981g Balance # 12  
 Mass of flask & 100mL acid: 171.5705g Balance# 12  
 Net Mass: 103.2724g  
 Density: 1.0327g/mL

2. Mass of 843.3610.56 transferred:  
 Mass of open empty nalgene: 74.7438 Balance# 12  
 Mass of nalgene & standard: 82.4483 Balance# 12  
 Net mass of standard transferred: 7.7045g Balance# NA

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1003.9g Balance# 26  
 Mass of empty nalgene (from above): 74.7438 Balance# 12  
 Net mass of new dilution: 929.1562g Balance# NA

4. Final activity calculation:

(U-238):  $2377.34 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 20.36 \text{ dpm/mL}$

(U-235):  $109.44 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 0.92 \text{ dpm/mL}$

(U-234):  $2,289.91 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 19.61 \text{ dpm/mL}$

Std ID: 843.3610.100

Description: U-238

Expiration: 8/4/2012  
 Activity: 20.36 dpm/mL

2s Uncertainty: 0.12 dpm/mL

Ref. Date: 8/1/1977 1997

Ref Time: N/A JP 7/9/11

Prep Date: 8/3/2011 Prep by: TE

Matrix/Comp. 1M HNO<sub>3</sub>

Half Life (y): 4.47E+09

Reverification Log		
Analysis Date	Initials	Expiration Date
7/11/12	JP	7/10/13
6/20/13	JP	6/20/2014

Continued on Page

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[Signature]  
Signed

8/3/11  
Date

[Signature]  
Signed

10/21/11  
Date



Prepare an intermediate Dilution of RSO # 843

Diluent is  $M HNO_3$  lot # H31041  
from Pg. 54 this logbook (3610)  
 $f = 1.0283\%$

Mass of Parent Transferred

Mass of Open Fall Ampule + beaker	33.1504g	12
Mass of Empty Ampule + beaker	32.9991g	1
Net Mass transferred	5.1513g	

Dilute to Final Volume

Mass of Open Empty 40 ml VOA	21.6331g	12
Mass of Open Fall Vial	53.0961g	1
Net mass of New Dilution	31.4624g	

Final Activity (U-238)

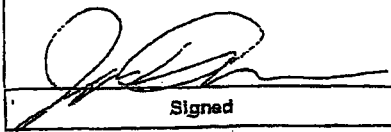
$$\left( \frac{247.0 \frac{Bq}{g}}{g} \right) \left( \frac{60 dpm}{Bq} \right) \left( \frac{5.1513g}{31.4624g} \right) = \frac{2382.5 \frac{dpm}{g}}{2372.34 \frac{dpm}{g}}$$

Final activity (U-238): 109.44 dpm/g  
(RSO: 843 = 11.14 Bq/g)

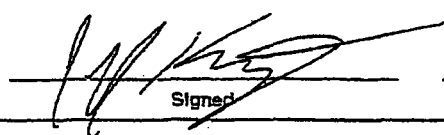
Final activity (U-234): 2289.91 dpm/g  
(RSO: 843 = 233.1 Bq/g)

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Signed

4/23/10  
Date

  
Signed

5/11/10  
Date



# National Institute of Standards & Technology Certificate

RSO #  
843  
rel 7-20-07

## Standard Reference Material 4321C Natural Uranium Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive uranium-238, uranium-235, and uranium-234 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. The solution, whose composition is specified in Table 1, is contained in a flame-sealed, 5 mL, NIST, borosilicate-glass ampoule (see Note 1)\*.

The certified massic activities for the uranium isotopes at a Reference Time of 1200 EST, 1 August 1997, are:

Uranium-238:  $(242.0 \pm 1.5) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-235:  $(11.14 \pm 0.07) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-234:  $(233.1 \pm 2.2) \text{ Bq}\cdot\text{g}^{-1}$

Additional physical, chemical, and radiological properties for the SRM, as well as details on the standardization method, are given in Table 1. Uncertainty intervals for certified quantities are expanded ( $k=2$ ) uncertainties calculated according to the ISO and NIST Guidelines (see Note 2). Table 2 contains a specification of the components that comprise the uncertainty analyses.

The certification of this SRM, within the measurement uncertainties specified, is valid for at least five (5) years after receipt. The solution matrix, in an unopened ampoule, is believed to be indefinitely homogeneous and stable, within its half-life-dependent useful lifetime. NIST will monitor this material and will report any substantive changes in certification to the purchaser. Should any of the certified values change, purchasers of this SRM will be notified of the change by NIST.

This SRM may represent a radiological hazard and a chemical hazard. Consult the Material Safety Data Sheet (MSDS), enclosed with the SRM shipment, for details (see Note 1).

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dr. M.P. Unterwiesing, Acting Group Leader. The overall technical direction and physical measurements leading to certification were provided by Dr. L.L. Lucas of the Radioactivity Group. The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program.

Gaithersburg, Maryland 20899

November 1997

Text revised and expiration date extended February 2007

Lisa R. Karam, Deputy Chief  
Ionizing Radiation Division

Robert L. Watters, Jr., Chief  
Measurement Services Division

Table 1. Properties of SRM 4321C

Certified values

Radionuclides	Natural Uranium (Mixture of $^{238}\text{U}$ , $^{235}\text{U}$ , and $^{234}\text{U}$ )
Reference time	1200 EST, 1 August 1997
Massic activities of the solution	$^{238}\text{U}$ : 242.0 Bq·g <sup>-1</sup> $^{235}\text{U}$ : 11.14 Bq·g <sup>-1</sup> $^{234}\text{U}$ : 233.1 Bq·g <sup>-1</sup>
Relative expanded uncertainties (k=2)	$^{238}\text{U}$ : 0.60% (see Note 2)* $^{235}\text{U}$ : 0.60% (see Note 2) $^{234}\text{U}$ : 0.96% (see Note 2)

Uncertified information

Source description	Liquid in flame-sealed, 5 mL NIST borosilicate ampoule (see Note 1)
Solution composition	1.0 mol·L <sup>-1</sup> HCl with 30 mg UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> per gram of solution
Solution density	(1.053 ± 0.001) g·mL <sup>-1</sup> at 21.4°C (see Note 3)
Solution mass	(5.258 ± 0.002) g (see Note 3)
Mass fraction of uranium	(0.01960 ± 0.00010) g·g <sup>-1</sup> (see Note 3)
Photon-emitting impurities	None detected (see Note 4)
Half-lives used [1]	$^{238}\text{U}$ : (4.468 ± 0.003) × 10 <sup>8</sup> a $^{235}\text{U}$ : (7.038 ± 0.005) × 10 <sup>8</sup> a $^{234}\text{U}$ : (2.455 ± 0.006) × 10 <sup>5</sup> a
Calibration method (and instruments)	The certified massic activity for natural uranium was obtained by mass spectrometer, silicon surface-barrier detector, and liquid scintillation (LS) counting systems.

\*See Note 5

Table 2. Uncertainty evaluation for the massic activity for SRM 4321C

	Uncertainty component	Assessment Type <sup>†</sup>	Relative standard uncertainty contribution on massic activity of Natural Uranium (%)
1	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>238</sup> U	A	0.001
2	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>235</sup> U	A	0.07
3	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for <sup>234</sup> U	A	0.3
4	Half life of <sup>238</sup> U; standard uncertainty of the half-life	A	0.07
5	Half life of <sup>235</sup> U; standard uncertainty of the half-life	A	0.07
6	Half life of <sup>234</sup> U; standard uncertainty of the half-life	A	0.24
7	Uranium mass fraction in SRM 960; from SRM960 certificate.	B	0.003
8	Quantitative dissolution	B	0.25
9	Gravimetric (mass) measurements	B	0.10
10	Limit for photon-emitting impurities	B	0.10
	<b>Relative combined standard uncertainty</b>		
	<sup>238</sup> U		0.30
	<sup>235</sup> U		0.50
	<sup>234</sup> U		0.48
	<b>Relative expanded uncertainty (k = 2)</b>		
	<sup>238</sup> U		0.60
	<sup>235</sup> U		0.60
	<sup>234</sup> U		0.96

<sup>†</sup> = (A) denotes evaluation by statistical methods; (B) denotes evaluation by other methods.

## NOTES

Note 1. Refer to <http://physics.nist.gov/Divisions/Div846/srm.html> for the standardized ampoule dimensions and for assistance and instructions on how to properly open an ampoule. Information on additional storage and handling requirements is also included in the website.

Note 2. The uncertainties on certified values are expanded uncertainties,  $U = k u_c$ . The quantity  $u_c$  is the combined standard uncertainty calculated according to the ISO and NIST Guides (see references [2] and [3]). The combined standard uncertainty is multiplied by a coverage factor of  $k = 2$  and was chosen to obtain an approximate 95 % level of confidence.

Note 3. The stated uncertainty is two times the standard uncertainty. See reference [3].

Note 4. The estimated lower limits of detection for photon-emitting impurities, expressed as massic photon emission rates are:

$$1.4 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 8 \text{ keV} < E < 59 \text{ keV}$$

$$1.1 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 57 \text{ keV} < E < 88 \text{ keV}$$

$$0.5 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 102 \text{ keV} < E < 197 \text{ keV}$$

$$0.3 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 205 \text{ keV} < E < 762 \text{ keV}$$

$$0.2 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 770 \text{ keV} < E < 996 \text{ keV, and}$$

$$0.1 \text{ s}^{-1} \cdot \text{g}^{-1} \text{ for } 1006 \text{ keV} < E < 1900 \text{ keV}$$

provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of  $^{235}\text{U}$ ,  $^{235}\text{U}$ , or their progeny

Note 5. The stated uncertainty is the standard uncertainty. See reference [3].

## REFERENCES

- [1] Evaluated Nuclear Structure Data File (ENSDF), online database, National Nuclear Data Center, Brookhaven Laboratory (Upton, NY), August 2007. Refer to <http://www.nndc.bnl.gov/ensdf/>
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993 (corrected and reprinted, 1995). Available from Global Engineering Documents, 12 Inverness Way East, Englewood, CO 80112, U.S.A. Telephone 1-800-854-7179.
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.

TE 10/22/13

Prepare a working dilution of 914.3610.62

1. Density of 1M HNO<sub>3</sub>, lot # 000045470  
 Mass of 100mL vol. flask: 66.4318g Balance # 12  
 Mass of flask & 100mL acid: 169.6212g Balance# 12  
 Net Mass: 103.1894g  
 Density: 1.0319 g/mL

2. Mass of 914.3610.62 transferred:  
 Mass of open empty nalgene: 75.4800g Balance# 12  
 Mass of nalgene & standard: 78.3581g Balance# 12  
 Net mass of standard transferred: 2.8781g Balance# NA

TE 10/22/13

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1173.7g Balance# 26  
 Mass of empty nalgene (from above): 75.4800g Balance# 12  
 Net mass of new dilution: 1098.22g Balance# NA

4. Final activity calculation:

$$7261.8 \text{ dpm/g} \left( \frac{2.8781 \text{ g}}{1098.22 \text{ g}} \right) (1.0319 \text{ g/mL}) = 19.64 \text{ dpm/mL}$$

TE 10/22/13

TE 10/22/13

JP 11/5/13

Std ID: 914.4095.46

Description: **U-232**  
 Expiration: **10/29/2014**  
 Activity: **19.64** dpm/mL  
 2s Uncertainty: **0.96** dpm/mL  
 Ref. Date: **5/27/2010**  
 Ref Time: **N/A**  
 Prep Date: **10/22/2013** Prep by: **TE**  
 Matrix/Comp. **1M HNO<sub>3</sub>**  
 Half Life (y): **6.89E+01**

JP 11/5/13

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 11/5/13

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 Signed Date

[Signature] 11/05/13  
 Read and Understood By Signed Date

Prepare a Intermediate dilution of RCO # 914

Diluent is  $1M HNO_3$  Acid lot # J11044

Mass of parent transferred		bal #
Mass of Open Full Ampule + Beaker	38.0670 g	12
Mass of Empty Ampule + Beaker	32.9311 g	12
Net mass transferred	5.1379 g	

Dilute to final Mass

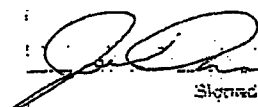
Mass of Vial, Std, + Diluent	58.6555 g	12
Mass of Vial	21.5781 g	12
Net Mass of New dilution	37.0574 g	

Final Activity

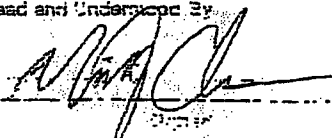
$$\left(4.552 \times 10^3 \text{ Bq}\right) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}}\right) \left(\frac{5.1379 \text{ g}}{5.21459 \text{ g}}\right) \left(\frac{1}{37.0574 \text{ g}}\right) = 7261.8 \text{ Bq}$$

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Read and Understood By

  
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6/4/10

  
Date

06-17-2010  
Date



**Eckert & Ziegler**  
Analytics

*Rec 6-1-10  
150# 914*

1380 Seaboard Industrial Blvd.  
Atlanta, Georgia 30318  
Tel 404-352-8677  
Fax 404-352-2837  
www.analyticsinc.com

**CERTIFICATE OF CALIBRATION**  
Standard Radionuclide Source

82306-307

U-232 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins  
P.O. No.: 73625 04-28-10, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.18, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			$k_a$	$k_b$	U	
U-232	2.617E+04	4.852E+03	0.5	2.4	4.9	05/27/2010

\*Uncertainty: U - Relative expanded uncertainty, k=2. See NIST Technical Note 1287, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

**Comments:**

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%. 5.81458 g 1M HNO3 solution, carrier free.

Source Prepared by: *W. Mao*  
W. Mao, Radiochemist

QA Approved: *J. D. McCorvey*  
J. D. McCorvey, QA Manager Alternate

Date: 5/27/10

AMA Form 0038 Rev. 1

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office  
24937 Avenue Tibbitts Valencia, California 91355

Laboratory  
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318





## Section 9

# **ADDITIONAL SUPPORTING DOCUMENTATION**



## **Alpha Spectroscopy**

# **Quality Control Data**

# **Weekly Background, Energy, and Efficiency Calibrations**

# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402168-1 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	81	C14021881	2/18/2014	30.83	Pass	29.34	29.86	31.89	32.42
					B14021881	2/18/2014	0.1050	Pass	0.0000	0.0500	0.5000	0.7500
					C14021881	2/18/2014	5553.6	Pass	5505.8	5515.8	5595.8	5605.8
1402168-2 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	82	C14021882	2/18/2014	30.65	Pass	29.85	30.38	32.46	32.99
					B14021882	2/18/2014	0.0990	Pass	0.0000	0.0500	0.5000	0.7500
					C14021882	2/18/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
1402168-3 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	83	C14021883	2/18/2014	31.20	Pass	29.72	30.25	32.31	32.84
					B14021883	2/18/2014	0.1290	Pass	0.0000	0.0500	0.5000	0.7500
					C14021883	2/18/2014	5557.7	Pass	5505.8	5515.8	5595.8	5605.8
1402168-4 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	84	C14021884	2/18/2014	30.40	Pass	28.92	29.44	31.44	31.96
					B14021884	2/18/2014	0.1410	Pass	0.0000	0.0500	0.5000	0.7500
					C14021884	2/18/2014	5555.8	Pass	5493.9	5503.9	5583.9	5593.9
1402168-5 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	85	C14021885	2/18/2014	30.11	Pass	28.78	29.30	31.30	31.82
					B14021885	2/18/2014	0.1040	Pass	0.0000	0.0500	0.5000	0.7500
					C14021885	2/18/2014	5543.9	Pass	5496.0	5506.0	5586.0	5596.0
1402168-6 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	86	C14021886	2/18/2014	30.61	Pass	28.91	29.42	31.42	31.94
					B14021886	2/18/2014	0.1000	Pass	0.0000	0.0500	0.5000	0.7500
					C14021886	2/18/2014	5546.0	Pass	5505.8	5515.8	5595.8	5605.8
1402168-7 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	87	C14021887	2/18/2014	31.55	Pass	29.84	30.37	32.45	32.98
					B14021887	2/18/2014	0.1180	Pass	0.0000	0.0500	0.5000	0.7500
					C14021887	2/18/2014	5548.0	Pass	5505.8	5515.8	5595.8	5605.8
1402168-8 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	88	C14021888	2/18/2014	30.79	Pass	28.96	29.47	31.48	32.00
					B14021888	2/18/2014	0.0940	Pass	0.0000	0.0500	0.5000	0.7500
					C14021888	2/18/2014	5543.9	Pass	5505.8	5515.8	5595.8	5605.8
1402168-9 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	89	C14021889	2/18/2014	31.24	Pass	29.50	30.02	32.07	32.60
					B14021889	2/18/2014	0.0990	Pass	0.0000	0.0500	0.5000	0.7500
					C14021889	2/18/2014	5555.8	Pass	5505.8	5515.8	5595.8	5605.8

Data Package ID: UR1402168-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
CI - The Analysis Date exceeds the Calibration Date by more than 14 days.				

Date Printed: Monday, February 24, 2014

ALS Environmental -- FC

Page 1 of 3

LIMS Version: 6.695

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128

# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402168-10 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	90	C14021890	2/18/2014	30.90	Pass	29.66	30.19	32.25	32.78
					B14021890	2/18/2014	0.1110	Pass	0.0000	0.0500	0.5000	0.7500
					C14021890	2/18/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
1402168-11 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	91	C14021891	2/18/2014	30.35	Pass	28.95	29.46	31.48	31.99
					B14021891	2/18/2014	0.0970	Pass	0.0000	0.0500	0.5000	0.7500
					C14021891	2/18/2014	5557.7	Pass	5507.8	5517.8	5597.8	5607.8
1402168-12 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	92	C14021892	2/18/2014	31.14	Pass	29.21	29.74	31.76	32.29
					B14021892	2/18/2014	0.1040	Pass	0.0000	0.0500	0.5000	0.7500
					C14021892	2/18/2014	5548.0	Pass	5507.8	5517.8	5597.8	5607.8
1402168-13 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	93	C14021893	2/18/2014	32.05	Pass	30.54	31.09	33.21	33.76
					B14021893	2/18/2014	0.1080	Pass	0.0000	0.0500	0.5000	0.7500
					C14021893	2/18/2014	5555.8	Pass	5507.8	5517.8	5597.8	5607.8
1402168-14 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	94	C14021894	2/18/2014	32.10	Pass	30.23	30.77	32.87	33.41
					B14021894	2/18/2014	0.0830	Pass	0.0000	0.0500	0.5000	0.7500
					C14021894	2/18/2014	5557.7	Pass	5507.8	5517.8	5597.8	5607.8
1402168-15 Spectrum #1 2/19/2014	SMP	AS140215-4 AS140215-4UR	UIISO	95	C14021895	2/18/2014	32.13	Pass	30.55	31.10	33.22	33.77
					B14021895	2/18/2014	0.0920	Pass	0.0000	0.0500	0.5000	0.7500
					C14021895	2/18/2014	5567.7	Pass	5507.8	5517.8	5597.8	5607.8
1402168-16 Spectrum #1 2/20/2014	SMP	AS140215-4 AS140215-4UR	UIISO	9a	C14021009	2/10/2014	31.42	Pass	29.48	30.00	32.06	32.58
					B14021009	2/10/2014	0.3920	Pass	0.0000	0.0498	0.4998	0.7500
					C14021009	2/10/2014	5569.7	Pass	5496.0	5506.0	5586.0	5596.0
1402168-17 Spectrum #1 2/20/2014	SMP	AS140215-4 AS140215-4UR	UIISO	10b	C14021010	2/10/2014	31.19	Pass	29.79	30.31	32.41	32.93
					B14021010	2/10/2014	0.3040	Pass	0.0000	0.0498	0.4998	0.7500
					C14021010	2/10/2014	5559.6	Pass	5486.2	5496.2	5576.2	5586.2
1402168-18 Spectrum #1 2/20/2014	SMP	AS140215-4 AS140215-4UR	UIISO	11a	C14021011	2/10/2014	30.43	Pass	29.69	30.21	32.29	32.81
					B14021011	2/10/2014	0.4130	Pass	0.0000	0.0498	0.4998	0.7500
					C14021011	2/10/2014	5559.6	Pass	5497.0	5507.0	5587.0	5597.0

Data Package ID: UR1402168-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
CI - The Analysis Date exceeds the Calibration Date by more than 14 days.				

Date Printed: Monday, February 24, 2014

ALS Environmental -- FC

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LIMS Version: 6.695

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# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Friday, February 21, 2014

PAI Work Order: 1402168

Analytical SOP: PAI 714

10:52:07 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402168-19 Spectrum #1 2/20/2014	SMP	AS140215-4 AS140215-4UR	UIISO	12a	C14021012	2/10/2014	30.32	Pass	29.29	29.80	31.86	32.37
					B14021012	2/10/2014	0.3430	Pass	0.0000	0.0498	0.4998	0.7500
					C14021012	2/10/2014	5559.6	Pass	5507.7	5517.7	5597.7	5607.7
1402168-20 Spectrum #1 2/20/2014	SMP	AS140215-4 AS140215-4UR	UIISO	13a	C14021013	2/10/2014	30.84	Pass	30.25	30.78	32.90	33.43
					B14021013	2/10/2014	0.3870	Pass	0.0000	0.0498	0.4998	0.7500
					C14021013	2/10/2014	5549.7	Pass	5486.2	5496.2	5576.2	5586.2
AS140215-4M Spectrum #1 2/20/2014	MB	AS140215-4 AS140215-4UR	UIISO	14a	C14021014	2/10/2014	28.44	Pass	27.48	27.98	29.88	30.38
					B14021014	2/10/2014	0.3470	Pass	0.0000	0.0498	0.4998	0.7500
					C14021014	2/10/2014	5569.7	Pass	5503.7	5513.7	5593.7	5603.7
AS140215-4P Spectrum #1 2/20/2014	MB	AS140215-4 AS140215-4UR	UIISO	16a	C14021016	2/10/2014	29.83	Pass	27.91	28.41	30.35	30.85
					B14021016	2/10/2014	0.3160	Pass	0.0000	0.0498	0.4998	0.7500
					C14021016	2/10/2014	5549.7	Pass	5497.9	5507.9	5587.9	5597.9
AS140215-4 Spectrum #1 2/20/2014	LCS	AS140215-4 AS140215-4UR	UIISO	25	C14021025	2/10/2014	29.18	Pass	26.95	27.42	29.32	29.79
					B14021025	2/10/2014	0.4650	Pass	0.0000	0.0500	0.5000	0.7500
					C14021025	2/10/2014	5557.7	Pass	5496.0	5506.0	5586.0	5596.0
AS140215-4 Spectrum #1 2/20/2014	LCSD	AS140215-4 AS140215-4UR	UIISO	26	C14021026	2/10/2014	30.73	Pass	29.40	29.92	31.98	32.50
					B14021026	2/10/2014	0.4800	Pass	0.0000	0.0498	0.4998	0.7500
					C14021026	2/10/2014	5546.0	Pass	5496.0	5506.0	5586.0	5596.0

Data Package ID: UR1402168-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
				CI - The Analysis Date exceeds the Calibration Date by more than 14 days.

Date Printed: Monday, February 24, 2014

ALS Environmental -- FC

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LIMS Version: 6.695

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# Alpha Spec Calibration Source Re-Certification

Recalibration performed by Isotope Products Laboratories

**Primary Certified Source**

Source PA ID: 190  
 Planchet Label: 9  
 Recalibrated on: 10/15/2013  
 Received by ALS on: 10/18/2013

Values from certificate	
Source ID:	92MIX223027
Total Activity:	3745.2 dpm
Ref Date:	10/15/2013

Nuclide	Act (Bq)	Act (dpm)	Half-Life (yrs)	Decay Corrected
U-234:	49.54	2972.4	2.48E+05	2972.40 dpm
U-235:	1.09	65.58	7.04E+08	65.58 dpm
Am-241:	11.79	707.4	432.17	707.38 dpm
<b>TOTAL</b>				<b>3745.36 dpm</b>

**Efficiency Determination for Detector:**

13

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Total cpm	Known dpm	Detector efficiency
92MIX223027	190	97-19-103-09	10/21/13	7688	32739	1135	2100		1187.43	3745.36	31.70%

**Sources 1 through 8 activity determination**

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Detector Efficiency	Am-241 dpm	U-234 dpm	U-235 dpm	Combined dpm
92MIX2203026	182	97-19-103-01	10/21/13	13543	81484	2889	2100		31.70%	1220.49	7343.29	242.33	8806.10
92MIX2203028	183	97-19-103-02	10/21/13	15830	158715	4155	2100		31.70%	1428.59	14123.06	334.45	15924.09
92MIX2203024	184	97-19-103-03	10/21/13	71784	74298	2052	2100		31.70%	6467.33	6895.89	184.92	13347.94
92MIX2203021	185	97-19-103-04	10/21/13	22944	62381	2198	2100		31.70%	2067.70	5621.74	198.88	7887.52
92MIX2203025	186	97-19-103-05	10/21/13	103302	124917	3425	2100		31.70%	9309.51	11257.44	308.86	20875.61
92MIX2203022	187	97-19-103-06	10/21/13	78934	84490	2349	2100		31.70%	7113.48	7814.19	211.89	14939.38
92MIX2203023	188	97-19-103-07	10/21/13	48085	71762	1847	2100		31.70%	4153.15	6467.15	188.45	10788.75
92MIX2203029	189	97-19-103-08	10/21/13	34624	218016	6721	2100		31.70%	3120.29	19647.47	688.89	23373.45

**Efficiency Verification**

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	Count dur (s)	Total cpm	Known dpm	Detector efficiency	RPD	FLAG
92MIX223027	190	97-19-103-09	10/21/13	7807	32933	1155	2100	1197.00	3745.36	31.96%	-0.80%	PASS

**Sources 1 through 8 activity re-verification**

Source Serial#	PA ID	Sequential #	Combined Observed dpm	Combined Certified dpm*	Percent Difference %	Within 5% of Certified value?
92MIX2203026	182	97-19-103-01	8806.10	8855.90	-0.56%	Yes
92MIX2203028	183	97-19-103-02	15924.09	15999.04	-0.47%	Yes
92MIX2203024	184	97-19-103-03	13347.94	13533.39	-1.37%	Yes
92MIX2203021	185	97-19-103-04	7887.52	8170.91	-3.47%	Yes
92MIX2203025	186	97-19-103-05	20875.61	21020.88	-0.69%	Yes
92MIX2203022	187	97-19-103-06	14939.38	15319.53	-2.48%	Yes
92MIX2203023	188	97-19-103-07	10788.75	10744.16	0.40%	Yes
92MIX2203029	189	97-19-103-08	23373.45	23608.79	-1.00%	Yes

**Data from certificates**

Reference Date	U-234 (Bq)	U-234 (dpm)	U-235 (Bq)	U-235 (dpm)	Am-241 (Bq)	Am-241 (dpm)
5/1/2003	24.10	7446.00	2.43	145.74	21.43	1285.80
5/1/2003	38.30	14358.00	4.20	252.00	23.55	1413.00
5/1/2003	19.40	7184.00	1.93	115.56	106.00	6360.00
4/1/2003	01.00	6060.00	1.26	75.84	34.50	2070.00
4/1/2003	03.00	12180.00	3.41	204.72	148.40	8784.00
4/1/2003	32.90	7974.00	3.17	189.96	121.30	7278.00
4/1/2003	07.10	6426.00	0.93	55.54	72.26	4335.60
5/1/2003	34.80	20888.00	6.55	393.18	53.02	3181.20

New Expiration Date => 10/21/2014  
 JP 10/22/13



**Eckert & Ziegler**

**Isotope Products**

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010

Fax 661-257-8303

#190  
Received 10/18/13

# CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide:</b> U-234	<b>Customer:</b> ALS LABORATORY
<b>Radionuclide:</b> U-235	<b>P.O. No.:</b> FC 35957/R5576
<b>Radionuclide:</b> Am-241	<b>Catalog No.:</b> *SOURCE-RECAL-STD
<b>Half-life (U-234):</b> (2.454 ± 0.006)E+05 years	<b>Reference Date:</b> 15-Oct-13 12:00 PST
<b>Half-life (U-235):</b> (7.037 ± 0.011)E+08 years	<b>Source No.:</b> 92MIX223027
<b>Half-life (Am-241):</b> 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234:	1.339 nCi,	49.54 Bq	Am-241:	0.3187 nCi,	11.79 Bq
U-235:	0.02954 nCi,	1.093 Bq	<b>Total Activity:</b>	1.687 nCi,	62.42 Bq

**Physical Description:**

- A. Capsule type: Disk (22 mm OD x 0.79 mm THK)
- B. Nature of active deposit: Electrodeposited and diffusion bonded oxide
- C. Active diameter/volume: 19 mm
- D. Backing: Stainless steel
- E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in May 2001.

**Uncertainty of Measurement:**

- A. Type A (random) uncertainty: ± 0.5 %
- B. Type B (systematic) uncertainty: ± 3.0 %
- C. Uncertainty in aliquot weighing: ± 0.0 %
- D. Total uncertainty at the 99% confidence level: ± 3.0 %

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 1893 α/min in 2π on 20-Sep-13.

*Donald James Van Dalsem*  
Quality Control

2-OCT-13  
Date

IPL Ref. No.: 987-28

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**

24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory 110 of 128**

1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13  
 $\alpha$  1 New Exp Date  $\Rightarrow$  10/21/2014  
 PAI 187  
 Recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 $\pm$ 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 $\pm$ 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 $\pm$ 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203026
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**Contained Radioactivity:**

U-234: 3.354 nCi (124.1 Bq) U-235: 0.06566 nCi (2.429 Bq)	Am-241: 0.5793 nCi (21.43 Bq) <b>Total Activity:</b> 3.999 nCi (148.0 Bq)
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**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4483  $\alpha$ /min in 2 $\pi$  on 11 Apr 03.

*Daniel James Van Dalsem*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED



Re-Calibrated 10/21/13  
α 2 New Exp Date  
 => 10/21/2014  
 PAI 183  
 Recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234	<b>Customer:</b> PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b> U-235	<b>P.O. No.:</b> EW040203/R2193
<b>Radionuclide C:</b> Am-241	<b>Catalog No.:</b> MISC-STD
<b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years	<b>Reference Date:</b> 1-May-03 12:00 PST
<b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years	<b>Source No.:</b> 92MIX2203028
<b>Half Life (Am-241):</b> 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234: 6.467 nCi (239.3 Bq)	Am-241: 0.6366 nCi (23.55 Bq)
U-235: 0.1135 nCi (4.200 Bq)	Total Activity: 7.217 nCi (267.1 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 8091 α/min in 2π on 11 Apr 03.

*Daniel James Van Dalsen*  
 Quality Control

15-Apr-03  
 Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED



**Isotope Products  
Laboratories**

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Fax 661-257-8303

$\alpha 3$

Re-Calibrated 10/21/13  
New Exp Date  
=> 10/21/2014

PAT I.D. 184  
recalibrated 4-15-03  
JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203024
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**Contained Radioactivity:**

U-234: 3.227 nCi (119.4 Bq)	Am-241: 2.866 nCi (106.0 Bq)
U-235: 0.05205 nCi (1.926 Bq)	Total Activity: 6.145 nCi (227.3 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.6%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 6889  $\alpha$ /min in 2 $\pi$  on 11 Apr 03.

*Daniel James Van Dolson*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
1800 North Keystone Street Burbank, California 91504



**Isotope Products  
Laboratories**

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Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
New Exp Date  
α4 ⇒ 10/21/2014

PAI ID: 00185  
rec'd from recalibrator  
3-28-03 TP 10/22/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234	<b>Customer:</b> PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b> U-235	<b>P.O. No.:</b> EW030603/R2155
<b>Radionuclide C:</b> Am-241	<b>Catalog No.:</b> MISC-STD
<b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years	<b>Reference Date:</b> 1-Apr-03 12:00 PST
<b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years	<b>Source No.:</b> 92MIX2203021
<b>Half Life (Am-241):</b> 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234: 2.731 nCi (101.0 Bq)	Am-241: 0.9325 nCi (34.50 Bq)
U-235: 0.03416 nCi (1.264 Bq)	Total Activity: 3.698 nCi (136.8 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4145 α/min in 2π on 18 Mar 03.

*Daniel James Ken Dalsen*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
1800 North Keystone Street Burbank, California 91504



**Isotope Products  
Laboratories**

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Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Ke-Calibrated 10/21/13  
 [α 5] New Exp Date  
 ⇒ 10/21/2014  
 PAI ID 00186  
 special calibration  
 received 186  
 3-28-03  
 JP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203025
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**Contained Radioactivity:**

U-234: 5.486 nCi (203.0 Bq) U-235: 0.09221 nCi (3.412 Bq)	Am-241: 3.958 nCi (146.4 Bq) <b>Total Activity:</b> 9.536 nCi (352.8 Bq)
--	---

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 10690 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
 Quality Control

19-Mar-03  
 Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
 24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
 1800 North Keystone Street Burbank, California 91504



**Isotope Products  
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
26 New Exp Date  
 ⇒ 10/21/2014  
 AISO 60187  
 rec'd for recalibration  
 3-28-03 JP 10/22/10

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203022
---	---

**Contained Radioactivity:**

U-234: 3.592 nCi (132.9 Bq)	Am-241: 3.279 nCi (121.3 Bq)
U-235: 0.08556 nCi (3.166 Bq)	Total Activity: 6.957 nCi (257.4 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 7799 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsen  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
1800 North Keystone Street Burbank, California 91504



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Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13  
α 7 New Exp Date  
 ⇒ 10/21/2014

PA ID 188  
 rec'd for recalibration  
 3-28-03 JP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203023
---	---

**Contained Radioactivity:**

U-234: 2.895 nCi (107.1 Bq)	Am-241: 1.953 nCi (72.26 Bq)
U-235: 0.02502 nCi (0.9257 Bq)	Total Activity: 4.873 nCi (180.3 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 5463 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsem*  
 Quality Control

19-Mar-03  
 Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
 24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
 1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13  
28 New Exp Date  
 ⇒ 10/21/2014  
 PAI ID 189  
 rec'd 4-21-03  
 recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203029
---	---

**Contained Radioactivity:**

U-234: 9.048 nCi (334.8 Bq) U-235: 0.1771 nCi (6.553 Bq)	Am-241: 1.433 nCi (53.02 Bq) <b>Total Activity:</b> 10.66 nCi (394.4 Bq)
---	---

**Physical description:**

A. Capsule type:	Disk (22 mm, OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.5%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.0%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 11950 α/min in 2π on 11 Apr 03.

*Daniel James Van Dalsem*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 190\_10.21.13 (#9)  
Description:

Analysis Date: 10/21/2013 10:15:08AM  
Calibration Type: Efficiency

Source Info

Certificate ID: A9 RSO#190  
Prepared by: IPL

Certification Date: 10/15/2013 10:00:00AM

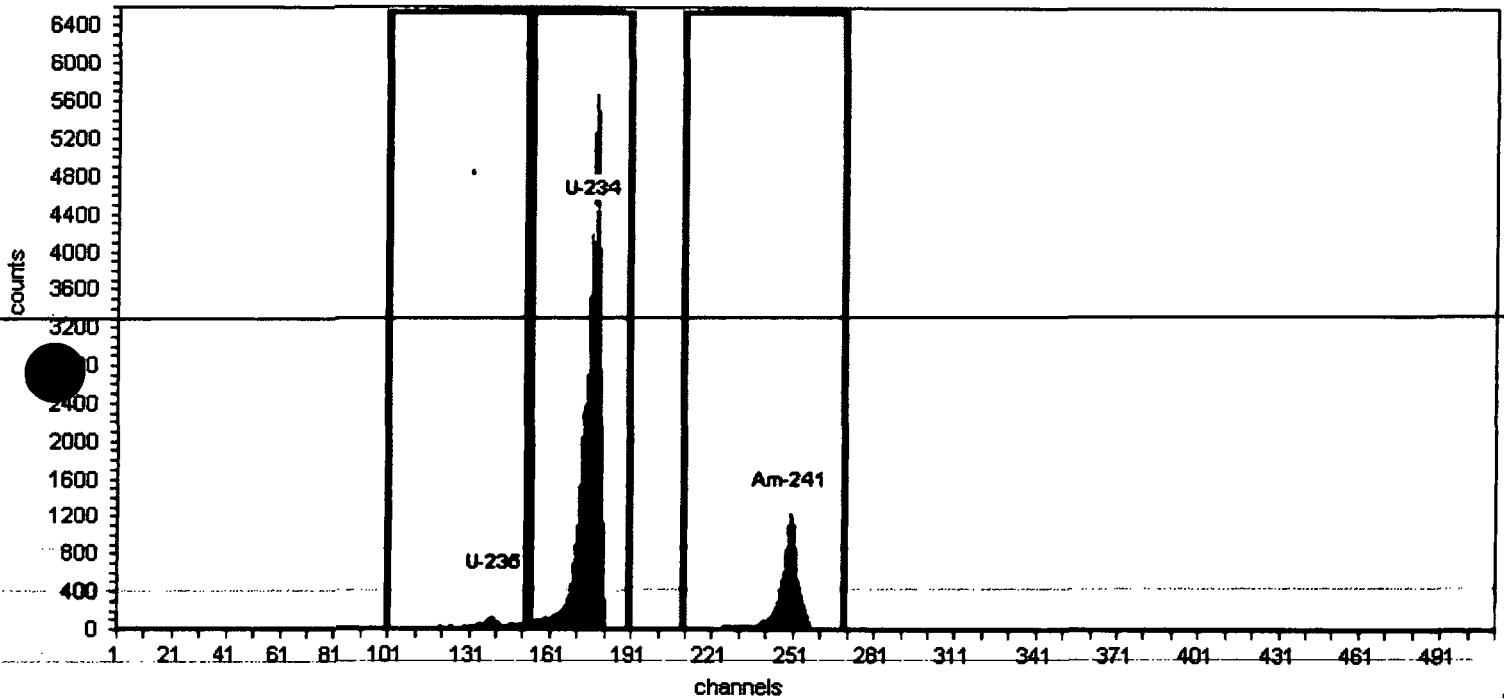
Description:

Acquisition

Detector: 13a, SN:  
Acquisition Start Date: 10/21/2013 8:31:19AM  
Live Time: 35.00 min.  
Real Time: 35.01 min.

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch  
Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>  
Efficiency: 31.46% +/- 0.32% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 190\_10.21.13 (



Method: Interactive ROI  
Algorithm: Linear

Initial Calibration: Yes  
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,135.00	32.43
U-234	176	4.78	153	190	32,739.00	935.40
Am-241	249	5.49	210	270	7,686.00	219.60

JP 10/21/13



Analyst: ORTEC  
Detector: 13a

Energy Calibration: SOURCE 182\_10.21.13 (#1)  
Description:

Calibration

Analysis Date: 10/21/2013 10:15:34AM  
Calibration Type: Efficiency

Source Info

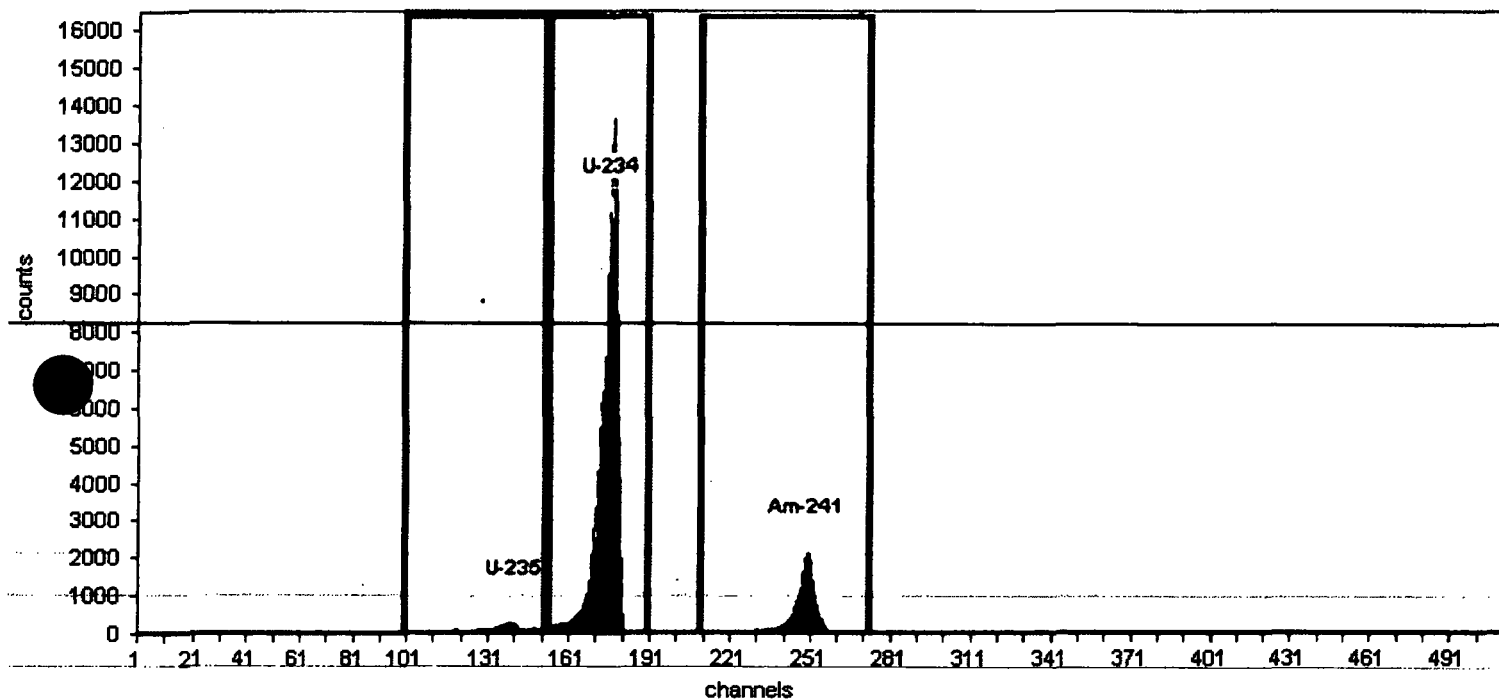
Certificate ID: A1 RSO#182  
Prepared by: IPL  
Description:

Certification Date: 5/1/2003 12:00:24PM

Acquisition

Detector: 13a , SN:  
Acquisition Start Date: 10/21/2013 9:09:15AM  
Live Time: 35.00 min.  
Real Time: 35.03 min.  
Efficiency Calibration Name: SOURCE 182\_10.21.13 (

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch  
Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>  
Efficiency: 31.17% +/- 0.20% TPU(2 sigma)



Method: Interactive ROI  
Algorithm: Linear

Initial Calibration: Yes  
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,689.00	76.83
U-234	176	4.78	153	190	81,484.00	2,328.11
Am-241	249	5.49	210	273	13,543.00	386.94

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 183\_10.21.13 (#2)

Description:

Analysis Date: 10/21/2013 10:39:26AM

Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A2 RSO#183

Prepared by: IPL

Description:

Certification Date: 5/1/2003 12:00:00PM

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 9:48:00AM

Live Time: 35.00 min.

Real Time: 35.06 min.

Efficiency Calibration Name: SOURCE 183\_10.21.13 (

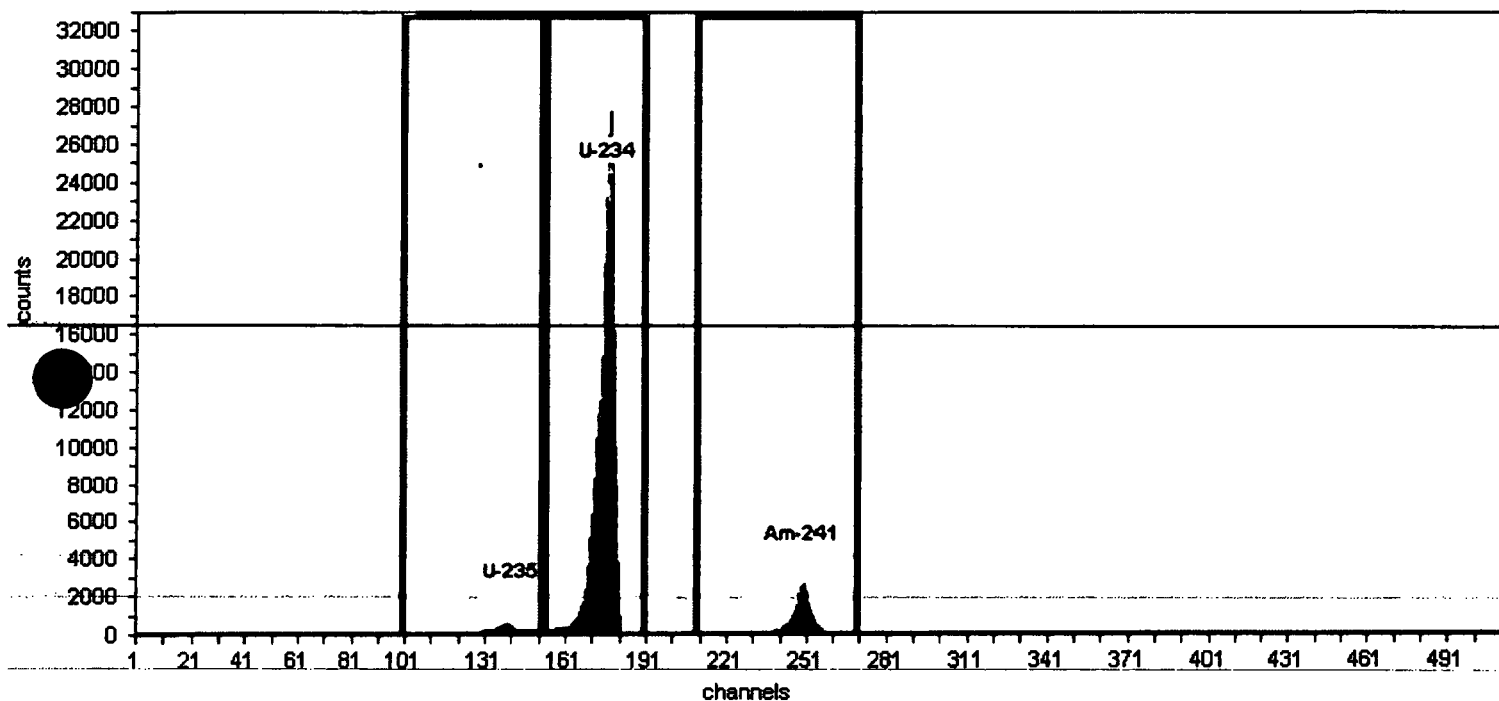
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 31.40% +/- 0.15% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	4,155.00	118.71
U-234	176	4.78	153	190	156,715.00	4,477.57
Am-241	249	5.49	210	270	15,830.00	452.29

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 11:08:15AM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 184\_10.21.13 (#3)

Description:

Source Info

Certificate ID: A3 RSO#184

Prepared by: IPL

Certification Date: 5/1/2003 12:00:00PM

Description:

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 10:30:47AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

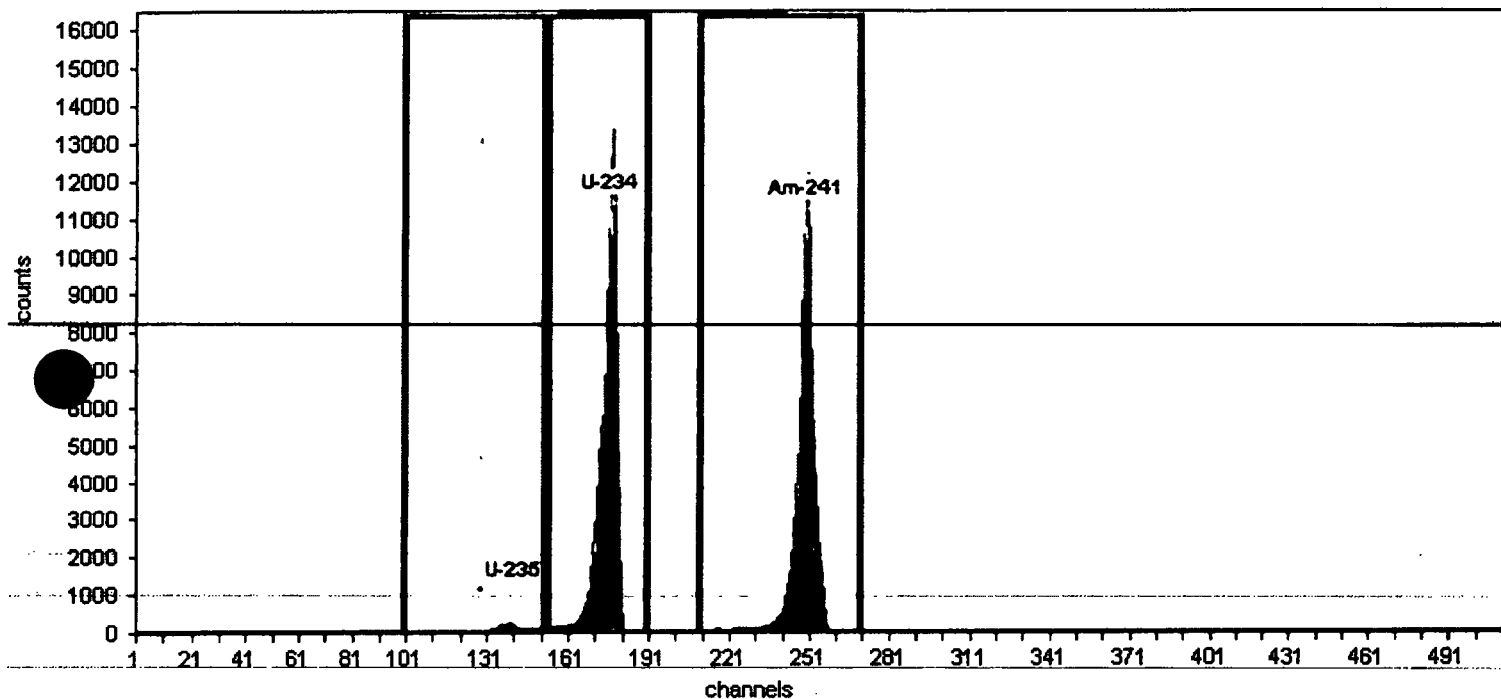
Real Time: 35.05 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 184\_10.21.13 (

Efficiency: 31.06% +/- 0.16% TPU(2 sigma)



Method: Interactive ROI

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,052.00	58.63
U-234	176	4.78	153	190	74,298.00	2,122.80
Am-241	249	5.49	210	270	71,764.00	2,050.40

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 185\_10.21.13 (#4)

Description:

Analysis Date: 10/21/2013 11:44:23AM  
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A4 RSO#185

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

Acquisition

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 11:08:08AM

Live Time: 35.00 min.

Real Time: 35.03 min.

Efficiency Calibration Name: SOURCE 185\_10.21.13 (

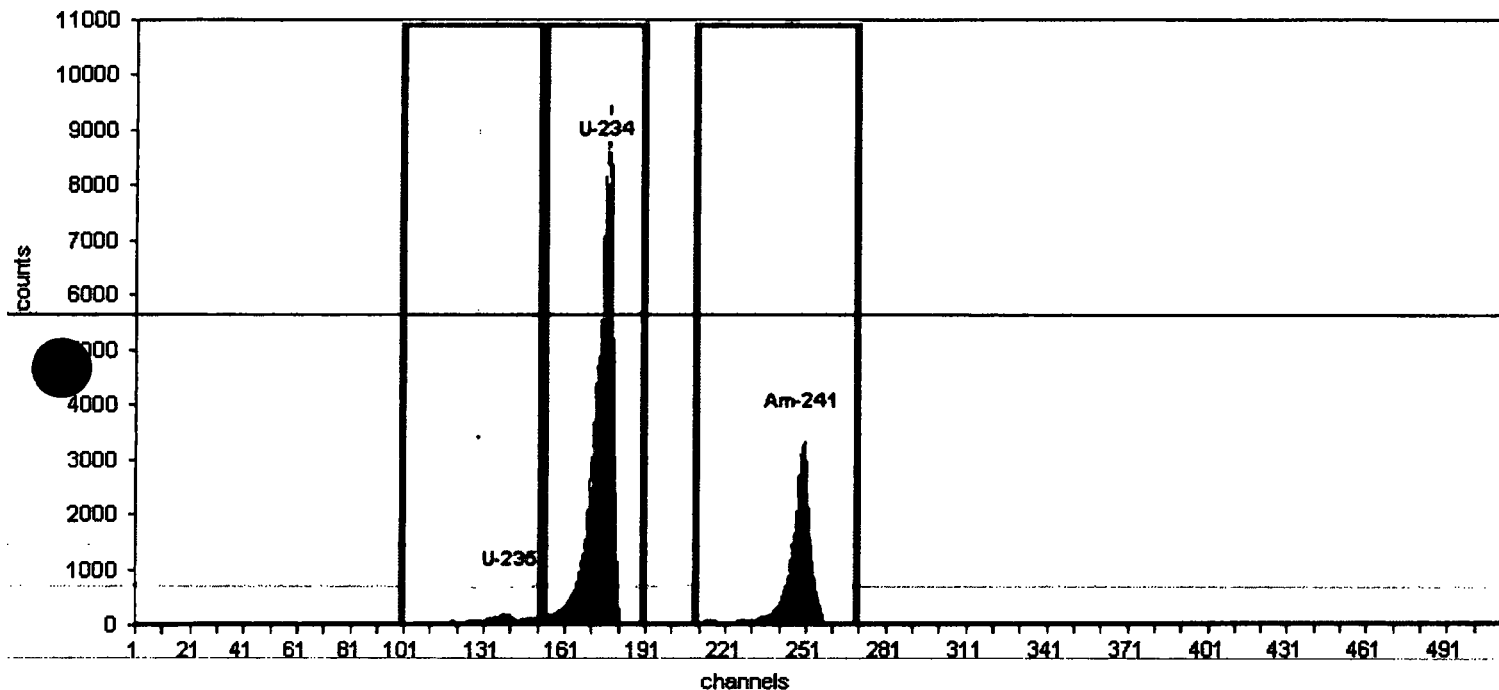
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 30.07% +/- 0.21% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,198.00	62.80
U-234	176	4.78	153	190	62,381.00	1,782.31
Am-241	249	5.49	210	270	22,944.00	655.54

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 12:20:40PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 186\_10.21.13 (#5)  
Description:

Source Info

Certificate ID: A5 RSO#186  
Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

Acquisition

Detector: 13a, SN:

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch

Acquisition Start Date: 10/21/2013 11:45:31AM

Offset = 3,010.51 keV

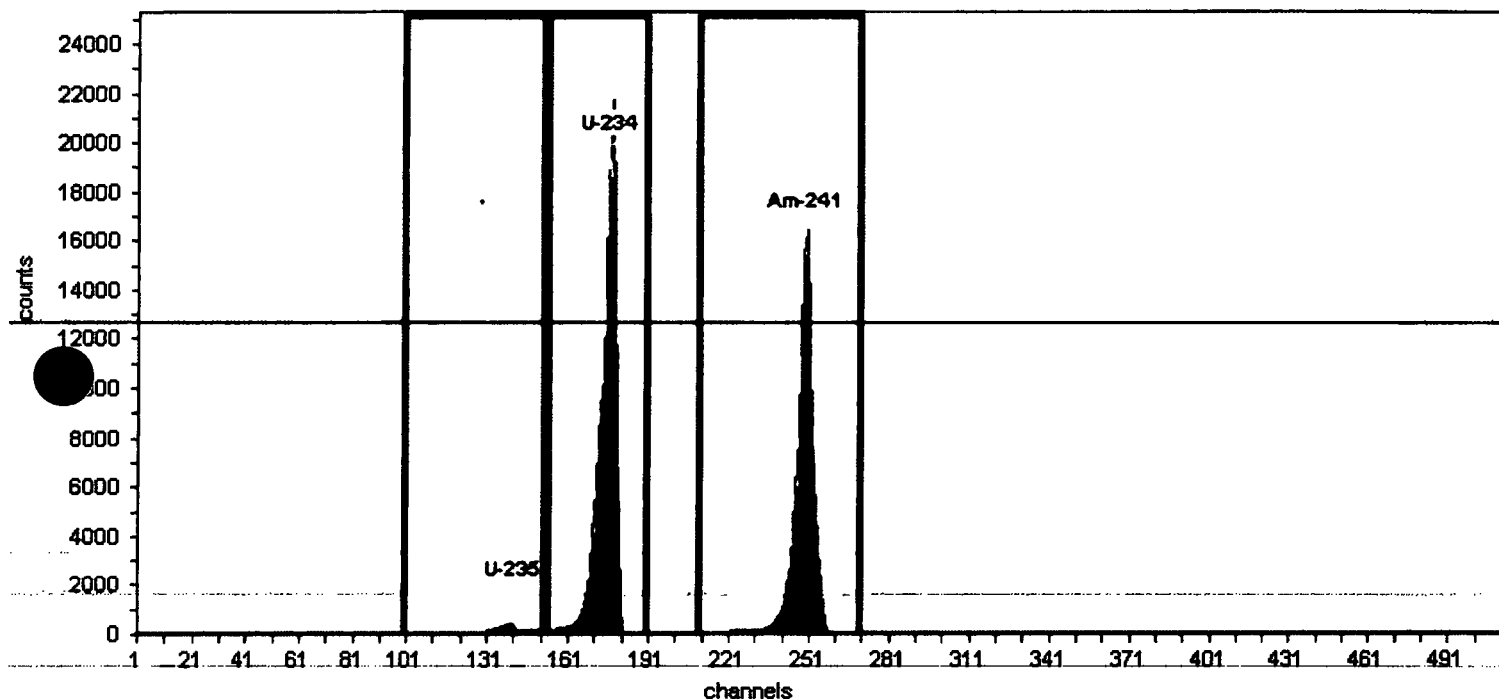
Live Time: 35.00 min.

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Real Time: 35.08 min.

Efficiency: 31.20% +/- 0.13% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 186\_10.21.13 (



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	3,425.00	97.86
U-234	176	4.78	153	190	124,917.00	3,569.06
Am-241	249	5.49	210	270	103,302.00	2,951.49

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 187\_10.21.13 (#6)

Description:

Analysis Date: 10/21/2013 12:56:51PM

Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A6 RSO#187

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

Acquisition

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 12:21:22PM

Live Time: 35.00 min.

Real Time: 35.06 min.

Efficiency Calibration Name: SOURCE 187\_10.21.13 (

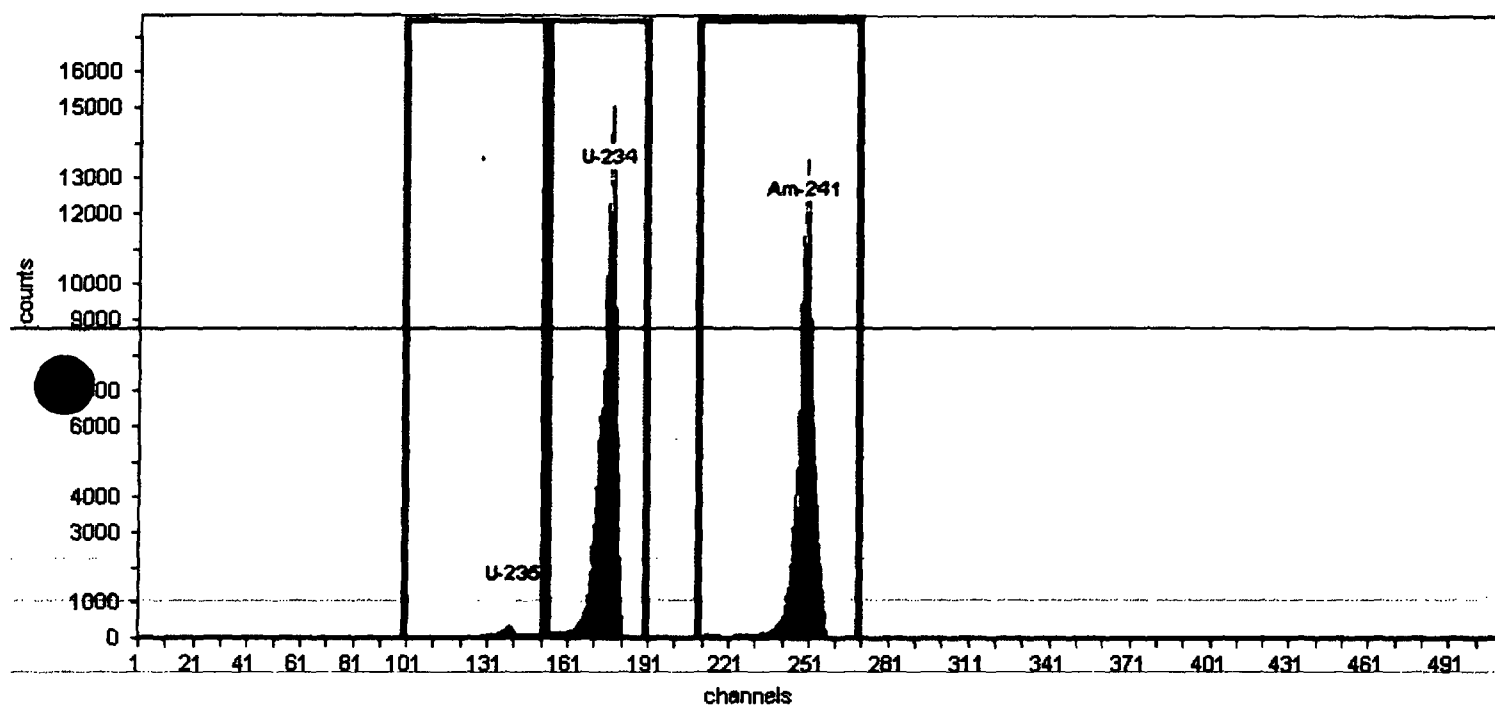
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 30.89% +/- 0.15% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,349.00	67.11
U-234	176	4.78	153	190	84,490.00	2,414.00
Am-241	249	5.49	210	270	78,934.00	2,255.26

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 1:32:57PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 188\_10.21.13 (#7)  
Description:

Source Info

Certificate ID: A7 RSO#188  
Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

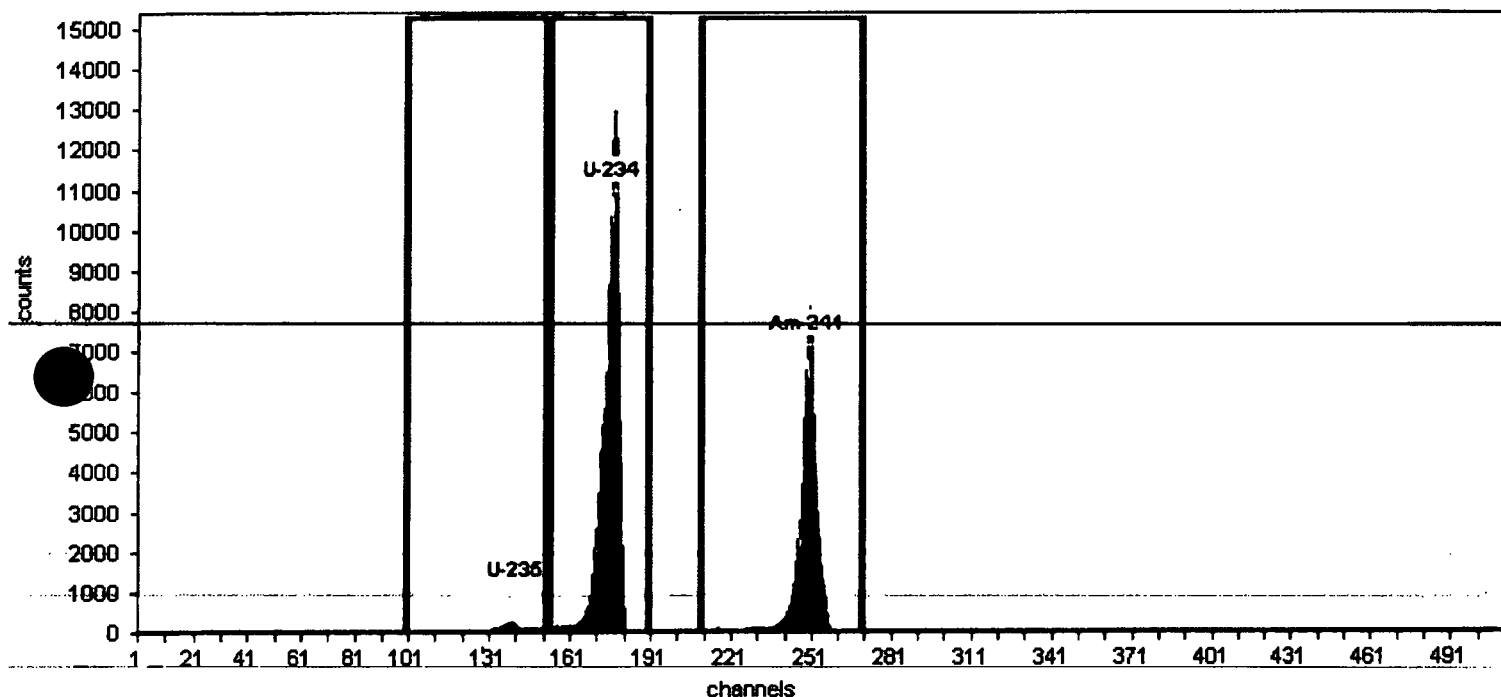
Acquisition

Detector: 13a, SN:  
Acquisition Start Date: 10/21/2013 12:57:17PM

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch  
Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>  
Efficiency: 31.50% +/- 0.19% TPU(2 sigma)

Live Time: 35.00 min.  
Real Time: 35.04 min.

Efficiency Calibration Name: SOURCE 188\_10.21.13 (



Method: Manual (ROI)  
Algorithm: Linear

Initial Calibration: Yes  
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,847.00	52.77
U-234	176	4.78	153	190	71,762.00	2,050.34
Am-241	249	5.49	210	270	46,085.00	1,316.71

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 2:09:42PM

Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 189\_10.21.13 (#8)

Description:

**Source Info**

Certificate ID: A8 RSO#189

Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 1:34:04PM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

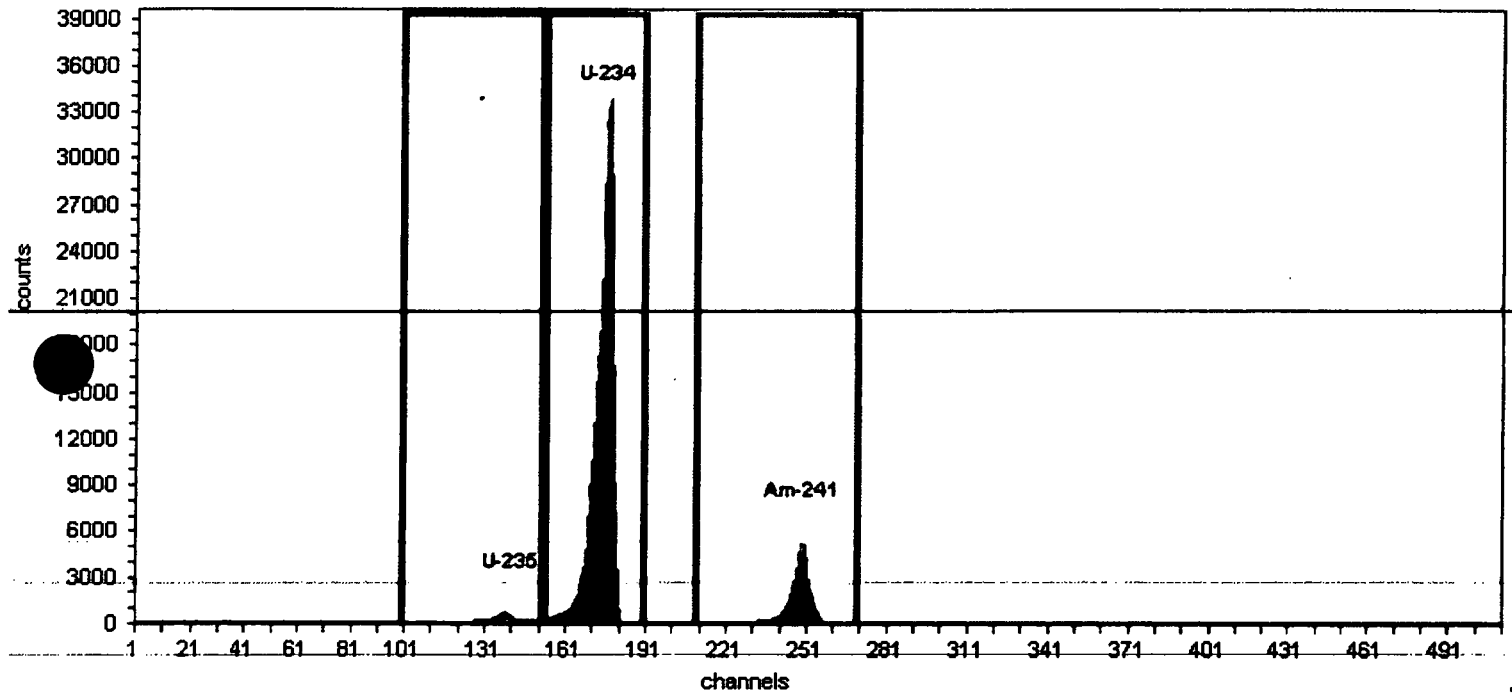
Real Time: 35.09 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 189\_10.21.13 (

Efficiency: 31.23% +/- 0.12% TPU(2 sigma)



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	6,721.00	192.03
U-234	176	4.78	153	190	218,016.00	6,229.03
Am-241	249	5.49	210	270	34,624.00	989.26

JP 10/21/13



Analyst: ORTEC

Detector: 13a

Energy Calibration: SOURCE 190A\_10.21.13 (#9)  
Description:

Calibration

Analysis Date: 10/21/2013 2:45:56PM  
Calibration Type: Energy And Efficiency

Certificate ID: A9 RSO#190  
Prepared by: IPL

Source Info

Certification Date: 10/15/2013 10:00:00AM

Description:

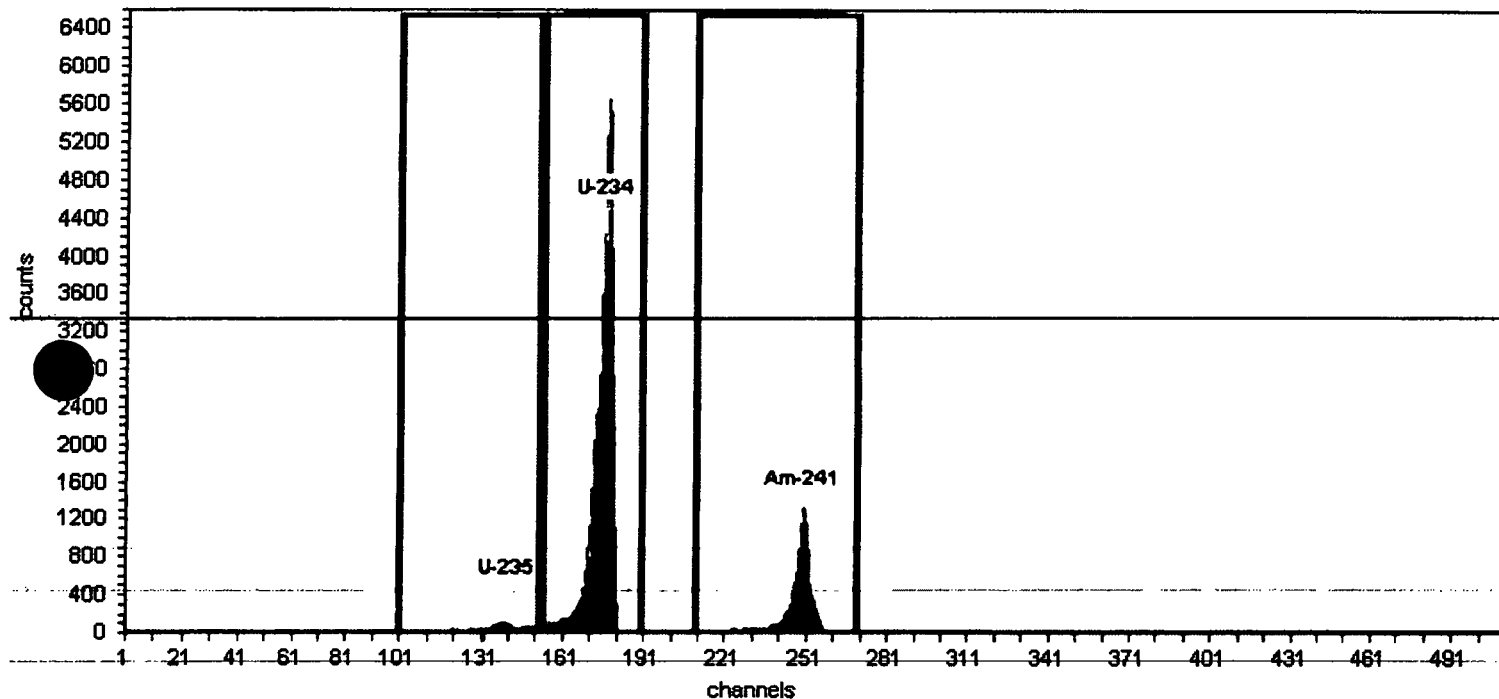
Acquisition

Detector: 13a , SN:  
Acquisition Start Date: 10/21/2013 2:10:16PM

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch  
Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>  
Efficiency: 31.69% +/- 0.32% TPU(2 sigma)

Live Time: 35.00 min.  
Real Time: 35.01 min.

Efficiency Calibration Name: SOURCE 190A\_10.21.13



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,155.00	33.00
U-234	176	4.78	153	190	32,933.00	940.94
Am-241	249	5.49	210	270	7,807.00	223.06

JP 10/21/13

Case Narrative -1402169

## Isotopic Uranium Case Narrative

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### **Cabrera Services, Inc** **Schofield Barracks – 08-3123.00**


Work Order Number: 1402169

1. This report consists of the analytical results and supporting documentation for 20 filter samples received by ALS on 2/14/2014.
2. These samples were prepared according to the current revisions of SOP 773 and SOP 778.
3. The samples were analyzed for the presence of isotopic uranium according to the current revision of SOP 714. The analyses were completed on 2/21/2014.
4. The isotopic analysis results for these samples are reported on an 'As Received' basis in units of  $\mu\text{Ci/mL}$ .
5. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate.
6. This analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to emission energies between those of U-234 and U-238. A potential limitation of this method is that measurable amounts of U-234 in the sample may cause a small amount of characteristic activity in the U-235 region of interest due to poorly resolved alpha activity at the boundary between the two regions. To minimize the potential for a high bias in the U-235 analytical results, the U-235 region of interest has been narrowed and limited to a lower energy region. An 85.1% abundance correction has been made to the final U-235 results.
7. The magnitude of the negative U-235 activity for sample 1402169-18 is greater than the 2 sigma TPU. The analyst's review of the data does not indicate a problem with the instrument data or the subsequent reporting systems. The data quality is not believed to be affected and the results are submitted without qualification. Under typical conditions, where background level sample data is normally distributed and analyzed by paired observations, this event is likely to occur at least 2.5% of the time.

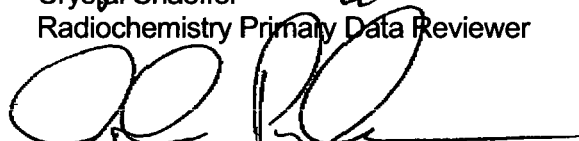


8. No further anomalous situations were encountered during the preparation or analysis of these samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
Crystal Shaeffer  
Radiochemistry Primary Data Reviewer

2/25/14  
Date

  
Radiochemistry Final Data Reviewer

02/26/14  
Date



## Section 1

# CHAIN OF CUSTODY

# ALS Environmental -- FC

## Sample Number(s) Cross-Reference Table

**OrderNum:** 1402169

**Client Name:** Cabrera Services, Inc.

**Client Project Name:** Schofield Barracks

**Client Project Number:** 08-3123.00

**Client PO Number:** 12-3541

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SBHF14-069-ST03-AS-HF	1402169-1		FILTER	10-Feb-14	13:36
SBHF14-070-ST04-AS-HF	1402169-2		FILTER	10-Feb-14	13:26
SBHF14-071-ST05-AS-HF	1402169-3		FILTER	10-Feb-14	13:18
SBHF14-072-ST06-AS-HF	1402169-4		FILTER	10-Feb-14	13:14
SBHF14-073-ST07-AS-HF	1402169-5		FILTER	10-Feb-14	13:11
SBHF14-074-ST08-AS-HF	1402169-6		FILTER	10-Feb-14	13:08
SBHF14-075-ST09-AS-HF	1402169-7		FILTER	10-Feb-14	13:03
SBHF14-076-ST10-AS-HF	1402169-8		FILTER	10-Feb-14	13:00
SBHF14-077-ST11-AS-HF	1402169-9		FILTER	10-Feb-14	12:58
SBHF14-056-ST01-AS-HF	1402169-10		FILTER	09-Feb-14	14:53
SBHF14-057-ST02-AS-HF	1402169-11		FILTER	09-Feb-14	14:55
SBHF14-058-ST03-AS-HF	1402169-12		FILTER	09-Feb-14	15:49
SBHF14-059-ST04-AS-HF	1402169-13		FILTER	09-Feb-14	14:56
SBHF14-060-ST05-AS-HF	1402169-14		FILTER	09-Feb-14	14:59
SBHF14-061-ST06-AS-HF	1402169-15		FILTER	09-Feb-14	15:42
SBHF14-062-ST07-AS-HF	1402169-16		FILTER	09-Feb-14	15:36
SBHF14-063-ST08-AS-HF	1402169-17		FILTER	09-Feb-14	15:34
SBHF14-064-ST09-AS-HF	1402169-18		FILTER	09-Feb-14	15:31
SBHF14-065-ST10-AS-HF	1402169-19		FILTER	09-Feb-14	15:28
SBHF14-066-ST11-AS-HF	1402169-20		FILTER	09-Feb-14	15:24



# ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524  
TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

## Chain-of-Custody

Form 202a

WORKORDER # TBD

1402115  
14021460  
2-14-14

SAMPLER	Stephan Owe	DATE	2/10/2014	PAGE	1 of 1
PROJECT NAME	Schofield Barracks	SITE ID	Schofield Barracks	TURNAROUND	30 days
PROJECT No.	08-3123.00	EDD FORMAT	n/a	DISPOSAL	(By Lab) or Return to Client
	Task 310	PURCHASE ORDER	12-3541		
COMPANY NAME	Cabrera Services	BILL TO COMPANY	Cabrera Services		
SEND REPORT TO	Mike Winters	INVOICE ATTN TO	Accounts Payable		
ADDRESS	2318 Bolger Ave	ADDRESS	473 Silver Lane		
CITY / STATE / ZIP	Spring Hill, FL 34609	CITY / STATE / ZIP	East Hartford, CT 06108		
PHONE	352-610-2150	PHONE	860-569-0095		
FAX	n/a	FAX	n/a		
E-MAIL	mwinters@cabreraseservices.com	E-MAIL	n/a		

Lab ID	Field ID	Matrix	Sample Date	Start Time	Stop Time	Run Time (Min)	Flow Rate (CFM)	Isotope Uranium by Alpha Spec												
1	SBHF14-069-ST03-AS-HF	F	2/10/2014	8:24	13:36	312	10	X												
2	SBHF14-070-ST04-AS-HF	F	2/10/2014	8:15	13:26	311	10	X												
3	SBHF14-071-ST05-AS-HF	F	2/10/2014	8:11	13:18	307	10	X												
4	SBHF14-072-ST06-AS-HF	F	2/10/2014	8:05	13:14	309	10	X												
5	SBHF14-073-ST07-AS-HF	F	2/10/2014	8:03	13:11	308	10	X												
6	SBHF14-074-ST08-AS-HF	F	2/10/2014	7:58	13:08	310	10	X												
7	SBHF14-075-ST09-AS-HF	F	2/10/2014	7:53	13:03	310	10	X												
8	SBHF14-076-ST10-AS-HF	F	2/10/2014	7:49	13:00	311	10	X												
9	SBHF14-077-ST11-AS-HF	F	2/10/2014	7:46	12:58	312	10	X												

\*Time Zone (Circle): EST CST MST **HAST** Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter

For metals or anions, please detail analytes below.

Comments:

Volumes provided in ft<sup>3</sup>; results requested in units of uCi/ml  
MDC is 1E-16 uCi/ml; see previously provided work plan for other MQC's  
Bag of blank unused filters included for QC sample purposes  
Preserve half of each sample for re-analysis/follow up testing

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

QC PACKAGE (check below)

	LEVEL II (Standard QC)
	LEVEL III (Std QC + forms)
X	LEVEL IV (Std QC + forms + raw data)

RELINQUISHED BY	SIGNATURE	PRINTED NAME	DATE	TIME
		Stephan Owe	2/10/2014	15:30
		Pat Horkman	2/10/2014	15:31
		Pat Horkman	2/12/14	1500
		C Trumble	2-14-14	1005









ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: CABRERA  
Project Manager: LS

Workorder No: 1402169  
Initials: CDT Date: 2-14-14

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	<input checked="" type="radio"/> NONE	YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	<input checked="" type="radio"/> N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<input checked="" type="radio"/> RAD ONLY	YES	<input checked="" type="radio"/> NO
Cooler #: <u>1</u>			
Temperature (°C): <u>Amb</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: <u>11</u>			
Background µR/hr reading: <u>11</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES / NO / NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

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If applicable, was the client contacted? YES / NO / NA Contact: [Signature] Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 2/14/14

From: (800) 324-3800  
Pat Hultman (no Client Services)  
CABRERA SERVICES  
1554 Lyman Road (Mtg 3000)  
Schaumburg, IL 60197

Origin ID: NOLA



Ship Date: 12FEB14  
Acctg: 1.0 LB  
CAD: 1053104800NET3400  
Dim: 12 X 12 X 12 M

1402169

SHIP TO: (378) 488-4314  
Lance Steere  
ALS Laboratories  
225 COMMERCE DR

BILL REMINDER

FORT COLLINS, CO 80524

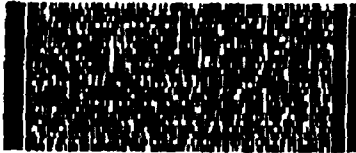
Delivery Address Bar Code



Ref # 00-3028-04 Task 021  
Invoice # N/A to ALS  
Dept #

FRI - 14 FEB 10:30A  
PRIORITY OVERNIGHT

TRK 7978 9058 5067  
CB1



XH FTCA

11  
-0

80524  
CO-US  
DEN



5201402169

After printing this label:

1. Use the "Print" button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.

Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com. FedEx will not be responsible for any claim in excess of \$100 per package, whether the result of loss, damage, delay, non-delivery, misdelivery, or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim. Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental, consequential, or special is limited to the greater of \$100 or the authorized declared value. Recovery cannot exceed actual documented loss. Maximum for items of extraordinary value is \$1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our ServiceGuide. Written claims must be filed within strict time limits, see current FedEx Service Guide.



Section 2

2

# **SAMPLE RESULTS SUMMARY**

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402169

**Page:** 1 of 7  
**Reported on:** Tuesday, February 25, 2014  
 2:46:34 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402169-1	SBHF14-069-ST03-AS-HF	Sample	U-234	7.1E-16 +/- 4.7E-16	1.9E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-1	SBHF14-069-ST03-AS-HF	Sample	U-235	0E+00 +/- 4.1E-16	6.2E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-1	SBHF14-069-ST03-AS-HF	Sample	U-238	2.1E-16 +/- 3.5E-16	5.3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-2	SBHF14-070-ST04-AS-HF	Sample	U-234	3.8E-16 +/- 3.2E-16	1.7E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-2	SBHF14-070-ST04-AS-HF	Sample	U-235	1.5E-16 +/- 3.7E-16	2E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-2	SBHF14-070-ST04-AS-HF	Sample	U-238	1.9E-16 +/- 3.4E-16	5.9E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-3	SBHF14-071-ST05-AS-HF	Sample	U-234	0E+00 +/- 2.6E-16	5.3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-3	SBHF14-071-ST05-AS-HF	Sample	U-235	1E-16 +/- 2.3E-16	1.3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-3	SBHF14-071-ST05-AS-HF	Sample	U-238	8E-17 +/- 2E-16	3.8E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U

**Comments:**

**Data Package ID:** UR1402169-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402169

**Page:** 2 of 7  
**Reported on:** Tuesday, February 25, 2014  
 2:46:34 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402169-4	SBHF14-072-ST06-AS-HF	Sample	U-234	2.1E-16 +/- 2E-16	1.1E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-4	SBHF14-072-ST06-AS-HF	Sample	U-235	-1E-16 +/- 2.4E-16	4.5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-4	SBHF14-072-ST06-AS-HF	Sample	U-238	2.5E-16 +/- 2E-16	1.1E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	LT
1402169-5	SBHF14-073-ST07-AS-HF	Sample	U-234	4.1E-16 +/- 3E-16	1.4E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-5	SBHF14-073-ST07-AS-HF	Sample	U-235	6E-17 +/- 2.9E-16	1.6E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-5	SBHF14-073-ST07-AS-HF	Sample	U-238	3.1E-16 +/- 2.5E-16	1.4E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	LT
1402169-6	SBHF14-074-ST08-AS-HF	Sample	U-234	3.4E-16 +/- 3E-16	3.6E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-6	SBHF14-074-ST08-AS-HF	Sample	U-235	-6E-17 +/- 2.8E-16	5.4E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-6	SBHF14-074-ST08-AS-HF	Sample	U-238	1.5E-16 +/- 2.4E-16	1.3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	LT

**Comments:**

**Data Package ID:** UR1402169-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

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- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402169

**Page:** 3 of 7  
**Reported on:** Tuesday, February 25, 2014  
 2:46:34 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402169-7	SBHF14-075-ST09-AS-HF	Sample	U-234	1.9E-16 +/- 1.9E-16	1E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-7	SBHF14-075-ST09-AS-HF	Sample	U-235	9E-17 +/- 2.2E-16	3.3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-7	SBHF14-075-ST09-AS-HF	Sample	U-238	2.3E-16 +/- 2.2E-16	2.8E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-8	SBHF14-076-ST10-AS-HF	Sample	U-234	2.5E-16 +/- 2.7E-16	3.7E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-8	SBHF14-076-ST10-AS-HF	Sample	U-235	1.2E-16 +/- 2.9E-16	4.4E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-8	SBHF14-076-ST10-AS-HF	Sample	U-238	1.5E-16 +/- 3.1E-16	5.5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-9	SBHF14-077-ST11-AS-HF	Sample	U-234	3.9E-16 +/- 4.5E-16	6.9E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-9	SBHF14-077-ST11-AS-HF	Sample	U-235	2.3E-16 +/- 3.7E-16	2.1E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-9	SBHF14-077-ST11-AS-HF	Sample	U-238	3.2E-16 +/- 3.2E-16	1.7E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	LT

**Comments:**

**Data Package ID:** UR1402169-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
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- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

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# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402169

**Page:** 4 of 7  
**Reported on:** Tuesday, February 25, 2014  
 2:46:34 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402169-10	SBHF14-056-ST01-AS-HF	Sample	U-234	1.4E-16 +/- 2.3E-16	1.3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-10	SBHF14-056-ST01-AS-HF	Sample	U-235	6E-17 +/- 2.7E-16	1.5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-10	SBHF14-056-ST01-AS-HF	Sample	U-238	5E-17 +/- 2.3E-16	4.4E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-11	SBHF14-057-ST02-AS-HF	Sample	U-234	1.6E-16 +/- 1.4E-16	7E-17	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-11	SBHF14-057-ST02-AS-HF	Sample	U-235	3E-17 +/- 1.6E-16	3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-11	SBHF14-057-ST02-AS-HF	Sample	U-238	1.6E-16 +/- 1.6E-16	2E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-12	SBHF14-058-ST03-AS-HF	Sample	U-234	2.4E-16 +/- 1.7E-16	7E-17	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-12	SBHF14-058-ST03-AS-HF	Sample	U-235	6E-17 +/- 1.6E-16	9E-17	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-12	SBHF14-058-ST03-AS-HF	Sample	U-238	5E-17 +/- 1.5E-16	2.9E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U

**Comments:**

**Data Package ID:** UR1402169-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
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- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
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# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402169

**Page:** 5 of 7  
**Reported on:** Tuesday, February 25, 2014  
 2:46:34 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402169-13	SBHF14-059-ST04-AS-HF	Sample	U-234	1.2E-16 +/- 2E-16	3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-13	SBHF14-059-ST04-AS-HF	Sample	U-235	0E+00 +/- 2.4E-16	3.6E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-13	SBHF14-059-ST04-AS-HF	Sample	U-238	4E-17 +/- 2.5E-16	5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-14	SBHF14-060-ST05-AS-HF	Sample	U-234	2.6E-16 +/- 3.5E-16	5.7E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-14	SBHF14-060-ST05-AS-HF	Sample	U-235	-1E-16 +/- 2.5E-16	5.5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-14	SBHF14-060-ST05-AS-HF	Sample	U-238	0E+00 +/- 2.1E-16	4.6E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-15	SBHF14-061-ST06-AS-HF	Sample	U-234	1E-16 +/- 2E-16	3.5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-15	SBHF14-061-ST06-AS-HF	Sample	U-235	0E+00 +/- 1.9E-16	2.8E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-15	SBHF14-061-ST06-AS-HF	Sample	U-238	3E-17 +/- 1.6E-16	2.4E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U

**Comments:**

**Data Package ID:** UR1402169-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402169

**Page:** 6 of 7  
**Reported on:** Tuesday, February 25, 2014  
 2:46:35 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402169-16	SBHF14-062-ST07-AS-HF	Sample	U-234	1.4E-16 +/- 3.1E-16	5.5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-16	SBHF14-062-ST07-AS-HF	Sample	U-235	4E-17 +/- 2E-16	3.8E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-16	SBHF14-062-ST07-AS-HF	Sample	U-238	1.7E-16 +/- 1.9E-16	2.6E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-17	SBHF14-063-ST08-AS-HF	Sample	U-234	7E-17 +/- 3.3E-16	6.2E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-17	SBHF14-063-ST08-AS-HF	Sample	U-235	0E+00 +/- 2E-16	4.5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-17	SBHF14-063-ST08-AS-HF	Sample	U-238	1.1E-16 +/- 1.9E-16	3.3E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-18	SBHF14-064-ST09-AS-HF	Sample	U-234	2.3E-16 +/- 3.1E-16	5.1E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-18	SBHF14-064-ST09-AS-HF	Sample	U-235	-2.1E-16 +/- 1.8E-16	4.7E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-18	SBHF14-064-ST09-AS-HF	Sample	U-238	1E-16 +/- 1.6E-16	2.7E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U

**Comments:**

**Data Package ID:** UR1402169-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Cabrera Services, Inc.  
**Client Project Name:** Schofield Barracks  
**Client Project Number:** 08-3123.00  
**Laboratory Name:** ALS Environmental -- FC  
**PAI Work Order:** 1402169

**Page:** 7 of 7  
**Reported on:** Tuesday, February 25, 2014  
 2:46:35 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
1402169-19	SBHF14-065-ST10-AS-HF	Sample	U-234	2.3E-16 +/- 3.1E-16	5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-19	SBHF14-065-ST10-AS-HF	Sample	U-235	1E-16 +/- 1.7E-16	2.5E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-19	SBHF14-065-ST10-AS-HF	Sample	U-238	2.3E-16 +/- 2.5E-16	3.8E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-20	SBHF14-066-ST11-AS-HF	Sample	U-234	1.98E-15 +/- 6.2E-16	3.8E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	
1402169-20	SBHF14-066-ST11-AS-HF	Sample	U-235	4E-17 +/- 1.8E-16	2.8E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U
1402169-20	SBHF14-066-ST11-AS-HF	Sample	U-238	-3E-17 +/- 1.9E-16	4.2E-16	uCi/ml	FILTER	AS140215-5	2/20/2014	U

**Comments:**

**Data Package ID:** UR1402169-1

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit



## Section 3

# QC RESULTS SUMMARY

**3**

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-5MMB

Sample Matrix: FILTER

Prep Batch: AS140215-5

Final Aliquot: 55600000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-5-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-5UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 20-Feb-14

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.3E-16 +/- 4.1E-16	7E-16		U
15117-96-1	U-235	5E-17 +/- 2.2E-16	3.4E-16		U
7440-61-1	U-238	0E+00 +/- 2.2E-16	4.7E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Method Blank Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-5PMB

Sample Matrix: FILTER

Prep Batch: AS140215-5

Final Aliquot: 55600000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-5-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-5UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 20-Feb-14

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3E-16 +/- 3.9E-16	6.3E-16		U
15117-96-1	U-235	0E+00 +/- 2.2E-16	4.1E-16		U
7440-61-1	U-238	4E-17 +/- 2.5E-16	5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-5LCS

Sample Matrix: FILTER

Prep Batch: AS140215-5

Final Aliquot: 55600000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-5-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-5UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 21-Feb-14

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	3.99E-14 +/- 6.9E-15	7E-16	3.970E-14	100	82 - 122	P
7440-61-1	U-238	4.18E-14 +/- 7.2E-15	5E-16	4.130E-14	101	82 - 122	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
L - LCS Recovery below lower control limit.  
H - LCS Recovery above upper control limit.  
P - LCS Recovery within control limits.  
M - The requested MDC was not met.  
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Minimum Detectable Concentration

Data Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Laboratory Control Sample(s)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Lab ID: AS140215-5LCSD

Sample Matrix: FILTER

Prep Batch: AS140215-5

Final Aliquot: 55600000 ml

Prep SOP: PAI 778 Rev 14

QCBatchID: AS140215-5-1

Result Units: uCi/ml

Date Collected: 15-Feb-14

Run ID: AS140215-5UR

File Name: Spectrum #1

Date Prepared: 15-Feb-14

Count Time: 1000 minutes

Date Analyzed: 21-Feb-14

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	4E-14 +/- 7.6E-15	7E-16	3.970E-14	101	82 - 122	P
7440-61-1	U-238	4.02E-14 +/- 7.6E-15	5E-16	4.130E-14	97.4	82 - 122	P

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

Data Package ID: UR1402169-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Duplicate Sample Results (DER)

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID:  
Lab ID: AS140215-5LCSD

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 15-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 21-Feb-14

Prep Batch: AS140215-5  
QCBatchID: AS140215-5-1  
Run ID: AS140215-5UR  
Count Time: 1000 minutes

Final Aliquot: 55600000 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
13966-29-5	U-234	3.99E-14 +/- 6.9E-15	7E-16	P	4E-14 +/- 7.6E-15	7E-16	P	0.0146	2.13
7440-61-1	U-238	4.18E-14 +/- 7.2E-15	5E-16	P	4.02E-14 +/- 7.6E-15	5E-16	P	0.157	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Package ID: UR1402169-1



## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-069-ST03-AS-HF

Lab ID: 1402169-1

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 10-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.42E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	7.1E-16 +/- 4.7E-16	1.9E-16		
15117-96-1	U-235	0E+00 +/- 4.1E-16	6.2E-16		U
7440-61-1	U-238	2.1E-16 +/- 3.5E-16	5.3E-16	1E-15	U

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

**Abbreviations:**

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-070-ST04-AS-HF  
Lab ID: 1402169-2

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 10-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5  
QCBatchID: AS140215-5-1  
Run ID: AS140215-5UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 4.40E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.8E-16 +/- 3.2E-16	1.7E-16		
15117-96-1	U-235	1.5E-16 +/- 3.7E-16	2E-16		U
7440-61-1	U-238	1.9E-16 +/- 3.4E-16	5.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-071-ST05-AS-HF  
Lab ID: 1402169-3

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 10-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5  
QCBatchID: AS140215-5-1  
Run ID: AS140215-5UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 4.34E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	0E+00 +/- 2.6E-16	5.3E-16		U
15117-96-1	U-235	1E-16 +/- 2.3E-16	1.3E-16		U
7440-61-1	U-238	8E-17 +/- 2E-16	3.8E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-072-ST06-AS-HF  
Lab ID: 1402169-4

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 10-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5  
QCBatchID: AS140215-5-1  
Run ID: AS140215-5UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 4.38E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.1E-16 +/- 2E-16	1.1E-16		
15117-96-1	U-235	-1E-16 +/- 2.4E-16	4.5E-16		U
7440-61-1	U-238	2.5E-16 +/- 2E-16	1.1E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-073-ST07-AS-HF  
Lab ID: 1402169-5

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 10-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5  
QCBatchID: AS140215-5-1  
Run ID: AS140215-5UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 4.36E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	4.1E-16 +/- 3E-16	1.4E-16		
15117-96-1	U-235	6E-17 +/- 2.9E-16	1.6E-16		U
7440-61-1	U-238	3.1E-16 +/- 2.5E-16	1.4E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-074-ST08-AS-HF

Lab ID: 1402169-6

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 10-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.39E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.4E-16 +/- 3E-16	3.6E-16		U
15117-96-1	U-235	-6E-17 +/- 2.8E-16	5.4E-16		U
7440-61-1	U-238	1.5E-16 +/- 2.4E-16	1.3E-16	1E-15	LT

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-075-ST09-AS-HF  
Lab ID: 1402169-7

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 10-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5  
QCBatchID: AS140215-5-1  
Run ID: AS140215-5UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 4.39E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.9E-16 +/- 1.9E-16	1E-16		
15117-96-1	U-235	9E-17 +/- 2.2E-16	3.3E-16		U
7440-61-1	U-238	2.3E-16 +/- 2.2E-16	2.8E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-076-ST10-AS-HF

Lab ID: 1402169-8

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 10-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 4.40E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.5E-16 +/- 2.7E-16	3.7E-16		U
15117-96-1	U-235	1.2E-16 +/- 2.9E-16	4.4E-16		U
7440-61-1	U-238	1.5E-16 +/- 3.1E-16	5.5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> SBHF14-077-ST11-AS-HF <b>Lab ID:</b> 1402169-9	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 10-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 20-Feb-14	<b>Prep Batch:</b> AS140215-5 <b>QCBatchID:</b> AS140215-5-1 <b>Run ID:</b> AS140215-5UR <b>Count Time:</b> 1000 minutes <b>Report Basis:</b> As Received	<b>Final Aliquot:</b> 4.42E+07 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	3.9E-16 +/- 4.5E-16	6.9E-16		U
15117-96-1	U-235	2.3E-16 +/- 3.7E-16	2.1E-16		
7440-61-1	U-238	3.2E-16 +/- 3.2E-16	1.7E-16	1E-15	LT

### Comments:

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

**Abbreviations:**

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-056-ST01-AS-HF  
Lab ID: 1402169-10

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 09-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5  
QCBatchID: AS140215-5-1  
Run ID: AS140215-5UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 6.50E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.4E-16 +/- 2.3E-16	1.3E-16		
15117-96-1	U-235	6E-17 +/- 2.7E-16	1.5E-16		U
7440-61-1	U-238	5E-17 +/- 2.3E-16	4.4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

#### Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-057-ST02-AS-HF

Lab ID: 1402169-11

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 09-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.50E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.6E-16 +/- 1.4E-16	7E-17		
15117-96-1	U-235	3E-17 +/- 1.6E-16	3E-16		U
7440-61-1	U-238	1.6E-16 +/- 1.6E-16	2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-058-ST03-AS-HF

Lab ID: 1402169-12

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 09-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QC Batch ID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.35E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.4E-16 +/- 1.7E-16	7E-17		
15117-96-1	U-235	6E-17 +/- 1.6E-16	9E-17		U
7440-61-1	U-238	5E-17 +/- 1.5E-16	2.9E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-059-ST04-AS-HF

Lab ID: 1402169-13

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 09-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.55E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.2E-16 +/- 2E-16	3E-16		U
15117-96-1	U-235	0E+00 +/- 2.4E-16	3.6E-16		U
7440-61-1	U-238	4E-17 +/- 2.5E-16	5E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-060-ST05-AS-HF

Lab ID: 1402169-14

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 09-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 5.80E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.6E-16 +/- 3.5E-16	5.7E-16		U
15117-96-1	U-235	-1E-16 +/- 2.5E-16	5.5E-16		U
7440-61-1	U-238	0E+00 +/- 2.1E-16	4.6E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-061-ST06-AS-HF  
Lab ID: 1402169-15

Sample Matrix: FILTER  
Prep SOP: PAI 778 Rev 14  
Date Collected: 09-Feb-14  
Date Prepared: 15-Feb-14  
Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5  
QCBatchID: AS140215-5-1  
Run ID: AS140215-5UR  
Count Time: 1000 minutes  
Report Basis: As Received

Final Aliquot: 6.65E+07 ml  
Prep Basis: As Received  
Moisture(%): NA  
Result Units: uCi/ml  
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1E-16 +/- 2E-16	3.5E-16		U
15117-96-1	U-235	0E+00 +/- 1.9E-16	2.8E-16		U
7440-61-1	U-238	3E-17 +/- 1.6E-16	2.4E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental – FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-062-ST07-AS-HF

Lab ID: 1402169-16

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 09-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.60E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.4E-16 +/- 3.1E-16	5.5E-16		U
15117-96-1	U-235	4E-17 +/- 2E-16	3.8E-16		U
7440-61-1	U-238	1.7E-16 +/- 1.9E-16	2.6E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-063-ST08-AS-HF

Lab ID: 1402169-17

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 09-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.65E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	7E-17 +/- 3.3E-16	6.2E-16		U
15117-96-1	U-235	0E+00 +/- 2E-16	4.5E-16		U
7440-61-1	U-238	1.1E-16 +/- 1.9E-16	3.3E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

<b>Field ID:</b> SBHF14-064-ST09-AS-HF <b>Lab ID:</b> 1402169-18	<b>Sample Matrix:</b> FILTER <b>Prep SOP:</b> PAI 778 Rev 14 <b>Date Collected:</b> 09-Feb-14 <b>Date Prepared:</b> 15-Feb-14 <b>Date Analyzed:</b> 20-Feb-14	<b>Prep Batch:</b> AS140215-5 <b>QCBatchID:</b> AS140215-5-1 <b>Run ID:</b> AS140215-5UR <b>Count Time:</b> 1000 minutes <b>Report Basis:</b> As Received	<b>Final Aliquot:</b> 6.65E+07 ml <b>Prep Basis:</b> As Received <b>Moisture(%):</b> NA <b>Result Units:</b> uCi/ml <b>File Name:</b> Spectrum #1
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CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.3E-16 +/- 3.1E-16	5.1E-16		U
15117-96-1	U-235	-2.1E-16 +/- 1.8E-16	4.7E-16		U
7440-61-1	U-238	1E-16 +/- 1.6E-16	2.7E-16	1E-15	U

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

**Abbreviations:**

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-065-ST10-AS-HF

Lab ID: 1402169-19

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 09-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QCBatchID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.70E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	2.3E-16 +/- 3.1E-16	5E-16		U
15117-96-1	U-235	1E-16 +/- 1.7E-16	2.5E-16		U
7440-61-1	U-238	2.3E-16 +/- 2.5E-16	3.8E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 12

## Sample Results

Lab Name: ALS Environmental -- FC

Work Order Number: 1402169

Client Name: Cabrera Services, Inc.

ClientProject ID: Schofield Barracks 08-3123.00

Field ID: SBHF14-066-ST11-AS-HF

Lab ID: 1402169-20

Sample Matrix: FILTER

Prep SOP: PAI 778 Rev 14

Date Collected: 09-Feb-14

Date Prepared: 15-Feb-14

Date Analyzed: 20-Feb-14

Prep Batch: AS140215-5

QC Batch ID: AS140215-5-1

Run ID: AS140215-5UR

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 6.70E+07 ml

Prep Basis: As Received

Moisture(%): NA

Result Units: uCi/ml

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
13966-29-5	U-234	1.98E-15 +/- 6.2E-16	3.8E-16		
15117-96-1	U-235	4E-17 +/- 1.8E-16	2.8E-16		U
7440-61-1	U-238	-3E-17 +/- 1.9E-16	4.2E-16	1E-15	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Package ID: UR1402169-1



## Section 5

# RAW DATA

5

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC Batch ID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402169-1 SMP	U-232 Tracer	2/10/2014 1:36:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44200000 ml 44200000 ml	AlphaSpec2 81	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	676.000 2.000	30.83% 1000	1000 46.4%	2.24E-14 3.7E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402169-1 SMP	U-234 Trg. Analyte	2/10/2014 1:36:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44200000 ml 44200000 ml	AlphaSpec2 81	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	10.000 0.000	30.83% 1000	1000 46.4%	7.1E-16 4.7E-16	1.9E-16 NA	uCi/ml As Received	NA NA	
1402169-1 SMP	U-235 Trg. Analyte	2/10/2014 1:36:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44200000 ml 44200000 ml	AlphaSpec2 81	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	0.000 1.000	30.83% 1000	1000 46.4%	0E+00 4.1E-16	6.2E-16 NA	uCi/ml As Received	NA NA	U
1402169-1 SMP	U-238 Trg. Analyte	2/10/2014 1:36:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44200000 ml 44200000 ml	AlphaSpec2 81	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	3.000 1.000	30.83% 1000	1000 46.4%	2.1E-16 3.5E-16	5.3E-16 NA	uCi/ml As Received	NA NA	U
1402169-2 SMP	U-232 Tracer	2/10/2014 1:26:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44000000 ml 44000000 ml	AlphaSpec2 82	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	758.000 2.000	30.65% 1000	1000 52.3%	2.53E-14 4.2E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402169-2 SMP	U-234 Trg. Analyte	2/10/2014 1:26:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44000000 ml 44000000 ml	AlphaSpec2 82	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	6.000 0.000	30.65% 1000	1000 52.3%	3.8E-16 3.2E-16	1.7E-16 NA	uCi/ml As Received	NA NA	
1402169-2 SMP	U-235 Trg. Analyte	2/10/2014 1:26:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44000000 ml 44000000 ml	AlphaSpec2 82	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	2.000 0.000	30.65% 1000	1000 52.3%	1.5E-16 3.7E-16	2E-16 NA	uCi/ml As Received	NA NA	U
1402169-2 SMP	U-238 Trg. Analyte	2/10/2014 1:26:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44000000 ml 44000000 ml	AlphaSpec2 82	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	3.000 2.000	30.65% 1000	1000 52.3%	1.9E-16 3.4E-16	5.9E-16 NA	uCi/ml As Received	NA NA	U
1402169-3 SMP	U-232 Tracer	2/10/2014 1:18:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43400000 ml 43400000 ml	AlphaSpec2 83	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	1206.000 1.000	31.20% 1000	1000 81.7%	4.01E-14 6.4E-15	2E-16 NA	uCi/ml As Received	NA NA	
1402169-3 SMP	U-234 Trg. Analyte	2/10/2014 1:18:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43400000 ml 43400000 ml	AlphaSpec2 83	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	0.000 5.000	31.20% 1000	1000 81.7%	0E+00 2.6E-16	5.3E-16 NA	uCi/ml As Received	NA NA	U
1402169-3 SMP	U-235 Trg. Analyte	2/10/2014 1:18:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43400000 ml 43400000 ml	AlphaSpec2 83	AS140215-5UR Spectrum #1	2/20/2014 2:51 PM	2.000 0.000	31.20% 1000	1000 81.7%	1E-16 2.3E-16	1.3E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit



# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental – FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402169-3 SMP	U-238 Trg. Analyte	2/10/2014 1:18:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43400000 ml 43400000 ml	AlphaSpec2 83	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	2.000 2.000	31.20% 1000	1000 81.7%	8E-17 2E-16	3.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-4 SMP	U-232 Tracer	2/10/2014 1:14:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43800000 ml 43800000 ml	AlphaSpec2 84	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1186.000 2.000	30.40% 1000	1000 82.5%	4.02E-14 6.4E-15	3E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-4 SMP	U-234 Trg. Analyte	2/10/2014 1:14:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43800000 ml 43800000 ml	AlphaSpec2 84	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	5.000 0.000	30.40% 1000	1000 82.5%	2.1E-16 2E-16	1.1E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-4 SMP	U-235 Trg. Analyte	2/10/2014 1:14:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43800000 ml 43800000 ml	AlphaSpec2 84	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	-2.000 2.000	30.40% 1000	1000 82.5%	-1E-16 2.4E-16	4.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-4 SMP	U-238 Trg. Analyte	2/10/2014 1:14:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43800000 ml 43800000 ml	AlphaSpec2 84	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	6.000 0.000	30.40% 1000	1000 82.5%	2.5E-16 2E-16	1.1E-16 NA	uCi/ml As Received	NA NA	NA LT
1402169-5 SMP	U-232 Tracer	2/10/2014 1:11:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43600000 ml 43600000 ml	AlphaSpec2 85	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	957.000 1.000	30.11% 1000	1000 67.2%	3.28E-14 5.3E-15	3E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-5 SMP	U-234 Trg. Analyte	2/10/2014 1:11:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43600000 ml 43600000 ml	AlphaSpec2 85	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	8.000 0.000	30.11% 1000	1000 67.2%	4.1E-16 3E-16	1.4E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-5 SMP	U-235 Trg. Analyte	2/10/2014 1:11:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43600000 ml 43600000 ml	AlphaSpec2 85	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1.000 0.000	30.11% 1000	1000 67.2%	6E-17 2.9E-16	1.6E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-5 SMP	U-238 Trg. Analyte	2/10/2014 1:11:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43600000 ml 43600000 ml	AlphaSpec2 85	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	6.000 0.000	30.11% 1000	1000 67.2%	3.1E-16 2.5E-16	1.4E-16 NA	uCi/ml As Received	NA NA	NA LT
1402169-6 SMP	U-232 Tracer	2/10/2014 1:08:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 86	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	985.000 3.000	30.61% 1000	1000 68.0%	3.3E-14 5.3E-15	4E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-6 SMP	U-234 Trg. Analyte	2/10/2014 1:08:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 86	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	7.000 1.000	30.61% 1000	1000 68.0%	3.4E-16 3E-16	3.6E-16 NA	uCi/ml As Received	NA NA	NA U

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402169-6 SMP	U-235 Trg. Analyte	2/10/2014 1:08:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 86	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	-1.000 2.000	30.61% 1000	1000 68.0%	-6E-17 2.8E-16	5.4E-16 NA	uCi/ml As Received	NA NA	U
1402169-6 SMP	U-238 Trg. Analyte	2/10/2014 1:08:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 86	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	3.000 0.000	30.61% 1000	1000 68.0%	1.5E-16 2.4E-16	1.3E-16 NA	uCi/ml As Received	NA NA	LT
1402169-7 SMP	U-232 Tracer	2/10/2014 1:03:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 87	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1272.000 2.000	31.55% 1000	1000 85.3%	4.14E-14 6.6E-15	3E-16 NA	uCi/ml As Received	NA NA	
1402169-7 SMP	U-234 Trg. Analyte	2/10/2014 1:03:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 87	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	5.000 0.000	31.55% 1000	1000 85.3%	1.9E-16 1.9E-16	1E-16 NA	uCi/ml As Received	NA NA	
1402169-7 SMP	U-235 Trg. Analyte	2/10/2014 1:03:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 87	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	2.000 1.000	31.55% 1000	1000 85.3%	9E-17 2.2E-16	3.3E-16 NA	uCi/ml As Received	NA NA	U
1402169-7 SMP	U-238 Trg. Analyte	2/10/2014 1:03:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	43900000 ml 43900000 ml	AlphaSpec2 87	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	6.000 1.000	31.55% 1000	1000 85.3%	2.3E-16 2.2E-16	2.8E-16 NA	uCi/ml As Received	NA NA	U
1402169-8 SMP	U-232 Tracer	2/10/2014 1:00:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44000000 ml 44000000 ml	AlphaSpec2 88	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	949.000 4.000	30.79% 1000	1000 65.2%	3.15E-14 5.1E-15	4E-16 NA	uCi/ml As Received	NA NA	
1402169-8 SMP	U-234 Trg. Analyte	2/10/2014 1:00:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44000000 ml 44000000 ml	AlphaSpec2 88	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	5.000 1.000	30.79% 1000	1000 65.2%	2.5E-16 2.7E-16	3.7E-16 NA	uCi/ml As Received	NA NA	U
1402169-8 SMP	U-235 Trg. Analyte	2/10/2014 1:00:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44000000 ml 44000000 ml	AlphaSpec2 88	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	2.000 1.000	30.79% 1000	1000 65.2%	1.2E-16 2.9E-16	4.4E-16 NA	uCi/ml As Received	NA NA	U
1402169-8 SMP	U-238 Trg. Analyte	2/10/2014 1:00:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44000000 ml 44000000 ml	AlphaSpec2 88	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	3.000 3.000	30.79% 1000	1000 65.2%	1.5E-16 3.1E-16	5.5E-16 NA	uCi/ml As Received	NA NA	U
1402169-9 SMP	U-232 Tracer	2/10/2014 12:58:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44200000 ml 44200000 ml	AlphaSpec2 89	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	749.000 7.000	31.24% 1000	1000 50.7%	2.45E-14 4.1E-15	5E-16 NA	uCi/ml As Received	NA NA	

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
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- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
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- B - Analyte concentration greater than MDC.
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**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
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**Abbreviations:**

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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **ALS Environmental -- FC**

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC Batch ID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402169-9 SMP	U-234 Trg. Analyte	2/10/2014 12:58:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44200000 ml 44200000 ml	AlphaSpec2 89	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	6.000 3.000	31.24% 1000	1000 50.7%	3.9E-16 4.5E-16	6.9E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-9 SMP	U-235 Trg. Analyte	2/10/2014 12:58:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44200000 ml 44200000 ml	AlphaSpec2 89	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	3.000 0.000	31.24% 1000	1000 50.7%	2.3E-16 3.7E-16	2.1E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-9 SMP	U-238 Trg. Analyte	2/10/2014 12:58:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	44200000 ml 44200000 ml	AlphaSpec2 89	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	5.000 0.000	31.24% 1000	1000 50.7%	3.2E-16 3.2E-16	1.7E-16 NA	uCi/ml As Received	NA NA	NA LT
1402169-10 SMP	U-232 Tracer	2/9/2014 2:53:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65000000 ml 65000000 ml	AlphaSpec2 90	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	689.000 5.000	30.90% 1000	1000 47.2%	1.55E-14 2.6E-15	3E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-10 SMP	U-234 Trg. Analyte	2/9/2014 2:53:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65000000 ml 65000000 ml	AlphaSpec2 90	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	3.000 0.000	30.90% 1000	1000 47.2%	1.4E-16 2.3E-16	1.3E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-10 SMP	U-235 Trg. Analyte	2/9/2014 2:53:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65000000 ml 65000000 ml	AlphaSpec2 90	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1.000 0.000	30.90% 1000	1000 47.2%	6E-17 2.7E-16	1.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-10 SMP	U-238 Trg. Analyte	2/9/2014 2:53:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65000000 ml 65000000 ml	AlphaSpec2 90	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1.000 2.000	30.90% 1000	1000 47.2%	5E-17 2.3E-16	4.4E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-11 SMP	U-232 Tracer	2/9/2014 2:55:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65000000 ml 65000000 ml	AlphaSpec2 91	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1207.000 4.000	30.35% 1000	1000 84.1%	2.76E-14 4.4E-15	3E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-11 SMP	U-234 Trg. Analyte	2/9/2014 2:55:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65000000 ml 65000000 ml	AlphaSpec2 91	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	6.000 0.000	30.35% 1000	1000 84.1%	1.6E-16 1.4E-16	7E-17 NA	uCi/ml As Received	NA NA	NA NA
1402169-11 SMP	U-235 Trg. Analyte	2/9/2014 2:55:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65000000 ml 65000000 ml	AlphaSpec2 91	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1.000 2.000	30.35% 1000	1000 84.1%	3E-17 1.6E-16	3E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-11 SMP	U-238 Trg. Analyte	2/9/2014 2:55:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65000000 ml 65000000 ml	AlphaSpec2 91	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	6.000 1.000	30.35% 1000	1000 84.1%	1.6E-16 1.6E-16	2E-16 NA	uCi/ml As Received	NA NA	NA U

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **ALS Environmental -- FC**

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402169-12 SMP	U-232 Tracer	2/9/2014 3:49:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	63500000 mt 63500000 mt	AlphaSpec2 92	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1233.000 1.000	31.14% 1000	2.81E-14 83.7%	2E-16 NA	uCi/ml As Received	NA NA		
1402169-12 SMP	U-234 Trg. Analyte	2/9/2014 3:49:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	63500000 mt 63500000 mt	AlphaSpec2 92	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	9.000 0.000	31.14% 1000	2.4E-16 83.7%	7E-17 NA	uCi/ml As Received	NA NA		
1402169-12 SMP	U-235 Trg. Analyte	2/9/2014 3:49:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	63500000 mt 63500000 mt	AlphaSpec2 92	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	2.000 0.000	31.14% 1000	6E-17 83.7%	9E-17 NA	uCi/ml As Received	NA NA		U
1402169-12 SMP	U-238 Trg. Analyte	2/9/2014 3:49:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	63500000 mt 63500000 mt	AlphaSpec2 92	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	2.000 3.000	31.14% 1000	5E-17 83.7%	2.9E-16 NA	uCi/ml As Received	NA NA		U
1402169-13 SMP	U-232 Tracer	2/9/2014 2:56:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65500000 mt 65500000 mt	AlphaSpec2 93	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	785.000 7.000	32.05% 1000	1.68E-14 51.8%	3E-16 NA	uCi/ml As Received	NA NA		
1402169-13 SMP	U-234 Trg. Analyte	2/9/2014 2:56:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65500000 mt 65500000 mt	AlphaSpec2 93	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	3.000 1.000	32.05% 1000	1.2E-16 51.8%	3E-16 NA	uCi/ml As Received	NA NA		U
1402169-13 SMP	U-235 Trg. Analyte	2/9/2014 2:56:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65500000 mt 65500000 mt	AlphaSpec2 93	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	0.000 1.000	32.05% 1000	0E+00 51.8%	3.6E-16 NA	uCi/ml As Received	NA NA		U
1402169-13 SMP	U-238 Trg. Analyte	2/9/2014 2:56:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	65500000 mt 65500000 mt	AlphaSpec2 93	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1.000 4.000	32.05% 1000	4E-17 51.8%	5E-16 NA	uCi/ml As Received	NA NA		U
1402169-14 SMP	U-232 Tracer	2/9/2014 2:59:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	58000000 mt 58000000 mt	AlphaSpec2 94	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	850.000 2.000	32.10% 1000	2.06E-14 56.0%	2E-16 NA	uCi/ml As Received	NA NA		
1402169-14 SMP	U-234 Trg. Analyte	2/9/2014 2:59:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	58000000 mt 58000000 mt	AlphaSpec2 94	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	6.000 5.000	32.10% 1000	2.6E-16 56.0%	5.7E-16 NA	uCi/ml As Received	NA NA		U
1402169-14 SMP	U-235 Trg. Analyte	2/9/2014 2:59:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	58000000 mt 58000000 mt	AlphaSpec2 94	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	-2.000 3.000	32.10% 1000	-1E-16 56.0%	5.5E-16 NA	uCi/ml As Received	NA NA		U

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
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- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

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- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer    TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **ALS Environmental -- FC**

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC Batch ID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	Spk. Recov Flags
1402169-14 SMP	U-238 Trg. Analyte	2/9/2014 2:59:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	58000000 ml 58000000 ml	AlphaSpec2 94	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	0.000 3.000	32.10% 1000	1000 56.0%	0E+00 2.1E-16	4.6E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-15 SMP	U-232 Tracer	2/9/2014 3:42:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 95	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	985.000 3.000	32.13% 1000	1000 64.8%	2.08E-14 3.4E-15	2E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-15 SMP	U-234 Trg. Analyte	2/9/2014 3:42:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 95	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	3.000 3.000	32.13% 1000	1000 64.8%	1E-16 2E-16	3.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-15 SMP	U-235 Trg. Analyte	2/9/2014 3:42:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 95	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	0.000 1.000	32.13% 1000	1000 64.8%	0E+00 1.9E-16	2.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-15 SMP	U-238 Trg. Analyte	2/9/2014 3:42:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 95	AS140215-SUR Spectrum #1	2/20/2014 2:51 PM	1.000 1.000	32.13% 1000	1000 64.8%	3E-17 1.6E-16	2.4E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-16 SMP	U-232 Tracer	2/9/2014 3:36:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66000000 ml 66000000 ml	AlphaSpec2 30	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	923.000 23.000	28.09% 1000	1000 69.5%	2.24E-14 3.7E-15	6E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-16 SMP	U-234 Trg. Analyte	2/9/2014 3:36:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66000000 ml 66000000 ml	AlphaSpec2 30	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	4.000 8.000	28.09% 1000	1000 69.5%	1.4E-16 3.1E-16	5.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-16 SMP	U-235 Trg. Analyte	2/9/2014 3:36:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66000000 ml 66000000 ml	AlphaSpec2 30	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	1.000 2.000	28.09% 1000	1000 69.5%	4E-17 2E-16	3.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-16 SMP	U-238 Trg. Analyte	2/9/2014 3:36:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66000000 ml 66000000 ml	AlphaSpec2 30	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	5.000 1.000	28.09% 1000	1000 69.5%	1.7E-16 1.9E-16	2.6E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-17 SMP	U-232 Tracer	2/9/2014 3:34:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 31	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	902.000 35.000	29.21% 1000	1000 65.3%	2.09E-14 3.4E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-17 SMP	U-234 Trg. Analyte	2/9/2014 3:34:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 31	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	2.000 10.000	29.21% 1000	1000 65.3%	7E-17 3.3E-16	6.2E-16 NA	uCi/ml As Received	NA NA	NA U

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.  
 Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.  
 Y2 - Chemical Yield outside default limits.  
 W - DER is greater than Warning Limit of 1.42  
 D - DER is greater than Control Limit of 2.13  
 + - Duplicate RPD not within limits.  
 LT - Result is less than Request MDC, greater than sample specific MDC  
 \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'  
 # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

M - Requested MDC not met.  
 M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
 L - LCS Recovery below lower control limit.  
 H - LCS Recovery above upper control limit.  
 P - LCS, Matrix Spike Recovery within control limits.  
 N - Matrix Spike Recovery outside control limits  
 NC - Not Calculated for duplicate results less than 5 times MDC  
 B - Analyte concentration greater than MDC.  
 B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

1) The Tracer results are not yield corrected (i.e. activity measured not activity added).  
 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

TR- Tracer TA - Target Analyte  
 TPU - Total Propagated Uncertainty  
 MDC - Minimum Detectable Concentration  
 DER - Duplicate Error Ratio  
 BDL - Below Detection Limit

51  
128

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	4Spk. Recov Flags
1402169-17 SMP	U-235 Trg. Analyte	2/9/2014 3:34:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 31	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	0.000 3.000	29.21% 1000	1000 65.3%	0E+00 2E-16	4.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-17 SMP	U-238 Trg. Analyte	2/9/2014 3:34:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 31	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	3.000 2.000	29.21% 1000	1000 65.3%	1.1E-16 1.9E-16	3.3E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-18 SMP	U-232 Tracer	2/9/2014 3:31:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 32	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	1263.000 15.000	29.03% 1000	1000 92.0%	2.95E-14 4.7E-15	5E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-18 SMP	U-234 Trg. Analyte	2/9/2014 3:31:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 32	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	9.000 14.000	29.03% 1000	1000 92.0%	2.3E-16 3.1E-16	5.1E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-18 SMP	U-235 Trg. Analyte	2/9/2014 3:31:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 32	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	-7.000 8.000	29.03% 1000	1000 92.0%	-2.1E-16 1.8E-16	4.7E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-18 SMP	U-238 Trg. Analyte	2/9/2014 3:31:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	66500000 ml 66500000 ml	AlphaSpec2 32	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	4.000 3.000	29.03% 1000	1000 92.0%	1E-16 1.6E-16	2.7E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-19 SMP	U-232 Tracer	2/9/2014 3:28:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 43	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	1105.000 47.000	32.34% 1000	1000 72.3%	2.3E-14 3.7E-15	7E-16 NA	uCi/ml As Received	NA NA	NA NA
1402169-19 SMP	U-234 Trg. Analyte	2/9/2014 3:28:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 43	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	8.000 10.000	32.34% 1000	1000 72.3%	2.3E-16 3.1E-16	5E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-19 SMP	U-235 Trg. Analyte	2/9/2014 3:28:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 43	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	3.000 1.000	32.34% 1000	1000 72.3%	1E-16 1.7E-16	2.5E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-19 SMP	U-238 Trg. Analyte	2/9/2014 3:28:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 43	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	8.000 5.000	32.34% 1000	1000 72.3%	2.3E-16 2.5E-16	3.8E-16 NA	uCi/ml As Received	NA NA	NA U
1402169-20 SMP	U-232 Tracer	2/9/2014 3:24:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 45	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	993.000 33.000	31.65% 1000	1000 66.4%	2.11E-14 3.4E-15	6E-16 NA	uCi/ml As Received	NA NA	NA NA

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1402169-20 SMP	U-234 Trg. Analyte	2/9/2014 3:24:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 45	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	62.000 4.000	31.65% 1000	1000 66.4%	1.98E-15 6.2E-16	3.8E-16 NA	uCi/ml As Received	NA NA	
1402169-20 SMP	U-235 Trg. Analyte	2/9/2014 3:24:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 45	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	1.000 1.000	31.65% 1000	1000 66.4%	4E-17 1.8E-16	2.8E-16 NA	uCi/ml As Received	NA NA	U
1402169-20 SMP	U-238 Trg. Analyte	2/9/2014 3:24:00 PM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	67000000 ml 67000000 ml	AlphaSpec2 45	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	-1.000 5.000	31.65% 1000	1000 66.4%	-3E-17 1.9E-16	4.2E-16 NA	uCi/ml As Received	NA NA	U
AS140215-5M MB	U-232 Tracer	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 46	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	987.000 18.000	30.58% 1000	1000 68.3%	2.62E-14 4.2E-15	6E-16 NA	uCi/ml As Received	NA NA	
AS140215-5M MB	U-234 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 46	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	6.000 11.000	30.58% 1000	1000 68.3%	2.3E-16 4.1E-16	7E-16 NA	uCi/ml As Received	NA NA	U
AS140215-5M MB	U-235 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 46	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	1.000 1.000	30.58% 1000	1000 68.3%	5E-17 2.2E-16	3.4E-16 NA	uCi/ml As Received	NA NA	U
AS140215-5M MB	U-238 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 46	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	0.000 4.000	30.58% 1000	1000 68.3%	0E+00 2.2E-16	4.7E-16 NA	uCi/ml As Received	NA NA	U
AS140215-5P MB	U-232 Tracer	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 47	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	1014.010 26.010	30.42% 1000	1000 70.5%	2.7E-14 4.4E-15	7E-16 NA	uCi/ml As Received	NA NA	
AS140215-5P MB	U-234 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 47	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	8.000 9.010	30.42% 1000	1000 70.5%	3E-16 3.9E-16	6.3E-16 NA	uCi/ml As Received	NA NA	U
AS140215-5P MB	U-235 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 47	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	0.000 2.000	30.42% 1000	1000 70.5%	0E+00 2.2E-16	4.1E-16 NA	uCi/ml As Received	NA NA	U
AS140215-5P MB	U-238 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 47	AS140215-SUR Spectrum #1	2/20/2014 2:35 PM	1.000 5.000	30.42% 1000	1000 70.5%	4E-17 2.5E-16	5E-16 NA	uCi/ml As Received	NA NA	U

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

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# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
AS140215-5 LCS	U-232 Tracer	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 11a	AS140215-SUR Spectrum #1	2/21/2014 1:41 PM	1000.000 24.000	30.43% 1000	1000 69.5%	2.66E-14 4.3E-15	7E-16 NA	uCi/ml As Received	NA NA	
AS140215-5 LCS	U-234 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 11a	AS140215-SUR Spectrum #1	2/21/2014 1:41 PM	1040.000 12.000	30.43% 1000	1000 69.5%	3.99E-14 6.9E-15	7E-16 NA	uCi/ml As Received	NA NA	100 P
AS140215-5 LCS	U-238 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 11a	AS140215-SUR Spectrum #1	2/21/2014 1:41 PM	1092.000 4.000	30.43% 1000	1000 69.5%	4.18E-14 7.2E-15	5E-16 NA	uCi/ml As Received	NA NA	101 P
AS140215-5 LCSD	U-232 Tracer	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 12a	AS140215-SUR Spectrum #1	2/21/2014 1:41 PM	592.000 33.000	30.32% 1000	1000 41.3%	1.58E-14 2.7E-15	8E-16 NA	uCi/ml As Received	NA NA	
AS140215-5 LCSD	U-234 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 12a	AS140215-SUR Spectrum #1	2/21/2014 1:41 PM	618.000 3.000	30.32% 1000	1000 41.3%	4E-14 7.6E-15	7E-16 NA	uCi/ml As Received	0.01 NA	101 P
AS140215-5 LCSD	U-238 Trg. Analyte	2/15/2014 8:40:10 AM	AS140215-5 AS140215-5-1	NA NA	NA NA	FILTER NA	55600000 ml 55600000 ml	AlphaSpec2 12a	AS140215-SUR Spectrum #1	2/21/2014 1:41 PM	621.000 1.000	30.32% 1000	1000 41.3%	4.02E-14 7.6E-15	5E-16 NA	uCi/ml As Received	0.16 NA	97.4 P

**Comments:**

**Data Package ID: UR1402169-1**

**Qualifiers/Flags:**

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
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- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

- TR- Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

1402169-1



# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-1  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 81  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:35PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021881; Det: 81; Spectrum #1; 2/18/2014 10:34:49 AM

Calibration Date: 2/18/2014 10:14:53AM

Efficiency Calibration: C14021881

Efficiency: 30.83% +/- 0.20% TPU(2 sigma)

Energy Calibration: C14021881

Energy Cal: Gain = 9.9176 keV / Ch

Offset = 3,014.71 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

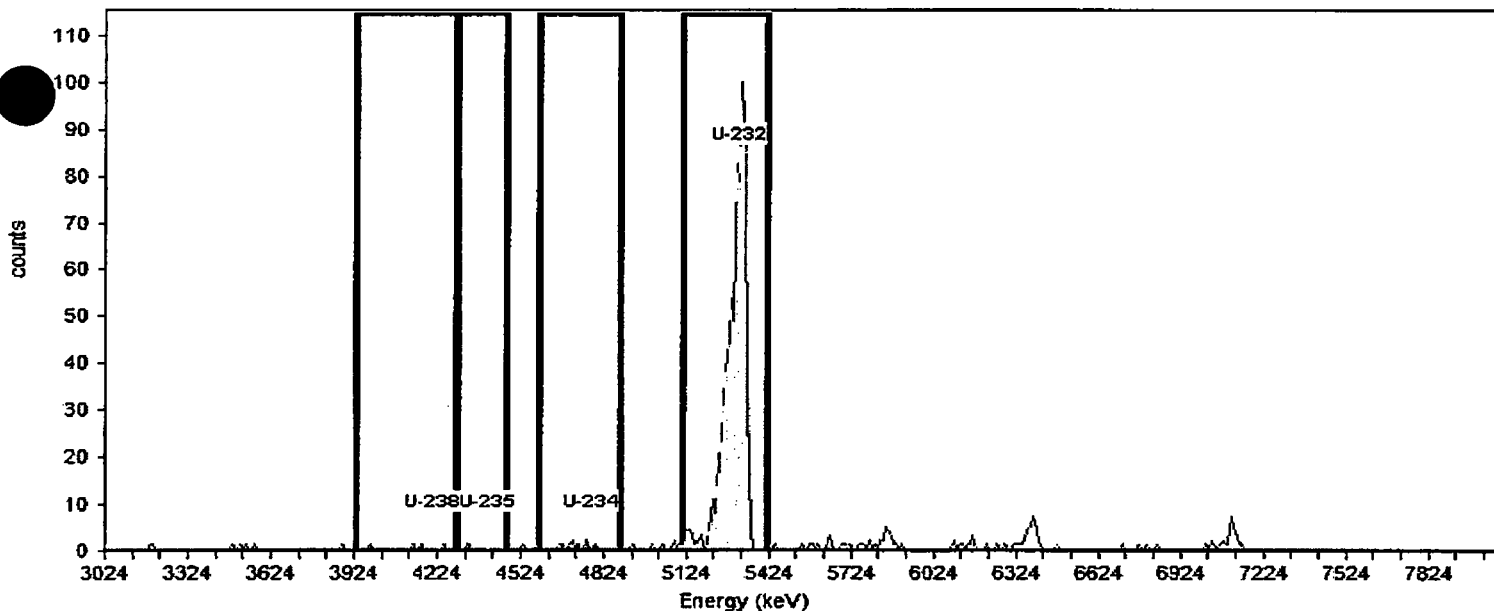
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 46.26%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4204.8	3927.1	4284.2	13.0	100.2	4.00	1.00	3.00	1.9E-002	1.4E-002	1.5E-002	4.6E-002
U-235	4403.2	4294.1	4472.6	24.3	80.9	1.00	1.00	0.00	0.0E+000	1.1E-002	1.8E-002	5.7E-002
U-234	4780.0	4591.6	4879.2	214.8	100.0	10.00	0.00	10.00	6.3E-002	2.1E-002	0.0E+000	1.7E-002
U-232	5315.6	5107.3	5414.8	57.4	100.1	678.00	2.00	676.00	2.0E+000	7.9E-002	2.2E-002	6.1E-002

Prepared By: JP

JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402169-3  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 83  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.03 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021883; Det: 83; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:30AM

Efficiency Calibration: C14021883

Efficiency: 31.20% +/- 0.16% TPU(2 sigma)

Energy Calibration: C14021883

Energy Cal: Gain = 9.8810 keV / Ch

Offset = 3,028.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

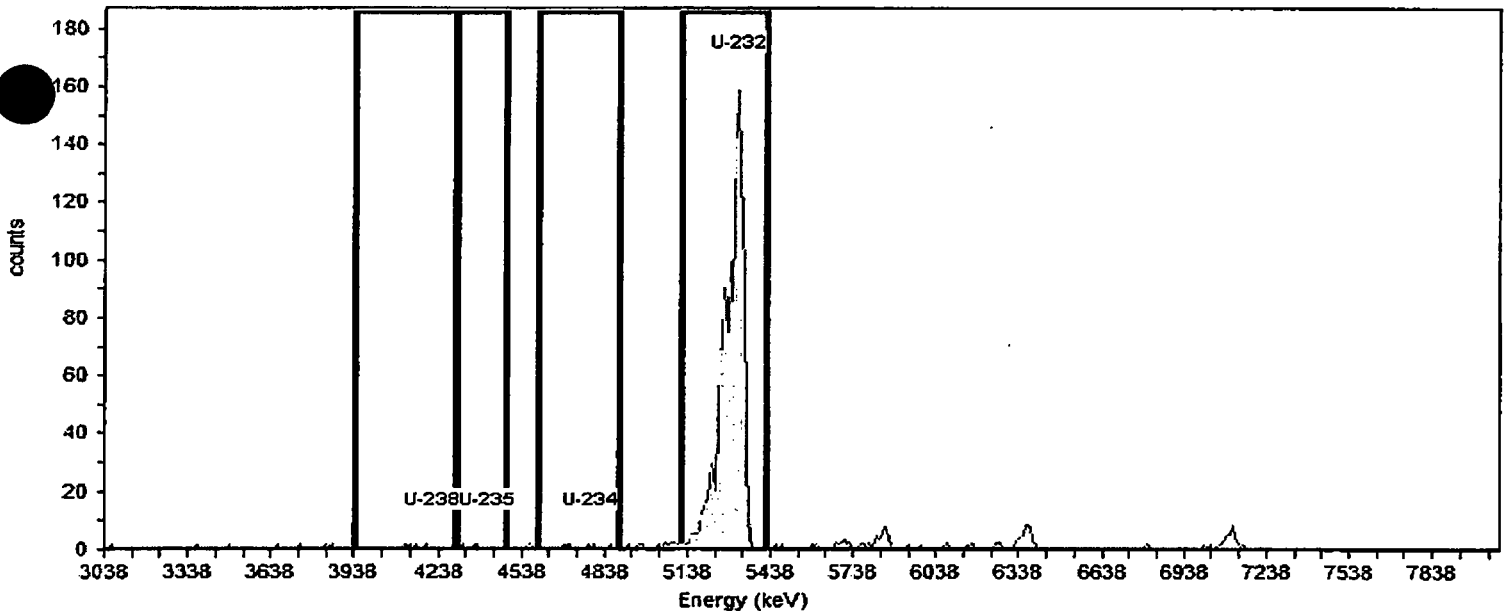
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 81.54%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	71.1	100.2	4.00	2.00	2.00	7.1E-003	8.7E-003	1.2E-002	3.3E-002
U-235	4411.5	4302.9	4480.7	27.2	80.9	2.00	0.00	2.00	8.8E-003	7.6E-003	0.0E+000	1.2E-002
U-234	4787.0	4599.3	4885.8	39.5	100.0	5.00	5.00	0.00	0.0E+000	1.1E-002	1.8E-002	4.6E-002
U-232	5320.6	5113.1	5419.4	82.3	100.1	1,207.00	1.00	1,206.00	3.6E+000	1.0E-001	8.5E-003	2.7E-002

Reviewed By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-4  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 84  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.00 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021884; Det: 84; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:15:49AM

Efficiency Calibration: C14021884

Efficiency: 30.40% +/- 0.21% TPU(2 sigma)

Energy Calibration: C14021884

Energy Cal: Gain = 9.9003 keV / Ch

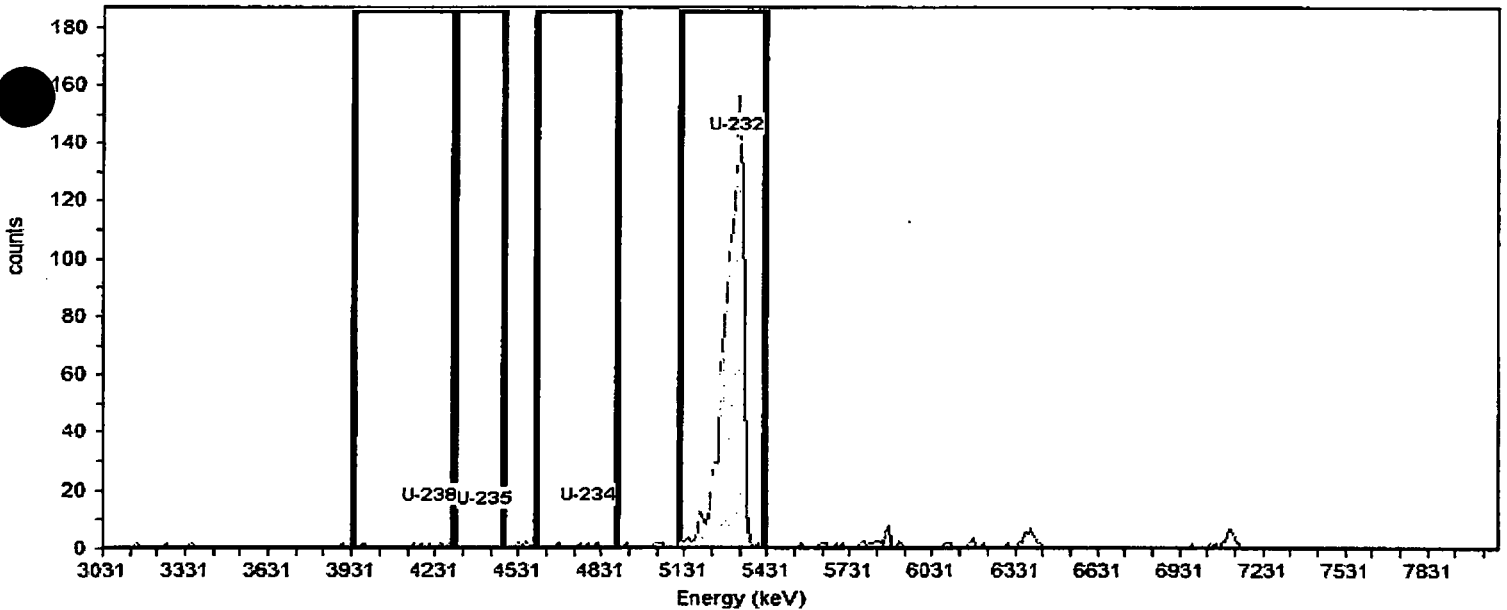
Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 82.29%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	43.7	100.2	6.00	0.00	6.00	2.2E-002	9.6E-003	0.0E+000	9.7E-003
U-235	4407.3	4298.4	4476.6	.0	80.9	0.00	2.00	-2.00	-8.9E-003	7.7E-003	1.5E-002	4.1E-002
U-234	4783.5	4595.4	4882.5	.4	100.0	5.00	0.00	5.00	1.8E-002	8.9E-003	0.0E+000	9.7E-003
U-232	5318.1	5110.2	5417.1	77.5	100.1	1,188.00	2.00	1,186.00	3.6E+000	1.1E-001	1.2E-002	3.5E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-5  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 85  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:36PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.02 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021885; Det: 85; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:16:07AM

Efficiency Calibration: C14021885

Efficiency: 30.11% +/- 0.13% TPU(2 sigma)

Energy Calibration: C14021885

Energy Cal: Gain = 9.8224 keV / Ch  
Offset = 3,029.39 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

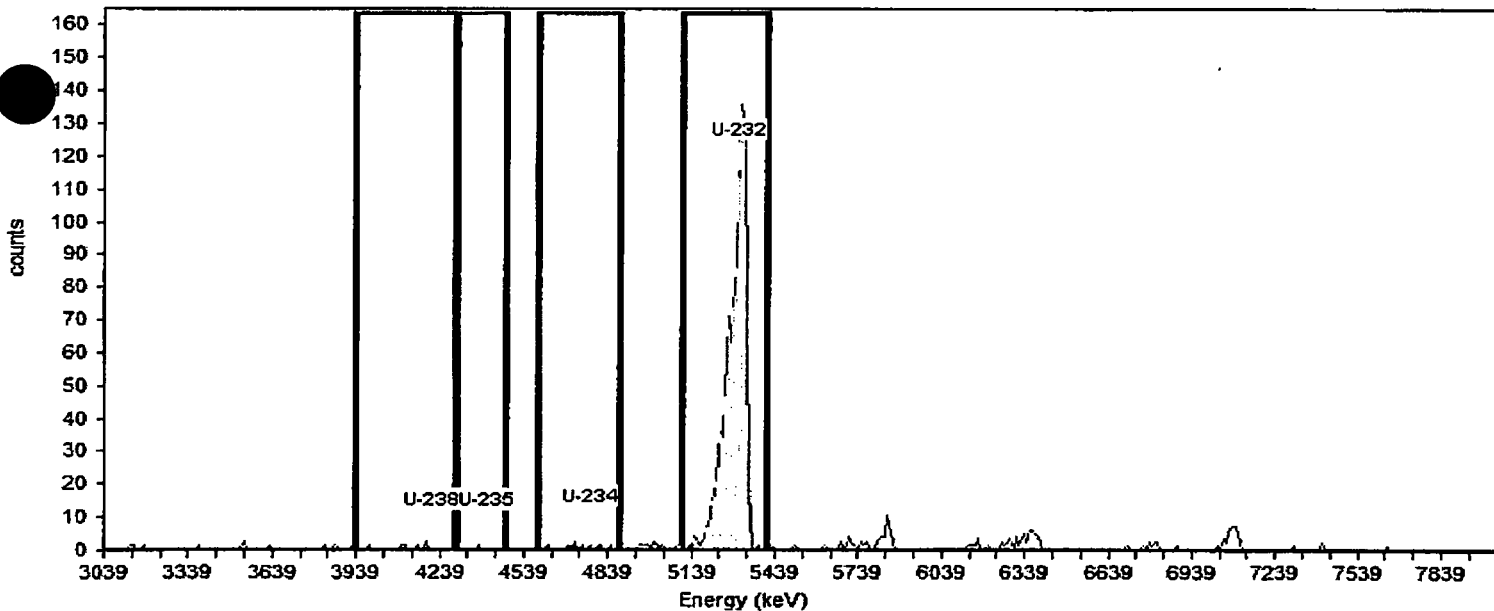
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 67.05%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.1	3933.1	4286.7	123.5	100.2	6.00	0.00	6.00	2.7E-002	1.2E-002	0.0E+000	1.2E-002
U-235	4404.5	4296.5	4473.3	24.1	80.9	1.00	0.00	1.00	5.5E-003	7.8E-003	0.0E+000	1.5E-002
U-234	4777.8	4591.2	4876.0	27.2	100.0	8.00	0.00	8.00	3.6E-002	1.4E-002	0.0E+000	1.2E-002
U-232	5308.2	5101.9	5406.4	62.5	100.1	958.00	1.00	957.00	3.0E+000	9.6E-002	1.1E-002	3.4E-002

Reviewed By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-6  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 86  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021886; Det: 86; Spectrum #1; 2/18/2014 10:34:50 AM

Calibration Date: 2/18/2014 10:16:26AM

Energy Calibration: C14021886

Efficiency Calibration: C14021886

Energy Cal: Gain = 9.8047 keV / Ch

Efficiency: 30.61% +/- 0.15% TPU(2 sigma)

Offset = 3,036.00 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

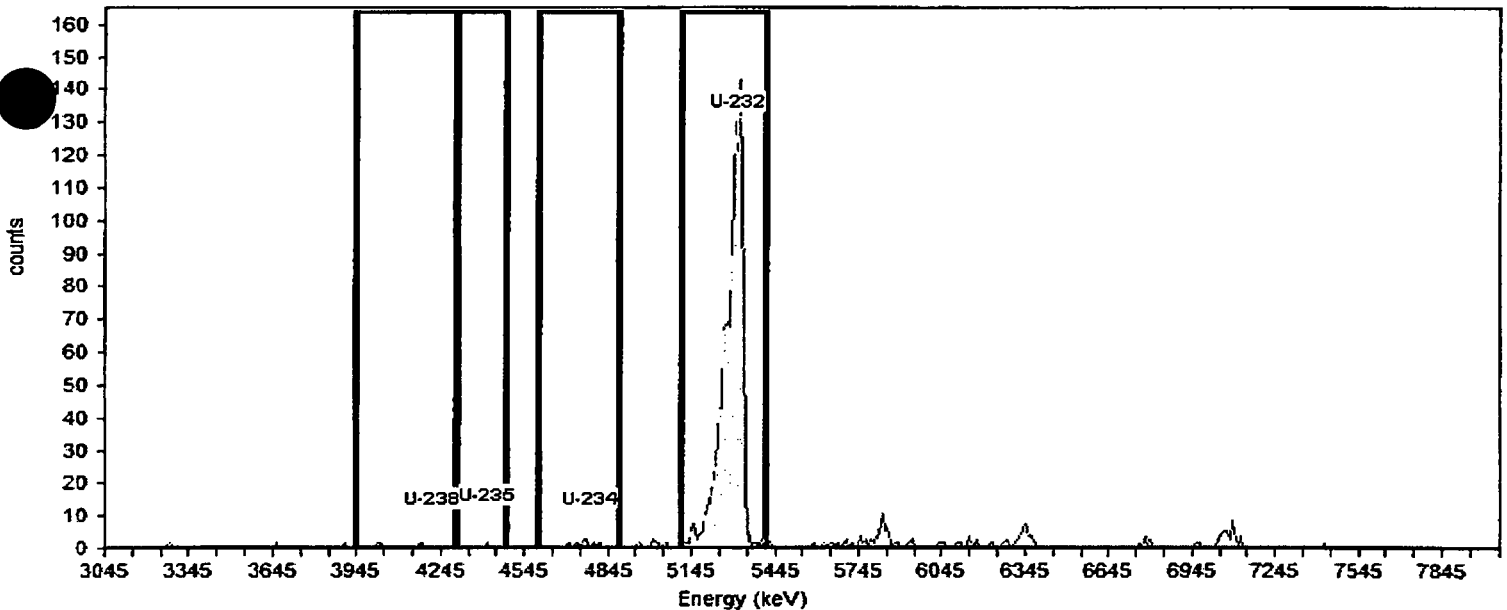
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Nuclide: U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Recovery: 67.88%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	58.7	100.2	3.00	0.00	3.00	1.3E-002	8.7E-003	0.0E+000	1.2E-002
U-235	4408.7	4300.8	4477.3	24.0	80.9	1.00	2.00	-1.00	-5.4E-003	9.3E-003	1.8E-002	5.0E-002
U-234	4781.2	4595.0	4879.3	24.5	100.0	8.00	1.00	7.00	3.0E-002	1.3E-002	1.0E-002	3.2E-002
U-232	5310.7	5104.8	5408.8	52.1	100.1	988.00	3.00	985.00	3.0E+000	9.6E-002	1.8E-002	4.8E-002

Reviewed By: JP

JA

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# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-7  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 87  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021887; Det: 87; Spectrum #1; 2/18/2014 10:34:51 AM

Calibration Date: 2/18/2014 10:16:46AM

Energy Calibration: C14021887

Efficiency Calibration: C14021887

Energy Cal: Gain = 9.7851 keV / Ch

Efficiency: 31.55% +/- 0.19% TPU(2 sigma)

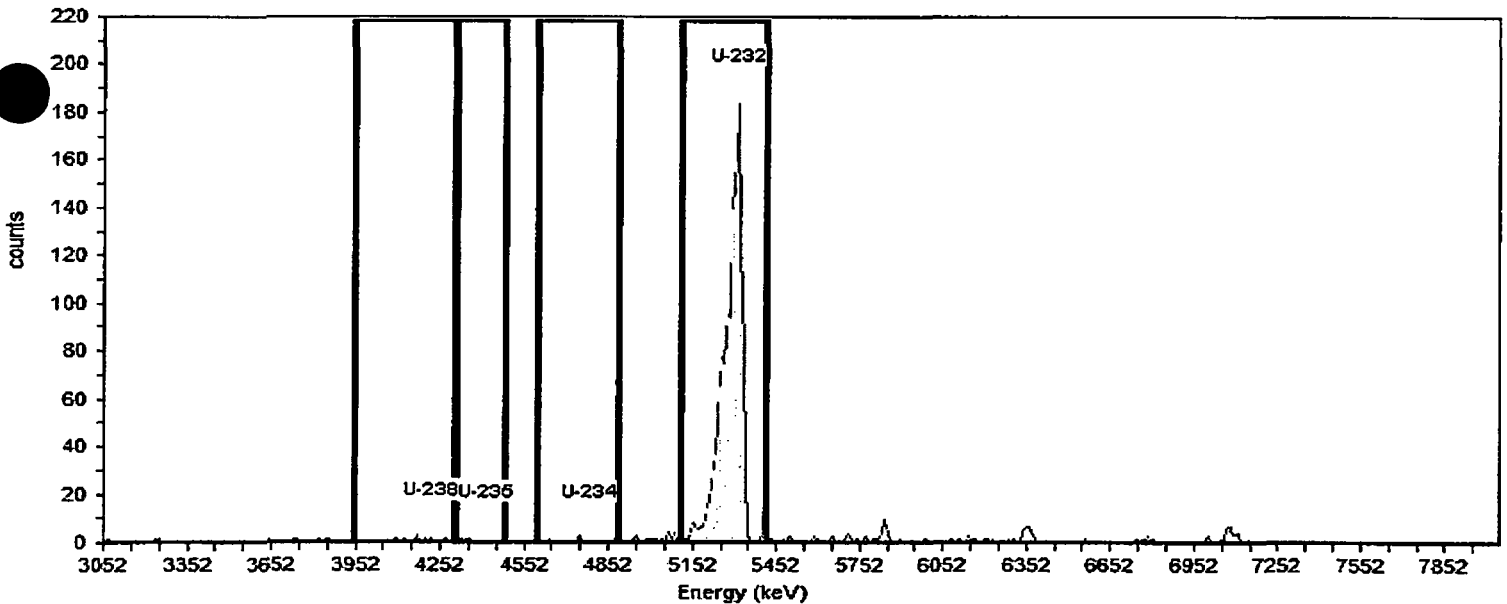
Offset = 3,042.97 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 85.04%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.2	3943.2	4295.5	13.4	100.2	7.00	1.00	6.00	2.0E-002	9.5E-003	7.8E-003	2.5E-002
U-235	4412.9	4305.2	4481.4	47.1	80.9	3.00	1.00	2.00	8.3E-003	8.3E-003	9.7E-003	3.1E-002
U-234	4784.7	4598.8	4882.6	141.5	100.0	5.00	0.00	5.00	1.7E-002	8.3E-003	0.0E+000	9.1E-003
U-232	5313.1	5107.6	5411.0	55.6	100.1	1,274.00	2.00	1,272.00	3.8E+000	1.1E-001	1.1E-002	3.2E-002

Reviewed By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402169-8  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 88  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021888; Det: 88; Spectrum #1; 2/18/2014 10:34:51 AM

Calibration Date: 2/18/2014 10:17:09AM

Efficiency Calibration: C14021888

Efficiency: 30.79% +/- 0.12% TPU(2 sigma)

Energy Calibration: C14021888

Energy Cal: Gain = 9.8224 keV / Ch

Offset = 3,029.39 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

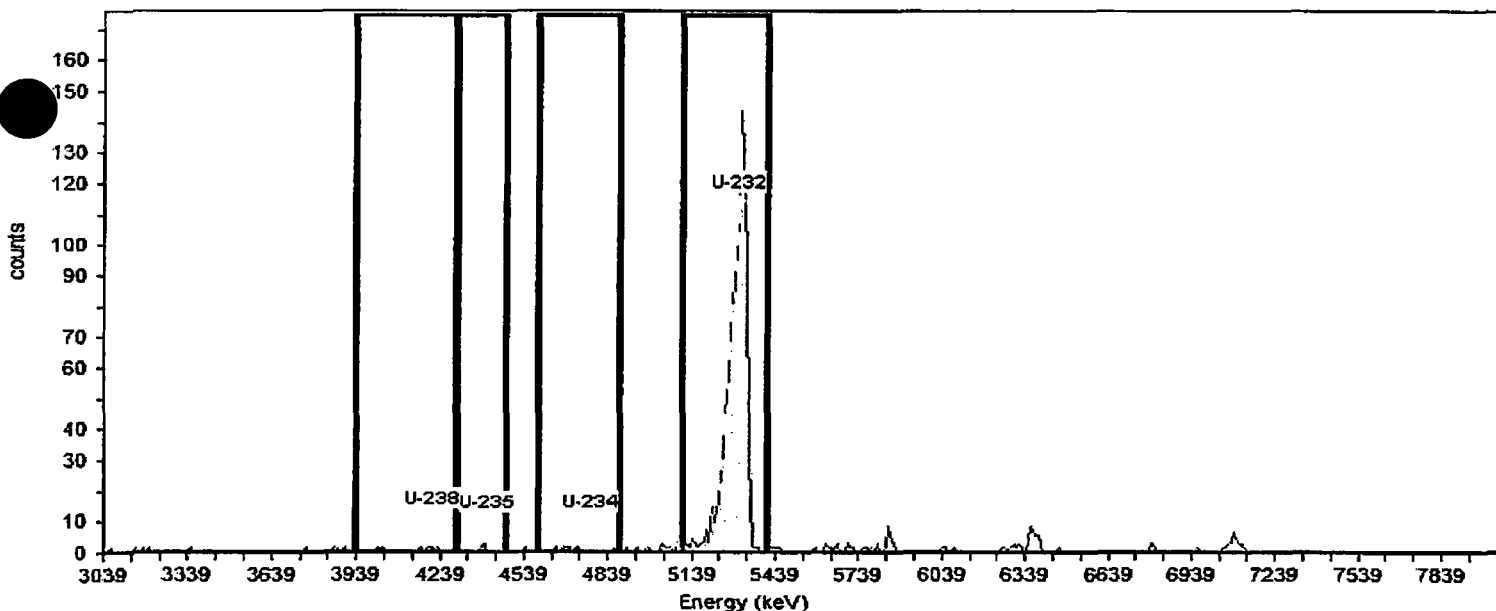
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 65.02%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4208.1	3933.1	4286.7	235.3	100.2	6.00	3.00	3.00	1.3E-002	1.3E-002	1.8E-002	4.8E-002
U-235	4404.5	4296.5	4473.3	23.4	80.9	3.00	1.00	2.00	1.1E-002	1.1E-002	1.3E-002	4.1E-002
U-234	4777.8	4591.2	4876.0	192.5	100.0	6.00	1.00	5.00	2.2E-002	1.2E-002	1.0E-002	3.3E-002
U-232	5308.2	5101.9	5408.4	64.8	100.1	953.00	4.00	949.00	2.9E+000	9.4E-002	2.2E-002	5.6E-002

Reviewed By: JP JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-9  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 89  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021889; Det: 89; Spectrum #1; 2/18/2014 10:35:40 AM

Calibration Date: 2/18/2014 10:21:39AM

Energy Calibration: C14021889

Efficiency Calibration: C14021889

Energy Cal: Gain = 9.9003 keV / Ch

Efficiency: 31.24% +/- 0.20% TPU(2 sigma)

Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

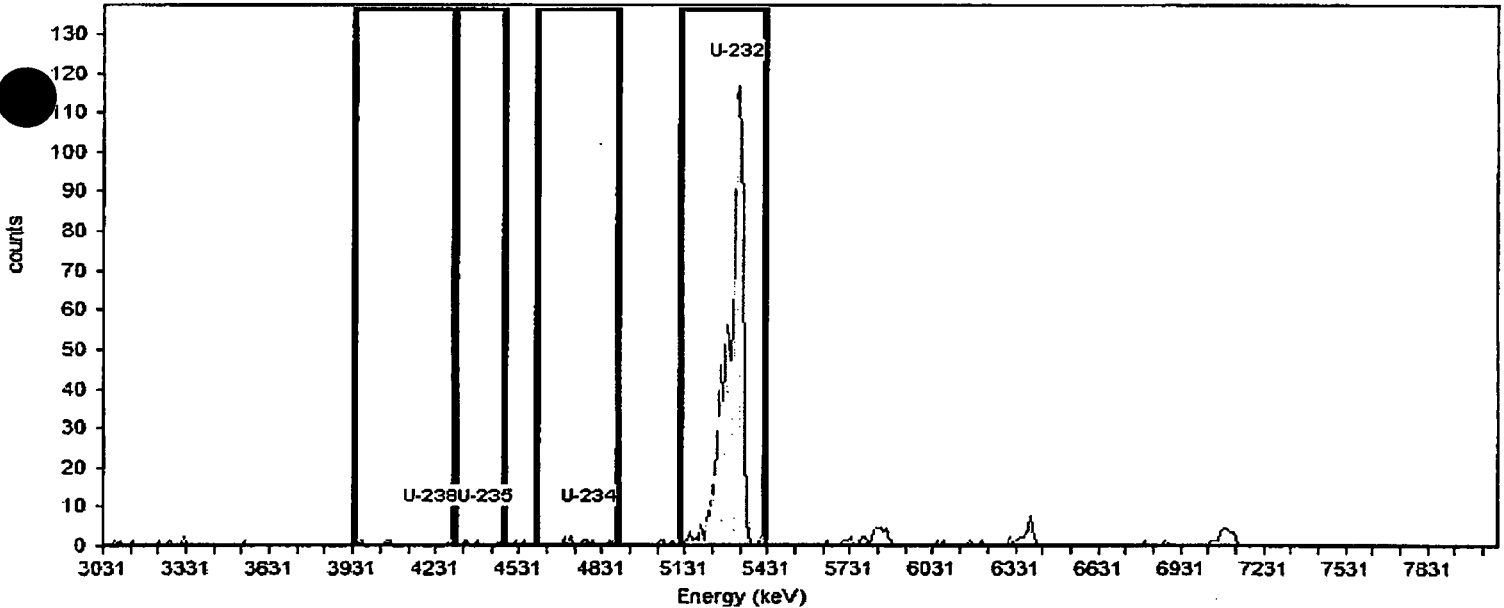
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Nuclide: U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Recovery: 50.57%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	334.3	100.2	5.00	0.00	5.00	2.8E-002	1.4E-002	0.0E+000	1.5E-002
U-235	4407.3	4298.4	4476.6	14.7	80.9	3.00	0.00	3.00	2.1E-002	1.4E-002	0.0E+000	1.9E-002
U-234	4783.5	4595.4	4882.5	193.8	100.0	9.00	3.00	6.00	3.4E-002	2.0E-002	2.3E-002	6.1E-002
U-232	5318.1	5110.2	5417.1	38.9	100.1	756.00	7.00	749.00	2.2E+000	8.3E-002	3.6E-002	8.9E-002

Reviewed By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

Print Date: 2/24/2014

AlphaVision v5.3

Custom Report Iteration: 05/21/09

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# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-10  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 90  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:37PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021890; Det: 90; Spectrum #1; 2/18/2014 10:35:40 AM

Calibration Date: 2/18/2014 10:21:56AM

Efficiency Calibration: C14021890

Efficiency: 30.90% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021890

Energy Cal: Gain = 9.9003 keV / Ch

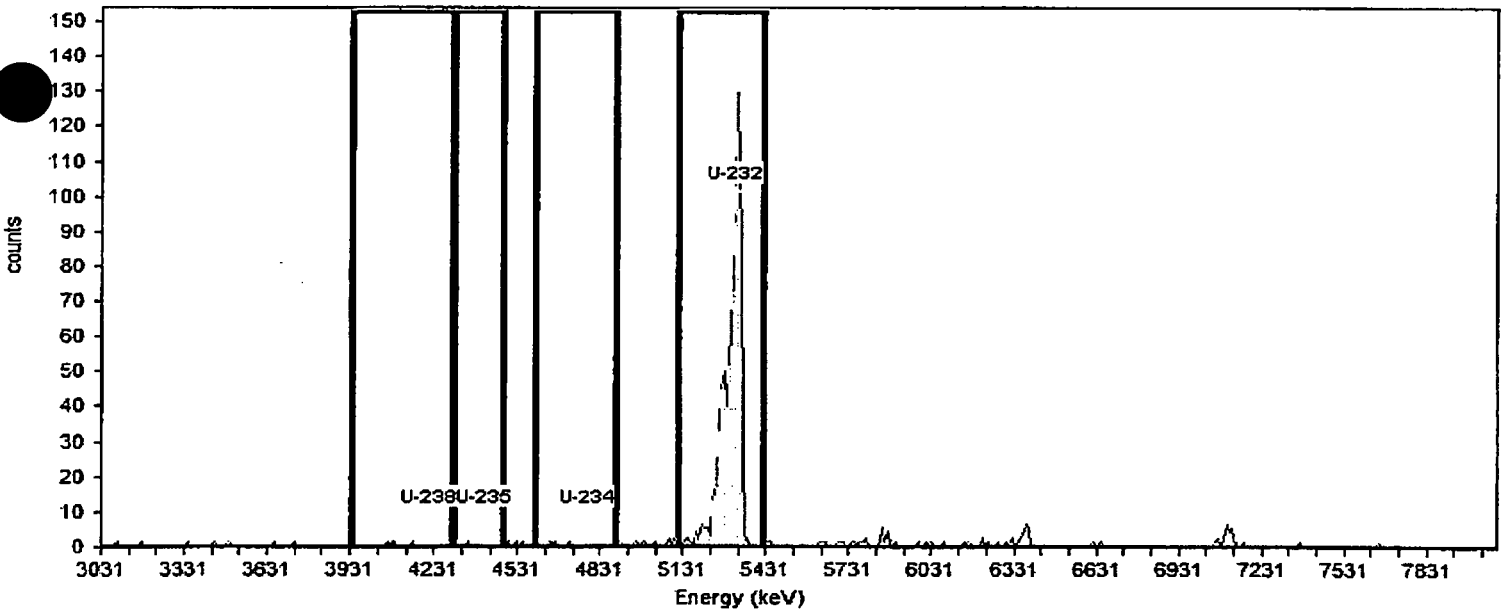
Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 47.04%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	53.8	100.2	3.00	2.00	1.00	6.2E-003	1.4E-002	2.0E-002	5.7E-002
U-235	4407.3	4298.4	4476.6	24.2	80.9	1.00	0.00	1.00	7.7E-003	1.1E-002	0.0E+000	2.1E-002
U-234	4783.5	4595.4	4882.5	39.6	100.0	3.00	0.00	3.00	1.9E-002	1.2E-002	0.0E+000	1.7E-002
U-232	5318.1	5110.2	5417.1	40.6	100.1	694.00	5.00	689.00	2.1E+000	8.0E-002	3.3E-002	8.4E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-11  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 91  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:38PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021891; Det: 91; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:22:19AM

Efficiency Calibration: C14021891

Efficiency: 30.35% +/- 0.16% TPU(2 sigma)

Energy Calibration: C14021891

Energy Cal: Gain = 9.8810 keV / Ch

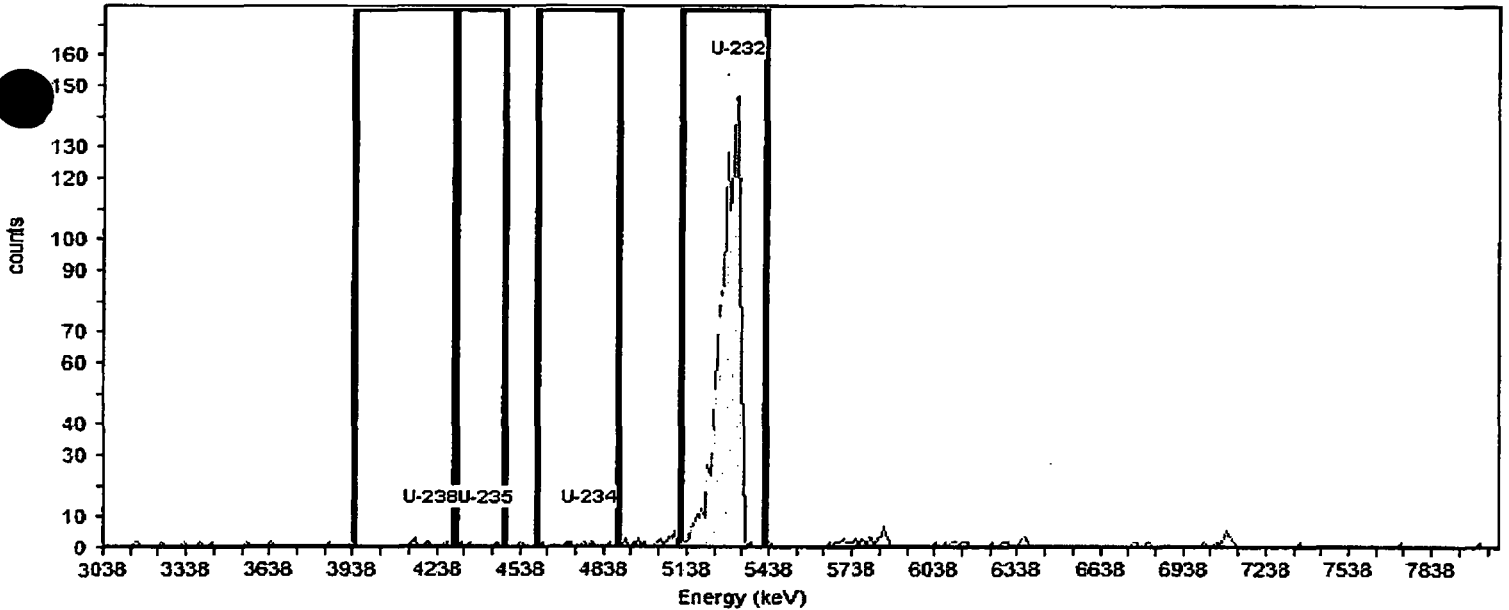
Offset = 3,028.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 83.90%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	21.5	100.2	7.00	1.00	6.00	2.1E-002	1.0E-002	8.2E-003	2.6E-002
U-235	4411.5	4302.9	4480.7	24.4	80.9	3.00	2.00	1.00	4.4E-003	9.8E-003	1.4E-002	4.1E-002
U-234	4787.0	4599.3	4885.8	114.4	100.0	6.00	0.00	6.00	2.1E-002	9.4E-003	0.0E+000	9.6E-003
U-232	5320.6	5113.1	5419.4	79.4	100.1	1,211.00	4.00	1,207.00	3.7E+000	1.1E-001	1.7E-002	4.4E-002

Reviewed By: *JM*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

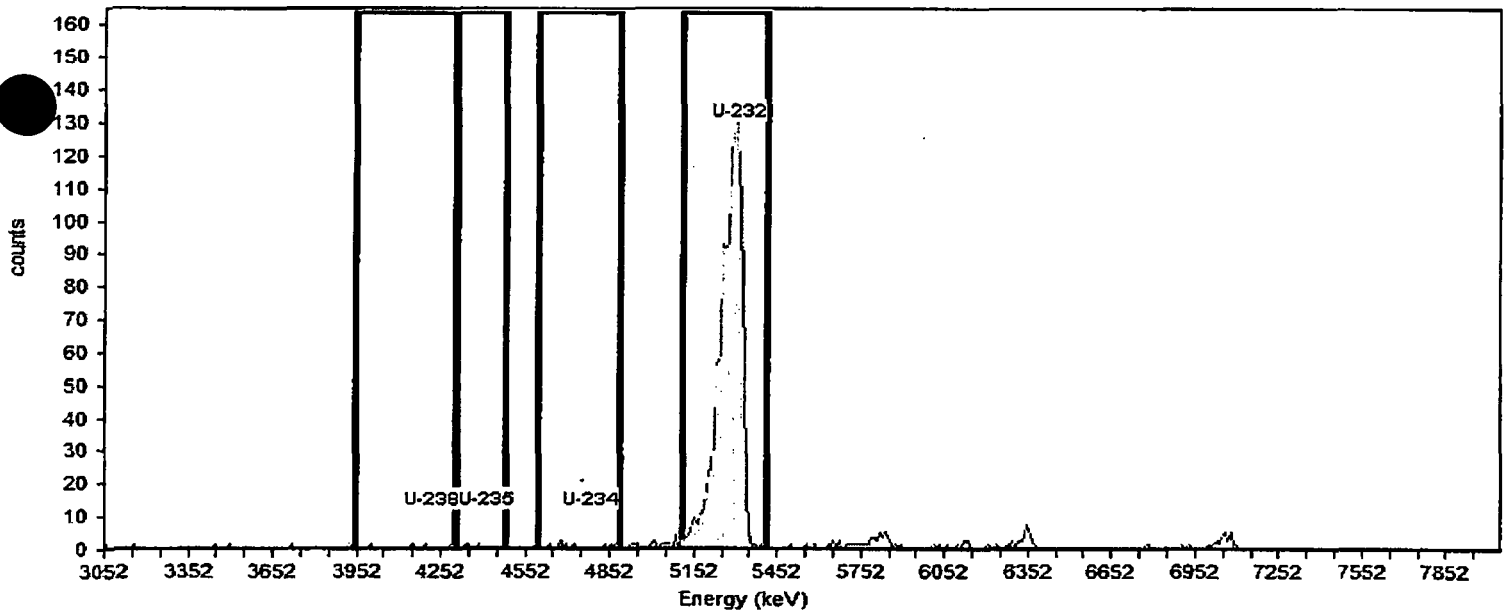
## Alpha-Spectroscopy Analysis Report

Sample: 1402169-12      Sample Size : 0.50  
 Spectrum #1      Analysis #1

**Acquisition**  
 Detector: 92      Acquisition Start Date: 2/20/2014 2:51:38PM  
 Batch Name: UAS140215-5\_A      Live Time: 1,000.00 min.  
 Nuclide Library: Uranium      Real Time: 1,000.00 min.  
 Analysis Method: ROI Analysis, Set Name = Uranium Default      Dead Time: 0.00 %  
 ROI Set: Uranium Default

**Calibration**  
 Bkgd Info: Sample: B14021892; Det: 92; Spectrum #1; 2/18/2014 10:35:41 AM  
 Calibration Date: 2/18/2014 10:22:35AM      Energy Calibration: C14021892  
 Efficiency Calibration: C14021892      Energy Cal: Gain = 9.7851 keV / Ch  
 Efficiency: 31.14% +/- 0.21% TPU(2 sigma)      Offset = 3,042.97 keV  
    Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232      Tracer Nuclide: U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM      Tracer Recovery: 83.53%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.2	3943.2	4295.5	.0	100.2	5.00	3.00	2.00	6.9E-003	9.8E-003	1.4E-002	3.7E-002
U-235	4412.9	4305.2	4481.4	23.3	80.9	2.00	0.00	2.00	8.6E-003	7.4E-003	0.0E+000	1.2E-002
U-234	4784.7	4598.8	4882.6	168.1	100.0	9.00	0.00	9.00	3.1E-002	1.1E-002	0.0E+000	9.4E-003
U-232	5313.1	5107.6	5411.0	86.3	100.1	1,234.00	1.00	1,233.00	3.7E+000	1.1E-001	8.3E-003	2.6E-002

*JP*

*JA*

Reviewed By:

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-13  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 93  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:38PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021893; Det: 93; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:22:53AM

Efficiency Calibration: C14021893

Efficiency: 32.05% +/- 0.13% TPU(2 sigma)

Energy Calibration: C14021893

Energy Cal: Gain = 9.9003 keV / Ch

Offset = 3,021.28 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

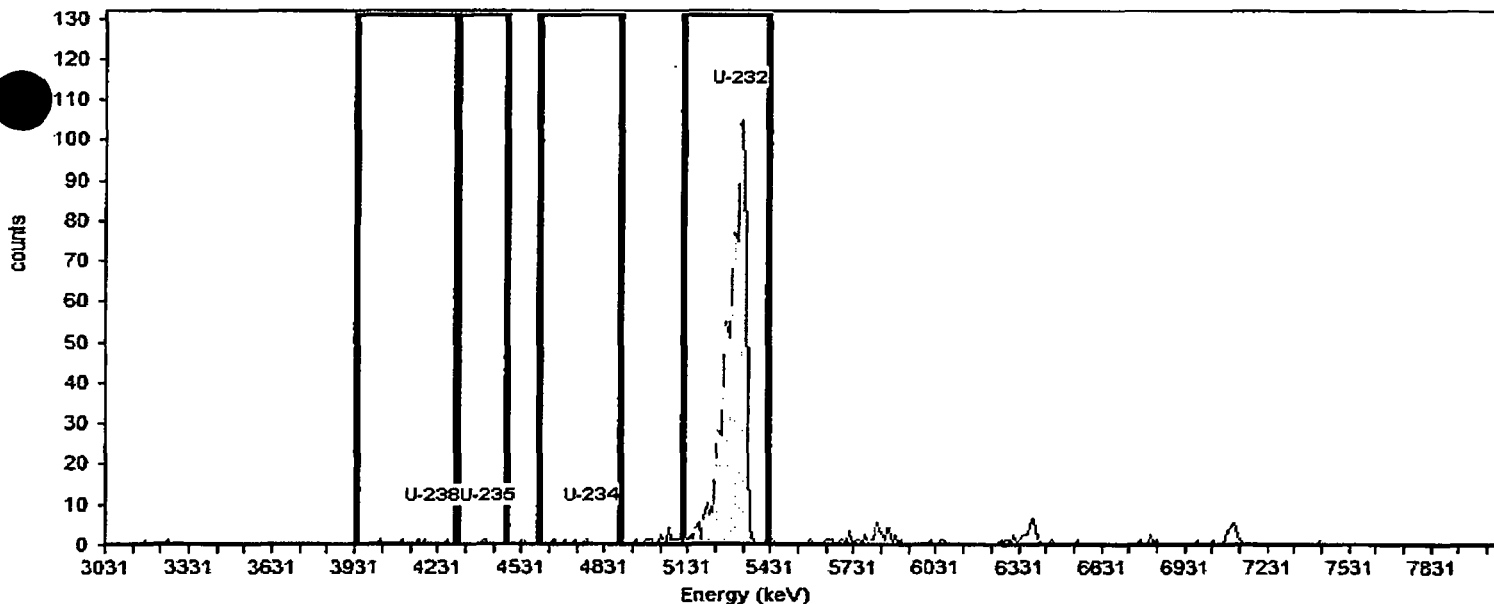
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 51.67%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	13.5	100.2	5.00	4.00	1.00	5.4E-003	1.6E-002	2.5E-002	6.5E-002
U-235	4407.3	4298.4	4476.6	24.2	80.9	1.00	1.00	0.00	0.0E+000	9.5E-003	1.6E-002	4.9E-002
U-234	4783.5	4595.4	4882.5	23.6	100.0	4.00	1.00	3.00	1.6E-002	1.2E-002	1.3E-002	4.0E-002
U-232	5318.1	5110.2	5417.1	66.0	100.1	792.00	7.00	785.00	2.3E+000	8.2E-002	3.5E-002	8.5E-002

JP

JA

Prepared By:

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 1402169-14  
Spectrum #1 Analysis #1

Sample Size : 0.50

### Acquisition

Detector: 94  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:38PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.14 min.  
Dead Time: 0.01 %

### Calibration

Bkgd Info: Sample: B14021894; Det: 94; Spectrum #1; 2/18/2014 10:35:41 AM

Calibration Date: 2/18/2014 10:23:21AM

Efficiency Calibration: C14021894

Efficiency: 32.10% +/- 0.16% TPU(2 sigma)

Energy Calibration: C14021894

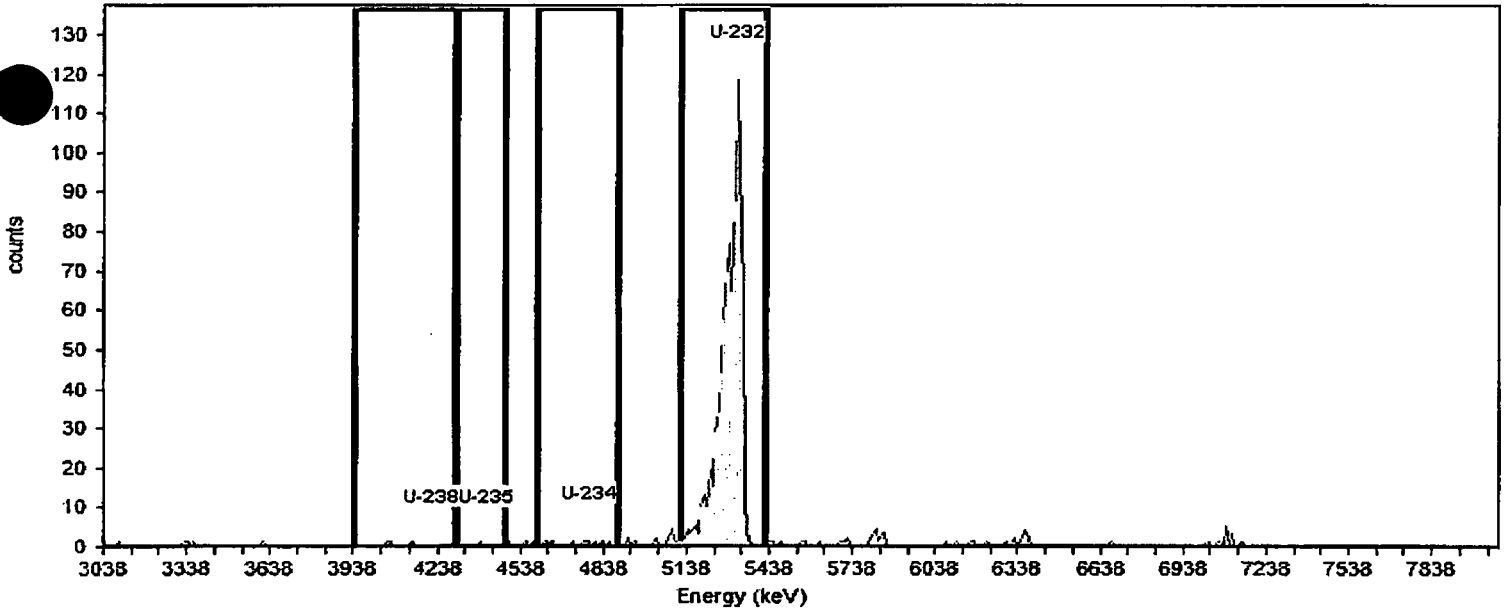
Energy Cal: Gain = 9.8810 keV / Ch  
Offset = 3,028.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

### Tracer

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 55.86%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4213.9	3937.3	4293.0	57.0	100.2	3.00	3.00	0.00	0.0E+000	1.2E-002	2.0E-002	5.4E-002
U-235	4411.5	4302.9	4480.7	24.2	80.9	1.00	3.00	-2.00	-1.2E-002	1.2E-002	2.5E-002	6.7E-002
U-234	4787.0	4599.3	4885.8	242.5	100.0	11.00	5.00	6.00	3.0E-002	2.0E-002	2.6E-002	6.6E-002
U-232	5320.6	5113.1	5419.4	70.9	100.1	852.00	2.00	850.00	2.5E+000	8.5E-002	1.7E-002	4.8E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402169-15  
Spectrum #1 Analysis #1

Sample Size : 0.50

**Acquisition**

Detector: 95  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium  
Analysis Method: ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

Acquisition Start Date: 2/20/2014 2:51:38PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.03 min.  
Dead Time: 0.00 %

**Calibration**

Bkgd Info: Sample: B14021895; Det: 95; Spectrum #1; 2/18/2014 10:35:41 AM

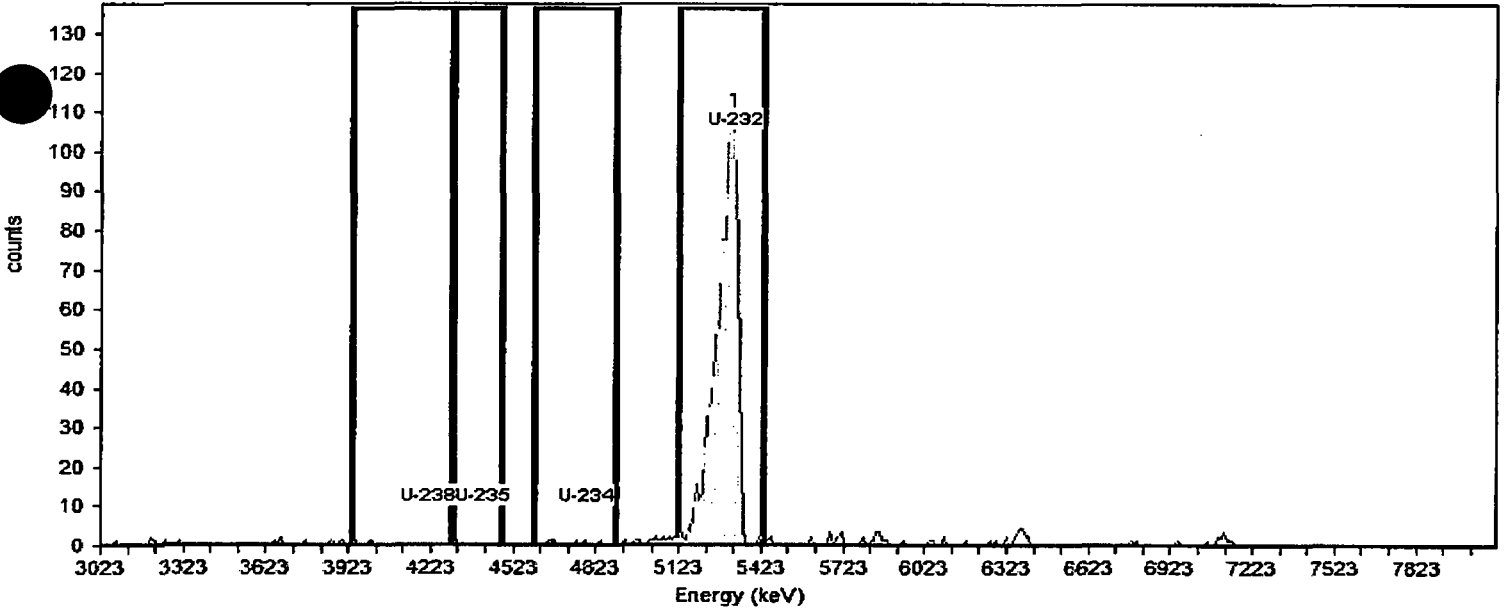
Calibration Date: 2/18/2014 10:23:39AM  
Efficiency Calibration: C14021895  
Efficiency: 32.13% +/- 0.19% TPU(2 sigma)

Energy Calibration: C14021895  
Energy Cal: Gain = 9.9784 keV / Ch  
Offset = 3,013.21 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**

Tracer Name: 914.4095.46\_U-232  
Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232  
Tracer Recovery: 64.67%



**Nuclide Summary (ROI)**

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	1.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4210.6	3931.2	4290.5	22.7	100.2	2.00	1.00	1.00	4.3E-003	7.5E-003	1.0E-002	3.2E-002
U-235	4410.2	4300.4	4480.0	17.0	80.9	1.00	1.00	0.00	0.0E+000	7.6E-003	1.2E-002	3.9E-002
U-234	4789.4	4599.8	4889.2	25.8	100.0	6.00	3.00	3.00	1.3E-002	1.3E-002	1.7E-002	4.7E-002
U-232	5328.2	5118.7	5428.0	75.8	100.1	988.00	3.00	985.00	2.9E+000	9.2E-002	1.8E-002	4.8E-002

Reviewed By:  JA

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402169-16  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 30  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

### Acquisition

Acquisition Start Date: 2/20/2014 2:35:01PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.01 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021030; Det: 30; Spectrum #1; Feb-10-2014 13:27

Calibration Date: 2/10/2014 12:04:44PM

Efficiency Calibration: C14021030

Efficiency: 28.09% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021030

Energy Cal: Gain = 9.8047 keV / Ch

Offset = 3,036.00 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

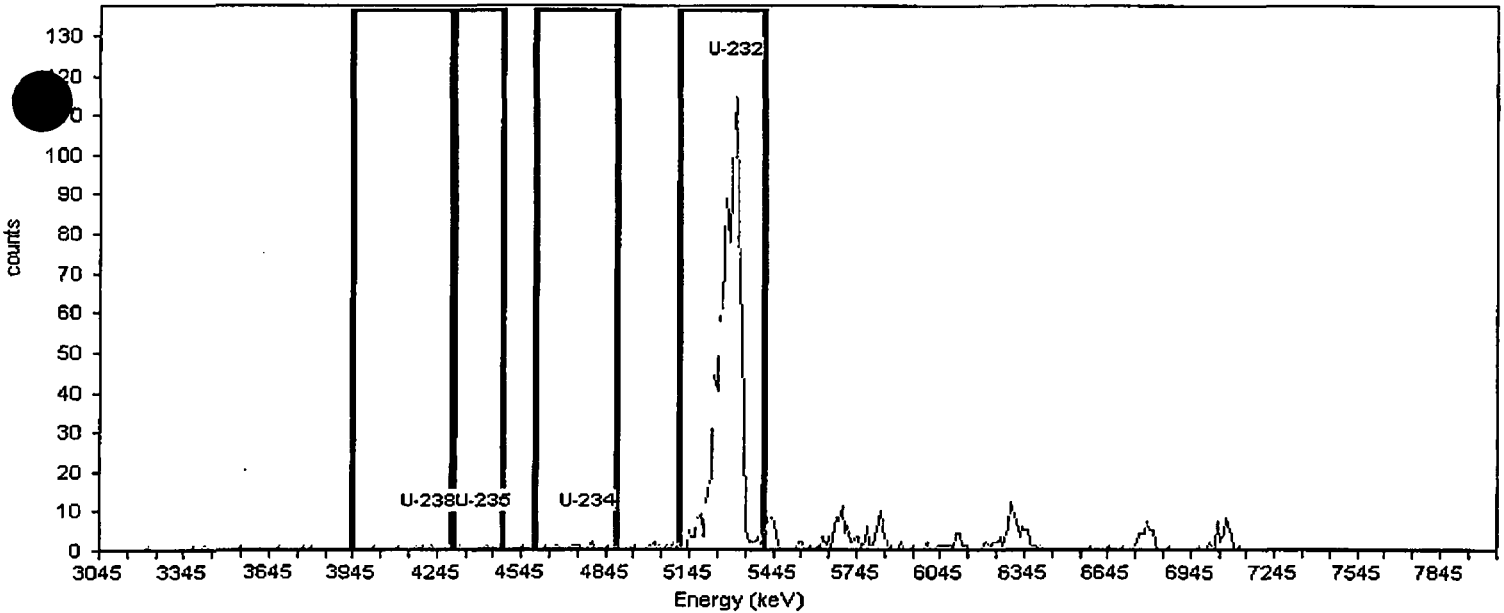
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 69.33%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	13.9	100.2	6.00	1.00	5.00	2.3E-002	2.5E-002	1.1E-002	3.4E-002
U-235	4408.7	4300.8	4477.3	26.8	99.7	3.00	2.00	1.00	4.6E-003	2.1E-002	1.5E-002	4.3E-002
U-234	4781.3	4595.0	4879.3	145.0	100.0	12.00	8.00	4.00	1.8E-002	4.1E-002	3.0E-002	7.3E-002
U-232	5310.7	5104.8	5408.8	75.8	100.1	946.00	23.00	923.00	3.1E+000	2.1E-001	5.3E-002	1.2E-001

Revised By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



# ALS Laboratory Group - Fort Collins

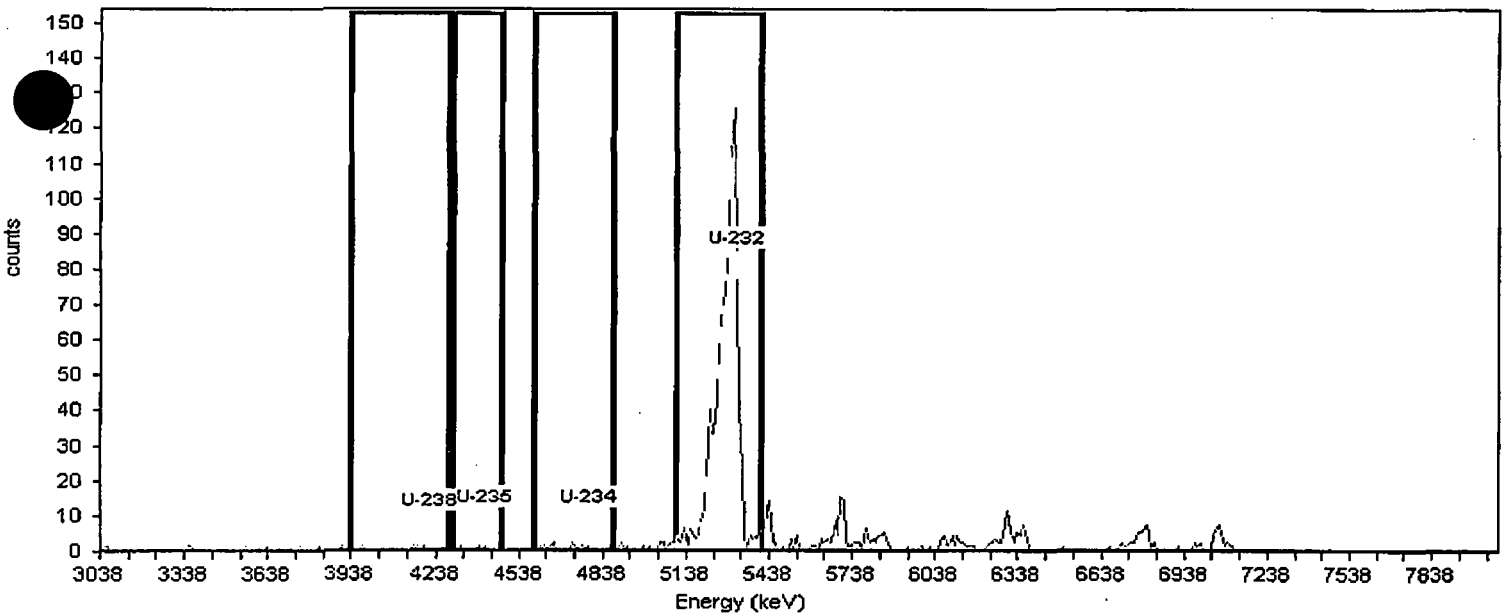
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402169-17  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 31  
 Batch Name: UAS140215-5\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:35:01PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021031; Det: 31; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:05:06PM  
 Efficiency Calibration: C14021031  
 Efficiency: 29.21% +/- 0.18% TPU(2 sigma)  
 Energy Calibration: C14021031  
 Energy Cal: Gain = 9.8810 keV / Ch  
 Offset = 3,028.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 65.15%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4204.0	3927.4	4283.1	13.6	100.2	5.00	2.00	3.00	1.4E-002	2.5E-002	1.6E-002	4.4E-002
U-235	4401.7	4293.0	4470.8	111.8	99.7	3.00	3.00	0.00	0.0E+000	2.3E-002	1.9E-002	5.1E-002
U-234	4777.1	4589.4	4876.0	126.3	100.0	12.00	10.00	2.00	9.5E-003	4.4E-002	3.5E-002	8.2E-002
U-232	5310.7	5103.2	5409.5	68.4	100.1	937.00	35.00	902.00	2.9E+000	2.0E-001	6.7E-002	1.5E-001

Received By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

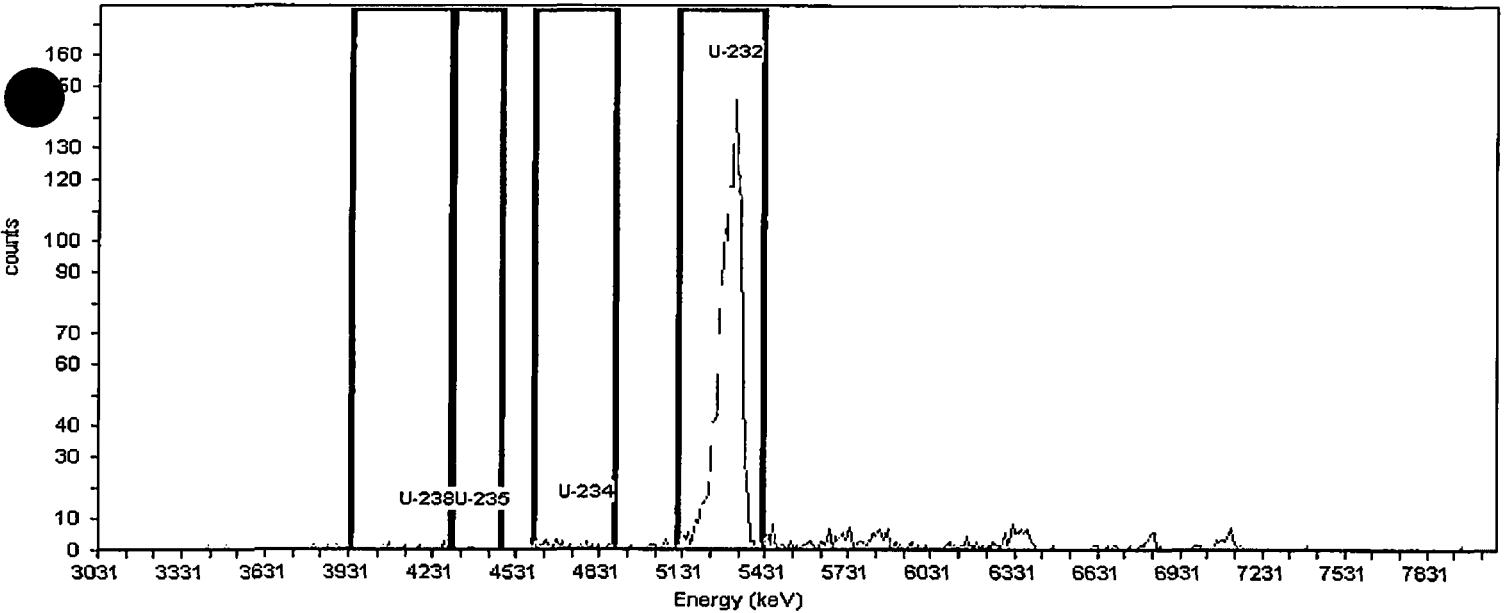
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402169-18  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 32  
 Batch Name: UAS140215-5\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:35:02PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.01 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021032; Det: 32; Spectrum #1; Feb-10-2014 13:27  
 Calibration Date: 2/10/2014 12:05:30PM  
 Efficiency Calibration: C14021032  
 Efficiency: 29.03% +/- 0.12% TPU(2 sigma)  
 Energy Calibration: C14021032  
 Energy Cal: Gain = 9.9003 keV / Ch  
 Offset = 3,021.28 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 91.79%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4209.3	3932.1	4288.5	14.1	100.2	7.00	3.00	4.00	1.3E-002	2.1E-002	1.4E-002	3.6E-002
U-235	4407.3	4298.4	4476.6	24.2	99.7	1.00	8.00	-7.00	0.0E+000	2.1E-002	2.2E-002	5.4E-002
U-234	4783.5	4595.4	4882.5	323.4	100.0	23.00	14.00	9.00	3.0E-002	4.1E-002	2.9E-002	6.8E-002
U-232	5318.1	5110.2	5417.1	86.6	100.1	1,278.00	15.00	1,263.00	4.1E+000	2.3E-001	3.2E-002	7.3E-002

Reported By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

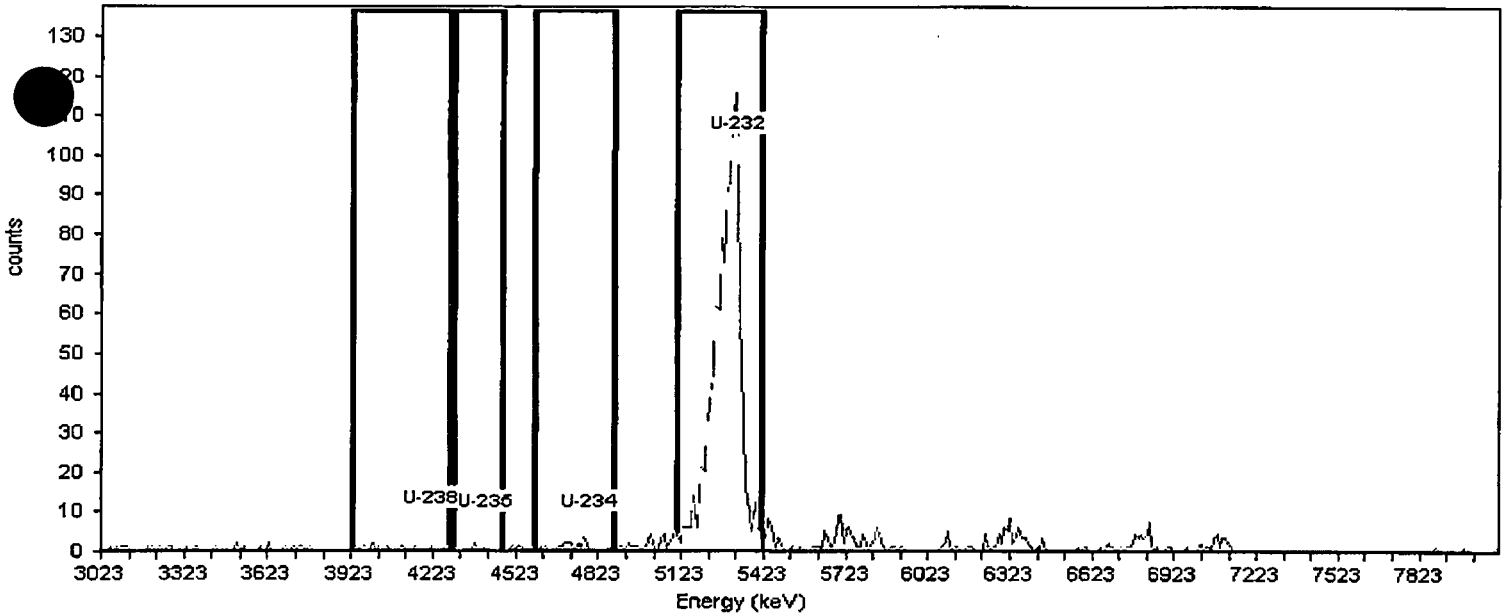
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: 1402169-19  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 43  
 Batch Name: UAS140215-5\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:35:02PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021043; Det: 43; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:46:17PM  
 Efficiency Calibration: C14021043  
 Efficiency: 32.34% +/- 0.21% TPU(2 sigma)  
 Energy Calibration: C14021043  
 Energy Cal: Gain = 9.9784 keV / Ch  
 Offset = 3,013.21 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 72.07%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4200.6	3921.3	4280.5	21.9	100.2	13.00	5.00	8.00	3.1E-002	3.3E-002	2.0E-002	5.1E-002
U-235	4400.2	4290.5	4470.1	73.5	99.7	4.00	1.00	3.00	1.2E-002	1.7E-002	9.0E-003	2.9E-002
U-234	4779.4	4589.8	4879.2	35.9	100.0	18.00	10.00	8.00	3.1E-002	4.1E-002	2.8E-002	6.7E-002
U-232	5318.2	5108.7	5418.0	91.4	100.1	1,152.00	47.00	1,105.00	3.2E+000	2.0E-001	6.4E-002	1.4E-001

Revised By: *JP* *JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: 1402169-20  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 45  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

### Acquisition

Acquisition Start Date: 2/20/2014 2:35:03PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.02 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021045; Det: 45; Spectrum #1; Feb-10-2014 13:28

Calibration Date: 2/10/2014 12:46:47PM

Efficiency Calibration: C14021045

Efficiency: 31.65% +/- 0.15% TPU(2 sigma)

Energy Calibration: C14021045

Energy Cal: Gain = 9.8047 keV / Ch

Offset = 3,036.00 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

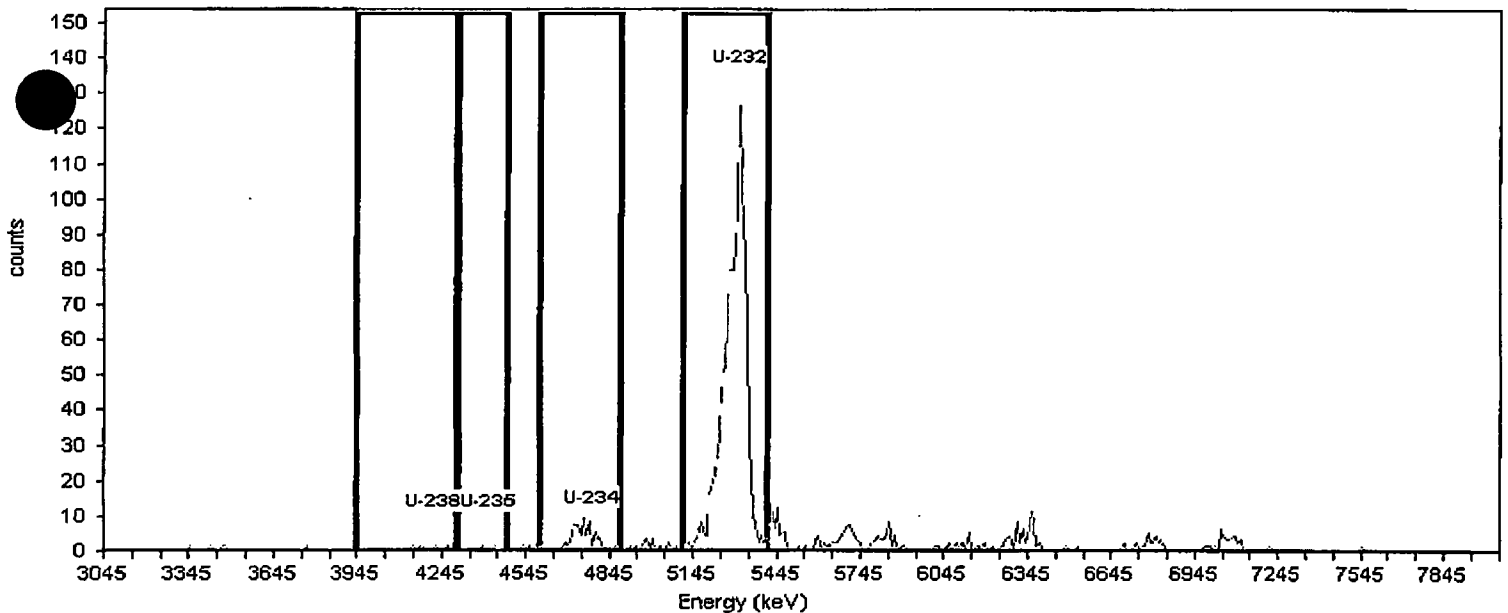
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 66.19%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4212.6	3938.0	4291.0	14.1	100.2	4.00	5.00	-1.00	0.0E+000	2.6E-002	2.2E-002	5.6E-002
U-235	4408.7	4300.8	4477.3	63.2	99.7	2.00	1.00	1.00	4.3E-003	1.5E-002	1.0E-002	3.2E-002
U-234	4781.3	4595.0	4879.3	78.4	100.0	66.00	4.00	62.00	2.7E-001	7.9E-002	2.0E-002	5.2E-002
U-232	5310.7	5104.8	5408.8	80.7	100.1	1,026.00	33.00	993.00	2.9E+000	1.9E-001	6.0E-002	1.3E-001

Recorded By: *JR*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

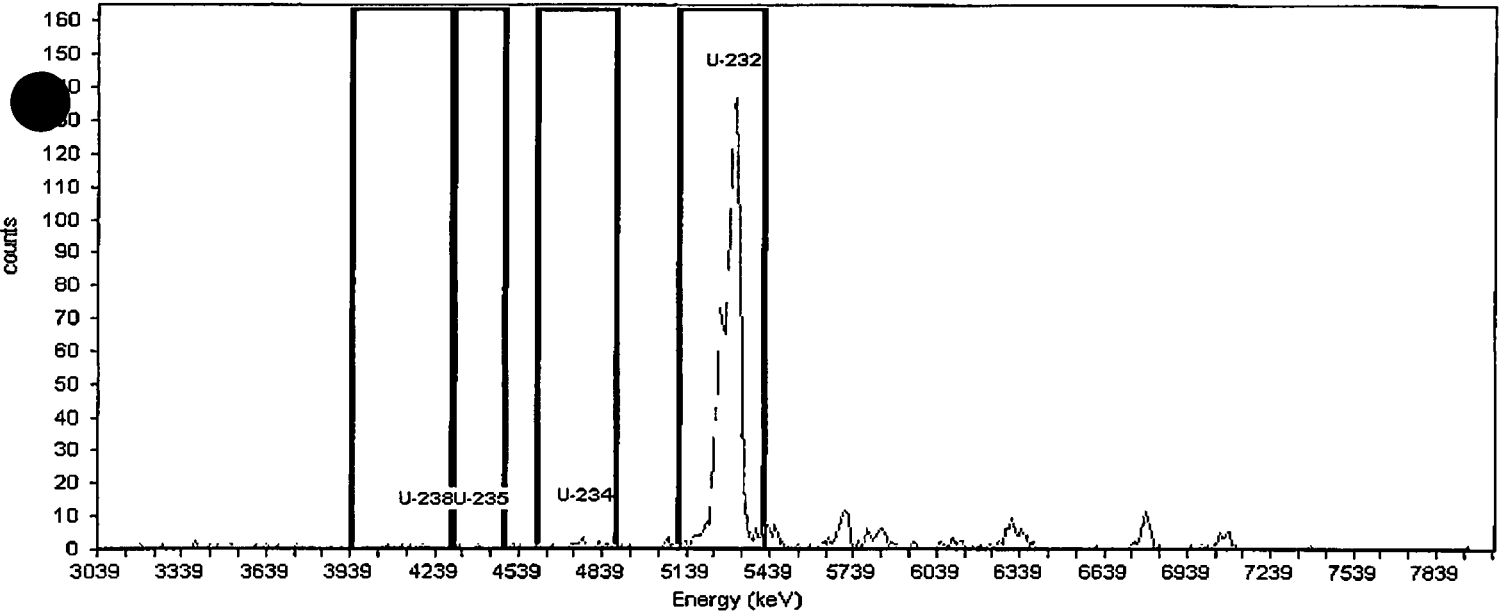
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-5MMB  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 46  
 Batch Name: UAS140215-5\_A  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/20/2014 2:35:03PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.02 min.  
 Dead Time: 0.00 %

**Calibration**  
 Bkgd Info: Sample: B14021046; Det: 46; Spectrum #1; Feb-10-2014 13:28  
 Calibration Date: 2/10/2014 12:47:15PM  
 Efficiency Calibration: C14021046  
 Efficiency: 30.58% +/- 0.16% TPU(2 sigma)  
 Energy Calibration: C14021046  
 Energy Cal: Gain = 9.8224 keV / Ch  
 Offset = 3,029.39 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 68.09%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4217.9	3942.9	4296.5	109.6	100.2	4.00	4.00	0.00	0.0E+000	2.4E-002	2.0E-002	5.2E-002
U-235	4414.4	4306.3	4483.1	23.8	99.7	2.00	1.00	1.00	4.3E-003	1.5E-002	1.0E-002	3.2E-002
U-234	4787.6	4601.0	4885.8	46.1	100.0	17.00	11.00	6.00	2.6E-002	4.6E-002	3.3E-002	7.8E-002
U-232	5318.0	5111.8	5416.2	67.7	100.1	1,005.00	18.00	987.00	3.0E+000	2.0E-001	4.4E-002	1.0E-001

Reviewed By: *JIP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: AS140215-5PMB  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 47  
Batch Name: UAS140215-5\_A  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

### Acquisition

Acquisition Start Date: 2/20/2014 2:35:04PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.02 min.  
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B14021047; Det: 47; Spectrum #1; Feb-10-2014 13:28

Calibration Date: 2/10/2014 12:47:41PM

Efficiency Calibration: C14021047

Efficiency: 30.42% +/- 0.21% TPU(2 sigma)

Energy Calibration: C14021047

Energy Cal: Gain = 9.8810 keV / Ch

Offset = 3,028.21 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

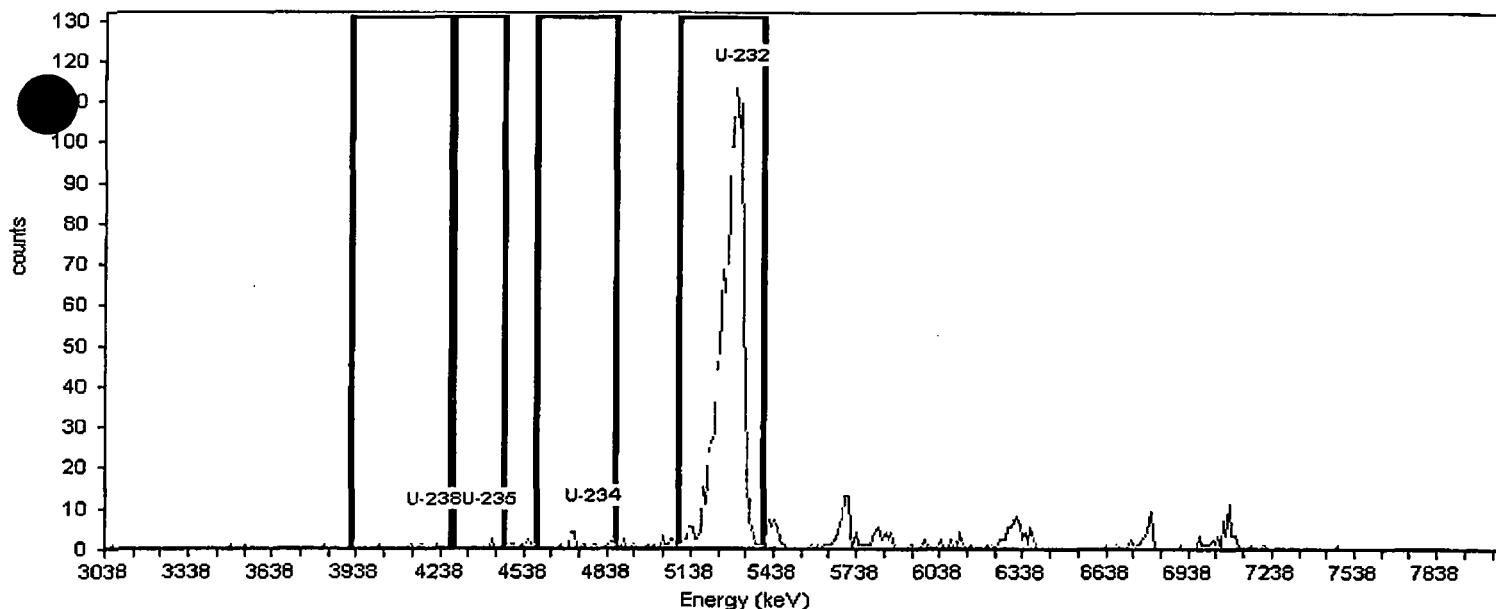
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 70.31%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4194.3	3917.6	4273.3	48.9	100.2	6.00	5.00	1.00	4.2E-003	2.8E-002	2.2E-002	5.5E-002
U-235	4391.9	4283.2	4461.0	62.9	99.7	2.00	2.00	0.00	0.0E+000	1.7E-002	1.4E-002	3.9E-002
U-234	4767.4	4579.6	4866.2	22.8	100.0	17.01	9.01	8.00	3.4E-002	4.3E-002	2.9E-002	7.0E-002
U-232	5300.9	5093.4	5399.7	88.1	100.1	1,040.02	26.01	1,014.01	3.1E+000	2.0E-001	5.2E-002	1.2E-001

Revised By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

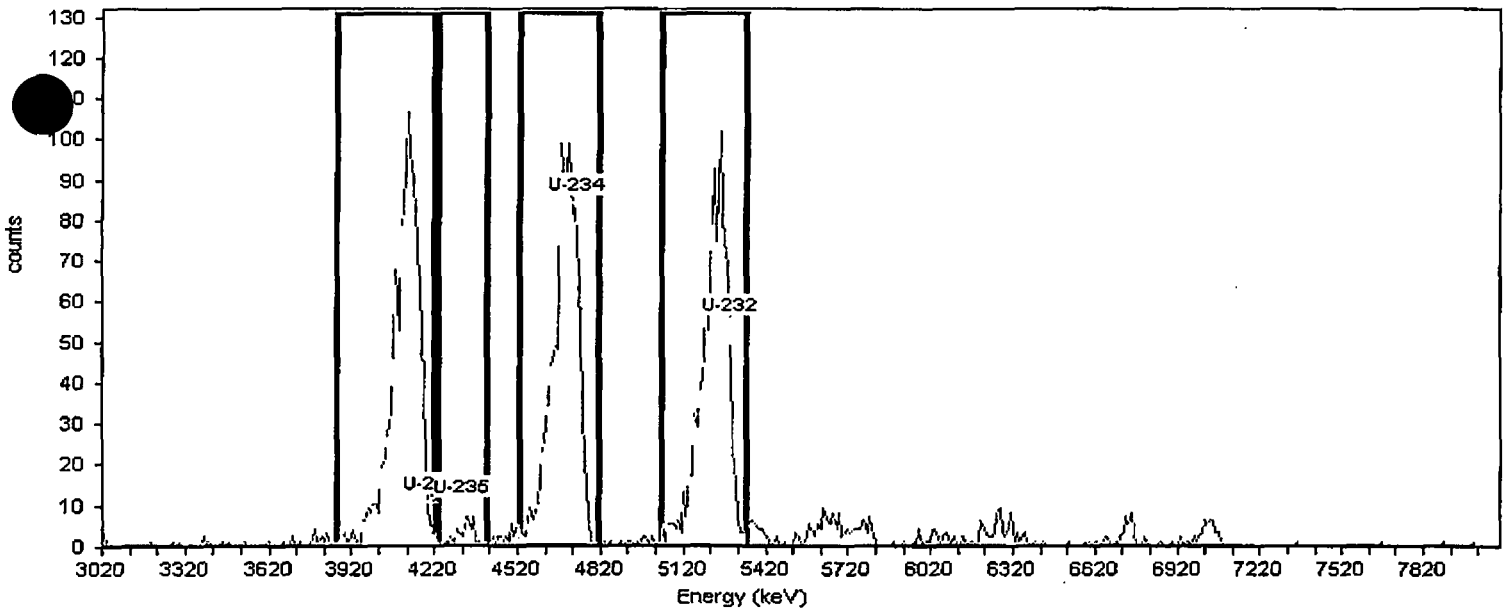
## Alpha-Spectroscopy Analysis Report

**Sample**  
 Sample: AS140215-5LCS  
 Spectrum #1 Analysis #1  
 Sample Size : 0.50

**Acquisition**  
 Detector: 11a  
 Batch Name: UAS140215-5\_B  
 Nuclide Library: Uranium Default  
 Analysis Method: Absolute Interactive ROI Analysis  
 ROI Set: Uranium Default  
 Acquisition Start Date: 2/21/2014 1:41:57PM  
 Live Time: 1,000.00 min.  
 Real Time: 1,000.91 min.  
 Dead Time: 0.09 %

**Calibration**  
 Bkgd Info: Sample: B14021011; Det: 11a; Spectrum #1; Feb-10-2014 13:23  
 Calibration Date: 2/10/2014 10:23:50AM  
 Efficiency Calibration: C14021011  
 Efficiency: 30.43% +/- 0.16% TPU(2 sigma)  
 Energy Calibration: C14021011  
 Energy Cal: Gain = 9.9575 keV / Ch  
 Offset = 3,010.51 keV  
 Quadratic = 0.0000 keV / Ch<sup>2</sup>

**Tracer**  
 Tracer Name: 914.4095.46\_U-232  
 Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM  
 Tracer Nuclide: U-232  
 Tracer Recovery: 69.32%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4205.4	3856.9	4215.4	100.9	100.2	1,096.00	4.00	1,092.00	4.7E+000	6.2E-001	2.0E-002	5.1E-002
U-235	4314.9	4225.3	4404.6	61.2	99.7	41.00	3.00	38.00	1.6E-001	6.0E-002	1.7E-002	4.6E-002
U-234	4733.2	4524.0	4812.8	89.5	100.0	1,052.00	12.00	1,040.00	4.4E+000	6.0E-001	3.4E-002	8.0E-002
U-232	5290.8	5041.8	5350.5	403.9	100.1	1,024.00	24.00	1,000.00	3.1E+000	2.0E-001	5.0E-002	1.1E-001

Reported By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.

# ALS Laboratory Group - Fort Collins

## Alpha-Spectroscopy Analysis Report

Sample: AS140215-5LCSD  
Spectrum #1 Analysis #1

Sample Size : 0.50

Detector: 12a  
Batch Name: UAS140215-5\_B  
Nuclide Library: Uranium Default  
Analysis Method: Absolute ROI Analysis, Set Name = Uranium Default  
ROI Set: Uranium Default

### Acquisition

Acquisition Start Date: 2/21/2014 1:41:58PM  
Live Time: 1,000.00 min.  
Real Time: 1,000.91 min.  
Dead Time: 0.09 %

### Calibration

Bkgd Info: Sample: B14021012; Det: 12a; Spectrum #1; Feb-10-2014 13:23

Calibration Date: 2/10/2014 10:25:15AM

Efficiency Calibration: C14021012

Efficiency: 30.32% +/- 0.21% TPU(2 sigma)

Energy Calibration: C14021012

Energy Cal: Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

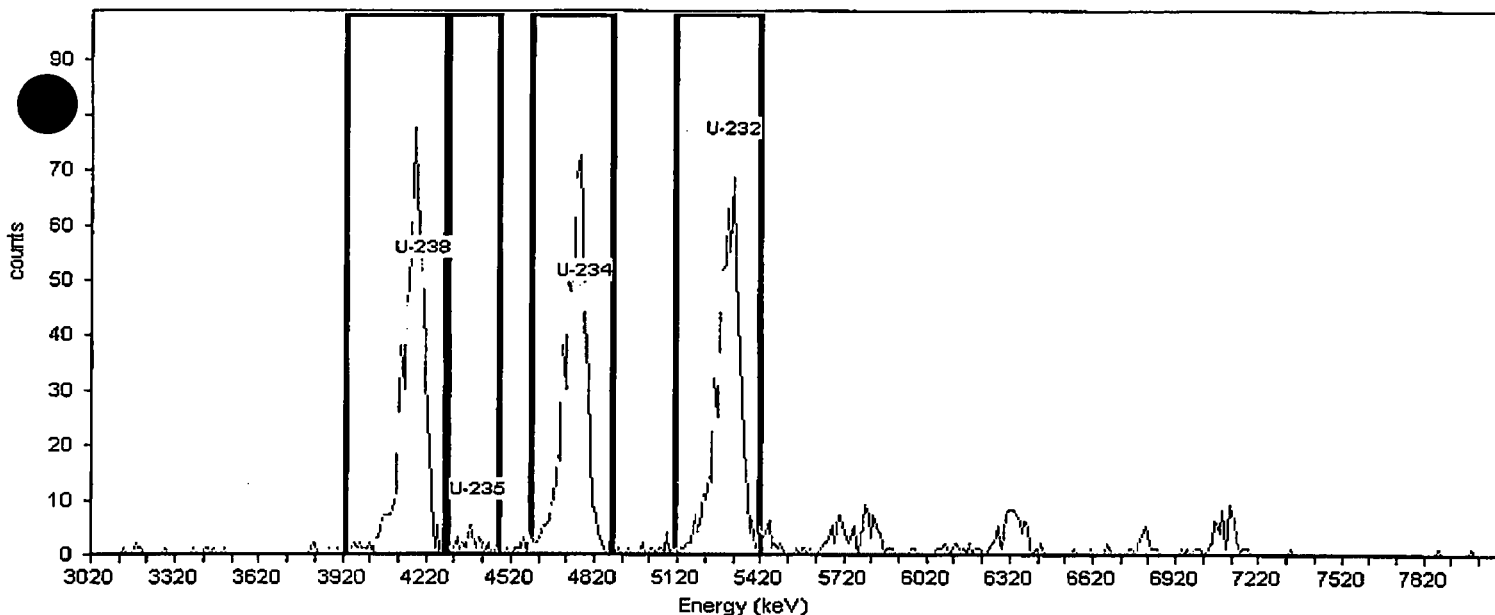
### Tracer

Tracer Name: 914.4095.46\_U-232

Tracer Activity: 19.64 DPM/mL x (Vol.)0.25 mL = 4.91 DPM

Tracer Nuclide: U-232

Tracer Recovery: 41.19%



### Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi/L	2.00Sigma TPU pCi/L	Critical Level pCi/L	MDA pCi/L
U-238	4205.4	3926.6	4285.1	85.2	100.2	622.00	1.00	621.00	4.5E+000	6.9E-001	1.7E-002	5.3E-002
U-235	4404.6	4295.0	4474.3	76.7	99.7	28.00	1.00	27.00	2.0E-001	8.2E-002	1.7E-002	5.3E-002
U-234	4782.9	4593.7	4882.5	78.9	100.0	621.00	3.00	618.00	4.5E+000	6.9E-001	2.9E-002	7.8E-002
U-232	5320.6	5111.5	5420.2	82.2	100.1	625.00	33.00	592.00	1.8E+000	1.6E-001	1.0E-001	2.2E-001

Reviewed By: *JP*

*JA*

All activity values and tracer recoveries are estimated values. The LIMS reporting system uses the count results to calculate all sample activity results. Thus, all activity values on this report may not be directly comparable to actual results on LIMS forms. The LIMS forms contain the actual true activity results for this sample.



ALS

Alpha Spectrometer Instrument Run Log

SOP 714; FORM 746r8.xls (10/2/07)

Date: 2/20/14/2/21/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
81	UAS140215-5 A	1402169-1	U/F	1000	JA
82		-2			
83		-3			
84		-4			
85		-5			
86		-6			
87		-7			
88		-8			
89		-9			
90		-10			
91		-11			
92		-12			
93		-13			
94		-14			
95		-15			
30		-16			
31		-17			
32		-18			
43		-19			
45		-20			
46		AS140215-5mmB			
47		-5PMB			
9	UAS140919-LA	1402060-1	Ur/W	360	JA
10		-2			

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
11	UAS140219-LA	1402060-3	Ur/W	360	JA
12		-30			
13		-4			
14		-5			
16		-6			
25		-7			
26		-10			
30		1402238-1			
31		-10			
32		-11			
43		-13			
45		AS140219-1MB			
46		-1CS			
47	TAS140217-2-A	1402223-1	Th/S	360	JA
81		-2			
82		-3			
83		-4			
84		-5			
85		-6			
86		-7			
87		-8			
88		-9			
89		-10			
90		-10D			

2/21/14

2/21/14

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Notes:

Reviewed by: JMA  
Date: 2/21/14

ALS

Alpha Spectrometer Instrument Run Log

Date: 2/21/14

SOP 714; FORM 746r8.xls (10/2/07)

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
91	UAS140217-2A	1402223-11	Th/S	360	JA
92	↓	-12	↓	↓	↓
93	↓	-13	↓	↓	↓
94	↓	-14	↓	↓	↓
95	↓	-15	↓	↓	↓
29	UAS140219-1-B	1402211-1	U/F	360	JA
13	UAS140215-2-A	1402166-1	U/F	1000	JA
14	↓	-2	↓	↓	↓
16	↓	-3	↓	↓	↓
25	↓	-4	↓	↓	↓
26	↓	-5	↓	↓	↓
29	↓	-6	↓	↓	↓
30	↓	-7	↓	↓	↓
31	↓	-8	↓	↓	↓
32	↓	-9	↓	↓	↓
43	↓	-10	↓	↓	↓
45	↓	-11	↓	↓	↓
46	↓	-12	↓	↓	↓
47	↓	-13	↓	↓	↓
9	TAS140217-1-C	1402222-9	Th/S	1000	JA
10	↓	AS140217-1-MB	U/F	1000	↓
11	UAS140215-5-B	AS140215-5-LS	U/F	7000	JA
12	↓	-5-LS	↓	↓	↓

JMA 2/21/14

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
81	UAS140215-1-A	1402165-1	U/F	1000	JA
82	↓	-2	↓	↓	↓
83	↓	-3	↓	↓	↓
84	↓	-4	↓	↓	↓
85	↓	-5	↓	↓	↓
86	↓	-6	↓	↓	↓
87	↓	-7	↓	↓	↓
88	↓	-8	↓	↓	↓
89	↓	-9	↓	↓	↓
90	↓	-10	↓	↓	↓
91	↓	-11	↓	↓	↓
92	↓	-12	↓	↓	↓
93	↓	-13	↓	↓	↓
94	↓	-14	↓	↓	↓
95	↓	-15	↓	↓	↓

10 2/22/14

Notes:

Reviewed by: TE  
Date: 2/22/14



## Section 6

# QUALITY ASSURANCE SUMMARY REPORTS

**6**



**No *NON-CONFORMANCE REPORTS* or *QUALITY ASSURANCE SUMMARY SHEETS* are included in this data package.**



## Section 7

# LABORATORY BENCH SHEETS

**7**

# Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AS1402-5

Prep Procedure: UIISO V-Default IE-09 1 → 9 → Tower 3 10 → Any Tower 1000 Min Analytical QASS / NCR? Y (N) NA

2/28

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
1	1402169-1	SMP	0.5	0.5	sample	uCi/ml	_21691	81	JA	_21691			_21691			A
1	1402169-2	SMP	0.5	0.5	sample	uCi/ml	_21692	82		_21692			_21692			
1	1402169-3	SMP	0.5	0.5	sample	uCi/ml	_21693	83		_21693			_21693			
1	1402169-4	SMP	0.5	0.5	sample	uCi/ml	_21694	84		_21694			_21694			
1	1402169-5	SMP	0.5	0.5	sample	uCi/ml	_21695	85		_21695			_21695			
1	1402169-6	SMP	0.5	0.5	sample	uCi/ml	_21696	86		_21696			_21696			
1	1402169-7	SMP	0.5	0.5	sample	uCi/ml	_21697	87		_21697			_21697			
1	1402169-8	SMP	0.5	0.5	sample	uCi/ml	_21698	88		_21698			_21698			
1	1402169-9	SMP	0.5	0.5	sample	uCi/ml	_21699	89		_21699			_21699			
1	1402169-10	SMP	0.5	0.5	sample	uCi/ml	_216910	90		_216910			_216910			
1	1402169-11	SMP	0.5	0.5	sample	uCi/ml	_216911	91		_216911			_216911			
1	1402169-12	SMP	0.5	0.5	sample	uCi/ml	_216912	92		_216912			_216912			
1	1402169-13	SMP	0.5	0.5	sample	uCi/ml	_216913	93		_216913			_216913			
1	1402169-14	SMP	0.5	0.5	sample	uCi/ml	_216914	94		_216914			_216914			
1	1402169-15	SMP	0.5	0.5	sample	uCi/ml	_216915	95		_216915			_216915			
1	1402169-16	SMP	0.5	0.5	sample	uCi/ml	_216916	30	JA	_216916			_216916			
1	1402169-17	SMP	0.5	0.5	sample	uCi/ml	_216917	31		_216917			_216917			
1	1402169-18	SMP	0.5	0.5	sample	uCi/ml	_216918	32		_216918			_216918			
1	1402169-19	SMP	0.5	0.5	sample	uCi/ml	_216919	43		_216919			_216919			
1	1402169-20	SMP	0.5	0.5	sample	uCi/ml	_216920	45		_216920			_216920			
1	AS140215-5M	MB	0.5	0.5	sample	uCi/ml	_2155MB	46		_2155MB			_2155MB			
1	AS140215-5P	MB	0.5	0.5	sample	uCi/ml	_2155PB	47		_2155PB			_2155PB			
1	AS140215-5	LCS	0.5	0.5	sample	uCi/ml	_2155L	11	12	_2155L			_2155L			IP 2/25/14 B
1	AS140215-5	LCSD	0.5	0.5	sample	uCi/ml	_2155LD	12		_2155LD			_2155LD			IP 2/25/14

Tracer/Carrier Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25	ml	AW016

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25	ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25	ml	AW016

Prep Procedure: UISO

Analytical QASS / NCR? Y N ONA

Prep Num	LabID	QC Type	Init Aliq	Fin Aliq	Units	Report Units	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
							S1	U-238	843.3810.100	20.357	DPM/ml	02/15/14	0.25	ml	AW016	

Sample Barcodes

1402169-1 AS140215-5PS1		1402169-2 AS140215-5PS2		1402169-3 AS140215-5PS3	
1402169-4 AS140215-5PS4		1402169-5 AS140215-5PS5		1402169-6 AS140215-5PS6	
1402169-7 AS140215-5PS7		1402169-8 AS140215-5PS8		1402169-9 AS140215-5PS9	
1402169-10 AS140215-5PS10		1402169-11 AS140215-5PS11		1402169-12 AS140215-5PS12	
1402169-13 AS140215-5PS13		1402169-14 AS140215-5PS14		1402169-15 AS140215-5PS15	
1402169-16 AS140215-5PS16		1402169-17 AS140215-5PS17		1402169-18 AS140215-5PS18	
1402169-19 AS140215-5PS19		1402169-20 AS140215-5PS20		AS140215-5MMB AS140215-5PS21	
AS140215-5PMB AS140215-5PS22		AS140215-5LCS AS140215-5PS23		AS140215-5LCSD AS140215-5PS24	

Reporting Units

LabID:	TstGrpName:	RptUnits:
1402169-1	IsoU_PNV_Air Filter	uCi/ml
1402169-2	IsoU_PNV_Air Filter	uCi/ml
1402169-3	IsoU_PNV_Air Filter	uCi/ml
1402169-4	IsoU_PNV_Air Filter	uCi/ml
1402169-5	IsoU_PNV_Air Filter	uCi/ml
1402169-6	IsoU_PNV_Air Filter	uCi/ml
1402169-7	IsoU_PNV_Air Filter	uCi/ml
1402169-8	IsoU_PNV_Air Filter	uCi/ml
1402169-9	IsoU_PNV_Air Filter	uCi/ml
1402169-10	IsoU_PNV_Air Filter	uCi/ml
1402169-11	IsoU_PNV_Air Filter	uCi/ml
1402169-12	IsoU_PNV_Air Filter	uCi/ml
1402169-13	IsoU_PNV_Air Filter	uCi/ml
1402169-14	IsoU_PNV_Air Filter	uCi/ml
1402169-15	IsoU_PNV_Air Filter	uCi/ml
1402169-16	IsoU_PNV_Air Filter	uCi/ml
1402169-17	IsoU_PNV_Air Filter	uCi/ml
1402169-18	IsoU_PNV_Air Filter	uCi/ml
1402169-19	IsoU_PNV_Air Filter	uCi/ml
1402169-20	IsoU_PNV_Air Filter	uCi/ml



# Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AS140215-5

Prep Procedure: **UIISO**

Reviewed By: cas *cas*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  Y  N    Batch: See Comments    Re-Prep?  Y  N    Batch: NIA    Prep QASS / NCR?  Y  N NIA

Prep SOP: PAI 778    Rev: 14    Prep Analyst: Tandrae Elhart    Balance: 27  
 Prep SOP: NONE    Prep Date: 2/15/2014    Balance:  
 Matrix Class: solid    Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402169-1	SMP		0.5	0.5	As Received		<i>cas</i>	<i>2/19/14</i>	T1	
2	1	1402169-2	SMP		0.5	0.5	As Received				T1	
3	1	1402169-3	SMP		0.5	0.5	As Received				T1	
4	1	1402169-4	SMP		0.5	0.5	As Received				T1	
5	1	1402169-5	SMP		0.5	0.5	As Received				T1	
6	1	1402169-6	SMP		0.5	0.5	As Received				T1	
7	1	1402169-7	SMP		0.5	0.5	As Received				T1	
8	1	1402169-8	SMP		0.5	0.5	As Received				T1	
9	1	1402169-9	SMP		0.5	0.5	As Received				T1	
10	1	1402169-10	SMP		0.5	0.5	As Received				T1	
11	1	1402169-11	SMP		0.5	0.5	As Received				T1	
12	1	1402169-12	SMP		0.5	0.5	As Received				T1	
13	1	1402169-13	SMP		0.5	0.5	As Received				T1	
14	1	1402169-14	SMP		0.5	0.5	As Received				T1	
15	1	1402169-15	SMP		0.5	0.5	As Received				T1	
16	1	1402169-16	SMP		0.5	0.5	As Received				T1	
17	1	1402169-17	SMP		0.5	0.5	As Received				T1	
18	1	1402169-18	SMP		0.5	0.5	As Received				T1	
19	1	1402169-19	SMP		0.5	0.5	As Received				T1	
20	1	1402169-20	SMP		0.5	0.5	As Received				T1	
21	1	AS140215-5M	MB		0.5	0.5	As Received				T1	
22	1	AS140215-5P	MB		0.5	0.5	As Received				T1	
23	1	AS140215-5	LCS		0.5	0.5	As Received				S1,T1	
24	1	AS140215-5	LCSD		0.5	0.5	As Received				S1,T1	

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# Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AS14015-5

Prep Procedure: **UIISO**

Reviewed By: cas *cas*

Review Date: 2/17/2014

Non-Routine Pre-Treatment?  Y /  N    Batch: see comments    Re-Prep?  Y /  N    Batch: NIA    Prep QASS / NCR?  Y /  N NIA

Prep SOP: PAI 778    Rev: 14    Prep Analyst: Tamrae Elhart    Balance: 27  
 Prep SOP: NONE    Prep Date: 2/15/2014    Balance:  
 Matrix Class: solid    Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
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**Comments**

Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffed at 600C. After muffing, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: Tamrae Elhart    Date: 2/15/2014

Witnessed By: Emily R. Lyons    Date: 2/15/2014

Tracer/Carrier Solution Information							
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Allquot	Pipet ID
T1	U-232	914.4095.48	18.916	DPM/ml	02/15/14	0.25 ml	AW016

Spike Solution Information							
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Allquot	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25 ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25 ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25 ml	AW016

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Prep Procedure: UIISO

**Prep Batch Not Validated!!!**

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: \_\_\_\_\_ Re-Prep? Y / N Batch: \_\_\_\_\_ Prep QASS / NCR? Y / N \_\_\_\_\_

Prep SOP: PAI 778 Rev: 14

Prep Analyst: Tamrae Elhart

Balance:

Prep SOP: NONE

Prep Date: 2/15/2014 *TE*

Balance:

Matrix Class: solid

Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
1	1	1402169-1	SMP		0.5	0.5	As Received					T1
2	1	1402169-2	SMP		0.5	0.5	As Received					T1
3	1	1402169-3	SMP		0.5	0.5	As Received					T1
4	1	1402169-4	SMP		0.5	0.5	As Received					T1
5	1	1402169-5	SMP		0.5	0.5	As Received					T1
6	1	1402169-6	SMP		0.5	0.5	As Received					T1
7	1	1402169-7	SMP		0.5	0.5	As Received					T1
8	1	1402169-8	SMP		0.5	0.5	As Received					T1
9	1	1402169-9	SMP		0.5	0.5	As Received					T1
10	1	1402169-10	SMP		0.5	0.5	As Received					T1
11	1	1402169-11	SMP		0.5	0.5	As Received					T1
12	1	1402169-12	SMP		0.5	0.5	As Received					T1
13	1	1402169-13	SMP		0.5	0.5	As Received					T1
14	1	1402169-14	SMP		0.5	0.5	As Received					T1
15	1	1402169-15	SMP		0.5	0.5	As Received					T1
16	1	1402169-16	SMP		0.5	0.5	As Received					T1
17	1	1402169-17	SMP		0.5	0.5	As Received					T1
18	1	1402169-18	SMP		0.5	0.5	As Received					T1
19	1	1402169-19	SMP		0.5	0.5	As Received					T1
20	1	1402169-20	SMP		0.5	0.5	As Received					T1
21	1	AS140215-5M	MB		1	1	As Received	<i>41</i>				T1
22	1	AS140215-5P	MB		1	1	As Received	<i>471</i>				T1
23	1	AS140215-5	LCS		1	1	As Received	<i>474</i>				S1,T1
24	1	AS140215-5	LCSD		1	1	As Received	<i>517</i>				S1,T1

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Prep Procedure: UIISO

Prep Batch Not Validated!!!

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: Re-Prep? Y / N Batch: Prep QASS / NCR? Y / N

Prep SOP: PAI 778 Rev: 14

Prep Analyst: Tambræ Elhart

Balance:

Prep SOP: NONE

Prep Date: 2/15/2014

Balance:

Matrix Class: solid

Prep Dept: AP

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq sample	Fin Aliq sample	Prep Basis	# of Filters	Micro Init	Micro Date	Standards	Prep Notes
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Comments

Filters consist of 4" circles that were cut in half. One half was aliquotted into a pre-weighed beaker and weighed. The matrix MB (MMB), LCS, and LCSD (due to limited volume) were created using client provided blank filters. The reagent MB (PMB) was created using an ALS blank filter. All samples were spiked/traced and muffled at 600C. After muffling, the beakers were re-weighed to determine sample ash weight. Samples were transferred and digested using 15mL each HCl and HNO3, and 5mL HF. Further prep proceeded per SOP 778.

Spiked By: TE Date: 2/15/14

Witnessed By: EML Date: 2.15.14

Tracer/Carrier Solution Information							
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Pipet ID
T1	U-232	914.4095.46	18.916	DPM/ml	02/15/14	0.25 ml	AW016

Spike Solution Information							
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Pipet ID
S1	U-234	843.3610.100	19.608	DPM/ml	02/15/14	0.25 ml	AW016
S1	U-235	843.3610.100	0.937	DPM/ml	02/15/14	0.25 ml	AW016
S1	U-238	843.3610.100	20.357	DPM/ml	02/15/14	0.25 ml	AW016

10.29.14

Exp 6<sup>0</sup>20.14

## Sample Condition Form (Solids)

Analyst: TC

Analysis Date: 2/15/14

Method: Prep

Sample Condition (Visual Appearance of Analysis Aliquot at Time of Prep)

Work Order	Sample ID	Dry/Wet/Moist	Texture	Remarks
<u>1402169</u>	<u>1</u>	<u>dry</u>	<u>filter</u>	<u>1-half filter</u>
	<u>2</u>			
	<u>3</u>			
	<u>4</u>			
	<u>5</u>			
	<u>6</u>			
	<u>7</u>			
	<u>8</u>			
	<u>9</u>			
	<u>10</u>			
	<u>11</u>			
	<u>12</u>			
	<u>13</u>			
	<u>14</u>			
	<u>15</u>			
	<u>16</u>			
	<u>17</u>			
	<u>18</u>			
	<u>19</u>			
✓	<u>20</u>	✓	✓	

**1402169 Filter Weight Spreadsheet**

Sample ID	Beaker ID	Beaker, Watch glass wt (g)	Beaker, Watch Glass, Filter Wt (g)	Beaker, Watch Glass, Ashed Filter Wt (g)	Net Filter Wt (g)	Net Ash Wt (g)
1402169-1	462	55.1961	55.6141	55.1964	0.418	0.0003
1402169-2	457	54.089	54.4586	54.089	0.3696	0
1402169-3	L35	57.8721	58.2609	57.8723	0.3888	0.0002
1402169-4	207	57.8784	58.2874	57.8784	0.409	0
1402169-5	438	53.4026	53.8075	53.4038	0.4049	0.0012
1402169-6	201	57.3142	57.7293	57.3154	0.4151	0.0012
1402169-7	451	54.6202	55.0212	54.6214	0.401	0.0012
1402169-8	466	55.3545	55.735	55.3551	0.3805	0.0006
1402169-9	L49	55.8684	56.2517	55.8686	0.3833	0.0002
1402169-10	LL15X	55.5324	55.9245	55.5334	0.3921	0.001
1402169-11	210	54.6538	55.0349	54.6558	0.3811	0.002
1402169-12	L43	57.7701	58.1613	57.7715	0.3912	0.0014
1402169-13	445	54.8299	55.23	54.832	0.4001	0.0021
1402169-14	L57	58.4032	58.811	58.4048	0.4078	0.0016
1402169-15	L63	58.7486	59.1344	58.7517	0.3858	0.0031
1402169-16	L50	58.002	58.4281	58.0074	0.4261	0.0054
1402169-17	L14	55.3962	55.7967	55.3983	0.4005	0.0021
1402169-18	L51	55.9312	56.3191	55.9334	0.3879	0.0022
1402169-19	L65	54.7476	55.1387	54.7488	0.3911	0.0012
1402169-20	L45	54.3101	54.6996	54.3107	0.3895	0.0006

Balance: 27

Note: Prior to aliquotting, the filters were cut in half. Only one half of the filter was placed into the weighed beaker, spiked/traced, and muffled. Following muffling, the beaker/filter was reweighed to determine ash weight.

Batch: AS140215-5

**U Solid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Conc. Hydrofluoric Acid	0000061467
Boric Acid	J23624
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MKKBK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467

**U Liquid**

Reagent	Lot #
Conc. Hydrochloric Acid	0000058916
Iron Carrier	96344, 0000043374
Ammonium Hydroxide	0000036215
9N Hydrochloric Acid	0000058916
Polyethylene Glycol	10172053
Sodium Nitrite	0000023153
Methanol	DJ459
1x8 Anion Exchange Resin	MKKBK3092V
Ammonium Iodide	F05Z019
0.5N Hydrochloric Acid	0000058916
Conc. Nitric Acid	0000046694
Ascorbic Acid	000023965, 0000035561
Lanthanum Carrier	0000058916, H04599
Safranine	1211310
Titanium Chloride	D04Z008
3N Hydrofluoric Acid	0000061467



## Section 8

# STANDARDS TRACEABILITY DOCUMENTS





Prepare a working dilution of 843.3610.56

1. Density of 1M HNO<sub>3</sub>, lot # K16045  
 Mass of 100mL vol. flask: 68.2981g Balance # 12  
 Mass of flask & 100mL acid: 171.5705g Balance# 12  
 Net Mass: 103.2724g  
 Density: 1.0327g/mL

2. Mass of 843.3610.56 transferred:  
 Mass of open empty nalgene: 74.7438 Balance# 12  
 Mass of nalgene & standard: 82.4483 Balance# 12  
 Net mass of standard transferred: 7.7045g Balance# NA

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1003.9g Balance# 26  
 Mass of empty nalgene (from above): 74.7438 Balance# 12  
 Net mass of new dilution: 929.1562g Balance# NA

4. Final activity calculation:

(U-238):  $2377.34 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 20.36 \text{ dpm/mL}$

(U-235):  $109.44 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 0.92 \text{ dpm/mL}$

(U-234):  $2289.91 \text{ dpm/g} \left( \frac{7.7045 \text{g}}{929.1562 \text{g}} \right) (1.0327 \text{g/mL}) = 19.61 \text{ dpm/mL}$

Sind ID: 843.3610.100

Description: U-238

Expiration: 8/4/2012  
 Activity: 20.36 dpm/mL

2s Uncertainty: 0.12 dpm/mL

Ref. Date: 8/1/1977 1997

Ref Time: N/A JP 7/9/11

Prep Date: 8/3/2011 Prep by: TE

Matrix/Comp. 1M HNO3

Half Life (y): 4.47E+09

Reverification Log		
Analysis Date	Initials	Expiration Date
7/11/12	JP	7/10/13
6/20/13	JP	6/20/2014

Continued on Page

Read and Understood By

TE

Signed

8/3/11

Date

Renee Hellock

Signed

10/21/11

Date

Prepare an intermediate Dilution of RSO # 843

Diluent is (M)  $HNO_3$  lot # H31041  
from Pg. 54 this logbook (3610)  
 $\rho = 1.0283 \frac{g}{ml}$

Mass of Parent Transferred

Mass of Open full Ampule + beaker	38.1504g	12
Mass of Empty Ampule + beaker	32.9991g	1
Net Mass transferred	5.1513g	

Dilute to Final Volume

Mass of Open Empty 40 ml VOA	21.6337g	12
Mass of Open full / Vial	53.0961g	1
Net mass of New Dilution	31.4624g	

Final Activity (U-238)

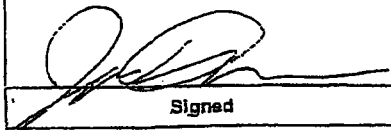
$$\left( \frac{242.0 \frac{Bq}{g}}{3} \right) \left( \frac{60 \text{ dpm}}{1 \text{ Bq}} \right) \left( \frac{5.1513 \text{ g}}{31.4624 \text{ g}} \right) = \frac{2382.5 \text{ dpm}}{2372.34 \text{ g}}$$

Final activity (U-238): 109.44 dpm/g  
(RSO: 843) = 11.14 Bq/g

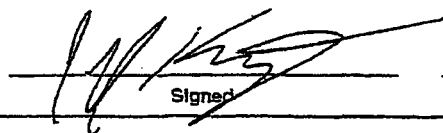
Final activity (U-234): 2289.91 dpm/g  
(RSO: 843) = 233.1 Bq/g

Continued on Page

Read and Understood By

  
Signed

4/23/10  
Date

  
Signed

5/11/10  
Date



# National Institute of Standards & Technology Certificate

RSO #  
843  
rel 7-20-07

## Standard Reference Material 4321C Natural Uranium Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive uranium-238, uranium-235, and uranium-234 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. The solution, whose composition is specified in Table 1, is contained in a flame-sealed, 5 mL, NIST, borosilicate-glass ampoule (see Note 1)\*.

The certified massic activities for the uranium isotopes at a Reference Time of 1200 EST, 1 August 1997 are:

Uranium-238:  $(242.0 \pm 1.5) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-235:  $(11.14 \pm 0.07) \text{ Bq}\cdot\text{g}^{-1}$

Uranium-234:  $(233.1 \pm 2.2) \text{ Bq}\cdot\text{g}^{-1}$

Additional physical, chemical, and radiological properties for the SRM, as well as details on the standardization method, are given in Table 1. Uncertainty intervals for certified quantities are expanded ( $k=2$ ) uncertainties calculated according to the ISO and NIST Guidelines (see Note 2). Table 2 contains a specification of the components that comprise the uncertainty analyses.

The certification of this SRM, within the measurement uncertainties specified, is valid for at least five (5) years after receipt. The solution matrix, in an unopened ampoule, is believed to be indefinitely homogeneous and stable, within its half-life-dependent, useful lifetime. NIST will monitor this material and will report any substantive changes in certification to the purchaser. Should any of the certified values change, purchasers of this SRM will be notified of the change by NIST.

This SRM may represent a radiological hazard and a chemical hazard. Consult the Material Safety Data Sheet (MSDS), enclosed with the SRM shipment, for details (see Note 1).

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dr. M.P. Unterwiesing, Acting Group Leader. The overall technical direction and physical measurements leading to certification were provided by Dr. L.L. Lucas of the Radioactivity Group. The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program.

Gaithersburg, Maryland 20899

November 1997

Text revised and expiration date extended February 2007

Lisa R. Karam, Deputy Chief  
Ionizing Radiation Division

Robert L. Watters, Jr., Chief  
Measurement Services Division

SRM 4321C page 1 of 4

\*Notes and references are on page 4.

Table 1. Properties of SRM 4321C

Certified values	
Radionuclides	Natural Uranium (Mixture of $^{238}\text{U}$ , $^{235}\text{U}$ , and $^{234}\text{U}$ )
Reference time	1200 EST, 1 August 1997
Massic activities of the solution	$^{238}\text{U}$ : 242.0 Bq·g <sup>-1</sup> $^{235}\text{U}$ : 11.14 Bq·g <sup>-1</sup> $^{234}\text{U}$ : 233.1 Bq·g <sup>-1</sup>
Relative expanded uncertainties ( $k=2$ )	$^{238}\text{U}$ : 0.60% (see Note 2) $^{235}\text{U}$ : 0.60% (see Note 2) $^{234}\text{U}$ : 0.96% (see Note 2)

Uncertified information	
Source description	Liquid in flame-sealed, 5 mL NIST borosilicate ampoule (see Note 1)
Solution composition	1.0 mol·L <sup>-1</sup> HCl with 30 mg UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> per gram of solution
Solution density	(1.053 ± 0.001) g·mL <sup>-1</sup> at 21.4°C (see Note 3)
Solution mass	(5.258 ± 0.002) g (see Note 3)
Mass fraction of uranium	(0.01960 ± 0.00010) g·g <sup>-1</sup> (see Note 5)
Photon-emitting impurities	None detected (see Note 4)
Half-lives used [1]	$^{238}\text{U}$ : (4.468 ± 0.003) × 10 <sup>8</sup> a $^{235}\text{U}$ : (7.038 ± 0.005) × 10 <sup>8</sup> a $^{234}\text{U}$ : (2.435 ± 0.006) × 10 <sup>5</sup> a
Calibration method (and instruments)	The certified massic activity for natural uranium was obtained by mass spectrometry, silicon surface barrier detector, and 4πβ-βγ scintillation (LS) counting systems.

<sup>1</sup> See Note 5

Table 2. Uncertainty evaluation for the massic activity for SRM 4321C

	Uncertainty component	Assessment Type †	Relative standard uncertainty contribution on massic activity of Natural Uranium (%)
1	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for $^{238}\text{U}$	A	0.001
2	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for $^{235}\text{U}$	A	0.07
3	Isotopic uranium atom fraction in SRM 960; standard deviation of the mean for replicate mass-spectrometric measurements for $^{234}\text{U}$	A	0.3
4	Half life of $^{238}\text{U}$ ; standard uncertainty of the half-life	A	0.07
5	Half life of $^{235}\text{U}$ ; standard uncertainty of the half-life	A	0.07
6	Half life of $^{234}\text{U}$ ; standard uncertainty of the half-life	A	0.24
7	Uranium mass fraction in SRM 960; from SRM960 certificate	B	0.003
8	Quantitative dissolution	B	0.25
9	Gravimetric (mass) measurements	B	0.10
10	Limit for photon-emitting impurities	B	0.10
	Relative combined standard uncertainty		
	$^{238}\text{U}$		0.30
	$^{235}\text{U}$		0.50
	$^{234}\text{U}$		0.48
	Relative expanded uncertainty ( $k = 2$ )		
	$^{238}\text{U}$		0.60
	$^{235}\text{U}$		0.60
	$^{234}\text{U}$		0.96

† = (A) denotes evaluation by statistical methods; (B) denotes evaluation by other methods.

## NOTES

Note 1. Refer to <http://physics.nist.gov/Divisions/Div846/srm.html> for the standardized ampoule dimensions and for assistance and instructions on how to properly open an ampoule. Information on additional storage and handling requirements is also included in the website.

Note 2. The uncertainties on certified values are expanded uncertainties,  $U = k u_c$ . The quantity  $u_c$  is the combined standard uncertainty calculated according to the ISO and NIST Guides (see references [2] and [3]). The combined standard uncertainty is multiplied by a coverage factor of  $k = 2$  and was chosen to obtain an approximate 95 % level of confidence.

Note 3. The stated uncertainty is two times the standard uncertainty. See reference [3].

Note 4. The estimated lower limits of detection for photon-emitting impurities, expressed as massic photon emission rates are:

1.4  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $8 \text{ keV} < E < 59 \text{ keV}$

1.1  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $57 \text{ keV} < E < 88 \text{ keV}$

0.5  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $102 \text{ keV} < E < 197 \text{ keV}$

0.3  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $205 \text{ keV} < E < 762 \text{ keV}$

0.2  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $770 \text{ keV} < E < 996 \text{ keV}$ , and

0.1  $\text{s}^{-1}\cdot\text{g}^{-1}$  for  $1006 \text{ keV} < E < 1900 \text{ keV}$

provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of  $^{235}\text{U}$ ,  $^{238}\text{U}$ , or their progeny

Note 5. The stated uncertainty is the standard uncertainty. See reference [3].

## REFERENCES

- [1] Evaluated Nuclear Structure Data File (ENSDF), online database, National Nuclear Data Center, Brookhaven Laboratory (Upton, NY), August 2007. Refer to <http://www.nndc.bnl.gov/ensdf/>
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993 (corrected and reprinted, 1995). Available from Global Engineering Documents, 12 Inverness Way East, Englewood, CO 80112, U.S.A. Telephone 1-800-854-7179.
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.

TE 10/22/13

Prepare a working dilution of 914.3610.62

1. Density of 1M HNO<sub>3</sub>, lot # 000045470  
 Mass of 100mL vol. flask: 66.4318g Balance # 12  
 Mass of flask & 100mL acid: 169.6212g Balance# 12  
 Net Mass: 103.1894g  
 Density: 1.0319 g/mL

2. Mass of 914.3610.62 transferred:  
 Mass of open empty nalgene: 75.4800g Balance# 12  
 Mass of nalgene & standard: 78.3581g Balance# 12  
 Net mass of standard transferred: 2.8781g Balance# NA

TE 10/22/13

3. Dilute to final volume:  
 Mass of nalgene, standard, & diluent: 1173.7g Balance# 26  
 Mass of empty nalgene (from above): 75.4800g Balance# 12  
 Net mass of new dilution: 1098.22g Balance# NA

4. Final activity calculation:  
 $7261.8 \text{ dpm/g} \left( \frac{2.8781 \text{ g}}{1098.22 \text{ g}} \right) (1.0319 \text{ g/mL}) = 19.64 \text{ dpm/mL}$

TE 10/22/13

JP 11/5/13

Std ID: 914.4095.46

Description: **U-232**  
 Expiration: **10/29/2014**  
 Activity: **19.64 dpm/mL**  
 2s Uncertainty: **0.96 dpm/mL**  
 Ref. Date: **5/27/2010**  
 Ref Time: **N/A**  
 Prep Date: **10/22/2013** Prep by: **TE**  
 Matrix/Comp. **1M HNO<sub>3</sub>**  
 Half Life (y): **6.89E+01**

JP 11/5/13

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 11/5/13

Continued on Page \_\_\_\_\_

7 Elbert 10/22/13  
 Signed Date

Read and Understood By [Signature] 11/05/13  
 Signed Date

Prepare an Intermediate dilution of RCO # 914

Diluent is  $1M HNO_3$  Act lot # J11044

Mass of parent transferred:		
Mass of Open Fall Ampule + Beaker	38.0670 g	12
Mass of Empty Ampule + Beaker	32.9311 g	12
Net mass transferred	5.1379 g	

Dilute to final mass

Mass of Vial, Std, + Diluent	58.6555 g	12
Mass of Vial	21.5781 g	12
Net Mass of New dilution	37.0574 g	

Final Activity

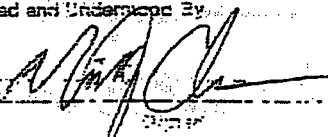
$$\left(4.552 \times 10^3 \text{ Bq}\right) \left(\frac{60 \text{ days}}{1 \text{ Bq}}\right) \left(\frac{5.1379 \text{ g}}{521457 \text{ g}}\right) \left(\frac{1}{37.0574 \text{ g}}\right) = 7267.8 \text{ Bq}$$

Continued on Page

Read and Understood By

  
Signed

6/4/10

  
Signed

06-17-2010

Date





**Eckert & Ziegler**  
Analytics

*Rec 6-1-10  
RSDH 914*

1380 Seaboard Industrial Blvd.  
Atlanta, Georgia 30318  
Tel 404-352-8677  
Fax 404-352-2837  
www.analyticinc.com

**CERTIFICATE OF CALIBRATION**  
Standard Radionuclide Source

82306-307

U-232 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins  
P.O. No.: 73625 04-28-10, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.18, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			$\sigma_x$	$\sigma_y$	U	
U-232	2.617E+04	4.852E+03	0.5	2.4	4.9	05/27/2010

\*Uncertainty: U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1287, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

**Comments:**

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%. 8.21489 g 1M HNO3 solution, carrier free.

Source Prepared by: W. Mao  
W. Mao, Radiochemist

QA Approved: J. D. McCorvey  
J. D. McCorvey, QA Manager Alternate

Date: 5/27/10

AMA Form 008 Rev. 1

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office  
24937 Avenue Tibbitts Valencia, California 91355

Laboratory  
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318



## Section 9

# **ADDITIONAL SUPPORTING DOCUMENTATION**



## **Alpha Spectroscopy**

# **Quality Control Data**

## **Weekly Background, Energy, and Efficiency Calibrations**

# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402169-1 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	81	C14021881	2/18/2014	30.83	Pass	29.34	29.86	31.89	32.42
					B14021881	2/18/2014	0.1050	Pass	0.0000	0.0500	0.5000	0.7500
					C14021881	2/18/2014	5553.6	Pass	5505.8	5515.8	5595.8	5605.8
1402169-2 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	82	C14021882	2/18/2014	30.65	Pass	29.85	30.38	32.46	32.99
					B14021882	2/18/2014	0.0990	Pass	0.0000	0.0500	0.5000	0.7500
					C14021882	2/18/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
1402169-3 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	83	C14021883	2/18/2014	31.20	Pass	29.72	30.25	32.31	32.84
					B14021883	2/18/2014	0.1290	Pass	0.0000	0.0500	0.5000	0.7500
					C14021883	2/18/2014	5557.7	Pass	5505.8	5515.8	5595.8	5605.8
1402169-4 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	84	C14021884	2/18/2014	30.40	Pass	28.92	29.44	31.44	31.96
					B14021884	2/18/2014	0.1410	Pass	0.0000	0.0500	0.5000	0.7500
					C14021884	2/18/2014	5555.8	Pass	5493.9	5503.9	5583.9	5593.9
1402169-5 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	85	C14021885	2/18/2014	30.11	Pass	28.78	29.30	31.30	31.82
					B14021885	2/18/2014	0.1040	Pass	0.0000	0.0500	0.5000	0.7500
					C14021885	2/18/2014	5543.9	Pass	5496.0	5506.0	5586.0	5596.0
1402169-6 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	86	C14021886	2/18/2014	30.61	Pass	28.91	29.42	31.42	31.94
					B14021886	2/18/2014	0.1000	Pass	0.0000	0.0500	0.5000	0.7500
					C14021886	2/18/2014	5546.0	Pass	5505.8	5515.8	5595.8	5605.8
1402169-7 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	87	C14021887	2/18/2014	31.55	Pass	29.84	30.37	32.45	32.98
					B14021887	2/18/2014	0.1180	Pass	0.0000	0.0500	0.5000	0.7500
					C14021887	2/18/2014	5548.0	Pass	5505.8	5515.8	5595.8	5605.8
1402169-8 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	88	C14021888	2/18/2014	30.79	Pass	28.96	29.47	31.48	32.00
					B14021888	2/18/2014	0.0940	Pass	0.0000	0.0500	0.5000	0.7500
					C14021888	2/18/2014	5543.9	Pass	5505.8	5515.8	5595.8	5605.8
1402169-9 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	89	C14021889	2/18/2014	31.24	Pass	29.50	30.02	32.07	32.60
					B14021889	2/18/2014	0.0990	Pass	0.0000	0.0500	0.5000	0.7500
					C14021889	2/18/2014	5555.8	Pass	5505.8	5515.8	5595.8	5605.8

Data Package ID: UR1402169-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
	CI - The Analysis Date exceeds the Calibration Date by more than 14 days.			

Date Printed: Tuesday, February 25, 2014

ALS Environmental -- FC

Page 1 of 3

LIMS Version: 6.695

106  
28

# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC  
 PAI Work Order: 1402169

Prep SOP: PAI 778  
 Analytical SOP: PAI 714

Reported on: Tuesday, February 25, 2014  
 8:23:39 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402169-10 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	90	C14021890	2/18/2014	30.90	Pass	29.66	30.19	32.25	32.78
					B14021890	2/18/2014	0.1110	Pass	0.0000	0.0500	0.5000	0.7500
					C14021890	2/18/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
1402169-11 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	91	C14021891	2/18/2014	30.35	Pass	28.95	29.46	31.48	31.99
					B14021891	2/18/2014	0.0970	Pass	0.0000	0.0500	0.5000	0.7500
					C14021891	2/18/2014	5557.7	Pass	5507.8	5517.8	5597.8	5607.8
1402169-12 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	92	C14021892	2/18/2014	31.14	Pass	29.21	29.74	31.76	32.29
					B14021892	2/18/2014	0.1040	Pass	0.0000	0.0500	0.5000	0.7500
					C14021892	2/18/2014	5548.0	Pass	5507.8	5517.8	5597.8	5607.8
1402169-13 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	93	C14021893	2/18/2014	32.05	Pass	30.54	31.09	33.21	33.76
					B14021893	2/18/2014	0.1080	Pass	0.0000	0.0500	0.5000	0.7500
					C14021893	2/18/2014	5555.8	Pass	5507.8	5517.8	5597.8	5607.8
1402169-14 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	94	C14021894	2/18/2014	32.10	Pass	30.23	30.77	32.87	33.41
					B14021894	2/18/2014	0.0830	Pass	0.0000	0.0500	0.5000	0.7500
					C14021894	2/18/2014	5557.7	Pass	5507.8	5517.8	5597.8	5607.8
1402169-15 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	95	C14021895	2/18/2014	32.13	Pass	30.55	31.10	33.22	33.77
					B14021895	2/18/2014	0.0920	Pass	0.0000	0.0500	0.5000	0.7500
					C14021895	2/18/2014	5567.7	Pass	5507.8	5517.8	5597.8	5607.8
1402169-16 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	30	C14021030	2/10/2014	28.09	Pass	26.99	27.46	29.36	29.83
					B14021030	2/10/2014	0.4190	Pass	0.0000	0.0500	0.5000	0.7500
					C14021030	2/10/2014	5546.0	Pass	5514.0	5524.0	5604.0	5614.0
1402169-17 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	31	C14021031	2/10/2014	29.21	Pass	28.09	28.58	30.56	31.05
					B14021031	2/10/2014	0.3950	Pass	0.0000	0.0500	0.5000	0.7500
					C14021031	2/10/2014	5557.7	Pass	5496.0	5506.0	5586.0	5596.0
1402169-18 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	32	C14021032	2/10/2014	29.03	Pass	27.66	28.16	30.08	30.58
					B14021032	2/10/2014	0.3190	Pass	0.0000	0.0500	0.5000	0.7500
					C14021032	2/10/2014	5555.8	Pass	5496.0	5506.0	5586.0	5596.0

Data Package ID: UR1402169-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit

CI - The Analysis Date exceeds the Calibration Date by more than 14 days.

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# Calibration Data Summary

Laboratory Name: ALS Environmental -- FC

Prep SOP: PAI 778

Reported on: Tuesday, February 25, 2014

PAI Work Order: 1402169

Analytical SOP: PAI 714

8:23:39 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS	FLAGS	LCL	LWL	UWL	UCL
							%Efficiency Bkg CPM Energy keV	Efficiency Background Energy	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV	%Efficiency Bkg CPM Energy keV
1402169-19 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	43	C14021043	2/10/2014	32.34	Pass	30.49	31.03	33.15	33.69
					B14021043	2/10/2014	0.4360	Pass	0.0000	0.0498	0.4998	0.7500
					C14021043	2/10/2014	5567.7	Pass	5496.0	5506.0	5586.0	5596.0
1402169-20 Spectrum #1 2/20/2014	SMP	AS140215-5 AS140215-5UR	UIISO	45	C14021045	2/10/2014	31.65	Pass	30.63	31.18	33.30	33.85
					B14021045	2/10/2014	0.4130	Pass	0.0000	0.0498	0.4998	0.7500
					C14021045	2/10/2014	5546.0	Pass	5496.0	5506.0	5586.0	5596.0
AS140215-5M Spectrum #1 2/20/2014	MB	AS140215-5 AS140215-5UR	UIISO	46	C14021046	2/10/2014	30.58	Pass	29.63	30.16	32.22	32.75
					B14021046	2/10/2014	0.3270	Pass	0.0000	0.0498	0.4998	0.7500
					C14021046	2/10/2014	5543.9	Pass	5505.8	5515.8	5595.8	5605.8
AS140215-5P Spectrum #1 2/20/2014	MB	AS140215-5 AS140215-5UR	UIISO	47	C14021047	2/10/2014	30.42	Warning	30.32	30.87	32.97	33.52
					B14021047	2/10/2014	0.3520	Pass	0.0000	0.0498	0.4998	0.7500
					C14021047	2/10/2014	5557.7	Pass	5507.7	5517.7	5597.7	5607.7
AS140215-5 Spectrum #1 2/21/2014	LCS	AS140215-5 AS140215-5UR	UIISO	11a	C14021011	2/10/2014	30.43	Pass	29.69	30.21	32.29	32.81
					B14021011	2/10/2014	0.4130	Pass	0.0000	0.0498	0.4998	0.7500
					C14021011	2/10/2014	5559.6	Pass	5497.0	5507.0	5587.0	5597.0
AS140215-5 Spectrum #1 2/21/2014	LCSD	AS140215-5 AS140215-5UR	UIISO	12a	C14021012	2/10/2014	30.32	Pass	29.29	29.80	31.86	32.37
					B14021012	2/10/2014	0.3430	Pass	0.0000	0.0498	0.4998	0.7500
					C14021012	2/10/2014	5559.6	Pass	5507.7	5517.7	5597.7	5607.7

Data Package ID: UR1402169-1

Abbreviations:	Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit
	Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit
CI - The Analysis Date exceeds the Calibration Date by more than 14 days.				

Date Printed: Tuesday, February 25, 2014

ALS Environmental -- FC

Page 3 of 3

LIMS Version: 6.695

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# Alpha Spec Calibration Source Re-Certification

Recalibration performed by Isotope Products Laboratories

**Primary Certified Source**

Source PA ID: 190  
 Planchet Label: 9  
 Recalibrated on: 10/15/2013  
 Received by ALS on: 10/18/2013

Values from certificate	
Source ID:	92MX223027
Total Activity:	3745.2 dpm
Ref. Date:	10/15/2013

Nuclide	Act (Bq)	Act (dpm)	Half-Life (yrs)	Decay Corrected
U-234:	49.54	2972.4	2.48E+05	2972.40 dpm
U-235:	1.09	65.58	7.04E+08	65.58 dpm
Am-241:	11.79	707.4	432.17	707.38 dpm
<b>TOTAL</b>				<b>3745.36 dpm</b>

**Efficiency Determination for Detector:**

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Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Total cpm	Known dpm	Detector efficiency
92MX223027	190	97-19-103-09	10/21/13	7888	32739	1135	2100		1187.43	3745.36	31.70%

**Sources 1 through 8 activity determination**

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	count (s)	dur	Detector Efficiency	Am-241 dpm	U-234 dpm	U-235 dpm	Combined dpm
92MX2203026	182	97-19-103-01	10/21/13	13543	81484	2689	2100		31.70%	1220.49	7343.29	242.33	8806.10
92MX2203028	183	97-19-103-02	10/21/13	15830	158715	4155	2100		31.70%	1426.59	14123.08	374.45	15924.09
92MX2203024	184	97-19-103-03	10/21/13	71764	74298	2052	2100		31.70%	8467.33	8695.69	184.92	13347.94
92MX2203021	185	97-19-103-04	10/21/13	22944	82381	2198	2100		31.70%	2067.70	5821.74	193.08	7887.52
92MX2203025	186	97-19-103-05	10/21/13	103302	124917	3425	2100		31.70%	9309.51	11257.44	308.66	20878.61
92MX2203022	187	97-19-103-06	10/21/13	78934	84490	2349	2100		31.70%	7113.48	7614.19	211.69	14939.36
92MX2203023	188	97-19-103-07	10/21/13	48085	71762	1847	2100		31.70%	4153.15	6467.15	189.45	10788.75
92MX2203029	189	97-19-103-08	10/21/13	34624	218016	6721	2100		31.70%	3120.29	19647.47	603.69	23373.45

**Efficiency Verification**

Source Serial#	PA ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	U-235 net cts	Count dur (s)	Total cpm	Known dpm	Detector efficiency	RPD	FLAG
92MX223027	190	97-19-103-09	10/21/13	7807	32933	1155	2100	1197.00	3745.36	31.96%	-0.50%	PASS

**Sources 1 through 8 activity re-verification**

Source Serial#	PA ID	Sequential #	Combined Observed dpm	Combined Certified dpm*	Percent Difference %	Within 5% of Certified value?
92MX2203026	182	97-19-103-01	8806.10	8855.90	-0.56%	Yes
92MX2203028	183	97-19-103-02	15924.09	15999.04	-0.47%	Yes
92MX2203024	184	97-19-103-03	13347.94	13533.39	-1.37%	Yes
92MX2203021	185	97-19-103-04	7887.52	8170.91	-3.47%	Yes
92MX2203025	186	97-19-103-05	20875.61	21020.88	-0.69%	Yes
92MX2203022	187	97-19-103-06	14939.36	15319.53	-2.48%	Yes
92MX2203023	188	97-19-103-07	10788.75	10744.16	0.40%	Yes
92MX2203029	189	97-19-103-08	23373.45	23608.79	-1.00%	Yes

**Data from certificates**

Reference Date	U-234 (Bq)	U-234 (dpm)	U-235 (Bq)	U-235 (dpm)	Am-241 (Bq)	Am-241 (dpm)
5/1/2003	24.10	7446.00	2.43	145.74	21.43	1285.80
5/1/2003	36.30	14358.00	4.20	262.00	23.55	1413.00
5/1/2003	19.40	7164.00	1.93	115.56	106.00	6360.00
4/1/2003	01.00	6060.00	1.26	75.84	34.50	2070.00
4/1/2003	03.00	12180.00	3.41	204.72	148.40	8784.00
4/1/2003	32.90	7974.00	3.17	189.96	121.30	7278.00
4/1/2003	07.10	6426.00	0.93	55.54	72.26	4335.60
5/1/2003	34.80	20088.00	8.55	393.18	53.02	3181.20

New Expiration Date => 10/21/2014  
 JP 10/22/13



Eckert & Ziegler

Isotope Products

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010

Fax 661-257-8303

#190  
Received 10/18/13

# CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

Radionuclide:	U-234	Customer:	ALS LABORATORY
Radionuclide:	U-235	P.O. No.:	FC 35957 R5576
Radionuclide:	Am-241	Catalog No.:	*SOURCE-RECAL-STD
Half-life (U-234):	(2.454 ± 0.006)E+05 years	Reference Date:	15-Oct-13 12:00 PST
Half-life (U-235):	(7.037 ± 0.011)E+08 years	Source No.:	92MIX223027
Half-life (Am-241):	432.17 ± 0.66 years		

**Contained Radioactivity:**

U-234:	1.339	nCi,	49.54	Bq	Am-241:	0.3187	nCi,	11.79	Bq
U-235:	0.02954	nCi,	1.093	Bq	Total Activity:	1.687	nCi,	62.42	Bq

**Physical Description:**

- A. Capsule type: Disk (22 mm OD x 0.79 mm THK)
- B. Nature of active deposit: Electrodeposited and diffusion bonded oxide
- C. Active diameter/volume: 19 mm
- D. Backing: Stainless steel
- E. Cover: None

Radioimpurities: Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in May 2001.

**Uncertainty of Measurement:**

- A. Type A (random) uncertainty: ± 0.5 %
- B. Type B (systematic) uncertainty: ± 3.0 %
- C. Uncertainty in aliquot weighing: ± 0.0 %
- D. Total uncertainty at the 99% confidence level: ± 3.0 %

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 1893 α/min in 2π on 20-Sep-13.

*Daniel James Van Dalsen*  
Quality Control

2-OCT-13  
Date

IPL Ref. No.: 987-28

ISO 9001 CERTIFIED

Medical Imaging Laboratory

24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory 110 of 128

1800 North Keystone Street Burbank, California 91504





**Isotope Products  
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Re-Calibrated 10/21/13

$\alpha$  1

New Exp Date  
=> 10/21/2014

PAI 187  
~~Recalibrated 4-15-03~~  
JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203026
---	---

**Contained Radioactivity:**

U-234: 3.354 nCi (124.1 Bq) U-235: 0.06566 nCi (2.429 Bq)	Am-241: 0.5793 nCi (21.43 Bq) <b>Total Activity:</b> 3.999 nCi (148.0 Bq)
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**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radiopurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4483  $\alpha$ /min in  $2\pi$  on 11 Apr 03.

*Daniel James Van Dalsen*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13  
New Exp Date  
=> 10/21/2014  
α 2  
PAI 183  
Recalibrated 4-15-03  
JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

Radionuclide A:	U-234	Customer:	PARAGON ANALYTICS, INC.
Radionuclide B:	U-235	P.O. No.:	EW040203/R2193
Radionuclide C:	Am-241	Catalog No.:	MISC-STD
Half Life (U-234):	(2.454 ± 0.006)E+05 years	Reference Date:	1-May-03 12:00 PST
Half Life (U-235):	(7.037 ± 0.011)E+08 years	Source No.:	92MIX2203028
Half Life (Am-241):	432.17 ± 0.66 years		

**Contained Radioactivity:**

U-234:	6.467 nCi (239.3 Bq)	Am-241:	0.6366 nCi (23.55 Bq)
U-235:	0.1135 nCi (4.200 Bq)	Total Activity:	7.217 nCi (267.1 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

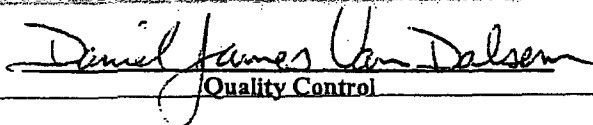
This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 8091 α/min in 2π on 11 Apr 03.

  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED



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Laboratories**

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Fax 661-257-8303

Re-Calibrated 10/21/13  
New Exp Date  
=> 10/21/2014  
 $\alpha 3$   
PAT I.D 184  
recalibrated 4-15-03  
JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203024
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**Contained Radioactivity:**

U-234: 3.227 nCi (119.4 Bq) U-235: 0.05205 nCi (1.926 Bq)	Am-241: 2.866 nCi (106.0 Bq) <b>Total Activity:</b> 6.145 nCi (227.3 Bq)
--	---

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.6%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.1%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 6889  $\alpha$ /min in 2 $\pi$  on 11 Apr 03.

*Daniel James Van Dalsen*  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13  
New Exp Date  
α4 ⇒ 10/21/2014

PAI ID: 00185  
rec'd from recalibrator  
3-28-03 TP 10/22/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234	<b>Customer:</b> PARAGON ANALYTICS, INC.
<b>Radionuclide B:</b> U-235	<b>P.O. No.:</b> EW030603/R2155
<b>Radionuclide C:</b> Am-241	<b>Catalog No.:</b> MISC-STD
<b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years	<b>Reference Date:</b> 1-Apr-03 12:00 PST
<b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years	<b>Source No.:</b> 92MIX2203021
<b>Half Life (Am-241):</b> 432.17 ± 0.66 years	

**Contained Radioactivity:**

U-234: 2.731 nCi (101.0 Bq)	Am-241: 0.9325 nCi (34.50 Bq)
U-235: 0.03416 nCi (1.264 Bq)	Total Activity: 3.698 nCi (136.8 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4145 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED



**Isotope Products  
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

Ke-Calibrated 10/21/13  
 [α 5] New Exp Date  
 => 10/21/2014  
 PAI ID 00186  
 se calibration  
 received 186  
 3-28-03  
 JP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203025
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**Contained Radioactivity:**

U-234: 5.486 nCi (203.0 Bq)	Am-241: 3.958 nCi (146.4 Bq)
U-235: 0.09221 nCi (3.412 Bq)	Total Activity: 9.536 nCi (352.8 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 10690 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
 Quality Control

19-Mar-03  
 Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory  
 24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory  
 1800 North Keystone Street Burbank, California 91504



**Isotope Products  
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts  
Valencia, California 91355

Tel 661-309-1010  
Fax 661-257-8303

*Re-Calibrated 10/21/13*  
*α6* *New Exp Date*  
*⇒ 10/21/2014*  
*RAIO 00187*  
*rec'd for recalibration*  
*3-28-03 JP 10/22/13*

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW030603/R2155 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-Apr-03 12:00 PST <b>Source No.:</b> 92MIX2203022
---	---

**Contained Radioactivity:**

U-234: 3.592 nCi (132.9 Bq)	Am-241: 3.279 nCi (121.3 Bq)
U-235: 0.08556 nCi (3.166 Bq)	Total Activity: 6.957 nCi (257.4 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 7799 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsen*  
Quality Control

*19-Mar-03*  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

**Medical Imaging Laboratory**  
24937 Avenue Tibbitts Valencia, California 91355

**Industrial Gauging Laboratory**  
1800 North Keystone Street Burbank, California 91504

Re-Calibrated 10/21/13  
New Exp Date  
⇒ 10/21/2014  
α 7

PA ID 188  
recd for recalibration  
3-28-03 TP 10/21/13

## CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

<p><b>Radionuclide A:</b> U-234  <b>Radionuclide B:</b> U-235  <b>Radionuclide C:</b> Am-241  <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years  <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years  <b>Half Life (Am-241):</b> 432.17 ± 0.66 years</p>	<p><b>Customer:</b> PARAGON ANALYTICS, INC.  <b>P.O. No.:</b> EW030603/R2155  <b>Catalog No.:</b> MISC-STD  <b>Reference Date:</b> 1-Apr-03 12:00 PST  <b>Source No.:</b> 92MIX2203023</p>
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**Contained Radioactivity:**

<p>U-234: 2.895 nCi (107.1 Bq)          U-235: 0.02502 nCi (0.9257 Bq)</p>	<p>Am-241: 1.953 nCi (72.26 Bq)  <b>Total Activity:</b> 4.873 nCi (180.3 Bq)</p>
--	--

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.8%
B. Type B (systematic) uncertainty:	± 3.1%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain Implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 5463 α/min in 2π on 18 Mar 03.

*Daniel James Van Dalsem*  
Quality Control

19-Mar-03  
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Re-Calibrated 10/21/13  
28 New Exp Date  
 ⇒ 10/21/2014  
 PAI ID 189  
 rec'd 4-21-03  
 recalibrated 4-15-03  
 JP 10/22/13

## CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

<b>Radionuclide A:</b> U-234 <b>Radionuclide B:</b> U-235 <b>Radionuclide C:</b> Am-241 <b>Half Life (U-234):</b> (2.454 ± 0.006)E+05 years <b>Half Life (U-235):</b> (7.037 ± 0.011)E+08 years <b>Half Life (Am-241):</b> 432.17 ± 0.66 years	<b>Customer:</b> PARAGON ANALYTICS, INC. <b>P.O. No.:</b> EW040203/R2193 <b>Catalog No.:</b> MISC-STD <b>Reference Date:</b> 1-May-03 12:00 PST <b>Source No.:</b> 92MIX2203029
---	---

**Contained Radioactivity:**

U-234: 9.048 nCi (334.8 Bq)	Am-241: 1.433 nCi (53.02 Bq)
U-235: 0.1771 nCi (6.553 Bq)	Total Activity: 10.66 nCi (394.4 Bq)

**Physical description:**

A. Capsule type:	Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxides
C. Active Diameter:	19 mm
D. Backing:	Stainless steel
E. Cover:	None

**Radioimpurities:** Not determined

**Method of Calibration:**

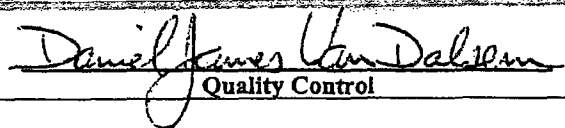
This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.5%
B. Type B (systematic) uncertainty:	± 3.0%
C. Uncertainty in aliquot weighing:	± 0.0%
D. Total uncertainty at the 99% confidence level:	± 3.0%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 11950 α/min in 2π on 11 Apr 03.

  
Quality Control

15-Apr-03  
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED



Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 10:15:08AM

Calibration Type: Efficiency

Energy Calibration: SOURCE 190\_10.21.13 (#9)

Description:

Source Info

Certificate ID: A9 RSO#190

Prepared by: IPL

Certification Date: 10/15/2013 10:00:00AM

Description:

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 8:31:19AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

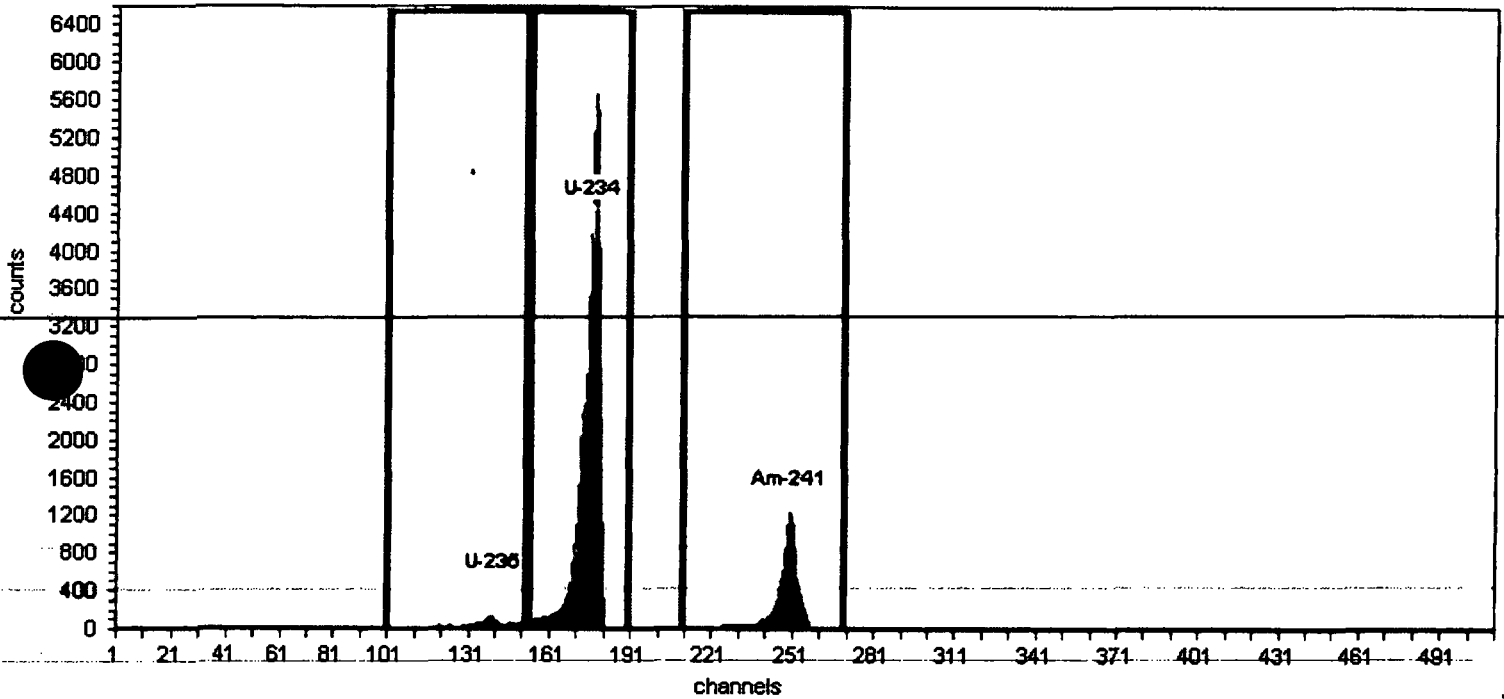
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Live Time: 35.00 min.

Real Time: 35.01 min.

Efficiency: 31.46% +/- 0.32% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 190\_10.21.13 (



Method: Interactive ROI

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,135.00	32.43
U-234	176	4.78	153	190	32,739.00	935.40
Am-241	249	5.49	210	270	7,686.00	219.60

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 10:15:34AM  
Calibration Type: Efficiency

Energy Calibration: SOURCE 182\_10.21.13 (#1)

Description:

Source Info

Certificate ID: A1 RSO#182

Prepared by: IPL

Certification Date: 5/1/2003 12:00:24PM

Description:

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 9:09:15AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

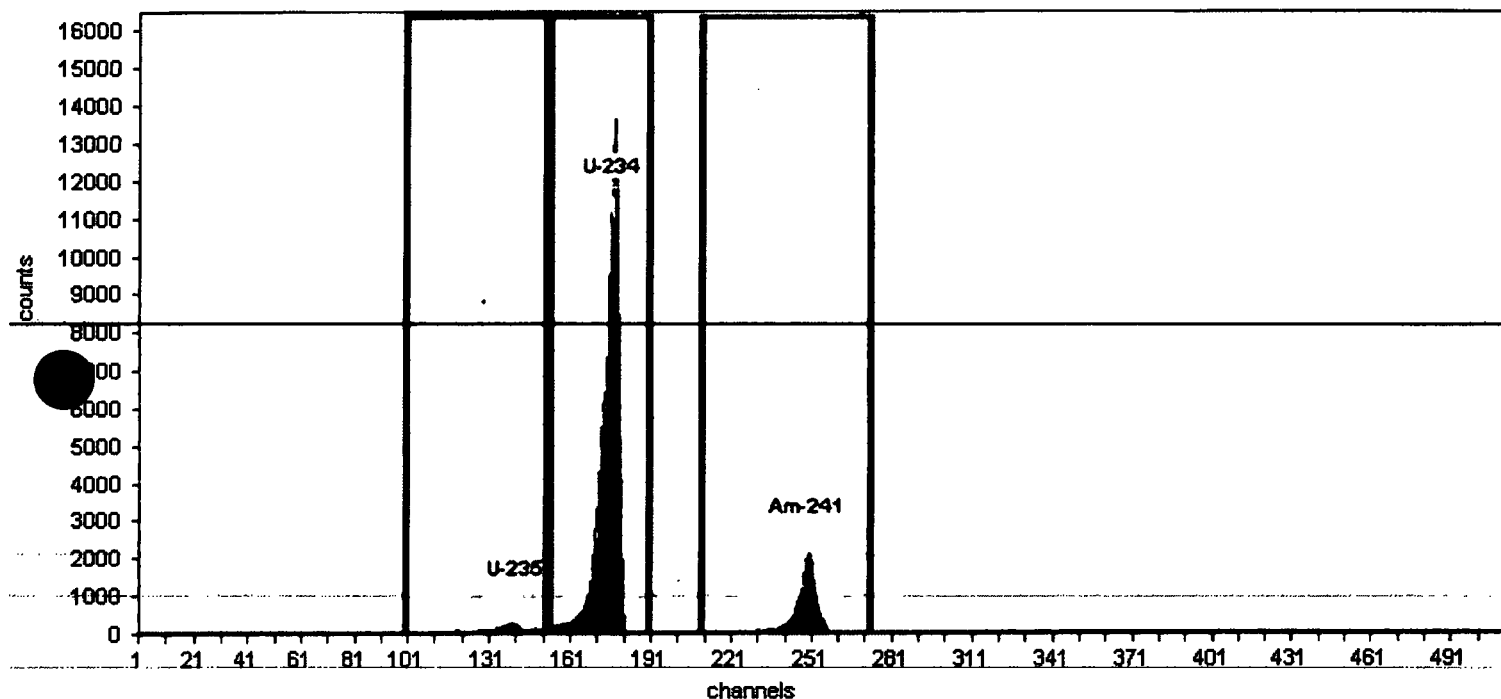
Real Time: 35.03 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 182\_10.21.13 (

Efficiency: 31.17% +/- 0.20% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,689.00	76.83
U-234	176	4.78	153	190	81,484.00	2,328.11
Am-241	249	5.49	210	273	13,543.00	386.94

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Energy Calibration: SOURCE 183\_10.21.13 (#2)

Description:

Analysis Date: 10/21/2013 10:39:26AM

Calibration Type: Energy And Efficiency

**Source Info**

Certificate ID: A2 RSO#183

Prepared by: IPL

Description:

Certification Date: 5/1/2003 12:00:00PM

**Acquisition**

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 9:48:00AM

Live Time: 35.00 min.

Real Time: 35.06 min.

Efficiency Calibration Name: SOURCE 183\_10.21.13 (

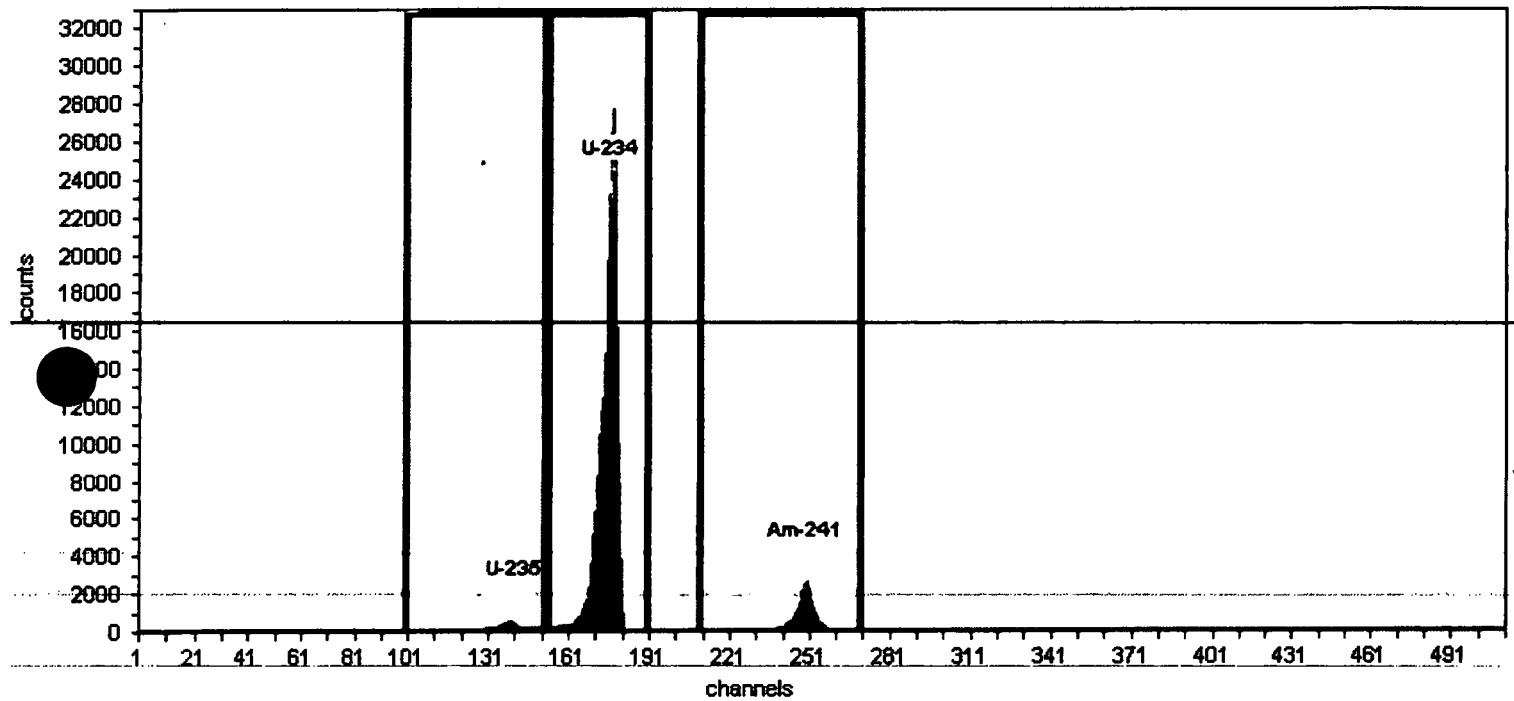
Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency: 31.40% +/- 0.15% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	4,155.00	118.71
U-234	176	4.78	153	190	156,715.00	4,477.57
Am-241	249	5.49	210	270	15,830.00	452.29

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Calibration

Energy Calibration: SOURCE 184\_10.21.13 (#3)

Description:

Analysis Date: 10/21/2013 11:08:15AM

Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A3 RSO#184

Prepared by: IPL

Description:

Certification Date: 5/1/2003 12:00:00PM

Acquisition

Detector: 13a, SN:

Acquisition Start Date: 10/21/2013 10:30:47AM

Live Time: 35.00 min.

Real Time: 35.05 min.

Energy Calibration Equation:

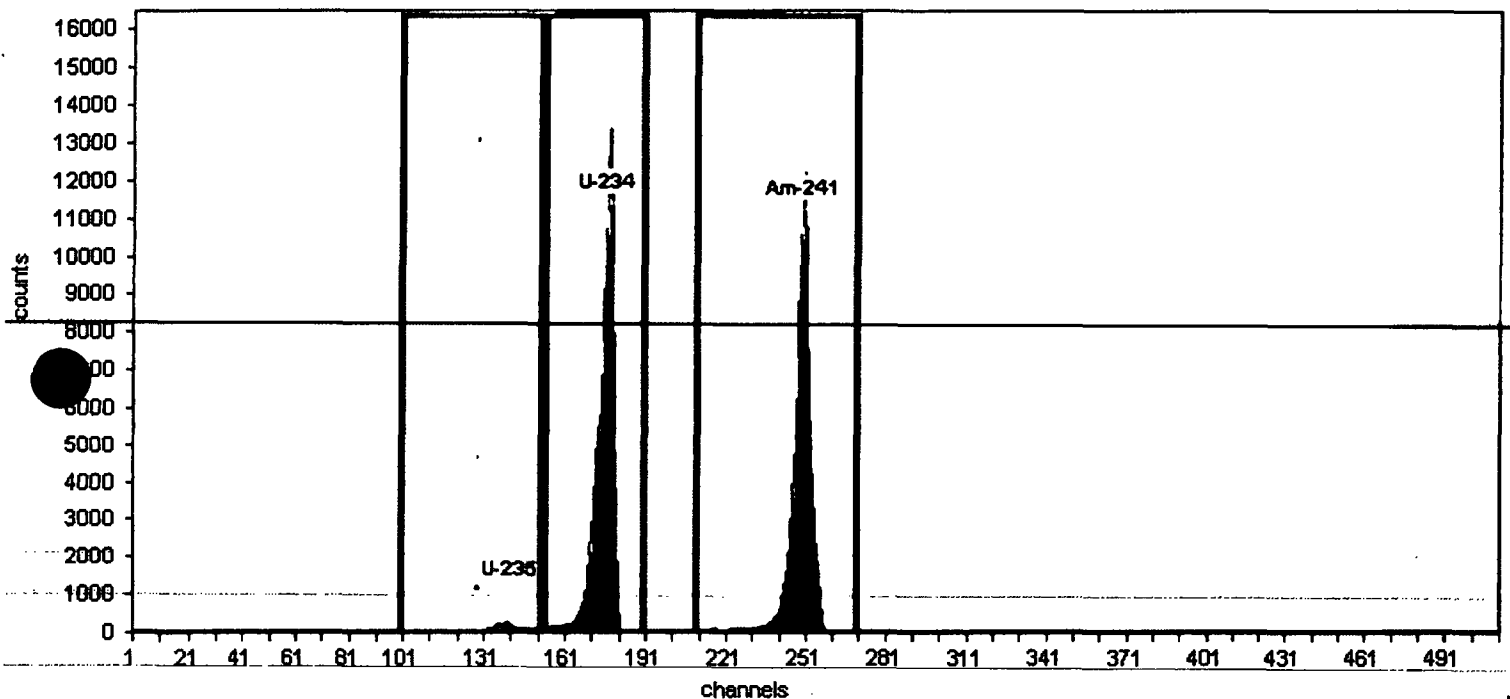
Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 184\_10.21.13 (

Efficiency: 31.06% +/- 0.16% TPU(2 sigma)



Method: Interactive ROI

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,052.00	58.63
U-234	176	4.78	153	190	74,298.00	2,122.80
Am-241	249	5.49	210	270	71,764.00	2,050.40

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 11:44:23AM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 185\_10.21.13 (#4)

Description:

**Source Info**

Certificate ID: A4 RSO#185

Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

**Acquisition**

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 11:08:08AM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Live Time: 35.00 min.

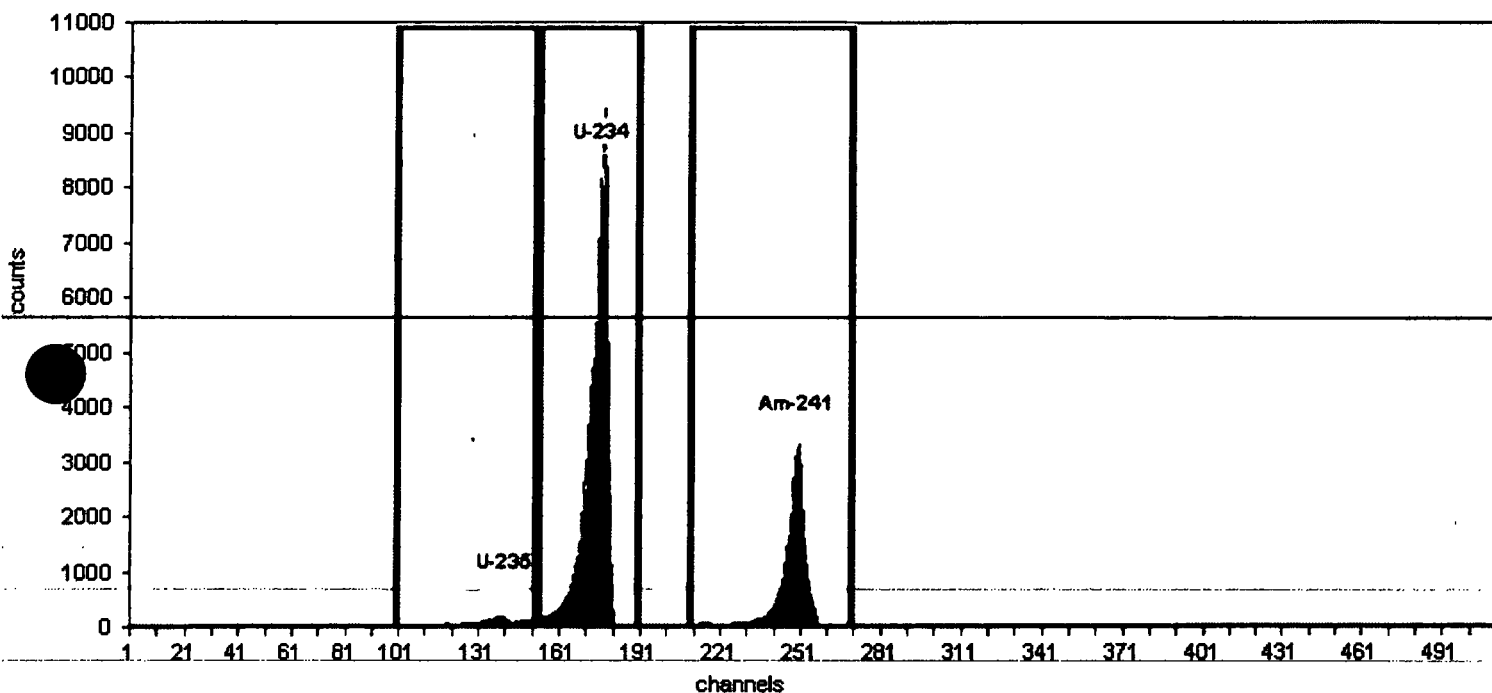
Real Time: 35.03 min.

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 185\_10.21.13 (

Efficiency: 30.07% +/- 0.21% TPU(2 sigma)



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,198.00	62.80
U-234	176	4.78	153	190	62,381.00	1,782.31
Am-241	249	5.49	210	270	22,944.00	655.54

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Analysis Date: 10/21/2013 12:20:40PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 186\_10.21.13 (#5)  
Description:

**Source Info**

Certification Date: 4/1/2003 12:00:00PM

Certificate ID: A5 RSO#186  
Prepared by: IPL

Description:

**Acquisition**

Detector: 13a , SN:  
Acquisition Start Date: 10/21/2013 11:45:31AM

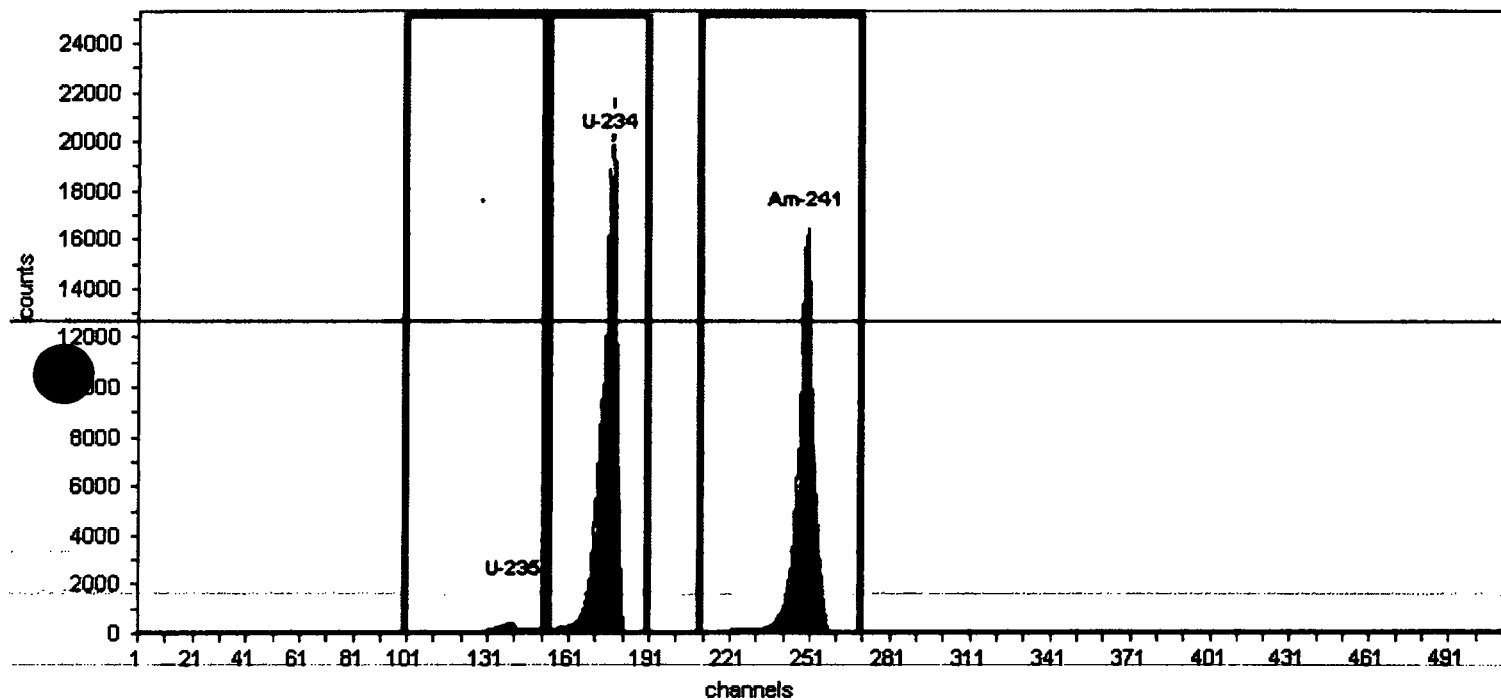
Energy Calibration Equation:  
Gain = 9.9575 keV / Ch

Live Time: 35.00 min.  
Real Time: 35.08 min.

Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 186\_10.21.13 (

Efficiency: 31.20% +/- 0.13% TPU(2 sigma)



Method: Manual (ROI)  
Algorithm: Linear

Initial Calibration: Yes  
Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	3,425.00	97.86
U-234	176	4.78	153	190	124,917.00	3,569.06
Am-241	249	5.49	210	270	103,302.00	2,951.49

JP 10/21/13

Analyst: ORTEC  
Detector: 13a

Calibration

Analysis Date: 10/21/2013 12:56:51PM  
Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 187\_10.21.13 (#6)  
Description:

Source Info

Certification Date: 4/1/2003 12:00:00PM

Certificate ID: A6 RSO#187  
Prepared by: IPL  
Description:

Acquisition

Detector: 13a, SN:  
Acquisition Start Date: 10/21/2013 12:21:22PM

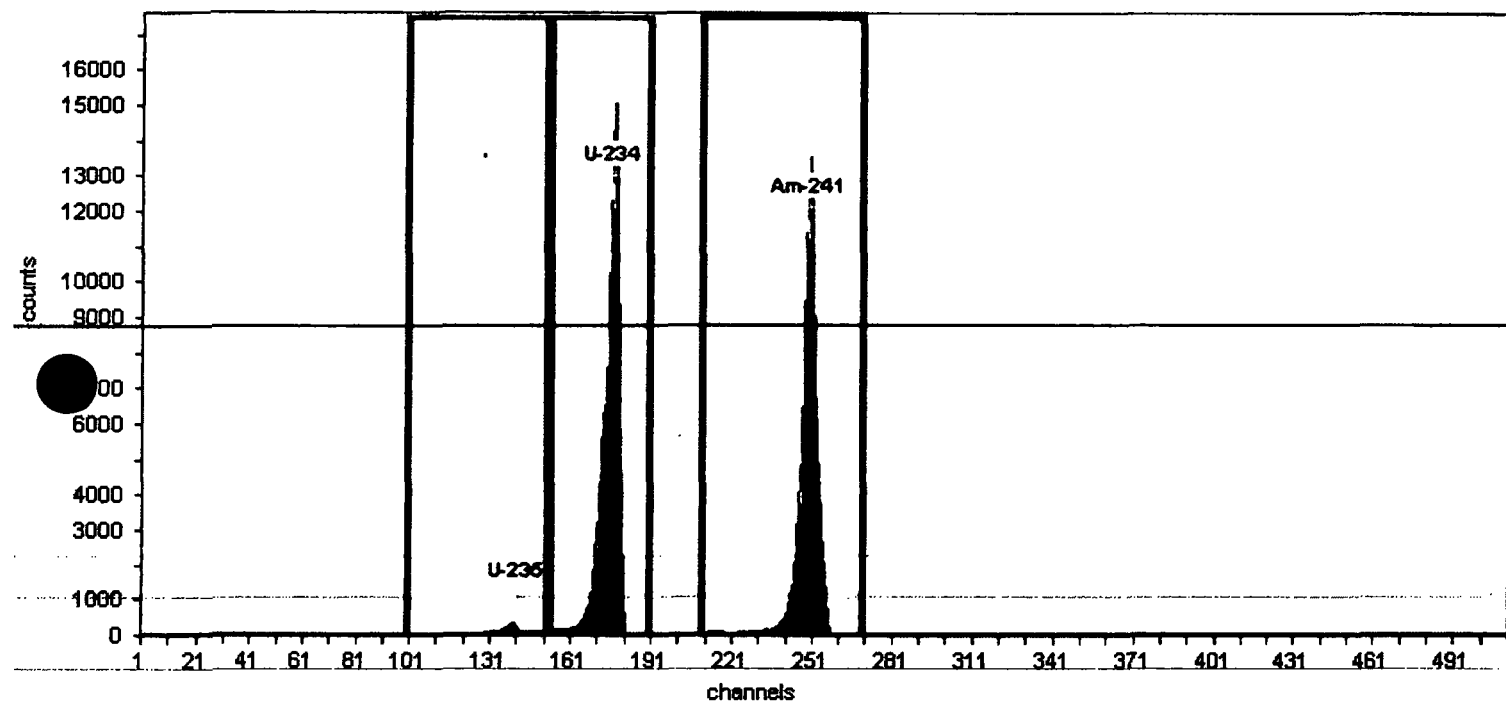
Energy Calibration Equation:  
Gain = 9.9575 keV / Ch

Live Time: 35.00 min.  
Real Time: 35.06 min.

Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 187\_10.21.13 (

Efficiency: 30.89% +/- 0.15% TPU(2 sigma)



Method: Manual (ROI)  
Algorithm: Linear

Initial Calibration: Yes  
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	2,349.00	67.11
U-234	176	4.78	153	190	84,490.00	2,414.00
Am-241	249	5.49	210	270	78,934.00	2,255.26

JP 10/21/13

Analyst: ORTEC

Detector: 13a

**Calibration**

Energy Calibration: SOURCE 188\_10.21.13 (#7)

Description:

Analysis Date: 10/21/2013 1:32:57PM  
Calibration Type: Energy And Efficiency

**Source Info**

Certificate ID: A7 RSO#188

Prepared by: IPL

Description:

Certification Date: 4/1/2003 12:00:00PM

**Acquisition**

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 12:57:17PM

Live Time: 35.00 min.

Real Time: 35.04 min.

Energy Calibration Equation:

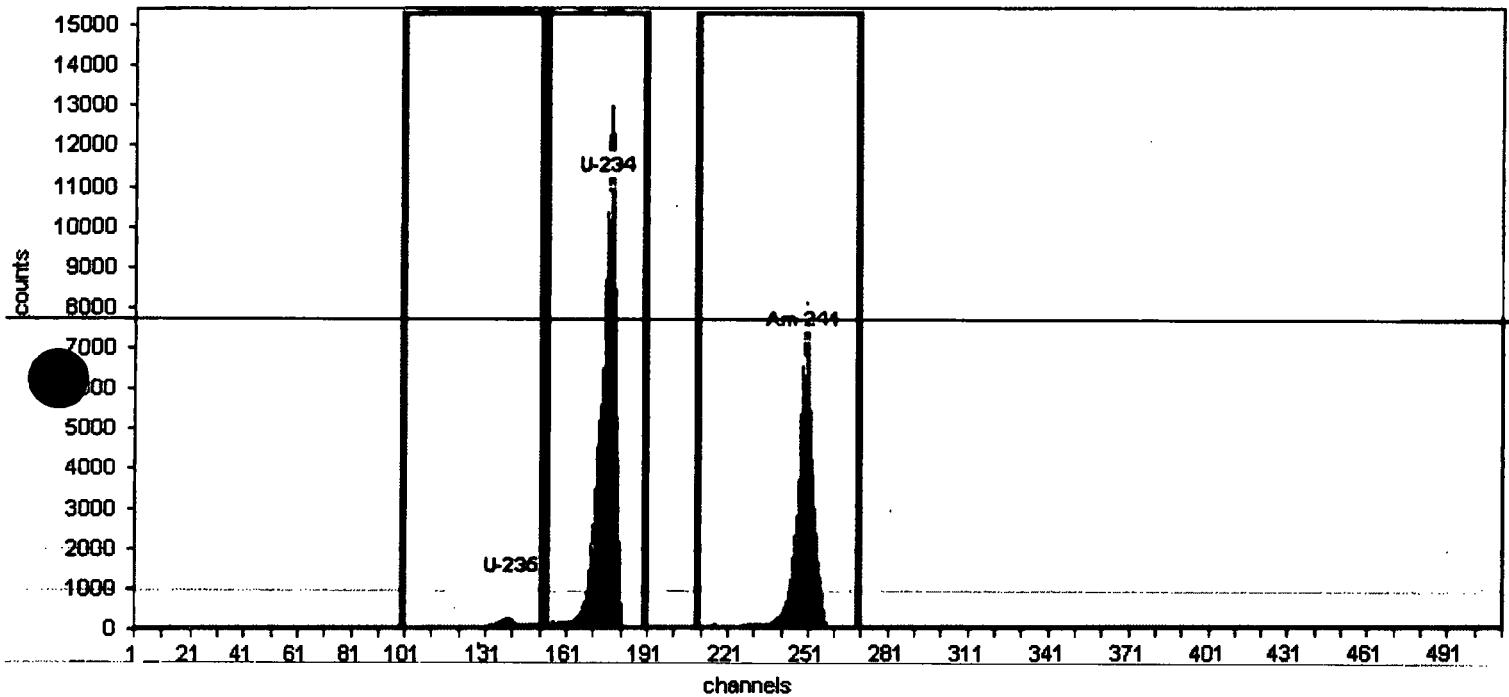
Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

Quadratic = 0.0000 keV / Ch<sup>2</sup>

Efficiency Calibration Name: SOURCE 188\_10.21.13 (

Efficiency: 31.50% +/- 0.19% TPU(2 sigma)



Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: Yes

Shelf: 0

**Nuclide Activity Summary**

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,847.00	52.77
U-234	176	4.78	153	190	71,762.00	2,050.34
Am-241	249	5.49	210	270	46,085.00	1,316.71

JP 10/21/13



Analyst: ORTEC

Detector: 13a

Calibration

Analysis Date: 10/21/2013 2:09:42PM

Calibration Type: Energy And Efficiency

Energy Calibration: SOURCE 189\_10.21.13 (#8)

Description:

Source Info

Certificate ID: A8 RSO#189

Prepared by: IPL

Certification Date: 4/1/2003 12:00:00PM

Description:

Acquisition

Detector: 13a , SN:

Acquisition Start Date: 10/21/2013 1:34:04PM

Energy Calibration Equation:

Gain = 9.9575 keV / Ch

Offset = 3,010.51 keV

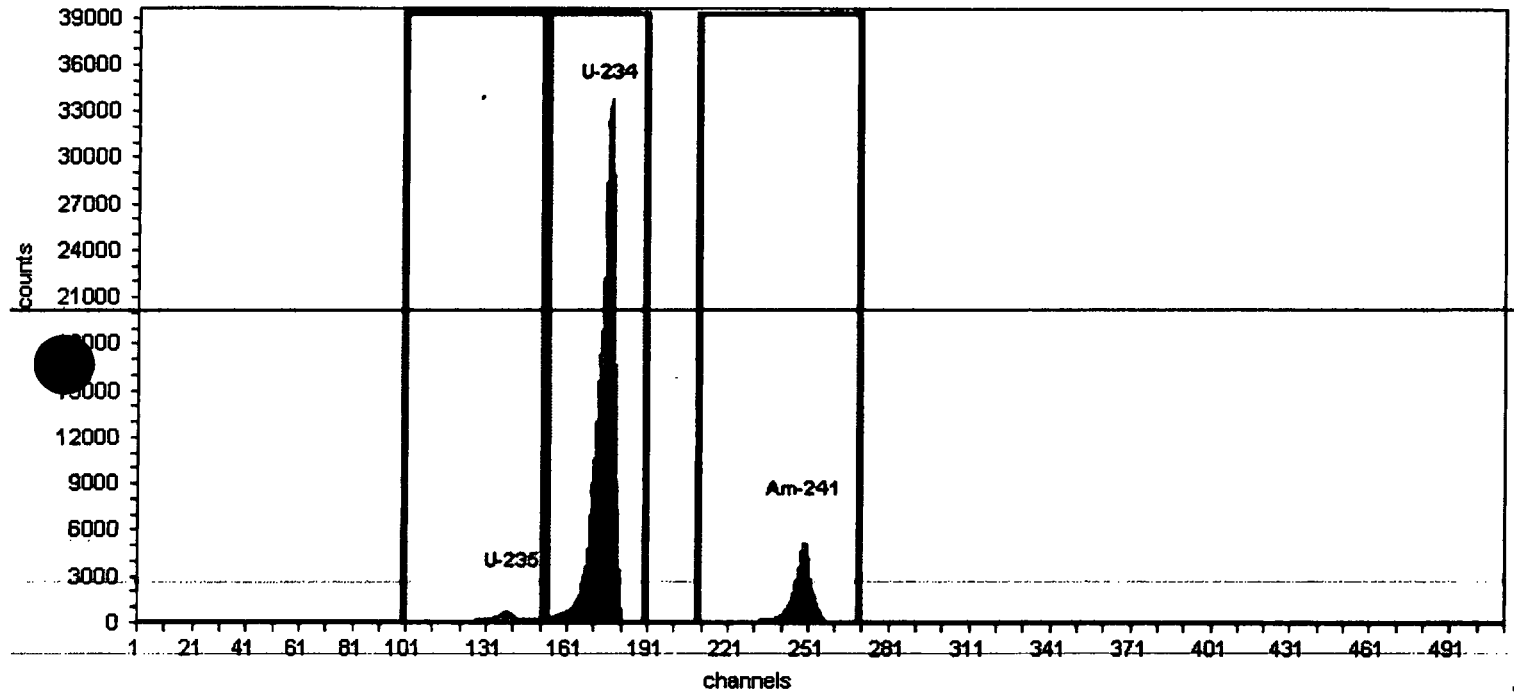
Quadratic = 0.0000 keV / Ch<sup>2</sup>

Live Time: 35.00 min.

Real Time: 35.09 min.

Efficiency: 31.23% +/- 0.12% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 189\_10.21.13 (



Method: Manual (ROI)

Initial Calibration: Yes

Algorithm: Linear

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	6,721.00	192.03
U-234	176	4.78	153	190	218,016.00	6,229.03
Am-241	249	5.49	210	270	34,624.00	989.26

JP 10/21/13

Analyst: ORTEC

Detector: 13a

Energy Calibration: SOURCE 190A\_10.21.13 (#9)  
Description:

Calibration

Analysis Date: 10/21/2013 2:45:56PM  
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A9 RSO#190  
Prepared by: IPL  
Description:

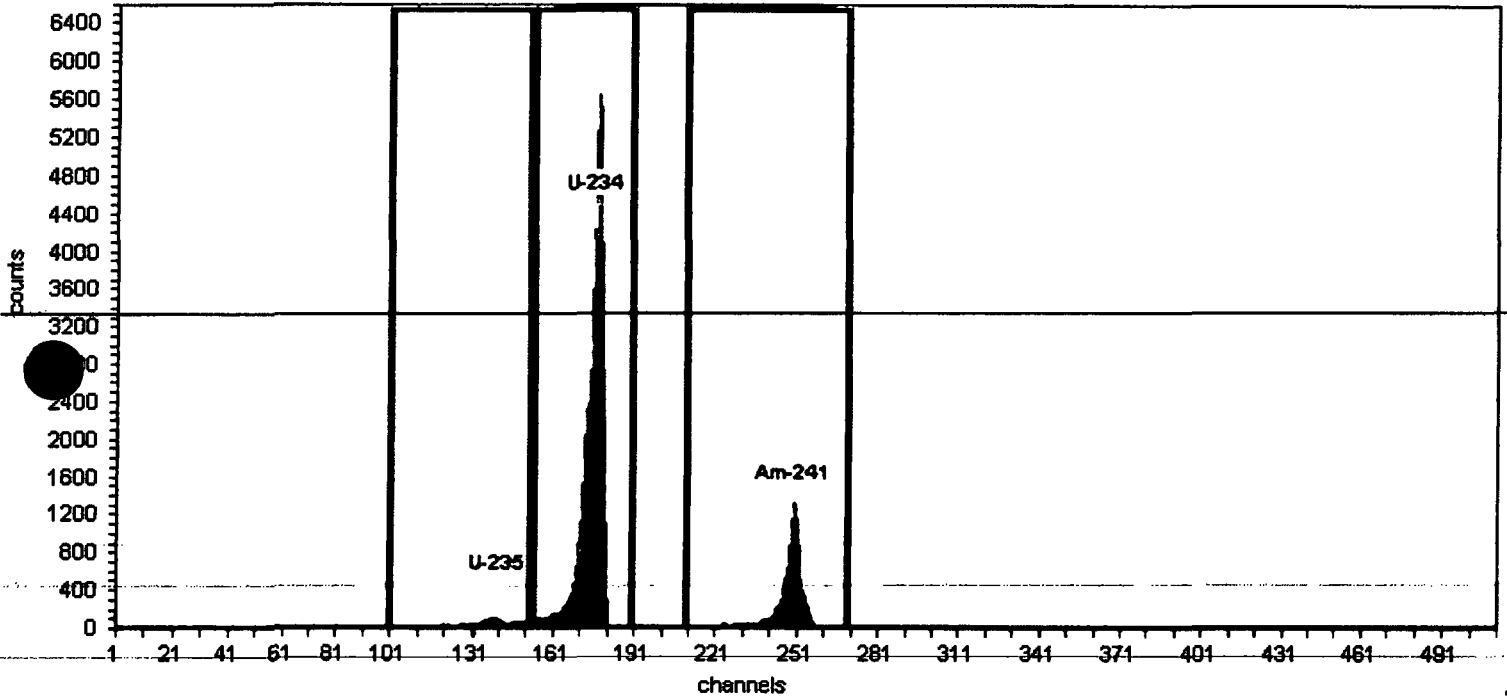
Certification Date: 10/15/2013 10:00:00AM

Acquisition

Detector: 13a , SN:  
Acquisition Start Date: 10/21/2013 2:10:16PM  
Live Time: 35.00 min.  
Real Time: 35.01 min.

Energy Calibration Equation:  
Gain = 9.9575 keV / Ch  
Offset = 3,010.51 keV  
Quadratic = 0.0000 keV / Ch<sup>2</sup>  
Efficiency: 31.69% +/- 0.32% TPU(2 sigma)

Efficiency Calibration Name: SOURCE 190A\_10.21.13



Method: Manual (ROI)  
Algorithm: Linear

Initial Calibration: Yes  
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	140	4.40	100	152	1,155.00	33.00
U-234	176	4.78	153	190	32,933.00	940.94
Am-241	249	5.49	210	270	7,807.00	223.06

JP 10/21/13

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**Attachment E**  
**Photo Logs and Photographs**

## **ATTACHMENT E. PHOTO LOGS AND PHOTOGRAPHS**

Photographs were taken before and during field activities for the effluent air sampling at Schofield Barracks. Photographs were taken to document the setup of the air monitors, sample location, HE activities, and plume behavior.

Photo Logs

<b>Site Location:</b>	Schofield Barracks	
<b>Date:</b>	2/3/2014 to 2/12/2014	
<b>Photographer:</b>	Stephan Owe	
<b>Photo #</b>	<b>Date</b>	<b>Comments</b>
001-ASLOC01	2/4/2014	AS-01 - BAX Area 3 Mover
002-ASLOC01	2/4/2014	AS-01 - BAX Area 3 Mover
003-ASLOC02	2/4/2014	AS-02 - BAX Area 3 Mover
004-ASLOC03	2/4/2014	AS-03 - KR-3 Tower
005-ASLOC03	2/4/2014	AS-03 - KR-3 Tower
006-ASLOC03	2/4/2014	AS-03 - KR-3 Tower
007-ASLOC04	2/4/2014	AS-04 - KR-5 Area
008-ASLOC04	2/4/2014	AS-04 - KR-5 Area
009-ASLOC05	2/4/2014	AS-05 - CR-2 Tower
010-ASLOC05	2/4/2014	AS-05 - CR-2 Tower
011-ASLOC05	2/4/2014	AS-05 - CR-2 Tower
012-ASLOC06	2/4/2014	AS-06 - Fire Break Road
013-ASLOC06	2/4/2014	AS-06 - Fire Break Road
014-ASLOC07	2/4/2014	AS-07 - Fire Break Road
015-ASLOC07	2/4/2014	AS-07 - Fire Break Road
016-ASLOC08	2/4/2014	AS-08 - Fire Break Road
017-ASLOC08	2/4/2014	AS-08 - Fire Break Road
018-ASLOC09	2/4/2014	AS-09 - Fire Break Road
019-ASLOC09	2/4/2014	AS-09 - Fire Break Road
020-ASLOC10	2/4/2014	AS-10 - Fire Break Road
021-ASLOC10	2/4/2014	AS-10 - Fire Break Road
022-ASLOC11	2/4/2014	AS-11 - Fire Break Road
023-ASLOC11	2/4/2014	AS-11 - Fire Break Road
024-ASLOC11	2/4/2014	AS-11 - Fire Break Road
025-FIREBREAK	2/4/2014	Fire Break Road facing South towards BAX
026-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 1.1
027-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 1.2
028-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 1.3
029-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 2.1
030-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 2.2
031-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 3.1
032-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 3.2
033-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 3.3
034-AREA6HE	2/6/2014	Area 6 - HE Impact - Time Elapsed Photo 3.4
035-AREA6HE	2/10/2014	Area 6 - HE Impact - Time Elapsed Photo 4.1
036-AREA6HE	2/10/2014	Area 6 - HE Impact - Time Elapsed Photo 4.2
037-AREA6HE	2/10/2014	Area 6 - HE Impact - Time Elapsed Photo 4.3

Photographs





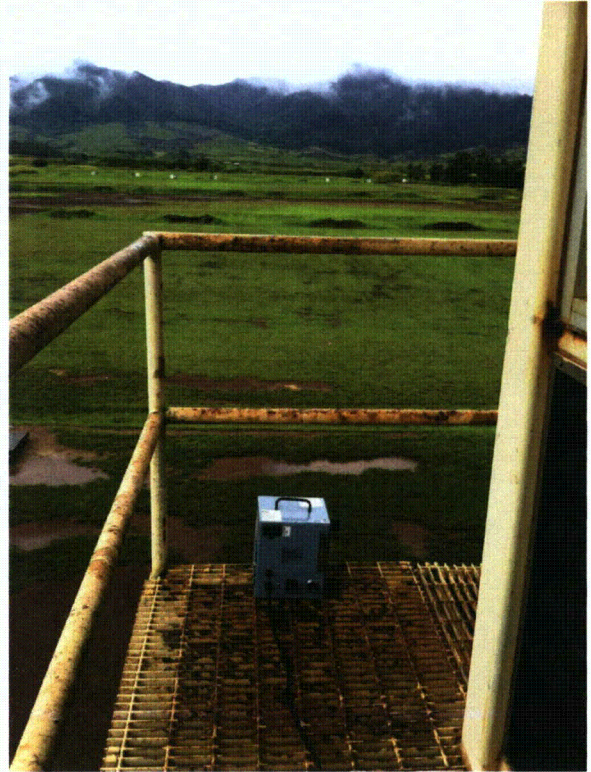
001-ASLOC01



002-ASLOC01



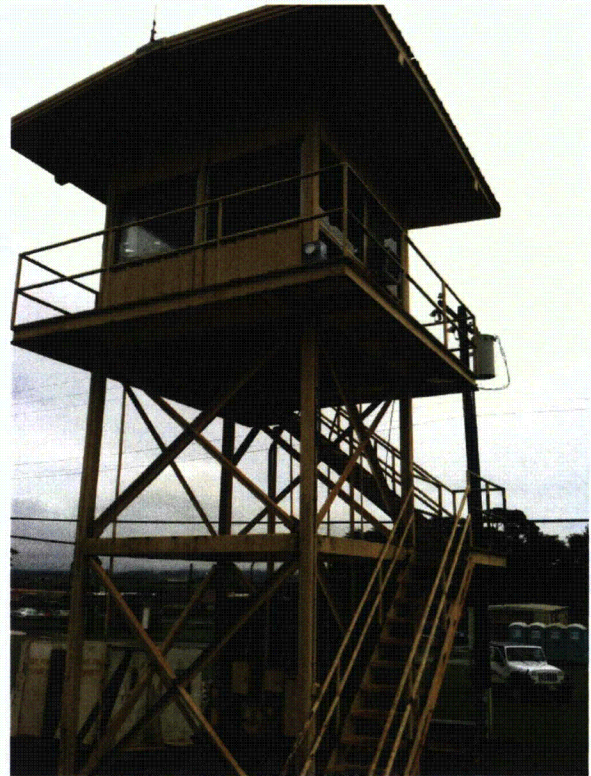
003-ASLOC02



004-ASLOC03



005-ASLOC03



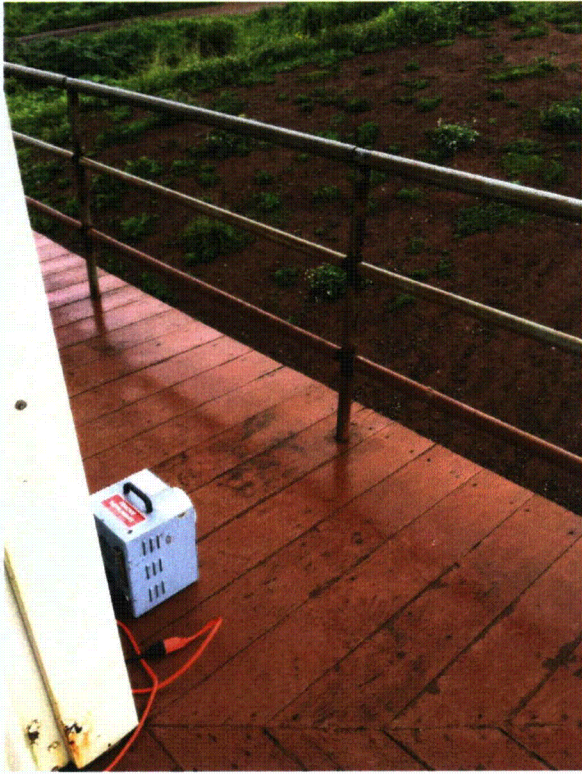
006-ASLOC03



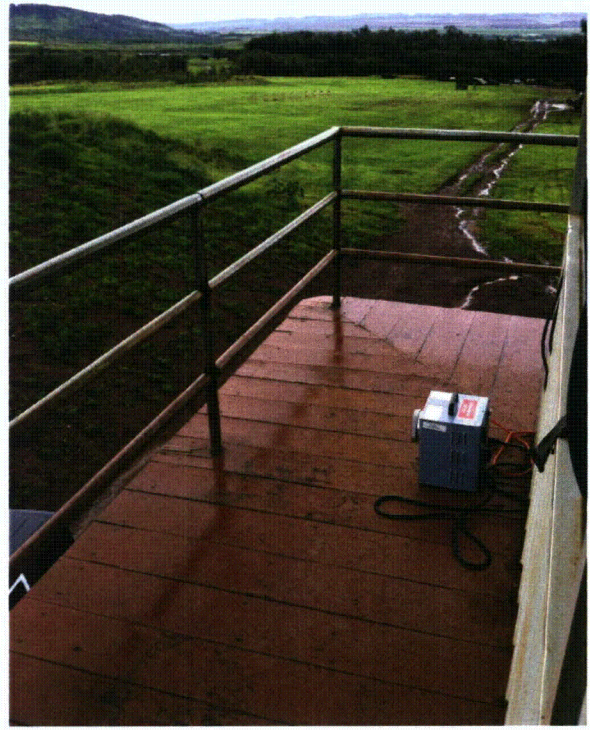
007-ASLOC04



008-ASLOC04



009-ASLOC05



010-ASLOC05



011-ASLOC05



012-ASLOC06



013-ASLOC06



014-ASLOC07



015-ASLOC07



016-ASLOC08



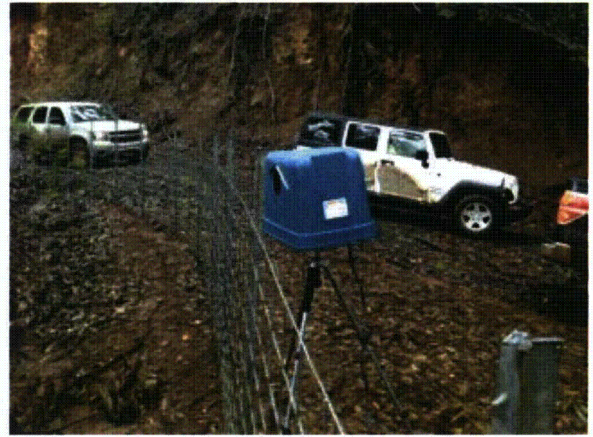
017-ASLOC08



018-ASLOC09



019-ASLOC09



020-ASLOC10



021-ASLOC10



022-ASLOC11



023-ASLOC11



024-ASLOC11



025-FIREBREAK



026-AREA6HE



027-AREA6HE



028-AREA6HE



029-AREA6HE



030-AREA6HE



031-AREA6HE



032-AREA6HE



033-AREA6HE



034-AREA6HE



035-AREA6HE



036-AREA6HE



037-AREA6HE

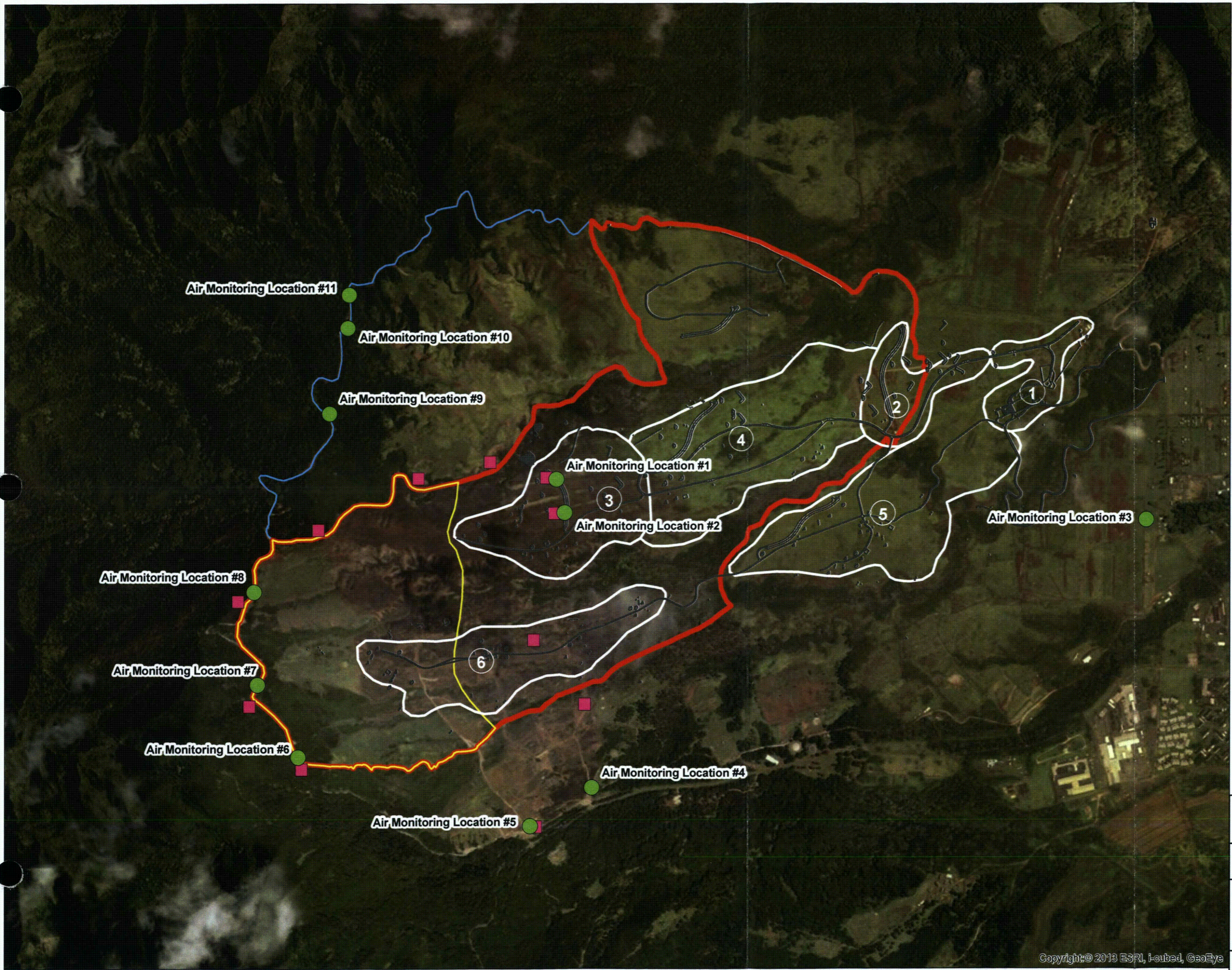


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**Attachment F**  
**Map Packages**

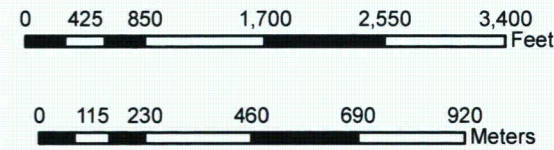
## **ATTACHMENT F. MAP PACKAGES/FIGURES**

Included in this attachment are the figures that were generated during this investigation. The map packages, or GIS files that were used to generate these figures are included electronically on a disc.



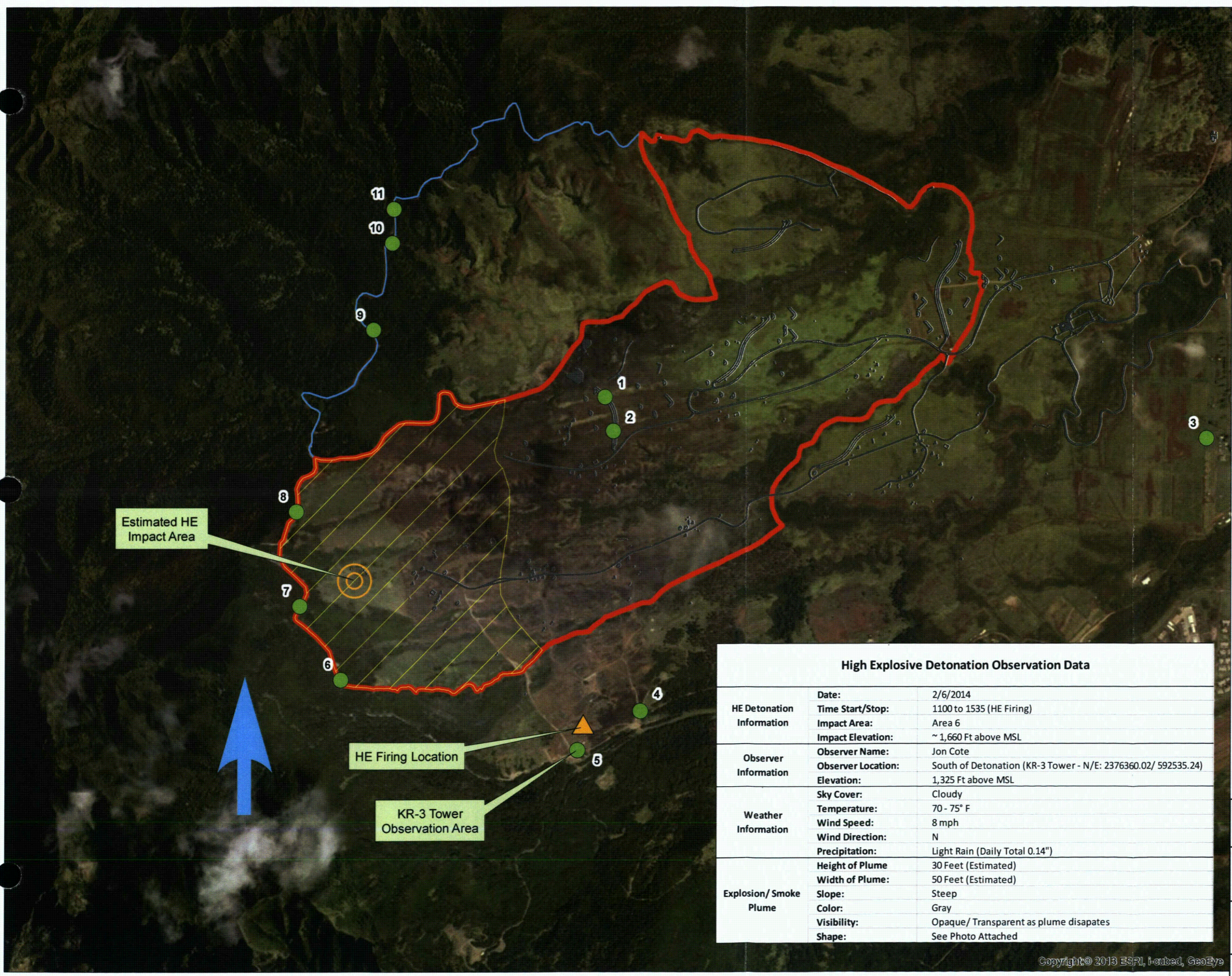
**Legend**

- Air Monitoring Locations: 2/4/14
- Propopsed Air Monitoring Locations
- Construction Footprint (SP)
- Areas 1, 2, 3, 4, 5 and 6
- Planned area where the controlled HE detonation is to take place
- Radiologically Controlled Area
- Fire Break Road

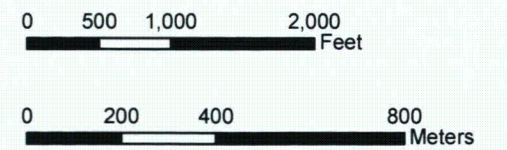


Air Monitoring Locations - February 2014

SCHOFIELD AREA BRAVO  
ISLAND OF OAHU



- Estimated HE Impact Location
- HE Firing Location
- Wind Direction
- Air Monitoring Locations
- HE Detonation Area
- Radiologically Controlled Area
- Construction Footprint
- Fire Break Road



**HIGH EXPLOSIVE  
DETONATION OBSERVATION  
06 FEBRUARY, 2014**

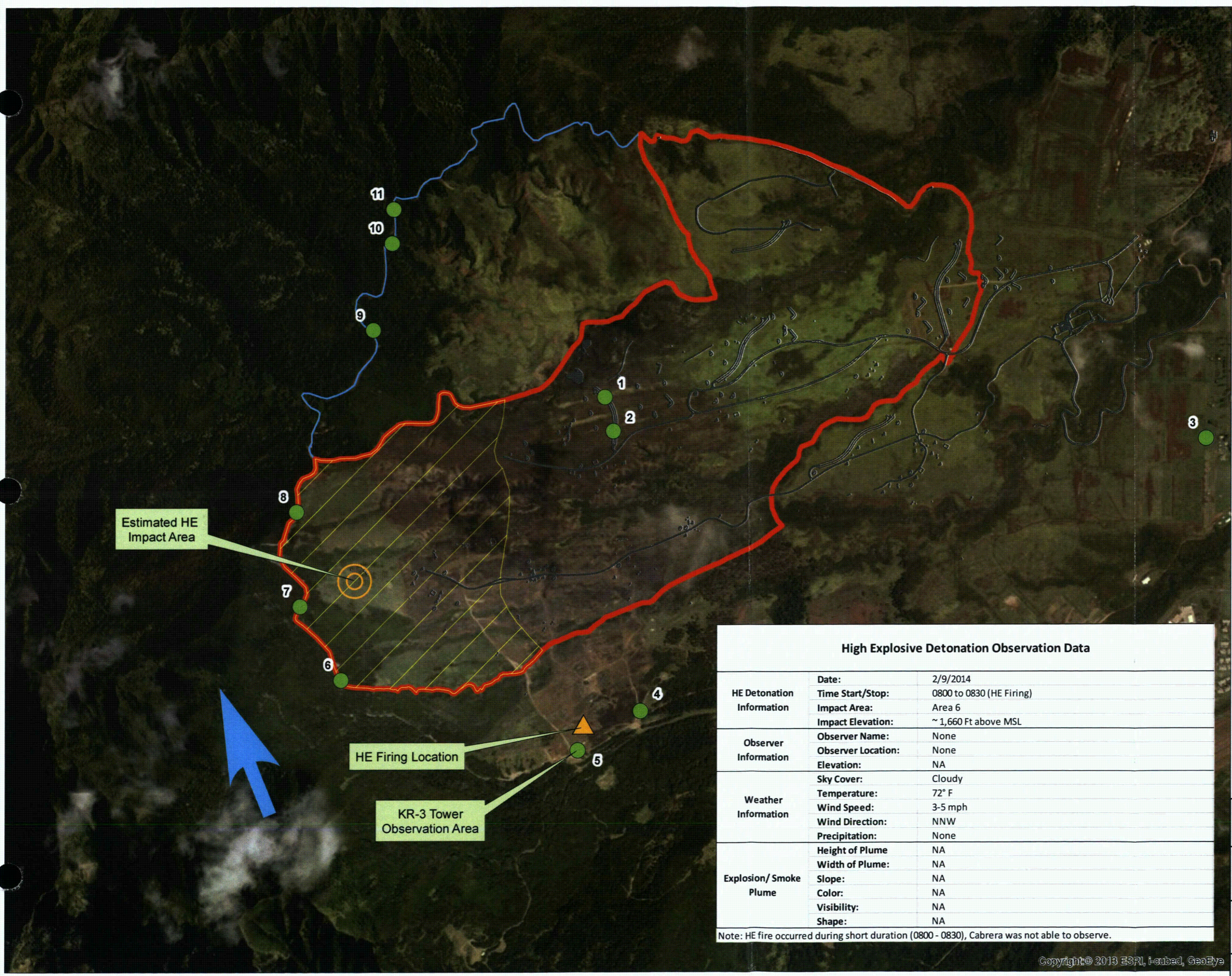
**SCHOFIELD AREA BRAVO  
ISLAND OF OAHU**

High Explosive Detonation Observation Data		
HE Detonation Information	Date:	2/6/2014
	Time Start/Stop:	1100 to 1535 (HE Firing)
	Impact Area:	Area 6
Observer Information	Impact Elevation:	~ 1,660 Ft above MSL
	Observer Name:	Jon Cote
	Observer Location:	South of Detonation (KR-3 Tower - N/E: 2376360.02/ 592535.24)
Weather Information	Elevation:	1,325 Ft above MSL
	Sky Cover:	Cloudy
	Temperature:	70 - 75° F
	Wind Speed:	8 mph
Explosion/ Smoke Plume	Wind Direction:	N
	Precipitation:	Light Rain (Daily Total 0.14")
	Height of Plume:	30 Feet (Estimated)
	Width of Plume:	50 Feet (Estimated)
	Slope:	Steep
	Color:	Gray
Explosion/ Smoke Plume	Visibility:	Opaque/ Transparent as plume disapates
	Shape:	See Photo Attached

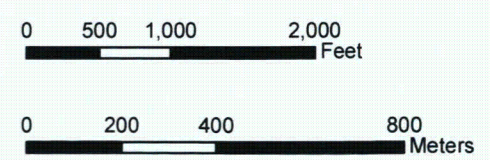
Estimated HE Impact Area

HE Firing Location

KR-3 Tower Observation Area



- Estimated HE Impact Location
- HE Firing Location
- Wind Direction
- Air Monitoring Locations
- HE Detonation Area
- Radiologically Controlled Area
- Construction Footprint
- Fire Break Road

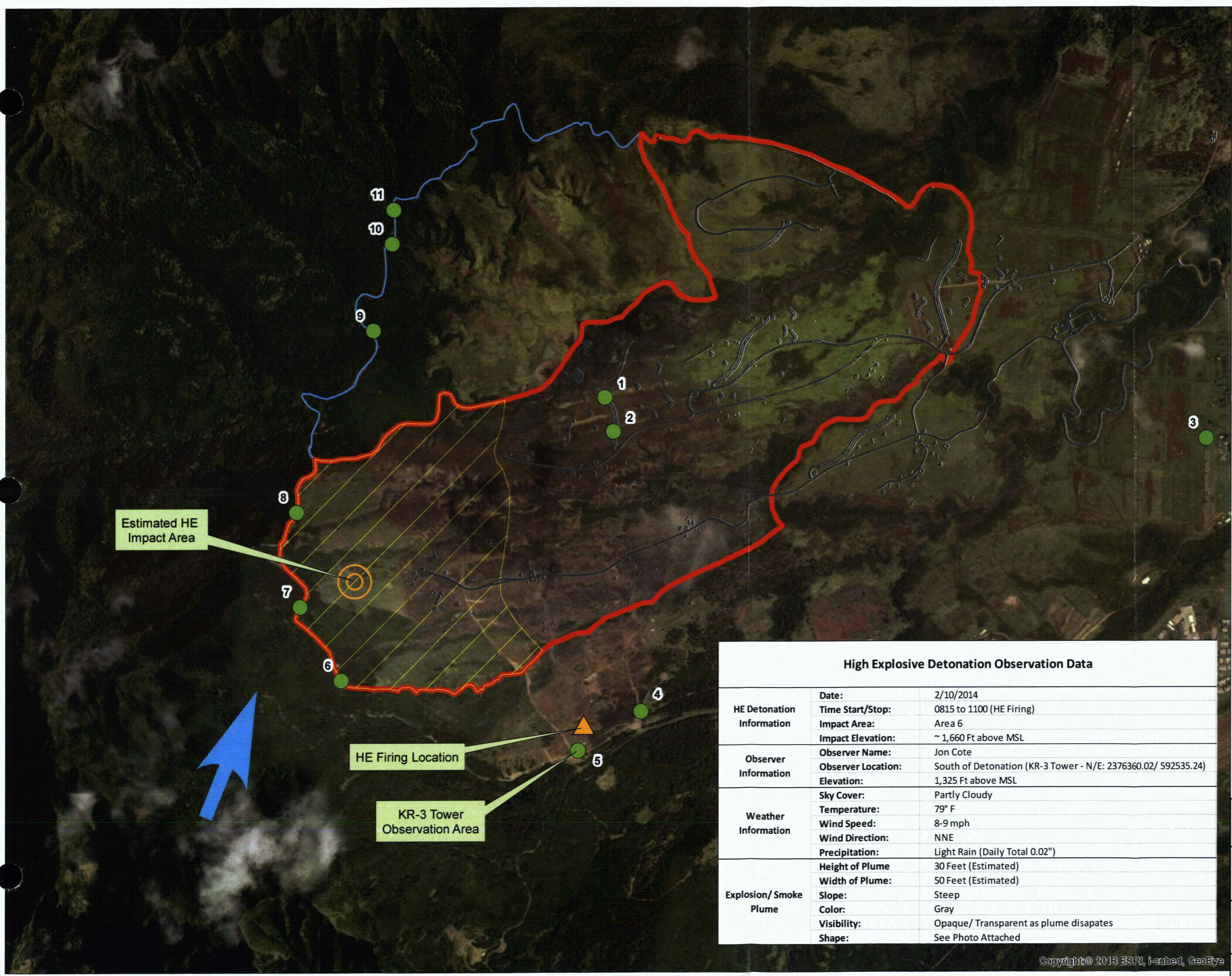


**HIGH EXPLOSIVE  
DETONATION OBSERVATION  
09 FEBRUARY, 2014**

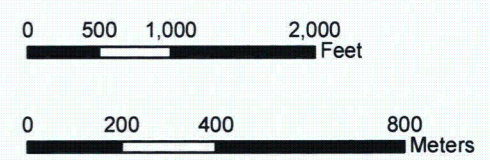
**SCHOFIELD AREA BRAVO  
ISLAND OF OAHU**

High Explosive Detonation Observation Data		
HE Detonation Information	Date:	2/9/2014
	Time Start/Stop:	0800 to 0830 (HE Firing)
	Impact Area:	Area 6
	Impact Elevation:	~1,660 Ft above MSL
Observer Information	Observer Name:	None
	Observer Location:	None
	Elevation:	NA
Weather Information	Sky Cover:	Cloudy
	Temperature:	72° F
	Wind Speed:	3-5 mph
	Wind Direction:	NNW
Explosion/ Smoke Plume	Precipitation:	None
	Height of Plume:	NA
	Width of Plume:	NA
	Slope:	NA
	Color:	NA
	Visibility:	NA
	Shape:	NA

Note: HE fire occurred during short duration (0800 - 0830), Cabrera was not able to observe.



- Estimated HE Impact Location
- HE Firing Location
- Wind Direction
- Air Monitoring Locations
- HE Detonation Area
- Radiologically Controlled Area
- Construction Footprint
- Fire Break Road



**HIGH EXPLOSIVE  
DETONATION OBSERVATION  
10 FEBRUARY, 2014**

**SCHOFIELD AREA BRAVO  
ISLAND OF OAHU**

High Explosive Detonation Observation Data		
HE Detonation Information	Date:	2/10/2014
	Time Start/Stop:	0815 to 1100 (HE Firing)
	Impact Area:	Area 6
	Impact Elevation:	~ 1,660 Ft above MSL
Observer Information	Observer Name:	Jon Cote
	Observer Location:	South of Detonation (KR-3 Tower - N/E: 2376360.02/ 592535.24)
Weather Information	Elevation:	1,325 Ft above MSL
	Sky Cover:	Partly Cloudy
	Temperature:	79° F
	Wind Speed:	8-9 mph
	Wind Direction:	NNE
Explosion/ Smoke Plume	Precipitation:	Light Rain (Daily Total 0.02")
	Height of Plume:	30 Feet (Estimated)
	Width of Plume:	50 Feet (Estimated)
	Slope:	Steep
	Color:	Gray
	Visibility:	Opaque/ Transparent as plume disappates
Shape:	See Photo Attached	

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**Attachment G**  
**Ammo Utilization Reports**

## **ATTACHMENT G. AMMO UTILIZATION REPORTS**

Included in this attachment are the reports that list the type and quantity of ammunition used during this training exercise.

DAILY TRAINING AMMUNITION BY DODIC REPORT

END DATE: 06/02/2014

FIRE DESK: SCHOFIELD BARRACKS

DODIC	Description	Quantity Fired	DUD
111	CTG 12 GAGE SHOTGUN #00 BUCKSHOT M19	1	0
159	CTG 5.56MM BALL M855 F/M16A2 RIFLE	5500	0
163	CTG 9MM M882 BALL (NEW)	5000	0
115	CTG 60MM FULL RANGE PRACTICE M769	2	0
109	CTG 120MM FULL RANGE PRACTICE (FRP) M931 F/MORTAR	6	0
145	CTG MORTAR, 120MM HE XM1101 EFSS	8	0
156	CORD DETONATING REINFORCED PLIOFILM WRAPPED WTRPRF	1	0

REPORT TOTAL 10,518

DUDIC	Description	Quantity Fired	DUD
159	CTG 5.56MM BALL M855 F/M16A2 RIFLE	8330	0
162	CTG 5.56MM BALL M855 LINKED W/M27 LINKS	7706	0
175	CTG 5.56MM BLANK W/M27 LINKS (SAWS)	2500	0
180	CTG 5.56MM BLANK M200 F/RIFLE M16	4370	0
11	CTG 7.62MM BLANK M82 LINKED GRADE MG	3200	0
43	CTG 7.62MM BALL M80 LINKED F/MG M60 M73	2550	0
187	CTG CAL.50 LINKED 4 API M8 1 API-T M20	1600	0
102	CTG CAL.50 PLASTIC LINKED 4 BALL M858 1 TR M860	1900	0
119	CTG 40MM PRACTICE M781 W/WO/FUZE F/GRENADE LAUNCHED	60	0
125	CTG 120MM ILLUM XM930 W/MTSQ FZ M776 F/MORTAR M120	9	0
104	120MM MORTAR HE M934A1	1	0
109	CTG 120MM FULL RANGE PRACTICE (FRP) M931 F/MORTAR	22	0
145	CTG MORTAR, 120MM HE XM1101 EFSS	25	0
180	GRENADE HAND FRAG M61 W/FUZE M204A2 W/SAFETY CLIP	21	0

J1AL TRAINING AMMUNITION BY DODIC REPORT

END DATE: 10/02/2014

FIRE DESK: SCHOFIELD BARRACKS

DDIC	Description	Quantity Fired	DUD
345	GRENADE HAND M18 YELLOW SMOKE W/FUZE M201A1	6	0

REPORT TOTAL 32,300

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