ALS Paragon

Isotopic Americium

Case Narrative

Los Alamos National Laboratory SMO

Rock -- 09-476

Work Order Number: 0812153

1. This report consists of the analytical results and supporting documentation for one solid sample received by ALS Paragon on 12/16/2008.

2. This sample was prepared according to procedures SOP773R10, SOP778R12, and SOP751R2. Modifications were made to the method as described in QASS #365782. Due to activity seen in prescreen, the sample was prepared at a reduced aliquot of ~0.25gram.

3. The sample was analyzed for the presence of ^{241}Am according to procedure SOP714R11. The analysis was completed on 01/28/2009.

4. The isotopic analysis results for this sample are reported on an 'as received' basis in units of pCi/gram.

5. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate.

6. The associated method blank was prepared at a reduced aliquot to facilitate accurate comparison with the sample. Consequently, the requested MDC of 0.02 pCi/gram was not achieved following a standard count time of 300 minutes. The achieved MDC for the method blank is less than one fifth the activity for the associated sample. The sample is identified with an "M" flag on the final reports.

7. The requested MDC of 0.02 pCi/gram was not met for sample 0812153-1. The reported activity for this sample is greater than the achieved MDC. This sample is identified with an "M3" flag on the final reports.

8. No further anomalous situations were encountered during the preparation or analysis of this sample. 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 Paragon certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Jean Anderson — 2/5/09
Jean Anderson
Radiochemistry Primary Data Reviewer
Date

2/5/09
Radiochemistry Final Data Reviewer
Date

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CHAIN OF CUSTODY

ALS Paragon

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0812153
Client Name: Los Alamos National Laboratory SMO
Client Project Name: Rock
Client Project Number: 09-476
Client PO Number: 33204-001-06 F3

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
CAPU-09-1656	0812153-1		SOLID	09-Dec-08	

0812153

Wednesday, December 10, 2008

REQUEST NUMBER: 09-476

LOS ALAMOS
NATIONAL LABORATORY

ATTN: Lance Steere
Paragon Analytics, Inc.
225 Commerce
Fort Collins, CO 80524

These Samples are on:
LANL Request Number:09-476
Per Agreement Number:1-800-443-1511
Project Cost Code: WEPR13110300

Please analyse the enclosed samples according to the schedule indicated:

SHIP DATE: 12/10/2008
TURNAROUND/REPORT DUE: 1/9/2009
TURNAROUND REQ'D: 30 Days

RAD SCREENING: Unscreened
LAB REQUEST COMMENTS: Please Send results, invoice and questions to Keith greene at LANL.

LANL ER SMO CONTACT:
Signature:

PRIORITY	METHOD CODE	CNTNR	SAMPLE ID	SAMPLE MATRIX	DATE SAMPLED	SAMPLE COMMENTS	SPECIAL INSTRUCTIONS
	EPA:901.1	1	CAPU-09-1656	S	12/9/2008		
	EPA:905.0	1	CAPU-09-1656	S	12/9/2008		
	HASL-300:AM-241	1	CAPU-09-1656	S	12/9/2008		
	HASL-300:ISOPU	1	CAPU-09-1656	S	12/9/2008		
	HASL-300:ISOU	1	CAPU-09-1656	S	12/9/2008		

Final Page of REQUEST NUMBER 09-476

0812153

Wednesday, December 10, 2008

LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 09-476C

REQUEST NUMBER: 09-476

LOS ALAMOS

NATIONAL LABORATORY

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 1/9/2009

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS: Please Send results, invoice and questions to Keith greene at LANL.

	SAMPLE ID	CTNR	CTNR DESC	ORDER	PRESERV	MATRIX
1	CAPU-09-1656	1	1 L POLY	AM241+GS+ISOPU+ISOU+SR90	None	S

Relinquished By:		Date	Time	Received By:		Date	Time
M. Kaltofen	[signature]	Dec. 15, 2008	10 AM	Cheryl Trimble	Cheryl Trimble	12-16-08	1015
Printed Name	Signature			Printed Name	Signature		
Printed Name	Signature			Printed Name	Signature		
Printed Name	Signature			Printed Name	Signature		

Received for DISPOSAL By:		Date	Time	Remarks:
Printed Name	Signature			

CONDITION OF SAMPLE UPON RECEIPT FORM **Paragon Analytics**

Client: LANL Workorder No: 0812153

Project Manager: LS Initials: CDT Date: 12-16-08

1.	Does this project require any **special handling** in addition to standard Paragon procedures?		YES	NO
2.	Are custody **seals** on **shipping containers** intact?	NONE	YES	NO
3.	Are Custody seals on **sample containers** intact?	NONE	YES	NO
4.	Is there a **COC (Chain-of-Custody) present** or other representative documents?		YES	NO
5.	Are the **COC and bottle labels complete and legible**?	CT 12-16-08	~~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	NO
7.	Were **airbills / shipping documents** present and/or removable?	DROP OFF	YES	NO
8.	Are all aqueous **samples requiring preservation preserved correctly?** (excluding volatiles)	N/A	YES	NO
9.	Are all aqueous **non-preserved samples pH 4-9**?	N/A	YES	NO
10.	Is there **sufficient sample** for the requested analyses?		YES	NO
11.	Were all samples placed in the **proper containers** for the requested analyses?		YES	NO
12.	Are all samples within **holding times** for the requested analyses?		YES	NO
13.	Were all sample containers received **intact**? (not broken or leaking, etc.)		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	N/A	YES	NO
15.	Do perchlorate LCMS-MS samples **have** headspace? (at least 1/3 of container required)	N/A	YES	NO
16.	Were samples checked for and free from the presence of **residual chlorine?** (Applicable when PM has indicated samples are from a chlorinated water source; note if field preservation with sodium thiosulfate was not observed.)	N/A	YES	NO
17.	Were the samples **shipped on ice**?		YES	NO
18.	Were cooler temperatures measured at 0.1-6.0°C? **IR gun used*:** #2 #4	RAD ONLY	YES	NO

Cooler #:	1							
Temperature (°C):	~~22.8~~ 22.3 CT 12-16-08							
No. of custody seals on cooler:	3							
DOT Survey/ Acceptance Information — External µR/hr reading:	13							
DOT Survey/ Acceptance Information — Background µR/hr reading:	11							

Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? **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.

No time listed on COC or label

Limited volume: 1 rock ~ 1.89g.

If applicable, was the client contacted? **YES / NO / NA** Contact: Keith G. Date/Time: 12/19/08

Project Manager Signature / Date: 12/19/08

*IR Gun #2: Oakton, SN 29922500201-0066 *IR Gun #4: Oakton, SN 2372220101-0002

Form 201r21.xls (7/30/08)

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SAMPLE RESULTS SUMMARY

Isotopic Americium By Alpha Spectroscopy Sample Results Summary

Client Name: Los Alamos National Laboratory SMO
Client Project Name: Rock
Client Project Number: 09-476

Laboratory Name: ALS Paragon
PAI Work Order: 0812153

Reported on: Tuesday, February 03, 2009 6:48:12 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 1 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0812153-1	CAPU-09-1656	Sample	Am-241	3.89 +/- 0.47	0.15	pCi/g	SOLID	AS090122-1	1/28/2009	M3

Comments:

Data Package ID: *AM0812153-1*

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 (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

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QC RESULTS SUMMARY

Isotopic Americium By Alpha Spectroscopy

PAI 714 Rev 11

Method Blank Results

Lab Name: **ALS Paragon**
Work Order Number: 0812153
Client Name: Los Alamos National Laboratory SMO
ClientProject ID: Rock 09-476

Lab ID: AS090122-1MB

Sample Matrix: SOLID
Prep SOP: PAI 778 Rev 12
Date Collected: 23-Jan-09
Date Prepared: 23-Jan-09
Date Analyzed: 28-Jan-09

Prep Batch: AS090122-1
QCBatchID: AS090122-1-1
Run ID: AS090122-1B
Count Time: 300 minutes

Final Aliquot: 0.259 g
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
14596-10-2	Am-241	0.016 +/- 0.042	0.121	0.02	U,M

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Am-243	17.61	13.9	pCi/g	78.9	30 - 110 %	

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 (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

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: *AM0812153-1*

Isotopic Americium By Alpha Spectroscopy

PAI 714 Rev 11

Laboratory Control Sample(s)

Lab Name: **ALS Paragon**
Work Order Number: 0812153
Client Name: Los Alamos National Laboratory SMO
ClientProject ID: Rock 09-476

Lab ID: AS090122-1LCS

Sample Matrix: SOLID
Prep SOP: PAI 778 Rev 12
Date Collected: 23-Jan-09
Date Prepared: 23-Jan-09
Date Analyzed: 28-Jan-09

Prep Batch: AS090122-1
QCBatchID: AS090122-1-1
Run ID: AS090122-1B
Count Time: 300 minutes

Final Aliquot: 0.259 g
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Results +/- 1s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14596-10-2	Am-241	16.7 +/- 1.5	0.1	17.2	96.9	79 - 118	P,M3

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Am-243	17.61	13.0	pCi/g	73.6	30 - 110 %	

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 (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *AM0812153-1*

Isotopic Americium By Alpha Spectroscopy

PAI 714 Rev 11

Laboratory Control Sample(s)

Lab Name: **ALS Paragon**
Work Order Number: 0812153
Client Name: Los Alamos National Laboratory SMO
ClientProject ID: Rock 09-476

Lab ID: AS090122-1LCSD

Sample Matrix: SOLID
Prep SOP: PAI 778 Rev 12
Date Collected: 23-Jan-09
Date Prepared: 23-Jan-09
Date Analyzed: 28-Jan-09

Prep Batch: AS090122-1
QCBatchID: AS090122-1-1
Run ID: AS090122-1B
Count Time: 300 minutes

Final Aliquot: 0.259 g
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Results +/- 1s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14596-10-2	Am-241	17.9 +/- 1.6	0.2	17.2	104	79 - 118	P,M3

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Am-243	17.61	13.2	pCi/g	74.7	30 - 110 %	

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 (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *AM0812153-1*

Isotopic Americium By Alpha Spectroscopy

PAI 714 Rev 11

Duplicate Sample Results (DER)

Lab Name: **ALS Paragon**
Work Order Number: 0812153
Client Name: Los Alamos National Laboratory SMO
ClientProject ID: Rock 09-476

Field ID:
Lab ID: AS090122-1LCSD

Sample Matrix: SOLID
Prep SOP: PAI 778 Rev 12
Date Collected: 23-Jan-09
Date Prepared: 23-Jan-09
Date Analyzed: 28-Jan-09

Prep Batch: AS090122-1
QCBatchID: AS090122-1-1
Run ID: AS090122-1B
Count Time: 300 minutes

Final Aliquot: 0.259 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Analyte	Sample Result +/- 1s TPU	Duplicate Result +/- 1s TPU	DER	Control Limit	Lab Qualifiers
14596-10-2	Am-241	16.7 +/- 1.5	17.9 +/- 1.6	0.28	2.13	P,M3

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 (see PAI SOP 743)
DER - Duplicate Error Ratio (see PAI SOP 715)
BDL - Below Detection Limit
NR - Not Reported

Data Package ID: *AM0812153-1*

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INDIVIDUAL SAMPLE RESULTS

Isotopic Americium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **ALS Paragon**
Work Order Number: 0812153
Client Name: Los Alamos National Laboratory SMO
ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656
Lab ID: 0812153-1

Analysis ReqCode: **ASP-A-021**

Sample Matrix: SOLID
Prep SOP: PAI 778 Rev 12
Date Collected: 09-Dec-08
Date Prepared: 23-Jan-09
Date Analyzed: 28-Jan-09

Prep Batch: AS090122-1
QCBatchID: AS090122-1-1
Run ID: AS090122-1B
Count Time: 300 minutes
Report Basis: As Received

Final Aliquot: 0.259 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
14596-10-2	Am-241	3.89 +/- 0.47	0.15	0.02	M3

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Am-243	17.61	11.44	pCi/g	65.0	30 - 110 %	

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 (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: *AM0812153-1*

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RAW DATA

Isotopic Americium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **ALS Paragon**
PAI Work Order: 0812153

Prep SOP: PAI 778
Analytical SOP: PAI 714

Reported on: Friday, January 30, 2009
10:18:42 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 +/- 1 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
0812153-1	Am-241	12/9/2008	AS090122-1	NA	NA	SOLID	0.259 g	AlphaSpec2	AS090122-1B	1/28/2009	133.700	30.63%	300	3.89	0.15	pCi/g	NA	
SMP	Trg. Analyte		AS090122-1-1	NA	NA	NA	0.259 g	50	Spectrum #1	9:07 AM	1.000	1000	65.0%	0.47	NA	As Received	NA	M3
0812153-1	Am-243	12/9/2008	AS090122-1	NA	NA	SOLID	0.259 g	AlphaSpec2	AS090122-1B	1/28/2009	605.400	30.63%	300	11.44	0.12	pCi/g	NA	
SMP	Tracer		AS090122-1-1	NA	NA	NA	0.259 g	50	Spectrum #1	9:07 AM	2.000	1000	65.0%	0.96	NA	As Received	NA	
AS090122-1	Am-241	1/23/2009	AS090122-1	NA	NA	SOLID	0.259 g	AlphaSpec2	AS090122-1B	1/28/2009	0.700	31.79%	300	0.016	0.121	pCi/g	NA	
MB	Trg. Analyte	8:21:05 AM	AS090122-1-1	NA	NA	NA	0.259 g	51	Spectrum #1	9:07 AM	1.000	1000	78.9%	0.042	NA	As Received	NA	U,M
AS090122-1	Am-243	1/23/2009	AS090122-1	NA	NA	SOLID	0.259 g	AlphaSpec2	AS090122-1B	1/28/2009	762.700	31.79%	300	13.9	0.1	pCi/g	NA	
MB	Tracer	8:21:05 AM	AS090122-1-1	NA	NA	NA	0.259 g	51	Spectrum #1	9:07 AM	1.000	1000	78.9%	1.1	NA	As Received	NA	
AS090122-1	Am-241	1/23/2009	AS090122-1	NA	NA	SOLID	0.259 g	AlphaSpec2	AS090122-1B	1/28/2009	650.000	30.66%	300	16.7	0.1	pCi/g	NA	96.9
LCS	Trg. Analyte	8:21:05 AM	AS090122-1-1	NA	NA	NA	0.259 g	52	Spectrum #1	9:07 AM	0.000	1000	73.6%	1.5	NA	As Received	NA	P,M3
AS090122-1	Am-243	1/23/2009	AS090122-1	NA	NA	SOLID	0.259 g	AlphaSpec2	AS090122-1B	1/28/2009	686.800	30.66%	300	13.0	0.1	pCi/g	NA	
LCS	Tracer	8:21:05 AM	AS090122-1-1	NA	NA	NA	0.259 g	52	Spectrum #1	9:07 AM	4.000	1000	73.6%	1.1	NA	As Received	NA	
AS090122-1	Am-241	1/23/2009	AS090122-1	NA	NA	SOLID	0.259 g	AlphaSpec2	AS090122-1B	1/28/2009	708.400	30.66%	300	17.9	0.2	pCi/g	0.28	104
LCSD	Trg. Analyte	8:21:05 AM	AS090122-1-1	NA	NA	NA	0.259 g	54	Spectrum #1	9:07 AM	2.000	1000	74.7%	1.6	NA	As Received	NA	P,M3
AS090122-1	Am-243	1/23/2009	AS090122-1	NA	NA	SOLID	0.259 g	AlphaSpec2	AS090122-1B	1/28/2009	697.100	30.66%	300	13.2	0.1	pCi/g	NA	
LCSD	Tracer	8:21:05 AM	AS090122-1-1	NA	NA	NA	0.259 g	54	Spectrum #1	9:07 AM	3.000	1000	74.7%	1.1	NA	As Received	NA	

Comments:

Data Package ID: *AM0812153-1*

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 (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0812153-1
Spectrum #1 Analysis #1

Sample Size : 0.25

Acquisition

Detector: 50
Batch Name: AAS090122-1_B
Nuclide Library: Am-241
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Am-241

Acquisition Start Date: 1/28/2009 9:07:08AM
Live Time: 300.00 min.
Real Time: 300.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B09012750; Det: 50; Spectrum #1; Jan-27-2009 15:24

Calibration Date: 1/27/2009 12:31:25PM

Efficiency Calibration: C09012750

Efficiency: 30.63% +/- 0.15% TPU(2 sigma)

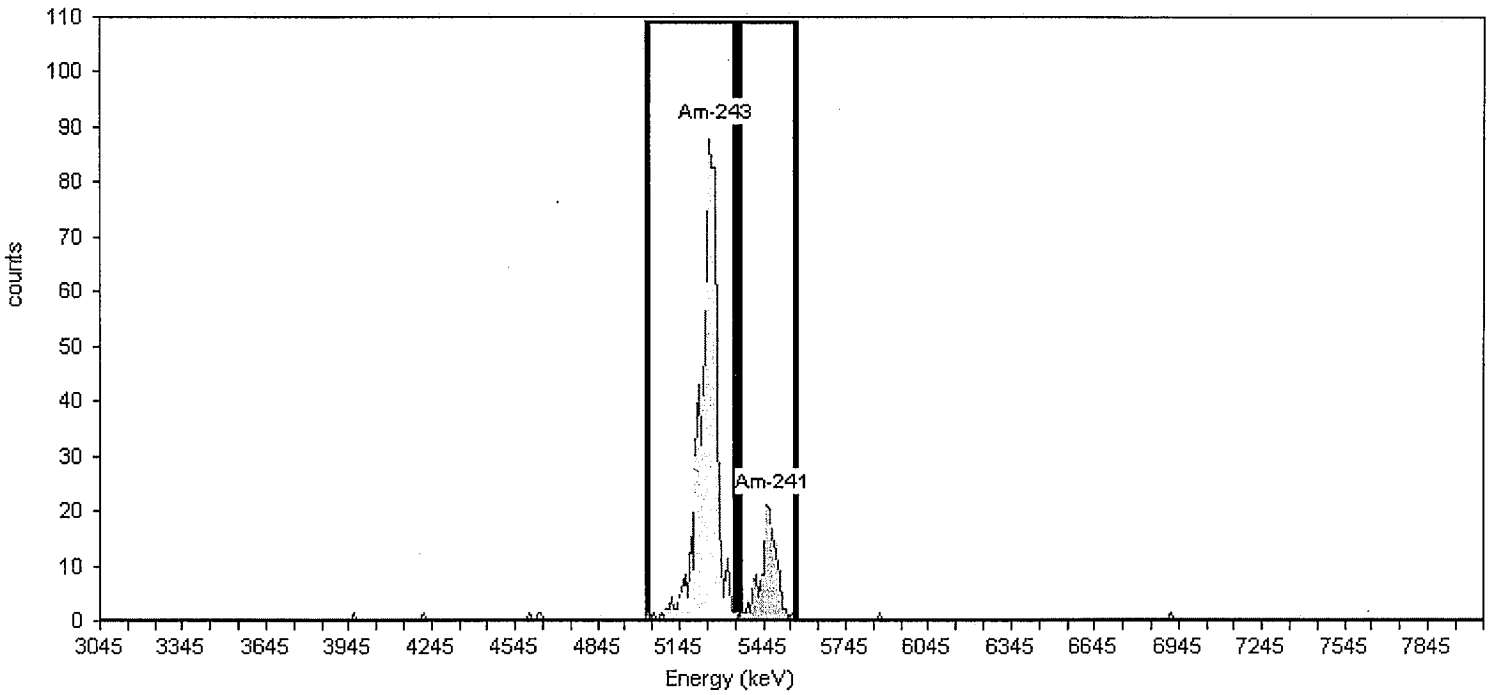
Energy Calibration: C09012750

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 872.3610.15 Am-243
Tracer Activity: 20.28 DPM/mL x (Vol.)0.50 mL = 10.14 DPM

Tracer Nuclide: Am-243
Tracer Recovery: 65.14%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Am-243	5271.5	5026.4	5349.9	72.0	99.7	606.00	0.60	605.40	1.2E+001	9.7E-001	4.4E-002	1.7E-001
Am-241	5477.4	5359.7	5565.6	53.4	100.0	134.00	0.30	133.70	4.0E+000	8.7E-001	3.1E-002	1.4E-001

Reviewed By: JMF JP

Print Date: 1/28/2009 4:08:18PM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: AS090122-1MB
Spectrum #1 Analysis #1

Sample Size : 0.25

Acquisition

Detector: 51
Batch Name: AAS090122-1_B
Nuclide Library: Am-241
Analysis Method: Absolute ROI Analysis, Set Name = Am-241
ROI Set: Am-241

Acquisition Start Date: 1/28/2009 9:07:08AM
Live Time: 300.00 min.
Real Time: 300.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B09012751; Det: 51; Spectrum #1; Jan-27-2009 15:24

Calibration Date: 1/27/2009 12:31:50PM

Efficiency Calibration: C09012751

Efficiency: 31.79% +/- 0.17% TPU(2 sigma)

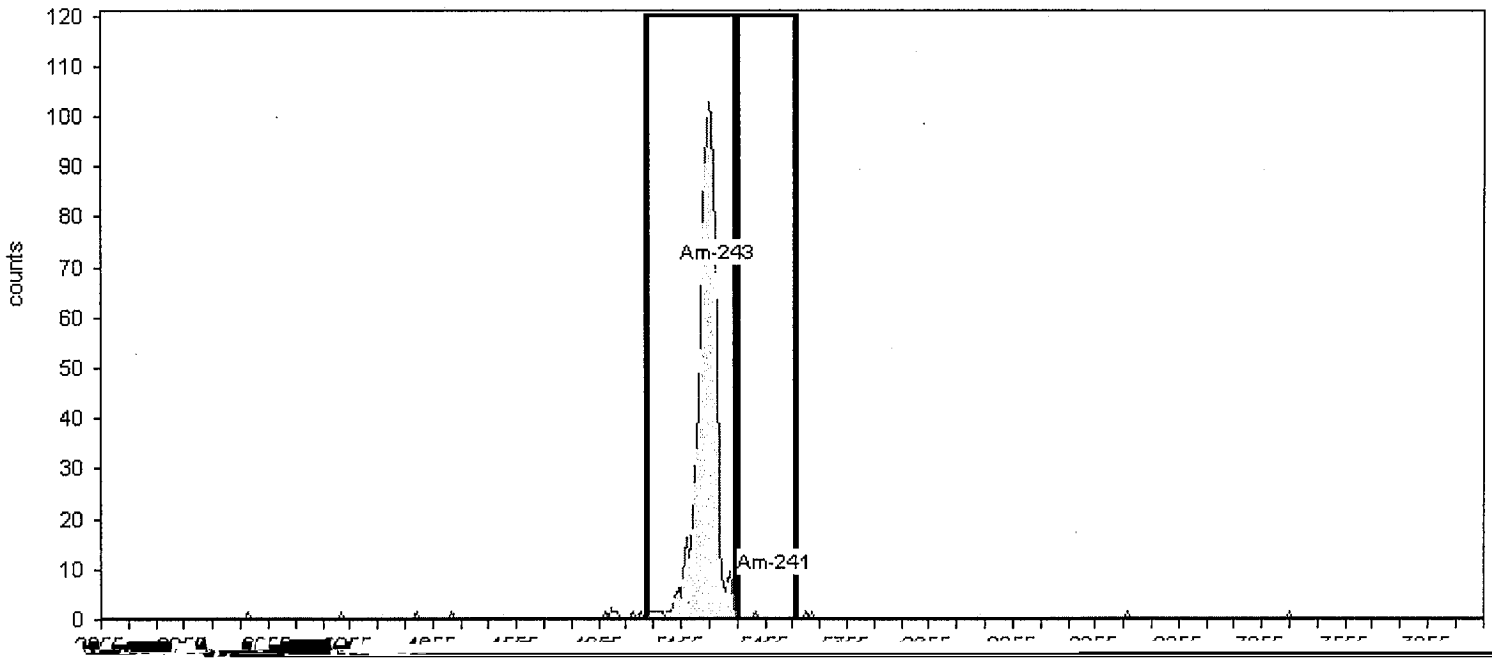
Energy Calibration: C09012751

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,045.81 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 872.3610.15 Am-243
Tracer Activity: 20.28 DPM/mL x (Vol.)0.50 mL = 10.14 DPM

Tracer Nuclide: Am-243
Tracer Recovery: 79.08%



Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: AS090122-1LCS
Spectrum #1 Analysis #1

Sample Size : 0.25

Acquisition

Detector: 52
Batch Name: AAS090122-1_B
Nuclide Library: Am-241
Analysis Method: Absolute ROI Analysis, Set Name = Am-241
ROI Set: Am-241

Acquisition Start Date: 1/28/2009 9:07:09AM
Live Time: 300.00 min.
Real Time: 300.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B09012752; Det: 52; Spectrum #1; Jan-27-2009 15:24

Calibration Date: 1/27/2009 12:32:13PM

Efficiency Calibration: C09012752

Efficiency: 30.66% +/- 0.21% TPU(2 sigma)

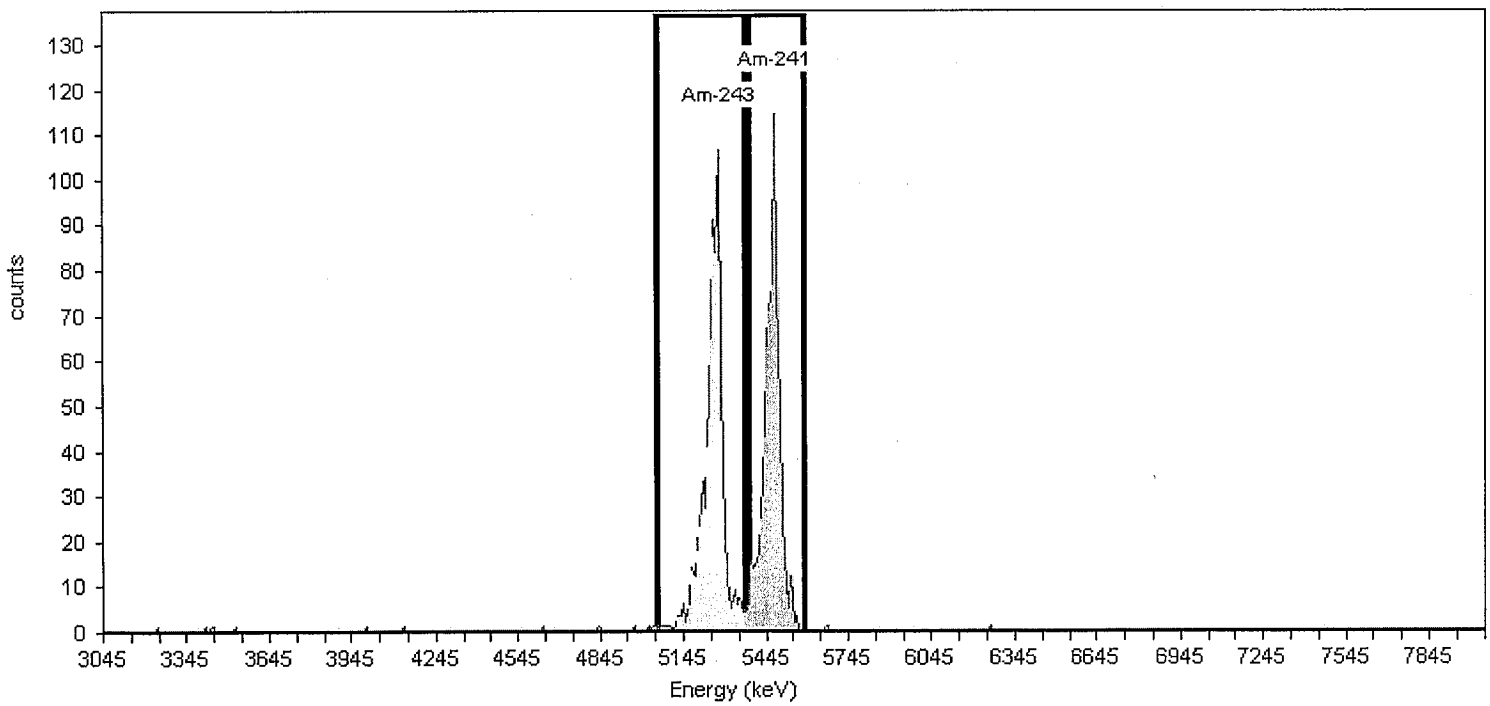
Energy Calibration: C09012752

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 872.3610.15 Am-243
Tracer Activity: 20.28 DPM/mL x (Vol.)0.50 mL = 10.14 DPM

Tracer Nuclide: Am-243
Tracer Recovery: 73.73%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Am-243	5271.5	5046.0	5369.5	68.4	99.9	688.00	1.20	686.80	1.3E+001	1.0E+000	5.5E-002	1.8E-001
Am-241	5477.4	5379.3	5585.2	55.7	100.0	650.00	0.00	650.00	1.7E+001	2.6E+000	0.0E+000	7.2E-002

Reviewed By: EMK JP

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: AS090122-1LCSD
Spectrum #1 Analysis #1

Sample Size : 0.25

Acquisition

Detector: 54
Batch Name: AAS090122-1_B
Nuclide Library: Am-241
Analysis Method: Absolute ROI Analysis, Set Name = Am-241
ROI Set: Am-241

Acquisition Start Date: 1/28/2009 9:07:10AM
Live Time: 300.00 min.
Real Time: 300.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B09012754; Det: 54; Spectrum #1; Jan-27-2009 15:24

Calibration Date: 1/27/2009 12:33:14PM

Efficiency Calibration: C09012754

Efficiency: 30.66% +/- 0.15% TPU(2 sigma)

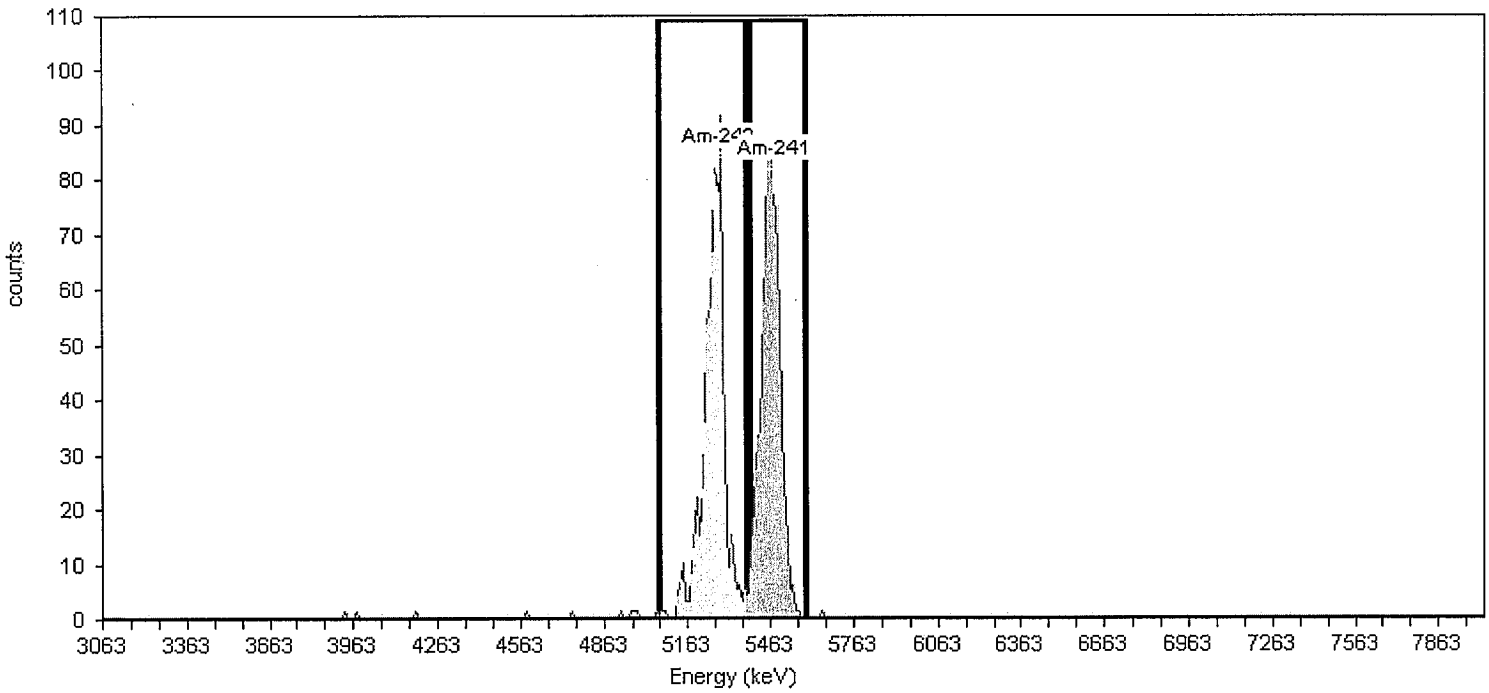
Energy Calibration: C09012754

Energy Cal: Gain = 9.7289 keV / Ch
Offset = 3,053.57 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 872.3610.15 Am-243
Tracer Activity: 20.28 DPM/mL x (Vol.)0.50 mL = 10.14 DPM

Tracer Nuclide: Am-243
Tracer Recovery: 74.83%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Am-243	5281.5	5057.7	5378.8	75.3	99.9	698.00	0.90	697.10	1.4E+001	1.0E+000	4.7E-002	1.6E-001
Am-241	5485.8	5388.5	5592.8	71.9	100.0	709.00	0.60	708.40	1.9E+001	2.7E+000	3.8E-002	1.5E-001

Reviewed By: EMC JP

6

QUALITY ASSURANCE SUMMARY REPORTS

Paragon Analytics

QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0812153
TEST γ
METHOD Prep
SOP/REV (PREP) 739/9
SOP/REV (ANAL)

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

1. Sample 0812153-1 consisted of a small rock that was placed into a Ziploc bag and crushed with a rubber mallet. The crushed rock was then transferred to a 220mL polypropylene cup and weighed. 1E 12/30/08
2. A three acid digestion was performed by adding 25mL each of HNO_3, HCl, and HF to the sample cup. A MB, LCS, and LCSD were created at this time by adding all three acids to empty 220mL cups. 1E 12/30/08
3. Following digestion, the sample was taken to dryness and then brought up in 10ml HNO_3 and ~150ml DI water. 1E 12/30/08
4. The sample was filtered through qualitative fluted filter paper, diluted to 1000ml with DI water, and packed for a geometry 1 gamma analysis.
5. Following gamma analysis, the sample will be released for all remaining rad analyses.

1E 12/30/08

1E 12/30/08

TECHNICIAN/ANALYST T Elliott DATE 12/30/08

DEPARTMENT MANAGER Crystal Sheuffer DATE 12/30/08

365782 FORM 302r6.doc (4/22/04)

LABORATORY BENCH SHEETS

7

Radiochemistry Instrument Worksheet

ALS Paragon

Prep Batch: AS090122-1

Prep Procedure: Am241

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
1	0812153-1	SMP	0.2594	0.2594	g	pCi/g	_C1531	34	EMF	_C1531	50	EMF	_C1531			A B incorrect count time
1	AS090122-1	MB	0.2594	0.2594	g	pCi/g	_1221B	35		_1221B	51		_1221B			~~longest count time~~ EMF 1/30/09
1	AS090122-1	LCS	0.2594	0.2594	g	pCi/g	_1221L	36		_1221L	52		_1221L			B incorrect count time
1	AS090122-1	LCSD	0.2594	0.2594	g	pCi/g	_1221LD	37		_1221LD	54		_1221LD	EMF 1/30/09		

Tracer/Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	837.3610.11	20.074	DPM/ml	01/23/09	0.25	ml	AW016
T2	Pu-242	861.3610.12	19.998	DPM/ml	01/23/09	1	ml	AW017
T3	Am-243	872.3610.15	20.277	DPM/ml	01/23/09	0.5	ml	AW013

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	AM-241	616.2382.92	19.806	DPM/ml	01/23/09	0.5	ml	AW013
S2	U-234	644.3610.02	19.272	DPM/ml	01/23/09	0.25	ml	AW016
S2	U-235	644.3610.02	0.921	DPM/ml	01/23/09	0.25	ml	AW016
S2	U-238	644.3610.02	20.008	DPM/ml	01/23/09	0.25	ml	AW016
S3	Pu-239	819.3020.51	20.927	DPM/ml	01/23/09	1	ml	AW017

Radiochemistry Prep Worksheet

ALS Paragon

Prep Batch: AS090122-1

Prep Procedure: Am241

Reviewed By: tde TDE **Review Date:** 1/23/2009

Non-Routine Pre-Treatment? (Y) / N **Batch:** See QASS **Re-Prep?** Y / (N) **Batch:** NA **Prep QASS / NCR?** (Y) / N 365782

Prep SOP: PAI 778 **Rev:** 12
Prep SOP: NONE
Matrix Class: solid

Prep Analyst: Tambrae Elhart TE
Prep Date: 1/23/2009
Prep Dept: AP

Balance:
Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq g	Fin Alq g	Prep Basis	Total Digestate Vol(ml)	Digestate Vol Taken(ml)	Micro Init	Micro Date	Standards	Prep Notes
1	1	0812153-1	SMP		0.259392	0.259392	As Received	1000	160	TE	1/24/09	T1,T2,T3	
2	1	AS090122-1	MB		0.259392	0.259392	As Received	1000	160			T1,T2,T3	
3	1	AS090122-1	LCS		0.259392	0.259392	As Received	1000	160			S1,S2,S3,T1,T2,T3	TE 1/23/09
4	1	AS090122-1	LCSD		0.259392	0.259392	As Received	1000	160			S1,S2,S3,T1,T2,T3	

Comments

Following the Pu microprecipitation of a small aliquot of sample 1, it was determined that the sample contained a Pu-239 activity. Therefore, a reduced aliquot of ~0.25g sample equivalent was taken from the gamma fraction for the sequental prep of Am, Pu, U analyses. Due to limited sample, an LCSD was prepped instead of a sample duplicate. A PEG treatment was performed on all samples.

Spiked By: Tambrae Elhart **Date:** 1/23/2009

Witnessed By: Mike Clemmer **Date:** 1/23/2009

Tracer/Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	837.3610.11	20.074	DPM/ml	01/23/09	0.25	ml	AW016
T2	Pu-242	861.3610.12	19.998	DPM/ml	01/23/09	1	ml	AW017
T3	Am-243	872.3610.15	20.277	DPM/ml	01/23/09	0.5	ml	AW013

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	AM-241	616.2382.92	19.806	DPM/ml	01/23/09	0.5	ml	AW013
S2	U-234	644.3610.02	19.272	DPM/ml	01/23/09	0.25	ml	AW016
S2	U-235	644.3610.02	0.921	DPM/ml	01/23/09	0.25	ml	AW016
S2	U-238	644.3610.02	20.008	DPM/ml	01/23/09	0.25	ml	AW016
S3	Pu-239	819.3020.51	20.927	DPM/ml	01/23/09	1	ml	AW017

ALS Paragon

Radiochemistry Prep Worksheet

Prep Batch: AS090122-1

Prep Procedure: Am241, Pu, U

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:** 12
Prep SOP: NONE
Matrix Class: solid

Prep Analyst: Tambrae Elhart TE
Prep Date: 1/23/2009
Prep Dept: AP

Balance:
Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq g	Fin Alq g	Prep Basis	Total Digestate Vol(ml)	Digestate Vol Taken(ml)	Micro Init	Micro Date	Standards	Prep Notes
1	1	0812153-1	SMP		1.6212	0.259392	As Received	1000	160			T1,T2,T3	
2	1	AS090122-1	MB		1.6212	0.259392	As Received	1000	160			T1,T2,T3	
3	1	AS090122-1	LCS		1.6212	0.259392	As Received	1000	160			S1,S2,S3,T1,T2,T3	
4	1	AS090122-1	LCSD		1.6212	0.259392	As Received	1000	160			S1,S2,S3,T1,T2,T3	

Comments

Following the Pu microprecipitation of a small aliquot of sample, it was determined that the sample contained a Pu-239 activity. Therefore, a reduced aliquot of ~0.25g sample equivalent was taken from the gamma fraction for the sequental prep of Am, Pu, U analyses. Due to limited sample, an LCSD was prepped instead of a sample duplicate. A PEG treatment was performed on all samples.

Spiked By: Tambrae Elhart TE **Date:** 1/23/2009 1/23/09
Witnessed By: MC **Date:** 01/23/09

Tracer/Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	U-232	837.3610.11	20.074	DPM/ml	01/23/09	0.25	ml	AW016
T2	Am-243	~~845.3010.06~~ 872.3610.15	19.989	DPM/ml	01/23/09	0.5	ml	AW013
T3	Pu-242	861.3610.12	19.998	DPM/ml	01/23/09	1	ml	AW017

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	AM-241	616.2382.92	19.806	DPM/ml	01/23/09	0.5	ml	AW013
S2	U-234	644.3610.02	19.272	DPM/ml	01/23/09	0.25	ml	AW016
S2	U-235	644.3610.02	0.921	DPM/ml	01/23/09	0.25	ml	AW016
S2	U-238	644.3610.02	20.008	DPM/ml	01/23/09	0.25	ml	AW016
S3	Pu-239	819.3020.51	20.927	DPM/ml	01/23/09	1	ml	AW017

T1 7/30/09
T2 10/14/09
T3 8/7/09

~~Exp~~
S1 7/31/09
S2 4/8/09
S3 8/1/09

TE 1/23/09

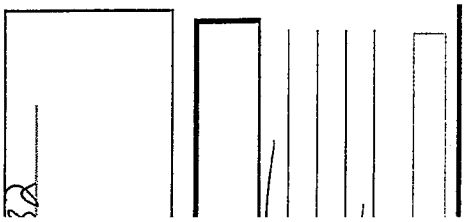
Supersedes: ~~AA~~ 12/30/08 9:37

229-1

Date: 12/30/2008

32

6:20



ALS Paragon

Radiochemistry Prep Worksheet

Prep Batch: GS081229-1

Prep Procedure: GAMMASCAN

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 739 **Rev:** 9
Prep SOP: NONE
Matrix Class: solid

Prep Analyst: Tambrae Elhart TE
Prep Date: 12/29/2008
Prep Dept: GM

Balance:
Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq g	Fin Alq g	Prep Basis	Geometry	Standards	Prep Notes
1	1	0812153-1	SMP		1	1	As Received	01		1.6212g
2	1	0812153-1	DUP		1	1	As Received	01		Count Dup, Insuff Sample
3	1	GS081229-1	MB		1	1	As Received	01		
4	1	GS081229-1	LCS		1	1	As Received	01	S1	

Comments

Spiked By: N/A **Date:** N/A

Witnessed By: N/A **Date:** N/A

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	824	220.230	DPM/ml	12/29/08	1000	ml	
S1	Co-60	824	102.627	DPM/ml	12/29/08	1000	ml	
S1	Cs-137	824	83.585	DPM/ml	12/29/08	1000	ml	

SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TE

ANALYSIS DATE: 12/29/08 METHOD: Prep

WORK ORDER	SAMPLE ID	SAMPLE CONDITION		
		Dry/Wet	TEXTURE	Remarks
0812153	1	dry	small rock	wrapped in ziplock bag & crushed w/ mallet prior to aliquotting

TE 12/29/08

STANDARDS TRACEABILITY DOCUMENTS

8

92
PROJECT Am-241 616.2382.92

Notebook No. _____
Continued From Page _____

Am-241 working level dilution

Prepare a working level dilution of Am-241 (616.2382.91) at 20 dpm/ml by diluting with 1M HCL (Lot 43065)

① Determine the density of 1M HCL (copied from previous page)

mass of 100 ml class A volumetric flask	67.5757 g (bal 12)
mass of flask and 1M HCL	168.85080 g
net mass of 1M HCL	101.2823 g
	ρ = 1.0128 g/ml

② Transfer approx 0.5 g of 616.2382.91 to a 1L nalgene bottle

mass of nalgene bottle without lid	74.4779 g (bal 12)
mass of standard, VOA vial, transfer pipet & 50 ml beaker before transfer	94.1502 g
mass of standard, VOA vial, transfer pipet & 50 ml beaker after transfer	93.4751 g
net mass of standard transferred	0.6751 g

③ Dilute to final volume with 1M HCL

mass of nalgene bottle without lid (from above)	74.4779 g
mass of bottle, standard and 1M HCL	1003.4 g (bal 26)
net mass of standard	928.92 g

RG 9/6/06

Reverification Log

Analysis Date	Initials	Expiration Date
8/11/06	RG	8/11/07
10/18/07	MC	10/18/08
7/31/08	MC	7/31/09

RG 9/6/06 RG 9/6/06 RG 9/6/06

④ final Activity calculation

27,201.49 ~~27,125.0~~ MC 10/31/07

SD 8/1/03 (~~27,168.64~~ dpm/g)(0.6751 g)(1.0128 g/ml) =

928.92 g

SD 6/2/04

20.02 dpm/ml ~~19.97~~ MC 10/31/07 ~~20.00~~ SD 8/1/03

RG 5/5/03

Stnd ID: 616.2382.92

Description: Am-241 MC 11/1/07
Expiration: 5/27/05
Activity: ~~19.97~~ 20.02 dpm/mL
2s Uncertainty: 0.44 dpm/mL
Ref. Date: 4/18/02
Ref Time: N/A
Prep Date: 4/25/03 Prep by: CDM
Matrix/Comp. 1M HCl
Half Life (y): 4.32E+02

SD 6/2/04 SD 6/2/04

Stnd ID: 616.2382.92 RG 5/13/05

Description: Am-241
Expiration: 4/30/06 MC 11/1/07
Activity: ~~19.97~~ 20.02 dpm/mL
2s Uncertainty: 0.44 dpm/mL
Ref. Date: 4/18/02
Ref Time: N/A
Prep Date: 4/25/03 Prep by: CDM
Matrix/Comp. 0.1M HCl
Half Life (y): 4.32E+02

RG 5/13/05 RG 5/13/05 RG 5/5/03

Stnd ID: 616.2382.92 RG 5/5/03

Description: Am-241 MC 11/1/07 ~~19.97~~ 20.02
Activity: ~~20.00~~ SD dpm/ml
2s Uncertainty: 0.44 8/1/03 dpm/ml
Ref. Date: 4/18/02
Ref Time: na
Prep Date: 4/25/03 Prep by: CDM
Expiration: 4/29/04
Matrix/Comp. 0.1M HCl
Half Life (y): 4.32E+02

RG 5/5/03

MAY REQUIRE NCR FOR ICPT WORK

C Moncavage 4/25/03 Signed Date

Renee Gallegos RG 5/5/03 Signed Date 5/5/03

Am-241 intermediary dilution

Prepare an intermediate dilution of 616.2382.38 by diluting with 1M HCL (Lot 43015)

(1) Determine the density of 1M HCL

mass of 100 ml Class A volumetric flask	67.5757 g (bal)
mass of flask and 1M HCl	168.8580 g
net mass of 1M HCL	101.2823
	ρ = 1.0128 g/ml

(2) Transfer Am-241 (616.2382.38) to a 40 ml VOA vial

mass of empty VOA vial without lid & 50 ml beaker	54.0248 g (bal)
mass of standard, transfer pipet & 50 ml beaker (initial)	95.0640 g
mass of standard, transfer pipet & 50 ml beaker after transfer)	~~74~~ 75.0076 g (CDM 4/2/03)
net mass of standard transferred	20.0564 g

(3) Dilute to final volume with 1M HCL

mass of empty VOA VIAL w/o lid & 50 ml beaker (from above)	54.0248 g bal
mass of standard, 1M HCL, VOA vial & 50 ml beaker	92.4609 g
net mass of standard	38.4361 g

(4) final activity calculation

$$\frac{\overset{SD\ 8/1/03}{(\cancel{52{,}066}\ 52{,}128.96\ dpm/g)}(20.0564\ g)}{38.4361\ g} = \cancel{27168.64}\ 27{,}201.49\ dpm/g$$

MC 11/1/07

Continued on Page

Read and Understood By

C Moncavage	4/25/03	Renee Gallegos	5/5/03
Signed	Date	Signed	Date

PROJECT 6116.2382.38 Am-241

Notebook No. _____

Continued From Page _____

Am-241 primary dilution

prepare a primary dilution of RSO 6116 (NIST: ~~SRM~~ SRS 63651-307) by diluting w/ 1M HCl

CM 10-14-02

SJB 10/14/02

1) Determine the density of 1M HCl (Lot # 42223 + Lot # 42216)

mass of 100ml vol flask	62.4712 g	(Bal 12)
mass of flask + 1M HCl	163.802 g	↓
Net mass of ~~std~~ HCl	101.330900 g	

RG 12/3/02

2) Transfer contents of ampule to 40 ml VOA vial

mass of VOA vial w/o lid	22.3577 g	(Bal 12)
mass of [illegible] + 50 ml beaker	37.9238 g	↓

CM 10-14-02

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

PAI.FO 0616
rec'd 4-22-02

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

63651-307

Am-241 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Am-241
ACTIVITY (dps):	3.728 E4
HALF-LIFE:	4.322 E2 years
CALIBRATION DATE:	April 18, 2002 12:00 EST
TOTAL UNCERTAINTY*:	3.3%
SYSTEMATIC:	3.0%
RANDOM:	0.3%

*99% confidence level.

Impurities: γ-impurities <0.1%

5.11972 grams 1M HCl solution.

P O NUMBER EW040502, Item 3

SOURCE PREPARED BY: M Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: M Rooty 4-19-02

Prepare a working dilution (20 dpm/ml) of Am-243 from RSO # 872.

1) determine ρ = of 1M HCl diluent lot #082195 bal#

Mass of Vol Flask	68.2984 g	12
Mass of Flask + 100 ml Acid	169.5688 g	↓
Net Mass of Acid	101.2704 g	
ρ = 1.0127 g/ml		

2) Mass of Parent Std Transferred:

Mass of Open Ampule + beaker	37.9148 g	12
Mass of Empty Ampule + beaker	32.8650 g	↓
Net Mass of parent Used	5.0498 g	

3) ~~Dluet~~ Dilute to Final Vol w/ 1M HCl JDD 10/13/08

Mass of Empty (No lid) 1000 ml Nalgene	74.5005 g	12
Mass of Std, Nalgene, + Diluent	1173.5 g	26
Net Mass of New dilution	1098.9995 g	

Final Activity Calc.

$$\left(3.715\times10^{2}\ \text{Bq}\right)\left(\frac{60\ \text{dpm}}{1\ \text{Bq}}\right)\left(\frac{1}{5.11505\ \text{g}}\right)\left(5.0498\ \text{g}\right)\left(\frac{1.0127\ \text{g/ml}}{1098.9995\ \text{g}}\right) = 20.28\ \text{dpm/ml}$$

Stnd ID: 872.3610.15 MC 11/3/08

Description: Am-243
Expiration: 10/14/2009
Activity: 20.28 dpm/mL
MC 11/3/08 2s Uncertainty: 0.81 dpm/mL
Ref. Date: 7/23/2008
Ref Time: N/A
Prep Date: 10/13/2008 Prep by: jdd
Matrix/Comp. 1.0 M HCl
Half Life (y): 7.37E+03

Reverification Log

Analysis Date	Initials	Expiration Date

MC 11/3/08

MC 11/3/08

Continued on Page

Read and Understood By

Signed [signature] Date 10/17/08 Signed [signature] Date TE 10/13/08 10/13/08

Eckert & Ziegler
Analytics

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

RSO # 872

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

77919-307

Am-243 5 mL Liquid in Flame Sealed Vial

Customer: Paragon Analytics
P. O. No.: 73625, 7-11-08, Item 1

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. [redacted]

ADDITIONAL SUPPORTING DOCUMENTATION

9

Calibration Data Summary

Laboratory Name: **ALS Paragon**
PAI Work Order: 0812153

Prep SOP: PAI 778
Analytical SOP: PAI 714

Reported on: Friday, January 30, 2009
10:18:42 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** %Efficiency Bkg CPM Energy keV	FLAGS Efficiency Background Energy	**LCL** %Efficiency Bkg CPM Energy keV	**LWL** %Efficiency Bkg CPM Energy keV	**UWL** %Efficiency Bkg CPM Energy keV	**UCL** %Efficiency Bkg CPM Energy keV
0812153-1	SMP	AS090122-1	Am241	50	C09012750	1/27/2009	30.63	Pass	29.40	29.92	31.98	32.50
Spectrum #1		AS090122-1B			B09012750	1/27/2009	0.0230	Pass	0.0000	0.0102	0.1002	0.1500
1/28/2009					C09012750	1/27/2009	5546.0	Pass	5486.2	5496.2	5576.2	5586.2
AS090122-1	MB	AS090122-1	Am241	51	C09012751	1/27/2009	31.79	Pass	30.14	30.67	32.79	33.32
Spectrum #1		AS090122-1B			B09012751	1/27/2009	0.0180	Pass	0.0000	0.0102	0.1002	0.1500
1/28/2009					C09012751	1/27/2009	5555.8	Pass	5486.2	5496.2	5576.2	5586.2
AS090122-1	LCS	AS090122-1	Am241	52	C09012752	1/27/2009	30.66	Pass	28.93	29.44	31.47	31.97
Spectrum #1		AS090122-1B			B09012752	1/27/2009	0.0190	Pass	0.0000	0.0102	0.1002	0.1500
1/28/2009					C09012752	1/27/2009	5546.0	Pass	5496.0	5506.0	5586.0	5596.0
AS090122-1	LCSD	AS090122-1	Am241	54	C09012754	1/27/2009	30.66	Pass	29.73	30.25	32.33	32.85
Spectrum #1		AS090122-1B			B09012754	1/27/2009	0.0210	Pass	0.0000	0.0102	0.1002	0.1500
1/28/2009					C09012754	1/27/2009	5544.2	Pass	5505.8	5515.8	5595.8	5605.8

Data Package ID: *AM0812153-1*

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 7 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: 6/1/2007

Received by PA on: 6/6/2007

Values from certificate	
Source ID:	92MIX223027
Total Activity:	3780.5962 dpm
Ref. Date:	6/1/07

Nuclide	Act (Bq)	Act (dpm)	Half-Life (yrs)	Decay Corrected
U-234:	49.91	2994.6	2.48E+05	2994.59 dpm
U-235:	1.10	65.94	7.04E+08	65.94 dpm
Am-241:	12.00	720	432.17	718.88 dpm
			TOTAL	3779.41 dpm

Efficiency Determination for Detector: 25

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
92MIX223027	190	97-19-103-09	5/20/08	7113	29841	789	2100	1078.37	3779.41	28.53%

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 dur (s)	Detector Efficiency	Am-241 dpm	U-234 dpm	U-235 dpm	Combined dpm
92MIX2203026	182	97-19-103-01	5/20/08	12417	73969	1678	2100	28.53%	1243.38	7406.92	168.03	8818.33
92MIX2203028	183	97-19-103-02	5/20/08	14459	141741	3156	2100	28.53%	1447.86	14193.30	316.03	15957.19
92MIX2203024	184	97-19-103-03	5/20/08	66052	68294	1480	2100	28.53%	6614.15	6838.65	148.20	13601.00
92MIX2203021	185	97-19-103-04	5/20/08	20822	58470	1507	2100	28.53%	2085.02	5854.92	150.90	8090.85
92MIX2203025	186	97-19-103-05	5/20/08	94084	114792	2491	2100	28.53%	9421.15	11494.75	249.44	21165.34
92MIX2203022	187	97-19-103-06	5/20/08	71430	75877	1663	2100	28.53%	7152.68	7597.98	166.53	14917.18
92MIX2203023	188	97-19-103-07	5/20/08	41741	65445	1420	2100	28.53%	4179.76	6553.37	142.19	10875.31
92MIX2203029	189	97-19-103-08	5/20/08	31922	200052	4643	2100	28.53%	3196.52	20032.30	464.93	23693.76

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	5/21/08	6967	29575	781	2100	1066.37	3779.41	28.22%	1.12%	PASS

Sources 1 through 8 activity re-verification

Source Serial#	PA ID	Sequential #	Combined Obseved dpm	Combined Certified dpm*	Percent Difference %	Within 5% of Certified value?
92MIX2203026	182	97-19-103-01	8818.33	8867.05	-0.55%	Yes
92MIX2203028	183	97-19-103-02	15957.19	16011.39	-0.34%	Yes
92MIX2203024	184	97-19-103-03	13601.00	13588.11	0.09%	Yes
92MIX2203021	185	97-19-103-04	8090.85	8188.77	-1.20%	Yes
92MIX2203025	186	97-19-103-05	21165.34	21096.48	0.33%	Yes
92MIX2203022	187	97-19-103-06	14917.18	15382.14	-3.02%	Yes
92MIX2203023	188	97-19-103-07	10875.31	10781.48	0.87%	Yes
92MIX2203029	189	97-19-103-08	23693.76	23636.41	0.24%	Yes

* Certificate values decay corrected to the count date

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	124.10	7446.00	2.43	145.74	21.43	1285.80
5/1/2003	239.30	14358.00	4.20	252.00	23.55	1413.00
5/1/2003	119.40	7164.00	1.93	115.56	106.00	6360.00
4/1/2003	101.00	6060.00	1.26	75.84	34.50	2070.00
4/1/2003	203.00	12180.00	3.41	204.72	146.40	8784.00
4/1/2003	132.90	7974.00	3.17	189.96	121.30	7278.00
4/1/2003	107.10	6426.00	0.93	55.54	72.26	4335.60
5/1/2003	334.80	20088.00	6.55	393.18	53.02	3181.20

OK
MC
6/5/08

R:\INST\alphspec\Cal Recert\CLCRT052008

AlphaVision v5.3 **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 25 190 GB 5/21/08

9:19:16AM 5/21/2008

Calibration

Energy Calibration: RSO (Source 9)
Description:

Analysis Date: 5/20/2008 11:57:30AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

Acquisition

Detector: 25 , SN:
Acquisition Start Date: 5/20/2008 10:43:22AM

Live Time: 35.00 min.
Real Time: 35.01 min.

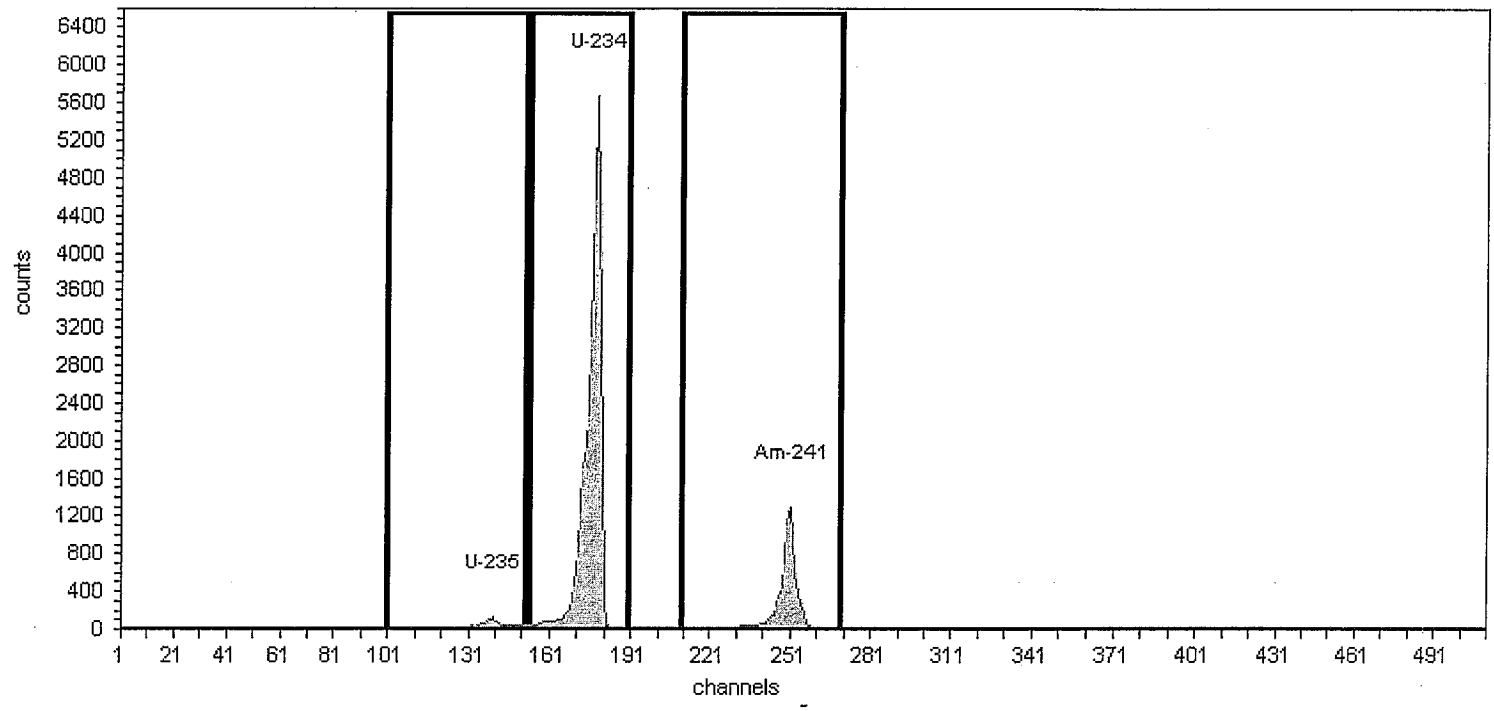
Efficiency Calibration Name: RSO (Source 9)

Energy Calibration Equation:
Gain = 9.8047 keV / Ch

Offset = 3,026.20 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.47% +/- 0.30% TPU(2 sigma)



Method: Interactive ROI
Algorithm: Linear

Initial Calibration: No
Shelf: 1

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	789.00	22.54
U-234	178	4.78	153	190	29,841.00	852.60
Am-241	251	5.49	210	270	7,113.00	203.23

AlphaVision v5.3 **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 25

9:19:22AM 5/21/2008

Calibration

Energy Calibration: RSO 182 (Source 1)
Description:

Analysis Date: 5/20/2008 12:25:48PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A1 RSO#182
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:45PM

Acquisition

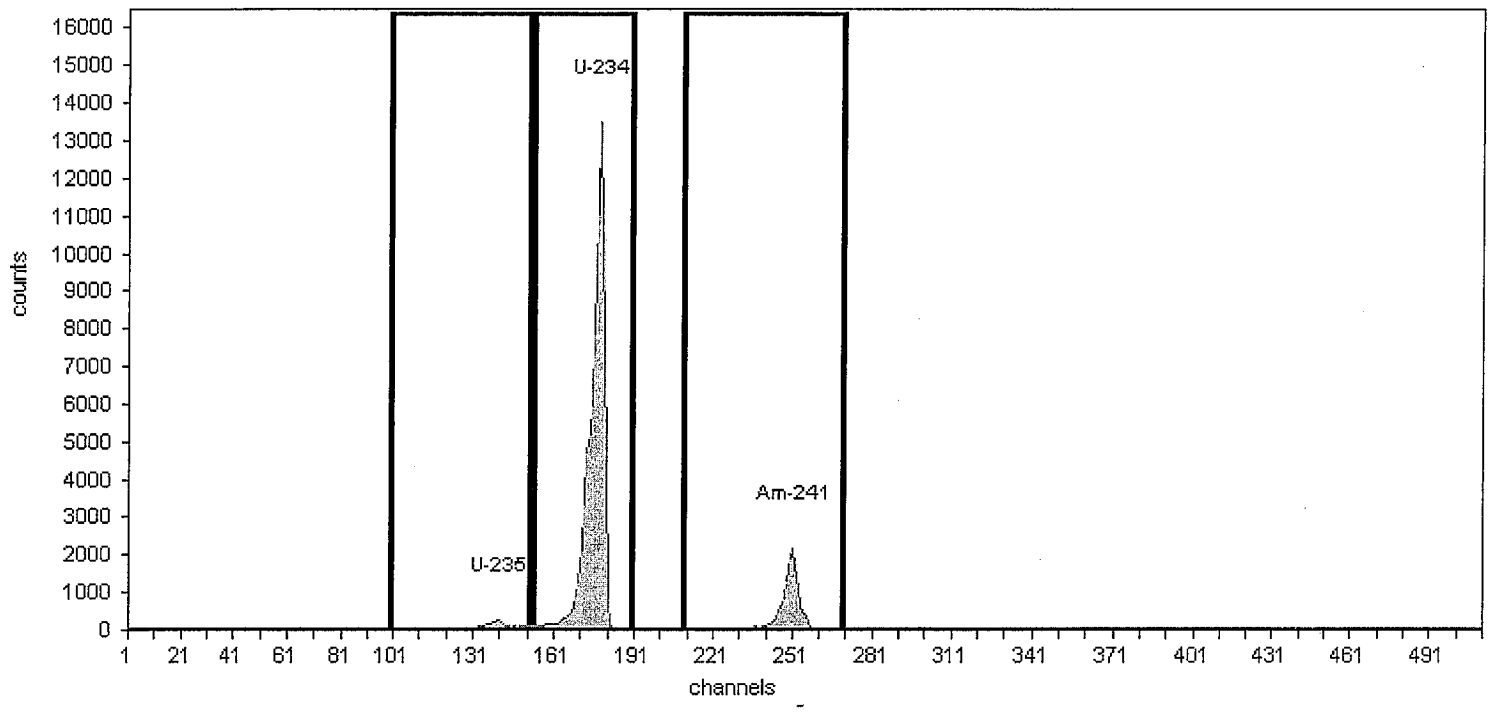
Detector: 25 , SN:
Acquisition Start Date: 5/20/2008 11:35:12AM

Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO 182 (Source 1)

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,026.20 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.35% +/- 0.19% TPU(2 sigma)



Method: Interactive ROI
Algorithm: Linear

Initial Calibration: No
Shelf: 1

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	1,678.00	47.94
U-234	178	4.78	153	190	73,969.00	2,113.40
Am-241	251	5.49	210	270	12,417.00	354.77

AlphaVision v5.3 **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 25

9:19:28AM 5/21/2008

Calibration

Energy Calibration: RSO 183 (Source 2)
Description:

Analysis Date: 5/20/2008 1:05:28PM
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: 25 , SN:
Acquisition Start Date: 5/20/2008 12:26:40PM

Live Time: 35.00 min.
Real Time: 35.05 min.

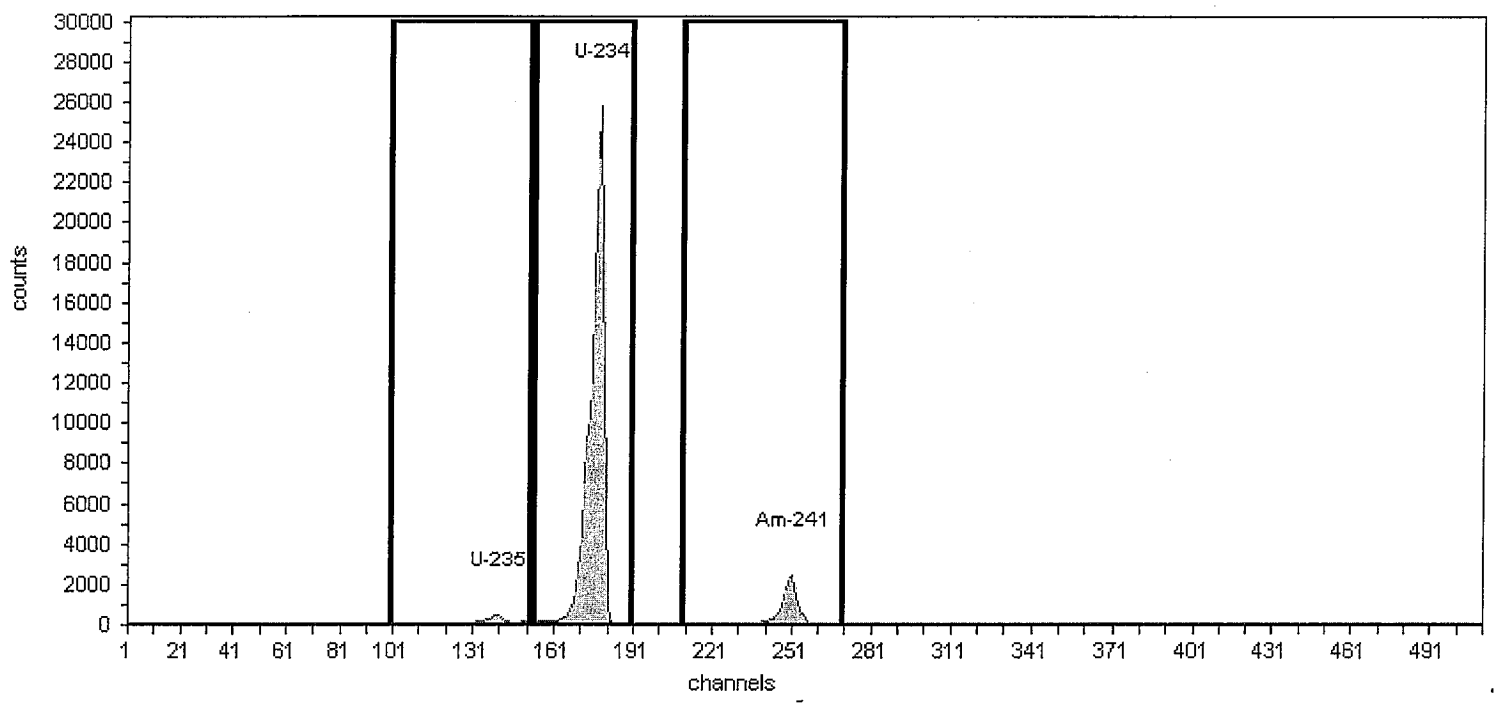
Efficiency Calibration Name: RSO 183 (Source 2)

Energy Calibration Equation:
Gain = 9.8047 keV / Ch

Offset = 3,026.20 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.38% +/- 0.14% TPU(2 sigma)



Method: Interactive ROI
Algorithm: Linear

Initial Calibration: No
Shelf: 1

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	3,156.00	90.17
U-234	178	4.78	153	190	141,741.00	4,049.74
Am-241	251	5.49	210	270	14,459.00	413.11

AlphaVision v5.3 **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 25

9:19:33AM 5/21/2008

Calibration

Energy Calibration: RSO 184 (Source 3)
Description:

Analysis Date: 5/20/2008 1:45:22PM
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: 25 , SN:
Acquisition Start Date: 5/20/2008 1:06:02PM

Live Time: 35.00 min.
Real Time: 35.04 min.

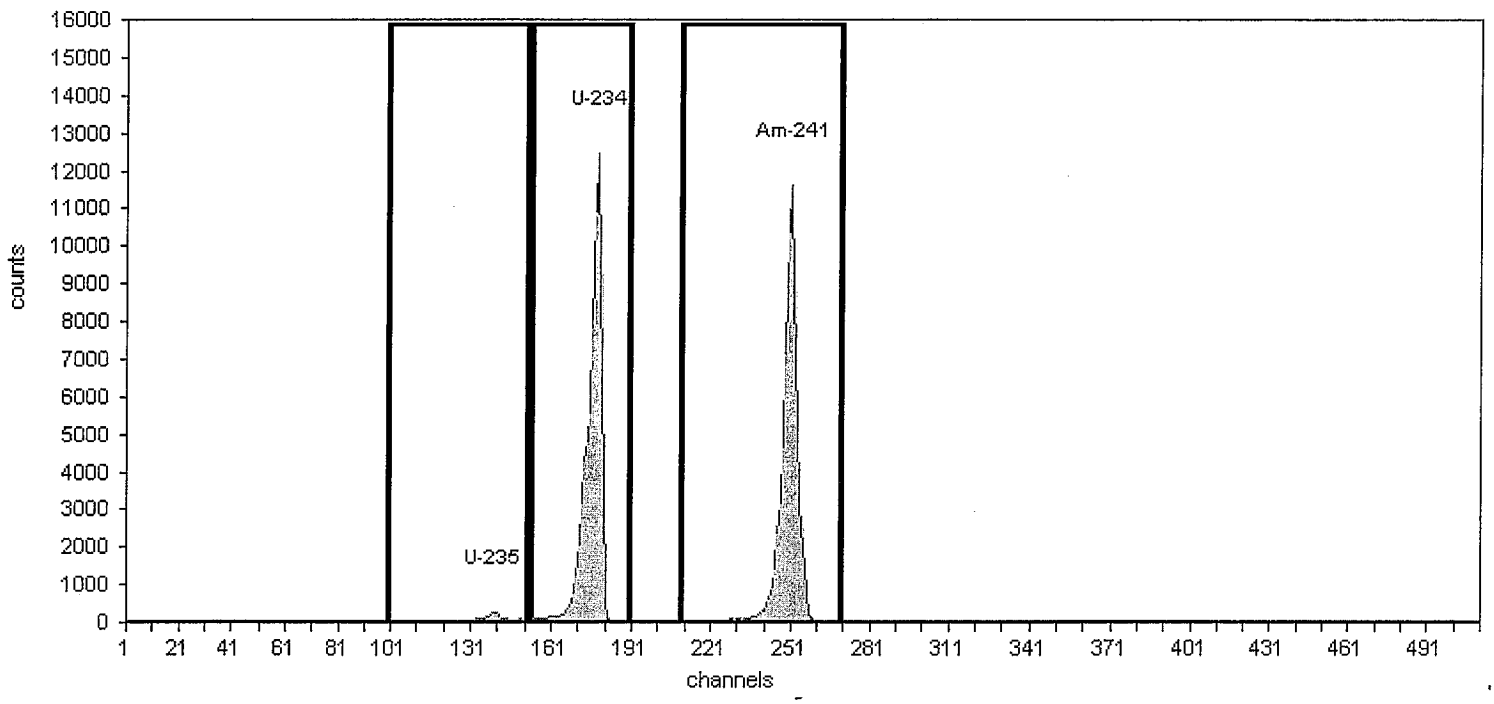
Efficiency Calibration Name: RSO 184 (Source 3)

Energy Calibration Equation:
Gain = 9.7289 keV / Ch

Offset = 3,043.84 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.45% +/- 0.16% TPU(2 sigma)



Method: Interactive ROI
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	139	4.40	100	152	1,480.00	42.29
U-234	178	4.78	153	190	68,294.00	1,951.26
Am-241	251	5.49	210	270	66,052.00	1,887.20

AlphaVision v5.3

Alpha-Spectroscopy Calibration Report

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 25

9:21:31AM 5/21/2008

Calibration

Energy Calibration: RSO 185 (Source 4)
Description:

Analysis Date: 5/20/2008 2:41:04PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A4-RSO#185

AlphaVision v5.3 **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 25

9:20:28AM 5/21/2008

Calibration

Energy Calibration: RSO 188 (Source 7)
Description:

Analysis Date: 5/20/2008 4:41:56PM
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: 25 , SN:
Acquisition Start Date: 5/20/2008 4:03:54PM

Live Time: 35.00 min.
Real Time: 35.03 min.

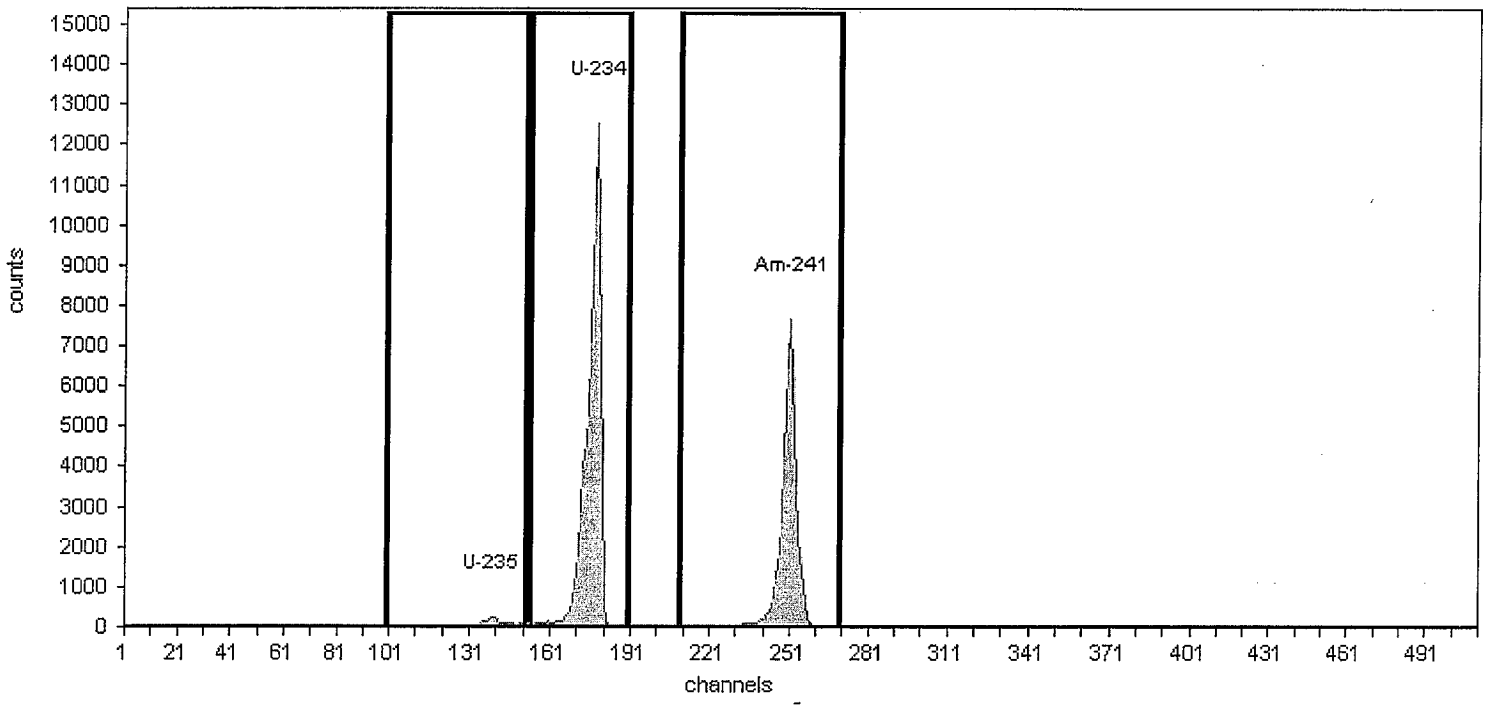
Efficiency Calibration Name: RSO 188 (Source 7)

Energy Calibration Equation:
Gain = 9.7289 keV / Ch

Offset = 3,043.84 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.55% +/- 0.18% TPU(2 sigma)



Method: Interactive ROI
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	139	4.40	100	152	1,420.00	40.57
U-234	178	4.78	153	190	65,445.00	1,869.86
Am-241	251	5.49	210	270	41,741.00	1,192.60

AlphaVision v5.3 **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
9:20:33AM 5/21/2008

Analyst: ORTEC
Detector: 25

Calibration

Energy Calibration: RSO 189 (Source 8)
Description:

Analysis Date: 5/21/2008 8:30:29AM
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: 25 , SN:
Acquisition Start Date: 5/20/2008 4:42:28PM

Live Time: 35.00 min.
Real Time: 35.07 min.

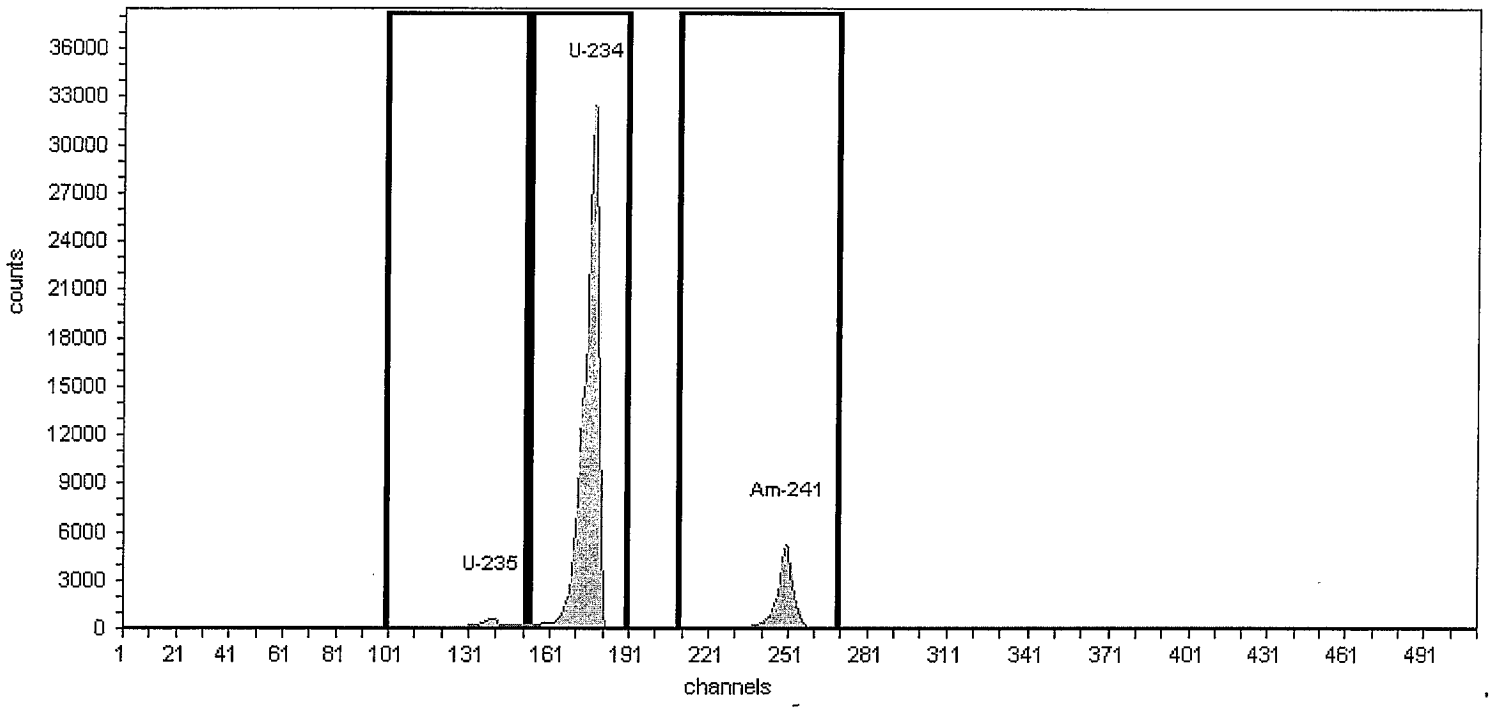
Efficiency Calibration Name: RSO 189 (Source 8)

Energy Calibration Equation:
Gain = 9.8047 keV / Ch

Offset = 3,036.00 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.59% +/- 0.12% TPU(2 sigma)



Method: Interactive ROI
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
U-235	139	4.40	100	152	4,643.00	132.66
U-234	177	4.78	153	190	200,052.00	5,715.77
Am-241	250	5.49	210	270	31,922.00	912.06

AlphaVision v5.3 **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 25

9:20:39AM 5/21/2008

Calibration

Energy Calibration: RSO 190 (Source 9)
Description:

Analysis Date: 5/21/2008 9:08:00AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

Acquisition

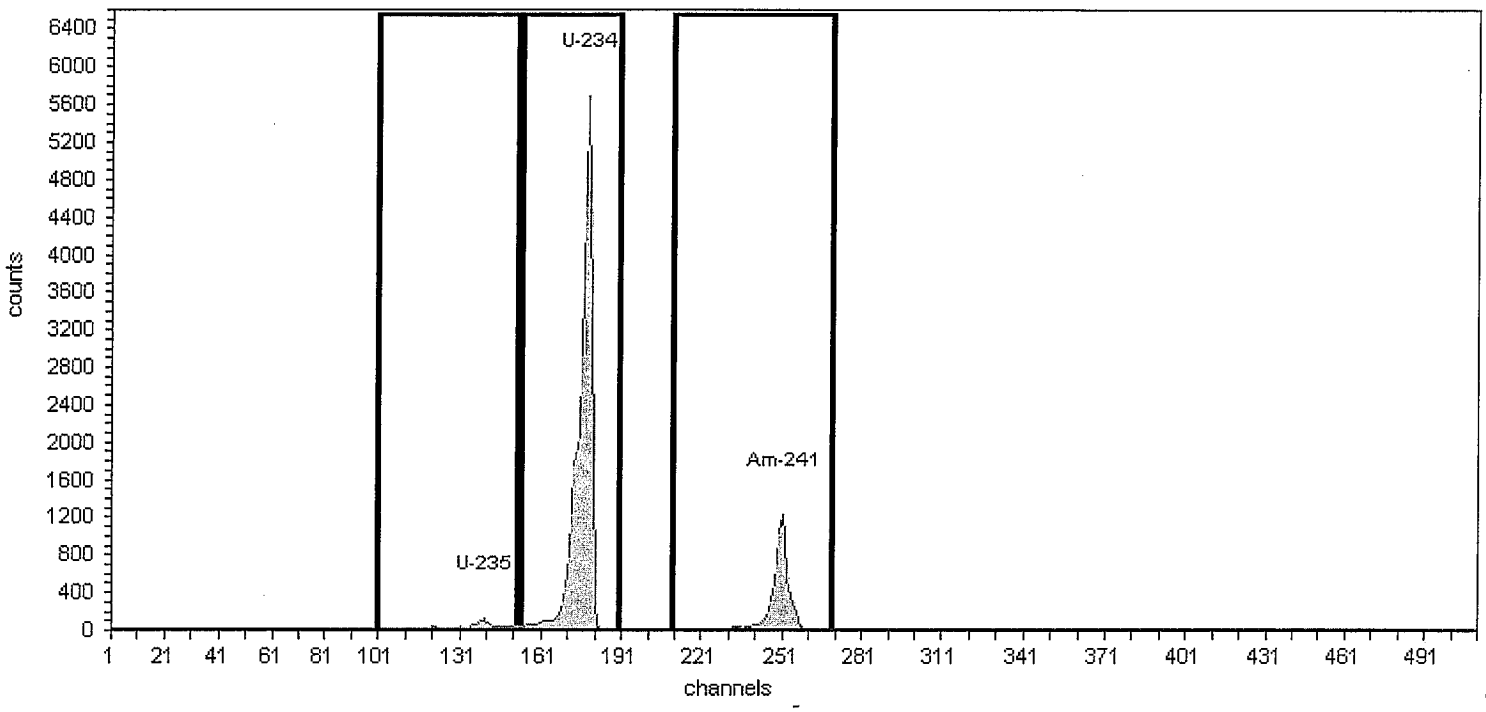
Detector: 25 , SN:
Acquisition Start Date: 5/21/2008 8:31:01AM

Live Time: 35.00 min.
Real Time: 35.01 min.

Efficiency Calibration Name: RSO 190 (Source 9)

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,026.20 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.16% +/- 0.30% TPU(2 sigma)



Method: Interactive ROI
Algorithm: Linear

Initial Calibration: No
Shelf: 1

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	781.00	22.31
U-234	178	4.78	153	190	29,575.00	845.00
Am-241	251	5.49	210	270	6,967.00	199.06

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

[α] reverified 5/20/08
expires 5/20/09

PAI 187
recalibrate 4-15-03

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.:**	92MIX2203026
Half Life (Am-241):	432.17 ± 0.66 years		

Contained Radioactivity:

U-234:	3.354	nCi	(124.1 Bq)	Am-241:	0.5793	nCi	(21.43 Bq)
U-235:	0.06566	nCi	(2.429 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 α/min in 2π on 11 Apr 03.

Daniel James Van Dalsem
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α2 reverified 5/20/08
expires 5/20/09
PAI 183
recalibrated 4-15-03

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 PDT

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

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α3

reverified 5/20/08
expires 5/20/09

PAT I.D 184
recalibrated 4-15-08

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.:**	92MIX2203024
Half Life (Am-241):	432.17 ± 0.66 years		

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 [illegible]

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α 4

reverified 5/20/08
expires 5/20/09

PAI ID 00185
rec'd from recalibration
3-28-03

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 Dalsem
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α5 reverified 5/20/08 expires 5/20/09
PAI ID 00186
recalibration received ~~186~~ 3-28-03

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.:**	92MIX2203025
Half Life (Am-241):	432.17 ± 0.66 years		

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 Dalsem
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α6 reverified 5/20/08
expires 5/20/09
BAID 00187
recd from recalibrate
3-28-03

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

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α7

reverified 5/20/08
expires 5/20/09

PAIP 188
rec'd for recalibration
3-28-03

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

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α 8

re verified 5/20/08
expires 5/20/09

PAI ID 189
recd 4-21-03
recalibrated 4-15-03

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.:**	92MIX2203029
Half Life (Am-241):	432.17 ± 0.66 years		

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.

Daniel James Van Dalsem
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

Eckert & Ziegler
Isotope Products

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RSO # 190
Rec'd 6/6/07 GW
Recertification 6/1/07

CERTIFICATE OF CALIBRATION
MIXED ALPHA STANDARD SOURCE

α 9

Radionuclide:	U-234	**Customer:**	PARAGON ANALYTICS, INC.
Radionuclide:	U-235	**P.O. No.:**	73179/R3768
Radio: 23	Am-241	**Catalog No.:**	MISC-STD
Half-life (U-234):	(2.454 ± 0.006)E+05 years	**Reference Date:**	1-Jun-07 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:	1.349	**nCi,**	49.91	**Bq**	Am-241:	0.3243	**nCi,**	12.00	**Bq**
U-235:	0.02970	**nCi,**	1.099	**Bq**	Total Activity:	1.703	**nCi,**	63.01	**Bq**

Physical Description:

A. Capsule type: Disk (47 mm OD x 0.76 mm THK)
B. Nature of active deposit: Electrodeposited and diffusion bonded oxide
C. Active diameter/volume: 19 mm