Paragon Analytics

Radiochemistry Case Narrative
Isotopic Thorium

CSU Dep't Ecological Radiological Health Sciences

Tissue Samples

PA WO 0805200

1. This report consists of the analytical results and supporting documentation for 19 tissue samples received by Paragon on 05/29/08.
2. These samples were prepared according to procedures PA SOP773R10 and PA SOP777R9. Modifications were made to the method as described on QASS 365713 and 365603.
3. The samples were analyzed for the presence of isotopic thorium according to procedure PA SOP714R11. The analyses were completed on 06/14/08.
4. The isotopic analysis results for these samples 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. Samples 0805200-16, -20, -24, -29, -33, and -37 have a chemical yield below the 30% lower control limit at 18-22%. Matrix interference is suspected. Spectral quality is adequate for accurate quantification. Since spectral quality is acceptable and the chemical recovery is greater than 15%, results are acceptable according to PA SOP714R11. The results are submitted without further qualification. These samples are flagged with an "Y2" qualifier on the final reports. Please refer to NCR #10702 in section 6 of this report.
7. Samples 0805200-16, -20, -24, -29, -33, and -37 analyses resulted in slightly lower Th-229 tracer counts at 381, 332, 291, 300, 328, and 336 net counts, respectively. This results in a counting uncertainty slightly above the Paragon standard of less than 5% at 5.12%, 5.49%, 5.86%, 5.77%, 5.52%, and 5.46%, respectively. This elevated uncertainty will result in a slightly higher reported TPU value for these samples. With supervisory approval, the results are submitted without further qualification.
8. The requested MDC of 0.1 pCi/gram was not met for Th-228 for sample 0805200-29. The reported activity for this sample is greater than the achieved MDC. This sample is identified with an "M3" qualifier on the final reports.
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, Paragon Analytics certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Linda Arend
Radiochemistry Primary Reviewer

06/25/08
Date

Radiochemistry Final Data Review

6/26/06
Date

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PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

CHAIN OF CUSTODY

Paragon Analytics

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0805200
Client Name: CSU Dep't Ecological Radiological Health Scie
Client Project Name: Tissue samples
Client Project Number:
Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
CSUPR-1	0805200-1	liver	TISSUE	20-May-08	
CSUPR-2	0805200-2	lung	TISSUE	20-May-08	
CSUPR-3	0805200-3	muscle	TISSUE	20-May-08	
CSUPR-4	0805200-4	bone	TISSUE	20-May-08	
CSUPR-5	0805200-5	liver	TISSUE	20-May-08	
CSUPR-6	0805200-6	lung	TISSUE	20-May-08	
CSUPR-7	0805200-7	muscle	TISSUE	20-May-08	
CSUPR-8	0805200-8	bone	TISSUE	20-May-08	
CSUPR-9	0805200-9	liver	TISSUE	20-May-08	
CSUPR-10	0805200-10	lung	TISSUE	20-May-08	
CSUPR-11	0805200-11	muscle	TISSUE	20-May-08	
CSUPR-12	0805200-12	bone	TISSUE	20-May-08	
CSUPR-13	0805200-13	liver	TISSUE	19-May-08	
CSUPR-14	0805200-14	lung	TISSUE	19-May-08	
CSUPR-15	0805200-15	muscle	TISSUE	19-May-08	
CSUPR-16	0805200-16	bone	TISSUE	19-May-08	
CSUPR-17	0805200-17	liver	TISSUE	19-May-08	
CSUPR-18	0805200-18	lung	TISSUE	19-May-08	
CSUPR-19	0805200-19	muscle	TISSUE	19-May-08	
CSUPR-20	0805200-20	bone	TISSUE	19-May-08	
CSUPR-21	0805200-21	liver	TISSUE	19-May-08	
CSUPR-22	0805200-22	lung	TISSUE	19-May-08	
CSUPR-23	0805200-23	muscle	TISSUE	19-May-08	
CSUPR-24	0805200-24	bone	TISSUE	19-May-08	
CSUPR-25	0805200-25	carcass	TISSUE	20-May-08	
CSUPR-26	0805200-26	liver	TISSUE	07-Apr-08	
CSUPR-27	0805200-27	lung	TISSUE	07-Apr-08	
CSUPR-28	0805200-28	muscle	TISSUE	07-Apr-08	
CSUPR-29	0805200-29	bone	TISSUE	07-Apr-08	
CSUPR-30	0805200-30	liver	TISSUE	12-Apr-08	
CSUPR-31	0805200-31	lung	TISSUE	12-Apr-08	
CSUPR-32	0805200-32	muscle	TISSUE	12-Apr-08	

Paragon Analytics

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0805200
Client Name: CSU Dep't Ecological Radiological Health Scie
Client Project Name: Tissue samples
Client Project Number:
Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
CSUPR-33	0805200-33	bone	TISSUE	12-Apr-08	
CSUPR-34	0805200-34	liver	TISSUE	13-Apr-08	
CSUPR-35	0805200-35	lung	TISSUE	13-Apr-08	
CSUPR-36	0805200-36	muscle	TISSUE	13-Apr-08	
CSUPR-37	0805200-37	bone	TISSUE	13-Apr-08	

COC for CSU Tissue Samples received 5/27/08 0805200

Samples delivered from Ward Whicker at CSU to Paragon Analytics on May 27, 2009

Sample #	LabID	species	tissue	Collection Date	Analytes requested U-nat	Th-230	Ra-226	Po-210	Pb-210
CSUPR-1	1	CTAIL	liver	5/20/2008		X		X	X
CSUPR-2	2	CTAIL	lung	5/20/2008				X	X
CSUPR-3	3	CTAIL	muscle	5/20/2008	X			X	
CSUPR-4	4	‡ CTAIL	bone	5/20/2008	X	X	X		X
CSUPR-5	5	CTAIL	liver	5/20/2008		X		X	X
CSUPR-6	6	CTAIL	lung	5/20/2008				X	X
CSUPR-7	7	CTAIL	muscle	5/20/2008	X			X	
CSUPR-8	8	‡ CTAIL	bone	5/20/2008	X	X	X		X
CSUPR-9	9	CTAIL	liver	5/20/2008		X		X	X
CSUPR-10	10	CTAIL	lung	5/20/2008				X	X
CSUPR-11	11	CTAIL	muscle	5/20/2008	X			X	
CSUPR-12	12	‡ CTAIL	bone	5/20/2008	X	X	X		X
CSUPR-13	13	JACK	liver	5/19/2008		X		X	X
CSUPR-14	14	JACK	lung	5/19/2008				X	X
CSUPR-15	15	JACK	muscle	5/19/2008	X			X	
CSUPR-16	16	‡ JACK	bone	5/19/2008	X	X	X		X
CSUPR-17	17	JACK	liver	5/19/2008		X		X	X
CSUPR-18	18	JACK	lung	5/19/2008				X	X
CSUPR-19	19	JACK	muscle	5/19/2008	X			X	
CSUPR-20	20	‡ JACK	bone	5/19/2008	X	X	X		X
CSUPR-21	21	JACK	liver	5/19/2008		X		X	X
CSUPR-22	22	JACK	lung	5/19/2008				X	X
CSUPR-23	23	JACK	muscle	5/19/2008	X			X	
CSUPR-24	24	‡ JACK	bone	5/19/2008	X	X	X		X
CSUPR-25	25	K-RAT	carcass	5/20/2008	X	X	X		X
CSUPR-26	26	COW	liver	4/7/2008	X	X		X	X
CSUPR-27	27	COW	lung	4/7/2008				X	X
CSUPR-28	28	COW	muscle	4/7/2008	X			X	
CSUPR-29	29	COW	bone	4/7/2008	X	X	X		X
CSUPR-30	30	COW	liver	4/12/2008	X	X		X	X
CSUPR-31	31	COW	lung	4/12/2008				X	X
CSUPR-32	32	COW	muscle	4/12/2008	X			X	
CSUPR-33	33	COW	bone	4/12/2008	X	X	X		X
CSUPR-34	34	COW	liver	4/13/2008	X	X		X	X
CSUPR-35	35	COW	lung	4/13/2008				X	X
CSUPR-36	36	COW	muscle	4/13/2008	X			X	
CSUPR-37	37	COW	bone	4/13/2008	X	X	X		X

‡ add'l bone (Femur and lower legs) recieved from Ward Whicker 6/5/08 ~ 4:30 pm 6/5/08

Note: original bone samples (all species) were scapula.

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

Client: CSU Workorder No: 0805200

Project Manager: LS Initials: CT Date: 5-29-08

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**?		(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~~ CT 5-29-08	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, Rx CN/S, radon), headspace free? **Size of bubble**: ____ < green pea ____> green pea	(N/A)	(YES)	NO
15.	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
16.	Were the samples **shipped on ice**?		(YES)	NO
17.	Were cooler temperatures measured at 0.1-6.0°C? **IR gun used*:** (#2) #4	RAD ONLY	YES	(NO)

Cooler #:	1							
Temperature (°C):	~~13~~ CT 5-29-08							
No. of custody seals on cooler:	0							
DOT Survey/ Acceptance Information — External µR/hr reading:	NA							
Background µR/hr reading:	13							

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

Samples received frozen

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

Project Manager Signature / Date: 5/29/08

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

Form 201r20.xls (12/27/07)

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PARAGON ANALYTICS
Radiochemistry Data Package

Section 2

SAMPLE RESULTS SUMMARY

Isotopic Thorium By Alpha Spectroscopy Sample Results Summary

Client Name: CSU Dep't Ecological Radiological Health Sciences
Client Project Name: Tissue samples
Client Project Number:

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Page: 1 of 7
Reported on: Wednesday, June 25, 2008
9:33:12 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0805200-1	CSUPR-1	Sample	Th-228	-0.008 +/- 0.013	0.024	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-1	CSUPR-1	Sample	Th-230	0.0048 +/- 0.0093	0.0158	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-1	CSUPR-1	Sample	Th-232	-0.0006 +/- 0.0045	0.0092	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-4	CSUPR-4	Sample	Th-228	0.041 +/- 0.031	0.046	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-4	CSUPR-4	Sample	Th-230	0 +/- 0.018	0.033	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-4	CSUPR-4	Sample	Th-232	0 +/- 0.0065	0.0143	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-5	CSUPR-5	Sample	Th-228	-0.001 +/- 0.012	0.022	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-5	CSUPR-5	Sample	Th-230	0.0015 +/- 0.0083	0.0148	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-5	CSUPR-5	Sample	Th-232	0.0018 +/- 0.0029	0.0043	pCi/g	TISSUE	AS080607-1	6/13/2008	U

Comments:

Data Package ID: *TH0805200-1*

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

Isotopic Thorium By Alpha Spectroscopy Sample Results Summary

Client Name: CSU Dep't Ecological Radiological Health Sciences
Client Project Name: Tissue samples
Client Project Number:

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Reported on: Wednesday, June 25, 2008
9:33:12 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0805200-8	CSUPR-8	Sample	Th-228	0.024 +/- 0.030	0.049	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-8	CSUPR-8	Sample	Th-230	-0.014 +/- 0.016	0.033	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-8	CSUPR-8	Sample	Th-232	0.0044 +/- 0.0079	0.0138	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-9	CSUPR-9	Sample	Th-228	-0.003 +/- 0.016	0.028	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-9	CSUPR-9	Sample	Th-230	-0.0069 +/- 0.0091	0.0181	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-9	CSUPR-9	Sample	Th-232	0.0025 +/- 0.0040	0.0068	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-12	CSUPR-12	Sample	Th-228	0.103 +/- 0.043	0.054	pCi/g	TISSUE	AS080607-1	6/13/2008	
0805200-12	CSUPR-12	Sample	Th-230	0.003 +/- 0.020	0.036	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-12	CSUPR-12	Sample	Th-232	0 +/- 0.0076	0.0144	pCi/g	TISSUE	AS080607-1	6/13/2008	U

Comments:

Data Package ID: *TH0805200-1*

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Isotopic Thorium By Alpha Spectroscopy Sample Results Summary

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Client Project Name: Tissue samples
Client Project Number:

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Reported on: Wednesday, June 25, 2008
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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
0805200-13	CSUPR-13	Sample	Th-228	-0.003 +/- 0.010	0.019	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-13	CSUPR-13	Sample	Th-230	-0.0054 +/- 0.0072	0.0145	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-13	CSUPR-13	Sample	Th-232	0 +/- 0.0031	0.0065	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-16	CSUPR-16	Sample	Th-228	0.078 +/- 0.037	0.050	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,LT
0805200-16	CSUPR-16	Sample	Th-230	0.004 +/- 0.016	0.029	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,U
0805200-16	CSUPR-16	Sample	Th-232	0.010 +/- 0.011	0.017	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,U
0805200-17	CSUPR-17	Sample	Th-228	0.003 +/- 0.011	0.019	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-17	CSUPR-17	Sample	Th-230	-0.0006 +/- 0.0070	0.0130	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-17	CSUPR-17	Sample	Th-232	0.0029 +/- 0.0031	0.0046	pCi/g	TISSUE	AS080607-1	6/13/2008	U

Comments:

Data Package ID: *TH0805200-1*

Qualifiers/Flags:

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Client Project Name: Tissue samples
Client Project Number:

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Reported on: Wednesday, June 25, 2008
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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
0805200-20	CSUPR-20	Sample	Th-228	0.053 +/- 0.039	0.058	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,U
0805200-20	CSUPR-20	Sample	Th-230	0.002 +/- 0.018	0.033	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,U
0805200-20	CSUPR-20	Sample	Th-232	0.009 +/- 0.013	0.022	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,U
0805200-21	CSUPR-21	Sample	Th-228	0.006 +/- 0.010	0.017	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-21	CSUPR-21	Sample	Th-230	-0.0004 +/- 0.0073	0.0135	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-21	CSUPR-21	Sample	Th-232	0.0010 +/- 0.0025	0.0014	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-24	CSUPR-24	Sample	Th-228	0.060 +/- 0.044	0.067	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,U
0805200-24	CSUPR-24	Sample	Th-230	0.015 +/- 0.019	0.030	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,U
0805200-24	CSUPR-24	Sample	Th-232	0.0081 +/- 0.0087	0.0119	pCi/g	TISSUE	AS080607-1	6/13/2008	Y2,U

Comments:

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Isotopic Thorium By Alpha Spectroscopy Sample Results Summary

Client Name: CSU Dep't Ecological Radiological Health Sciences
Client Project Name: Tissue samples
Client Project Number:

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Reported on: Wednesday, June 25, 2008
9:33:12 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0805200-25	CSUPR-25	Sample	Th-228	-0.025 +/- 0.028	0.052	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-25	CSUPR-25	Sample	Th-230	0 +/- 0.017	0.032	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-25	CSUPR-25	Sample	Th-232	0.0036 +/- 0.0064	0.0112	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-26	CSUPR-26	Sample	Th-228	0.009 +/- 0.012	0.019	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-26	CSUPR-26	Sample	Th-230	0.0029 +/- 0.0077	0.0133	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-26	CSUPR-26	Sample	Th-232	0.0016 +/- 0.0043	0.0078	pCi/g	TISSUE	AS080607-1	6/13/2008	U
0805200-29	CSUPR-29	Sample	Th-228	0.34 +/- 0.11	0.11	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2,M3
0805200-29	CSUPR-29	Sample	Th-230	0.038 +/- 0.032	0.047	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2,U
0805200-29	CSUPR-29	Sample	Th-232	-0.010 +/- 0.014	0.035	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2,U

Comments:

Data Package ID: *TH0805200-1*

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Client Project Number:

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Reported on: Wednesday, June 25, 2008
9:33:12 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0805200-30	CSUPR-30	Sample	Th-228	0.008 +/- 0.016	0.026	pCi/g	TISSUE	AS080607-1	6/14/2008	U
0805200-30	CSUPR-30	Sample	Th-230	-0.0020 +/- 0.0089	0.0167	pCi/g	TISSUE	AS080607-1	6/14/2008	U
0805200-30	CSUPR-30	Sample	Th-232	-0.0012 +/- 0.0041	0.0088	pCi/g	TISSUE	AS080607-1	6/14/2008	U
0805200-33	CSUPR-33	Sample	Th-228	0.189 +/- 0.062	0.066	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2
0805200-33	CSUPR-33	Sample	Th-230	0.006 +/- 0.017	0.030	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2,U
0805200-33	CSUPR-33	Sample	Th-232	0.0061 +/- 0.0075	0.0112	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2,U
0805200-34	CSUPR-34	Sample	Th-228	0.011 +/- 0.013	0.021	pCi/g	TISSUE	AS080607-1	6/14/2008	U
0805200-34	CSUPR-34	Sample	Th-230	-0.0057 +/- 0.0075	0.0152	pCi/g	TISSUE	AS080607-1	6/14/2008	U
0805200-34	CSUPR-34	Sample	Th-232	0.0018 +/- 0.0035	0.0063	pCi/g	TISSUE	AS080607-1	6/14/2008	U

Comments:

Data Package ID: *TH0805200-1*

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

Isotopic Thorium By Alpha Spectroscopy Sample Results Summary

Client Name: CSU Dep't Ecological Radiological Health Sciences
Client Project Name: Tissue samples
Client Project Number:

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Reported on: Wednesday, June 25, 2008
9:33:12 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0805200-37	CSUPR-37	Sample	Th-228	0.126 +/- 0.051	0.060	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2
0805200-37	CSUPR-37	Sample	Th-230	-0.003 +/- 0.020	0.038	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2,U
0805200-37	CSUPR-37	Sample	Th-232	0.0097 +/- 0.0097	0.0052	pCi/g	TISSUE	AS080607-1	6/14/2008	Y2,LT

Comments:

Data Package ID: *TH0805200-1*

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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PARAGON ANALYTICS
Radiochemistry Data Package

Section 3

QC RESULTS SUMMARY

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Method Blank Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Lab ID: AS080607-1MB

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 07-Jun-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes

Final Aliquot: 4.00 g
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	-0.003 +/- 0.015	0.026	0.1	U
14269-63-7	Th-230	-0.0026 +/- 0.0089	0.0170	0.1	U
7440-29-1	Th-232	-0.0026 +/- 0.0046	0.0104	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.6064	0.361	pCi/g	59.5	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Laboratory Control Sample(s)

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Lab ID: AS080607-1LCS

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 07-Jun-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes

Final Aliquot: 4.00 g
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14269-63-7	Th-230	0.61 +/- 0.10	0.02	0.639	95.1	85 - 121	P

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.6064	0.381	pCi/g	62.9	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Laboratory Control Sample(s)

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Lab ID: AS080607-1LCSD

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 07-Jun-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes

Final Aliquot: 4.00 g
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14269-63-7	Th-230	0.66 +/- 0.11	0.02	0.639	103	85 - 121	P

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.6064	0.423	pCi/g	69.8	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Duplicate Sample Results (DER)

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:
Lab ID: AS080607-1LCSD

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 07-Jun-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes

Final Aliquot: 4.00 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Analyte	Sample Result +/- 2s TPU	Duplicate Result +/- 2s TPU	DER	Control Limit	Lab Qualifiers
14269-63-7	Th-230	0.61 +/- 0.10	0.66 +/- 0.11	0.33	2.13	P

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: *TH0805200-1*

PARAGON ANALYTICS
Radiochemistry Data Package

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Section 4

INDIVIDUAL SAMPLE RESULTS

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID: CSUPR-1
Lab ID: 0805200-1

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 20-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.03 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	-0.008 +/- 0.013	0.024	0.1	U
14269-63-7	Th-230	0.0048 +/- 0.0093	0.0158	0.1	U
7440-29-1	Th-232	-0.0006 +/- 0.0045	0.0092	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4827	0.251	pCi/g	52.1	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID: CSUPR-4
Lab ID: 0805200-4

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 20-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 2.26 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.041 +/- 0.031	0.046	0.1	U
14269-63-7	Th-230	0 +/- 0.018	0.033	0.1	U
7440-29-1	Th-232	0 +/- 0.0065	0.0143	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	1.075	0.565	pCi/g	52.5	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-5
Lab ID:	0805200-5

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 20-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.00 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	-0.001 +/- 0.012	0.022	0.1	U
14269-63-7	Th-230	0.0015 +/- 0.0083	0.0148	0.1	U
7440-29-1	Th-232	0.0018 +/- 0.0029	0.0043	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4851	0.254	pCi/g	52.3	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-8
Lab ID:	0805200-8

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 20-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 2.36 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.024 +/- 0.030	0.049	0.1	U
14269-63-7	Th-230	-0.014 +/- 0.016	0.033	0.1	U
7440-29-1	Th-232	0.0044 +/- 0.0079	0.0138	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	1.026	0.462	pCi/g	45.0	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID: CSUPR-9
Lab ID: 0805200-9

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 20-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 3.70 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	-0.003 +/- 0.016	0.028	0.1	U
14269-63-7	Th-230	-0.0069 +/- 0.0091	0.0181	0.1	U
7440-29-1	Th-232	0.0025 +/- 0.0040	0.0068	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.6563	0.429	pCi/g	65.4	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID: CSUPR-12
Lab ID: 0805200-12

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 20-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 2.15 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.103 +/- 0.043	0.054	0.1	
14269-63-7	Th-230	0.003 +/- 0.020	0.036	0.1	U
7440-29-1	Th-232	0 +/- 0.0076	0.0144	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	1.128	0.511	pCi/g	45.3	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-13
Lab ID:	0805200-13

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 19-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.03 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	-0.003 +/- 0.010	0.019	0.1	U
14269-63-7	Th-230	-0.0054 +/- 0.0072	0.0145	0.1	U
7440-29-1	Th-232	0 +/- 0.0031	0.0065	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4824	0.272	pCi/g	56.4	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-16
Lab ID:	0805200-16

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 19-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.04 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.078 +/- 0.037	0.050	0.1	Y2,LT
14269-63-7	Th-230	0.004 +/- 0.016	0.029	0.1	Y2,U
7440-29-1	Th-232	0.010 +/- 0.011	0.017	0.1	Y2,U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4811	0.107	pCi/g	22.2	30 - 110 %	Y2

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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-17
Lab ID:	0805200-17

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 19-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.08 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.003 +/- 0.011	0.019	0.1	U
14269-63-7	Th-230	-0.0006 +/- 0.0070	0.0130	0.1	U
7440-29-1	Th-232	0.0029 +/- 0.0031	0.0046	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4779	0.277	pCi/g	57.9	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.

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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID: CSUPR-20
Lab ID: 0805200-20

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 19-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 4.97 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.053 +/- 0.039	0.058	0.1	Y2,U
14269-63-7	Th-230	0.002 +/- 0.018	0.033	0.1	Y2,U
7440-29-1	Th-232	0.009 +/- 0.013	0.022	0.1	Y2,U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4878	0.098	pCi/g	20.0	30 - 110 %	Y2

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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-21
Lab ID:	0805200-21

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 19-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.14 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.006 +/- 0.010	0.017	0.1	U
14269-63-7	Th-230	-0.0004 +/- 0.0073	0.0135	0.1	U
7440-29-1	Th-232	0.0010 +/- 0.0025	0.0014	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4724	0.259	pCi/g	54.9	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.

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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-24
Lab ID:	0805200-24

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 19-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.17 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.060 +/- 0.044	0.067	0.1	Y2,U
14269-63-7	Th-230	0.015 +/- 0.019	0.030	0.1	Y2,U
7440-29-1	Th-232	0.0081 +/- 0.0087	0.0119	0.1	Y2,U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4696	0.087	pCi/g	18.5	30 - 110 %	Y2

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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-25
Lab ID:	0805200-25

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 20-May-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 2.00 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	-0.025 +/- 0.028	0.052	0.1	U
14269-63-7	Th-230	0 +/- 0.017	0.032	0.1	U
7440-29-1	Th-232	0.0036 +/- 0.0064	0.0112	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	1.211	0.72	pCi/g	59.8	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-26
Lab ID:	0805200-26

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 07-Apr-08
Date Prepared: 07-Jun-08
Date Analyzed: 13-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.18 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.009 +/- 0.012	0.019	0.1	U
14269-63-7	Th-230	0.0029 +/- 0.0077	0.0133	0.1	U
7440-29-1	Th-232	0.0016 +/- 0.0043	0.0078	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4686	0.244	pCi/g	52.1	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID: CSUPR-29
Lab ID: 0805200-29

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 07-Apr-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 3.29 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.34 +/- 0.11	0.11	0.1	Y2,M3
14269-63-7	Th-230	0.038 +/- 0.032	0.047	0.1	Y2,U
7440-29-1	Th-232	-0.010 +/- 0.014	0.035	0.1	Y2,U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.7370	0.133	pCi/g	18.0	30 - 110 %	Y2

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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-30
Lab ID:	0805200-30

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 12-Apr-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.02 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.008 +/- 0.016	0.026	0.1	U
14269-63-7	Th-230	-0.0020 +/- 0.0089	0.0167	0.1	U
7440-29-1	Th-232	-0.0012 +/- 0.0041	0.0088	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4835	0.245	pCi/g	50.7	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-33
Lab ID:	0805200-33

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 12-Apr-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 4.87 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.189 +/- 0.062	0.066	0.1	Y2
14269-63-7	Th-230	0.006 +/- 0.017	0.030	0.1	Y2,U
7440-29-1	Th-232	0.0061 +/- 0.0075	0.0112	0.1	Y2,U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4985	0.103	pCi/g	20.8	30 - 110 %	Y2

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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID:	CSUPR-34
Lab ID:	0805200-34

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 13-Apr-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 5.14 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.011 +/- 0.013	0.021	0.1	U
14269-63-7	Th-230	-0.0057 +/- 0.0075	0.0152	0.1	U
7440-29-1	Th-232	0.0018 +/- 0.0035	0.0063	0.1	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.4723	0.244	pCi/g	51.7	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: *TH0805200-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 11

Sample Results

Lab Name: **Paragon Analytics**
Work Order Number: 0805200
Client Name: CSU Dep't Ecological Radiological Health Sciences
ClientProject ID: Tissue samples

Field ID: CSUPR-37
Lab ID: 0805200-37

Sample Matrix: TISSUE
Prep SOP: PAI 777 Rev 9
Date Collected: 13-Apr-08
Date Prepared: 07-Jun-08
Date Analyzed: 14-Jun-08

Prep Batch: AS080607-1
QCBatchID: AS080607-1-1
Run ID: AS080607-1A
Count Time: 1000 minutes
Report Basis: As Received

Final Aliquot: 3.73 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14274-82-9	Th-228	0.126 +/- 0.051	0.060	0.1	Y2
14269-63-7	Th-230	-0.003 +/- 0.020	0.038	0.1	Y2,U
7440-29-1	Th-232	0.0097 +/- 0.0097	0.0052	0.1	Y2,LT

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	0.6508	0.144	pCi/g	22.1	30 - 110 %	Y2

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: *TH0805200-1*

PARAGON ANALYTICS
Radiochemistry Data Package

5

Section 5

RAW DATA

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **Paragon Analytics** **Prep SOP:** PAI 777 **Reported on:** Monday, June 16, 2008

PAI Work Order: 0805200 **Analytical SOP:** PAI 714 1:31:11 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
0805200-1	Th-228	5/20/2008	AS080607-1	NA	NA	TISSUE	5.03 g	AlphaSpec2	AS080607-1A	6/13/2008	-13.000	29.70%	1000	-0.008	0.024	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.03 g	27	Spectrum #1	2:40 PM	67.000	1000	52.1%	0.013	NA	As Received	NA	U
0805200-1	Th-229	5/20/2008	AS080607-1	NA	NA	TISSUE	5.03 g	AlphaSpec2	AS080607-1A	6/13/2008	833.000	29.70%	1000	0.251	0.005	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.03 g	27	Spectrum #1	2:40 PM	9.000	1000	52.1%	0.041	NA	As Received	NA	
0805200-1	Th-230	5/20/2008	AS080607-1	NA	NA	TISSUE	5.03 g	AlphaSpec2	AS080607-1A	6/13/2008	8.286	29.70%	1000	0.0048	0.0158	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.03 g	27	Spectrum #1	2:40 PM	27.714	1000	52.1%	0.0093	NA	As Received	NA	U
0805200-1	Th-232	5/20/2008	AS080607-1	NA	NA	TISSUE	5.03 g	AlphaSpec2	AS080607-1A	6/13/2008	-1.000	29.70%	1000	-0.0006	0.0092	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.03 g	27	Spectrum #1	2:40 PM	8.000	1000	52.1%	0.0045	NA	As Received	NA	U
0805200-4	Th-228	5/20/2008	AS080607-1	NA	NA	TISSUE	2.26 g	AlphaSpec2	AS080607-1A	6/13/2008	30.000	28.60%	1000	0.041	0.046	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.26 g	28	Spectrum #1	2:40 PM	45.000	1000	52.5%	0.031	NA	As Received	NA	U
0805200-4	Th-229	5/20/2008	AS080607-1	NA	NA	TISSUE	2.26 g	AlphaSpec2	AS080607-1A	6/13/2008	809.000	28.60%	1000	0.565	0.008	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	2.26 g	28	Spectrum #1	2:40 PM	3.000	1000	52.5%	0.092	NA	As Received	NA	
0805200-4	Th-230	5/20/2008	AS080607-1	NA	NA	TISSUE	2.26 g	AlphaSpec2	AS080607-1A	6/13/2008	0.024	28.60%	1000	0	0.033	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.26 g	28	Spectrum #1	2:40 PM	21.976	1000	52.5%	0.018	NA	As Received	NA	U
0805200-4	Th-232	5/20/2008	AS080607-1	NA	NA	TISSUE	2.26 g	AlphaSpec2	AS080607-1A	6/13/2008	0.000	28.60%	1000	0	0.0143	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.26 g	28	Spectrum #1	2:40 PM	3.000	1000	52.5%	0.0065	NA	As Received	NA	U
0805200-5	Th-228	5/20/2008	AS080607-1	NA	NA	TISSUE	5 g	AlphaSpec2	AS080607-1A	6/13/2008	-2.000	29.25%	1000	-0.001	0.022	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5 g	29	Spectrum #1	2:40 PM	52.000	1000	52.3%	0.012	NA	As Received	NA	U
0805200-5	Th-229	5/20/2008	AS080607-1	NA	NA	TISSUE	5 g	AlphaSpec2	AS080607-1A	6/13/2008	824.000	29.25%	1000	0.254	0.004	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5 g	29	Spectrum #1	2:40 PM	4.000	1000	52.3%	0.041	NA	As Received	NA	
0805200-5	Th-230	5/20/2008	AS080607-1	NA	NA	TISSUE	5 g	AlphaSpec2	AS080607-1A	6/13/2008	2.631	29.25%	1000	0.0015	0.0148	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5 g	29	Spectrum #1	2:40 PM	23.369	1000	52.3%	0.0083	NA	As Received	NA	U

Comments:

Data Package ID: *TH0805200-1*

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

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **Paragon Analytics** **Prep SOP:** PAI 777 **Reported on:** Monday, June 16, 2008

PAI Work Order: 0805200 **Analytical SOP:** PAI 714 1:31:11 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
0805200-5	Th-232	5/20/2008	AS080607-1	NA	NA	TISSUE	5 g	AlphaSpec2	AS080607-1A	6/13/2008	3.000	29.25%	1000	0.0018	0.0043	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5 g	29	Spectrum #1	2:40 PM	1.000	1000	52.3%	0.0029	NA	As Received	NA	U
0805200-8	Th-228	5/20/2008	AS080607-1	NA	NA	TISSUE	2.36 g	AlphaSpec2	AS080607-1A	6/13/2008	16.000	28.60%	1000	0.024	0.049	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.36 g	30	Spectrum #1	2:40 PM	41.000	1000	45.0%	0.030	NA	As Received	NA	U
0805200-8	Th-229	5/20/2008	AS080607-1	NA	NA	TISSUE	2.36 g	AlphaSpec2	AS080607-1A	6/13/2008	693.000	28.60%	1000	0.462	0.010	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	2.36 g	30	Spectrum #1	2:40 PM	7.000	1000	45.0%	0.076	NA	As Received	NA	
0805200-8	Th-230	5/20/2008	AS080607-1	NA	NA	TISSUE	2.36 g	AlphaSpec2	AS080607-1A	6/13/2008	-9.221	28.60%	1000	-0.014	0.033	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.36 g	30	Spectrum #1	2:40 PM	18.221	1000	45.0%	0.016	NA	As Received	NA	U
0805200-8	Th-232	5/20/2008	AS080607-1	NA	NA	TISSUE	2.36 g	AlphaSpec2	AS080607-1A	6/13/2008	3.000	28.60%	1000	0.0044	0.0138	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.36 g	30	Spectrum #1	2:40 PM	2.000	1000	45.0%	0.0079	NA	As Received	NA	U
0805200-9	Th-228	5/20/2008	AS080607-1	NA	NA	TISSUE	3.7 g	AlphaSpec2	AS080607-1A	6/13/2008	-5.000	29.43%	1000	-0.003	0.028	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.7 g	31	Spectrum #1	2:40 PM	78.000	1000	65.4%	0.016	NA	As Received	NA	U
0805200-9	Th-229	5/20/2008	AS080607-1	NA	NA	TISSUE	3.7 g	AlphaSpec2	AS080607-1A	6/13/2008	1037.000	29.43%	1000	0.429	0.009	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	3.7 g	31	Spectrum #1	2:40 PM	18.000	1000	65.4%	0.068	NA	As Received	NA	
0805200-9	Th-230	5/20/2008	AS080607-1	NA	NA	TISSUE	3.7 g	AlphaSpec2	AS080607-1A	6/13/2008	-10.954	29.43%	1000	-0.0069	0.0181	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.7 g	31	Spectrum #1	2:40 PM	30.954	1000	65.4%	0.0091	NA	As Received	NA	U
0805200-9	Th-232	5/20/2008	AS080607-1	NA	NA	TISSUE	3.7 g	AlphaSpec2	AS080607-1A	6/13/2008	4.000	29.43%	1000	0.0025	0.0068	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.7 g	31	Spectrum #1	2:40 PM	3.000	1000	65.4%	0.0040	NA	As Received	NA	U
0805200-12	Th-228	5/20/2008	AS080607-1	NA	NA	TISSUE	2.15 g	AlphaSpec2	AS080607-1A	6/13/2008	65.000	29.78%	1000	0.103	0.054	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.15 g	32	Spectrum #1	2:40 PM	45.000	1000	45.3%	0.043	NA	As Received	NA	
0805200-12	Th-229	5/20/2008	AS080607-1	NA	NA	TISSUE	2.15 g	AlphaSpec2	AS080607-1A	6/13/2008	727.000	29.78%	1000	0.511	0.010	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	2.15 g	32	Spectrum #1	2:40 PM	6.000	1000	45.3%	0.084	NA	As Received	NA	

Comments:

Data Package ID: *TH0805200-1*

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

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **Paragon Analytics** **Prep SOP:** PAI 777 **Reported on:** Monday, June 16, 2008

PAI Work Order: 0805200 **Analytical SOP:** PAI 714 1:31:11 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
0805200-12	Th-230	5/20/2008	AS080607-1	NA	NA	TISSUE	2.15 g	AlphaSpec2	AS080607-1A	6/13/2008	1.968	29.78%	1000	0.003	0.036	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.15 g	32	Spectrum #1	2:40 PM	19.032	1000	45.3%	0.020	NA	As Received	NA	U
0805200-12	Th-232	5/20/2008	AS080607-1	NA	NA	TISSUE	2.15 g	AlphaSpec2	AS080607-1A	6/13/2008	0.000	29.78%	1000	0	0.0144	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2.15 g	32	Spectrum #1	2:40 PM	2.000	1000	45.3%	0.0076	NA	As Received	NA	U
0805200-13	Th-228	5/19/2008	AS080607-1	NA	NA	TISSUE	5.03 g	AlphaSpec2	AS080607-1A	6/13/2008	-5.000	29.42%	1000	-0.003	0.019	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.03 g	57	Spectrum #1	2:39 PM	44.000	1000	56.4%	0.010	NA	As Received	NA	U
0805200-13	Th-229	5/19/2008	AS080607-1	NA	NA	TISSUE	5.03 g	AlphaSpec2	AS080607-1A	6/13/2008	894.000	29.42%	1000	0.272	0.004	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.03 g	57	Spectrum #1	2:39 PM	4.000	1000	56.4%	0.044	NA	As Received	NA	
0805200-13	Th-230	5/19/2008	AS080607-1	NA	NA	TISSUE	5.03 g	AlphaSpec2	AS080607-1A	6/13/2008	-10.092	29.42%	1000	-0.0054	0.0145	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.03 g	57	Spectrum #1	2:39 PM	27.092	1000	56.4%	0.0072	NA	As Received	NA	U
0805200-13	Th-232	5/19/2008	AS080607-1	NA	NA	TISSUE	5.03 g	AlphaSpec2	AS080607-1A	6/13/2008	0.000	29.42%	1000	0	0.0065	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.03 g	57	Spectrum #1	2:39 PM	4.000	1000	56.4%	0.0031	NA	As Received	NA	U
0805200-16	Th-228	5/19/2008	AS080607-1	NA	NA	TISSUE	5.04 g	AlphaSpec2	AS080607-1A	6/13/2008	60.000	31.92%	1000	0.078	0.050	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.04 g	58	Spectrum #1	2:39 PM	60.000	1000	22.2%	0.037	NA	As Received	NA	Y2,LT
0805200-16	Th-229	5/19/2008	AS080607-1	NA	NA	TISSUE	5.04 g	AlphaSpec2	AS080607-1A	6/13/2008	381.000	31.92%	1000	0.107	0.006	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.04 g	58	Spectrum #1	2:39 PM	15.000	1000	22.2%	0.019	NA	As Received	NA	Y2
0805200-16	Th-230	5/19/2008	AS080607-1	NA	NA	TISSUE	5.04 g	AlphaSpec2	AS080607-1A	6/13/2008	3.258	31.92%	1000	0.004	0.029	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.04 g	58	Spectrum #1	2:39 PM	18.742	1000	22.2%	0.016	NA	As Received	NA	Y2,U
0805200-16	Th-232	5/19/2008	AS080607-1	NA	NA	TISSUE	5.04 g	AlphaSpec2	AS080607-1A	6/13/2008	8.000	31.92%	1000	0.010	0.017	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.04 g	58	Spectrum #1	2:39 PM	5.000	1000	22.2%	0.011	NA	As Received	NA	Y2,U
0805200-17	Th-228	5/19/2008	AS080607-1	NA	NA	TISSUE	5.08 g	AlphaSpec2	AS080607-1A	6/13/2008	5.000	31.26%	1000	0.003	0.019	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.08 g	59	Spectrum #1	2:39 PM	56.000	1000	57.9%	0.011	NA	As Received	NA	U

Comments:

Data Package ID: *TH0805200-1*

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

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **Paragon Analytics** **Prep SOP:** PAI 777 **Reported on:** Monday, June 16, 2008

PAI Work Order: 0805200 **Analytical SOP:** PAI 714 1:31:11 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
0805200-17	Th-229	5/19/2008	AS080607-1	NA	NA	TISSUE	5.08 g	AlphaSpec2	AS080607-1A	6/13/2008	975.000	31.26%	1000	0.277	0.005	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.08 g	59	Spectrum #1	2:39 PM	10.000	1000	57.9%	0.044	NA	As Received	NA	
0805200-17	Th-230	5/19/2008	AS080607-1	NA	NA	TISSUE	5.08 g	AlphaSpec2	AS080607-1A	6/13/2008	-1.232	31.26%	1000	-0.0006	0.0130	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.08 g	59	Spectrum #1	2:39 PM	26.232	1000	57.9%	0.0070	NA	As Received	NA	U
0805200-17	Th-232	5/19/2008	AS080607-1	NA	NA	TISSUE	5.08 g	AlphaSpec2	AS080607-1A	6/13/2008	6.000	31.26%	1000	0.0029	0.0046	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.08 g	59	Spectrum #1	2:39 PM	2.000	1000	57.9%	0.0031	NA	As Received	NA	U
0805200-20	Th-228	5/19/2008	AS080607-1	NA	NA	TISSUE	4.97 g	AlphaSpec2	AS080607-1A	6/13/2008	35.000	30.83%	1000	0.053	0.058	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	4.97 g	60	Spectrum #1	2:39 PM	60.000	1000	20.0%	0.039	NA	As Received	NA	Y2,U
0805200-20	Th-229	5/19/2008	AS080607-1	NA	NA	TISSUE	4.97 g	AlphaSpec2	AS080607-1A	6/13/2008	332.000	30.83%	1000	0.098	0.008	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	4.97 g	60	Spectrum #1	2:39 PM	25.000	1000	20.0%	0.018	NA	As Received	NA	Y2
0805200-20	Th-230	5/19/2008	AS080607-1	NA	NA	TISSUE	4.97 g	AlphaSpec2	AS080607-1A	6/13/2008	1.218	30.83%	1000	0.002	0.033	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	4.97 g	60	Spectrum #1	2:39 PM	17.782	1000	20.0%	0.018	NA	As Received	NA	Y2,U
0805200-20	Th-232	5/19/2008	AS080607-1	NA	NA	TISSUE	4.97 g	AlphaSpec2	AS080607-1A	6/13/2008	6.000	30.83%	1000	0.009	0.022	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	4.97 g	60	Spectrum #1	2:39 PM	7.000	1000	20.0%	0.013	NA	As Received	NA	Y2,U
0805200-21	Th-228	5/19/2008	AS080607-1	NA	NA	TISSUE	5.14 g	AlphaSpec2	AS080607-1A	6/13/2008	11.000	31.21%	1000	0.006	0.017	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.14 g	61	Spectrum #1	2:39 PM	42.000	1000	54.9%	0.010	NA	As Received	NA	U
0805200-21	Th-229	5/19/2008	AS080607-1	NA	NA	TISSUE	5.14 g	AlphaSpec2	AS080607-1A	6/13/2008	923.000	31.21%	1000	0.259	0.003	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.14 g	61	Spectrum #1	2:39 PM	4.000	1000	54.9%	0.042	NA	As Received	NA	
0805200-21	Th-230	5/19/2008	AS080607-1	NA	NA	TISSUE	5.14 g	AlphaSpec2	AS080607-1A	6/13/2008	-0.805	31.21%	1000	-0.0004	0.0135	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.14 g	61	Spectrum #1	2:39 PM	25.805	1000	54.9%	0.0073	NA	As Received	NA	U
0805200-21	Th-232	5/19/2008	AS080607-1	NA	NA	TISSUE	5.14 g	AlphaSpec2	AS080607-1A	6/13/2008	2.000	31.21%	1000	0.0010	0.0014	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.14 g	61	Spectrum #1	2:39 PM	0.000	1000	54.9%	0.0025	NA	As Received	NA	U

Comments:

Data Package ID: *TH0805200-1*

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

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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

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **Paragon Analytics** **Prep SOP:** PAI 777 **Reported on:** Monday, June 16, 2008

PAI Work Order: 0805200 **Analytical SOP:** PAI 714 1:31:11 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
0805200-24	Th-228	5/19/2008	AS080607-1	NA	NA	TISSUE	5.17 g	AlphaSpec2	AS080607-1A	6/13/2008	36.000	29.27%	1000	0.060	0.067	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.17 g	62	Spectrum #1	2:39 PM	66.000	1000	18.5%	0.044	NA	As Received	NA	Y2,U
0805200-24	Th-229	5/19/2008	AS080607-1	NA	NA	TISSUE	5.17 g	AlphaSpec2	AS080607-1A	6/13/2008	291.000	29.27%	1000	0.087	0.006	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.17 g	62	Spectrum #1	2:39 PM	15.000	1000	18.5%	0.017	NA	As Received	NA	Y2
0805200-24	Th-230	5/19/2008	AS080607-1	NA	NA	TISSUE	5.17 g	AlphaSpec2	AS080607-1A	6/13/2008	9.472	29.27%	1000	0.015	0.030	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.17 g	62	Spectrum #1	2:39 PM	11.528	1000	18.5%	0.019	NA	As Received	NA	Y2,U
0805200-24	Th-232	5/19/2008	AS080607-1	NA	NA	TISSUE	5.17 g	AlphaSpec2	AS080607-1A	6/13/2008	5.000	29.27%	1000	0.0081	0.0119	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.17 g	62	Spectrum #1	2:39 PM	1.000	1000	18.5%	0.0087	NA	As Received	NA	Y2,U
0805200-25	Th-228	5/20/2008	AS080607-1	NA	NA	TISSUE	2 g	AlphaSpec2	AS080607-1A	6/13/2008	-20.000	31.25%	1000	-0.025	0.052	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2 g	63	Spectrum #1	2:40 PM	73.000	1000	59.8%	0.028	NA	As Received	NA	U
0805200-25	Th-229	5/20/2008	AS080607-1	NA	NA	TISSUE	2 g	AlphaSpec2	AS080607-1A	6/13/2008	1007.000	31.25%	1000	0.72	0.01	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	2 g	63	Spectrum #1	2:40 PM	3.000	1000	59.8%	0.12	NA	As Received	NA	
0805200-25	Th-230	5/20/2008	AS080607-1	NA	NA	TISSUE	2 g	AlphaSpec2	AS080607-1A	6/13/2008	0.153	31.25%	1000	0	0.032	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2 g	63	Spectrum #1	2:40 PM	25.847	1000	59.8%	0.017	NA	As Received	NA	U
0805200-25	Th-232	5/20/2008	AS080607-1	NA	NA	TISSUE	2 g	AlphaSpec2	AS080607-1A	6/13/2008	3.000	31.25%	1000	0.0036	0.0112	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	2 g	63	Spectrum #1	2:40 PM	2.000	1000	59.8%	0.0064	NA	As Received	NA	U
0805200-26	Th-228	4/7/2008	AS080607-1	NA	NA	TISSUE	5.18 g	AlphaSpec2	AS080607-1A	6/13/2008	17.000	32.21%	1000	0.009	0.019	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.18 g	64	Spectrum #1	2:40 PM	46.000	1000	52.1%	0.012	NA	As Received	NA	U
0805200-26	Th-229	4/7/2008	AS080607-1	NA	NA	TISSUE	5.18 g	AlphaSpec2	AS080607-1A	6/13/2008	904.000	32.21%	1000	0.244	0.004	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.18 g	64	Spectrum #1	2:40 PM	5.000	1000	52.1%	0.039	NA	As Received	NA	
0805200-26	Th-230	4/7/2008	AS080607-1	NA	NA	TISSUE	5.18 g	AlphaSpec2	AS080607-1A	6/13/2008	5.638	32.21%	1000	0.0029	0.0133	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.18 g	64	Spectrum #1	2:40 PM	24.362	1000	52.1%	0.0077	NA	As Received	NA	U

Comments:

Data Package ID: *TH0805200-1*

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

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **Paragon Analytics** **Prep SOP:** PAI 777 **Reported on:** Monday, June 16, 2008

PAI Work Order: 0805200 **Analytical SOP:** PAI 714 1:31:11 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
0805200-26	Th-232	4/7/2008	AS080607-1	NA	NA	TISSUE	5.18 g	AlphaSpec2	AS080607-1A	6/13/2008	3.000	32.21%	1000	0.0016	0.0078	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.18 g	64	Spectrum #1	2:40 PM	7.000	1000	52.1%	0.0043	NA	As Received	NA	U
0805200-29	Th-228	4/7/2008	AS080607-1	NA	NA	TISSUE	3.29 g	AlphaSpec2	AS080607-1A	6/14/2008	130.000	30.93%	1000	0.34	0.11	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.29 g	17	Spectrum #1	11:39 AM	69.000	1000	18.0%	0.11	NA	As Received	NA	Y2,M3
0805200-29	Th-229	4/7/2008	AS080607-1	NA	NA	TISSUE	3.29 g	AlphaSpec2	AS080607-1A	6/14/2008	300.000	30.93%	1000	0.133	0.009	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	3.29 g	17	Spectrum #1	11:39 AM	14.000	1000	18.0%	0.025	NA	As Received	NA	Y2
0805200-29	Th-230	4/7/2008	AS080607-1	NA	NA	TISSUE	3.29 g	AlphaSpec2	AS080607-1A	6/14/2008	15.275	30.93%	1000	0.038	0.047	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.29 g	17	Spectrum #1	11:39 AM	12.725	1000	18.0%	0.032	NA	As Received	NA	Y2,U
0805200-29	Th-232	4/7/2008	AS080607-1	NA	NA	TISSUE	3.29 g	AlphaSpec2	AS080607-1A	6/14/2008	-4.000	30.93%	1000	-0.010	0.035	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.29 g	17	Spectrum #1	11:39 AM	6.000	1000	18.0%	0.014	NA	As Received	NA	Y2,U
0805200-30	Th-228	4/12/2008	AS080607-1	NA	NA	TISSUE	5.02 g	AlphaSpec2	AS080607-1A	6/14/2008	13.000	30.17%	1000	0.008	0.026	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.02 g	18	Spectrum #1	11:39 AM	71.000	1000	50.7%	0.016	NA	As Received	NA	U
0805200-30	Th-229	4/12/2008	AS080607-1	NA	NA	TISSUE	5.02 g	AlphaSpec2	AS080607-1A	6/14/2008	824.000	30.17%	1000	0.245	0.005	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.02 g	18	Spectrum #1	11:39 AM	9.000	1000	50.7%	0.040	NA	As Received	NA	
0805200-30	Th-230	4/12/2008	AS080607-1	NA	NA	TISSUE	5.02 g	AlphaSpec2	AS080607-1A	6/14/2008	-3.492	30.17%	1000	-0.0020	0.0167	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.02 g	18	Spectrum #1	11:39 AM	30.492	1000	50.7%	0.0089	NA	As Received	NA	U
0805200-30	Th-232	4/12/2008	AS080607-1	NA	NA	TISSUE	5.02 g	AlphaSpec2	AS080607-1A	6/14/2008	-2.000	30.17%	1000	-0.0012	0.0088	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.02 g	18	Spectrum #1	11:39 AM	7.000	1000	50.7%	0.0041	NA	As Received	NA	U
0805200-33	Th-228	4/12/2008	AS080607-1	NA	NA	TISSUE	4.87 g	AlphaSpec2	AS080607-1A	6/14/2008	117.000	29.35%	1000	0.189	0.066	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	4.87 g	19	Spectrum #1	11:39 AM	66.000	1000	20.8%	0.062	NA	As Received	NA	Y2
0805200-33	Th-229	4/12/2008	AS080607-1	NA	NA	TISSUE	4.87 g	AlphaSpec2	AS080607-1A	6/14/2008	328.000	29.35%	1000	0.103	0.005	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	4.87 g	19	Spectrum #1	11:39 AM	8.000	1000	20.8%	0.019	NA	As Received	NA	Y2

Comments:

Data Package ID: *TH0805200-1*

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

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **Paragon Analytics** **Prep SOP:** PAI 777 **Reported on:** Monday, June 16, 2008

PAI Work Order: 0805200 **Analytical SOP:** PAI 714 1:31:11 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
0805200-33	Th-230	4/12/2008	AS080607-1	NA	NA	TISSUE	4.87 g	AlphaSpec2	AS080607-1A	6/14/2008	3.734	29.35%	1000	0.006	0.030	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	4.87 g	19	Spectrum #1	11:39 AM	13.266	1000	20.8%	0.017	NA	As Received	NA	Y2,U
0805200-33	Th-232	4/12/2008	AS080607-1	NA	NA	TISSUE	4.87 g	AlphaSpec2	AS080607-1A	6/14/2008	4.000	29.35%	1000	0.0061	0.0112	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	4.87 g	19	Spectrum #1	11:39 AM	1.000	1000	20.8%	0.0075	NA	As Received	NA	Y2,U
0805200-34	Th-228	4/13/2008	AS080607-1	NA	NA	TISSUE	5.14 g	AlphaSpec2	AS080607-1A	6/14/2008	18.000	28.81%	1000	0.011	0.021	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.14 g	21	Spectrum #1	11:39 AM	43.000	1000	51.7%	0.013	NA	As Received	NA	U
0805200-34	Th-229	4/13/2008	AS080607-1	NA	NA	TISSUE	5.14 g	AlphaSpec2	AS080607-1A	6/14/2008	802.000	28.81%	1000	0.244	0.002	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	5.14 g	21	Spectrum #1	11:39 AM	1.000	1000	51.7%	0.040	NA	As Received	NA	
0805200-34	Th-230	4/13/2008	AS080607-1	NA	NA	TISSUE	5.14 g	AlphaSpec2	AS080607-1A	6/14/2008	-9.754	28.81%	1000	-0.0057	0.0152	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.14 g	21	Spectrum #1	11:39 AM	24.754	1000	51.7%	0.0075	NA	As Received	NA	U
0805200-34	Th-232	4/13/2008	AS080607-1	NA	NA	TISSUE	5.14 g	AlphaSpec2	AS080607-1A	6/14/2008	3.000	28.81%	1000	0.0018	0.0063	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	5.14 g	21	Spectrum #1	11:39 AM	3.000	1000	51.7%	0.0035	NA	As Received	NA	U
0805200-37	Th-228	4/13/2008	AS080607-1	NA	NA	TISSUE	3.73 g	AlphaSpec2	AS080607-1A	6/14/2008	61.000	28.19%	1000	0.126	0.060	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.73 g	22	Spectrum #1	11:39 AM	32.000	1000	22.1%	0.051	NA	As Received	NA	Y2
0805200-37	Th-229	4/13/2008	AS080607-1	NA	NA	TISSUE	3.73 g	AlphaSpec2	AS080607-1A	6/14/2008	336.000	28.19%	1000	0.144	0.005	pCi/g	NA	
SMP	Tracer		AS080607-1-1	NA	NA	NA	3.73 g	22	Spectrum #1	11:39 AM	3.000	1000	22.1%	0.026	NA	As Received	NA	Y2
0805200-37	Th-230	4/13/2008	AS080607-1	NA	NA	TISSUE	3.73 g	AlphaSpec2	AS080607-1A	6/14/2008	-1.340	28.19%	1000	-0.003	0.038	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.73 g	22	Spectrum #1	11:39 AM	13.340	1000	22.1%	0.020	NA	As Received	NA	Y2,U
0805200-37	Th-232	4/13/2008	AS080607-1	NA	NA	TISSUE	3.73 g	AlphaSpec2	AS080607-1A	6/14/2008	5.000	28.19%	1000	0.0097	0.0052	pCi/g	NA	
SMP	Trg. Analyte		AS080607-1-1	NA	NA	NA	3.73 g	22	Spectrum #1	11:39 AM	0.000	1000	22.1%	0.0097	NA	As Received	NA	Y2,LT
AS080607-1	Th-228	6/7/2008	AS080607-1	NA	NA	TISSUE	4 g	AlphaSpec2	AS080607-1A	6/14/2008	-4.000	28.76%	1000	-0.003	0.026	pCi/g	NA	
MB	Trg. Analyte	6:02:38 PM	AS080607-1-1	NA	NA	NA	4 g	23	Spectrum #1	11:39 AM	64.000	1000	59.5%	0.015	NA	As Received	NA	U

Comments:

Data Package ID: *TH0805200-1*

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

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: **Paragon Analytics** **Prep SOP:** PAI 777 **Reported on:** Monday, June 16, 2008

PAI Work Order: 0805200 **Analytical SOP:** PAI 714 1:31:11 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
AS080607-1	Th-229	6/7/2008	AS080607-1	NA	NA	TISSUE	4 g	AlphaSpec2	AS080607-1A	6/14/2008	922.000	28.76%	1000	0.361	0.006	pCi/g	NA	
MB	Tracer	6:02:38 PM	AS080607-1-1	NA	NA	NA	4 g	23	Spectrum #1	11:39 AM	8.000	1000	59.5%	0.058	NA	As Received	NA	
AS080607-1	Th-230	6/7/2008	AS080607-1	NA	NA	TISSUE	4 g	AlphaSpec2	AS080607-1A	6/14/2008	-3.879	28.76%	1000	-0.0026	0.0170	pCi/g	NA	
MB	Trg. Analyte	6:02:38 PM	AS080607-1-1	NA	NA	NA	4 g	23	Spectrum #1	11:39 AM	24.879	1000	59.5%	0.0089	NA	As Received	NA	U
AS080607-1	Th-232	6/7/2008	AS080607-1	NA	NA	TISSUE	4 g	AlphaSpec2	AS080607-1A	6/14/2008	-4.000	28.76%	1000	-0.0026	0.0104	pCi/g	NA	
MB	Trg. Analyte	6:02:38 PM	AS080607-1-1	NA	NA	NA	4 g	23	Spectrum #1	11:39 AM	8.000	1000	59.5%	0.0046	NA	As Received	NA	U
AS080607-1	Th-229	6/7/2008	AS080607-1	NA	NA	TISSUE	4 g	AlphaSpec2	AS080607-1A	6/14/2008	993.000	29.32%	1000	0.381	0.006	pCi/g	NA	
LCS	Tracer	6:02:38 PM	AS080607-1-1	NA	NA	NA	4 g	24	Spectrum #1	11:39 AM	8.000	1000	62.9%	0.061	NA	As Received	NA	
AS080607-1	Th-230	6/7/2008	AS080607-1	NA	NA	TISSUE	4 g	AlphaSpec2	AS080607-1A	6/14/2008	995.375	29.32%	1000	0.61	0.02	pCi/g	NA	95.1
LCS	Trg. Analyte	6:02:38 PM	AS080607-1-1	NA	NA	NA	4 g	24	Spectrum #1	11:39 AM	27.625	1000	62.9%	0.10	NA	As Received	NA	P
AS080607-1	Th-229	6/7/2008	AS080607-1	NA	NA	TISSUE	4 g	AlphaSpec2	AS080607-1A	6/14/2008	1101.000	29.29%	1000	0.423	0.005	pCi/g	NA	
LCSD	Tracer	6:02:38 PM	AS080607-1-1	NA	NA	NA	4 g	25	Spectrum #1	11:30 AM	6.000	1000	69.8%	0.067	NA	As Received	NA	
AS080607-1	Th-230	6/7/2008	AS080607-1	NA	NA	TISSUE	4 g	AlphaSpec2	AS080607-1A	6/14/2008	1194.767	29.29%	1000	0.66	0.02	pCi/g	0.33	103
LCSD	Trg. Analyte	6:02:38 PM	AS080607-1-1	NA	NA	NA	4 g	25	Spectrum #1	11:30 AM	33.233	1000	69.8%	0.11	NA	As Received	NA	P

Comments:

Data Package ID: *TH0805200-1*

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

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L - LCS Recovery below lower control limit.

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B - Analyte concentration greater than MDC.

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

Notes:

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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: 0805200-1
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 27
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:40:02PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08061027; Det: 27; Spectrum #1; Jun-10-2008 14:12

Calibration Date: 6/10/2008 12:25:45PM

Efficiency Calibration: C08061027

Efficiency: 29.70% +/- 0.16% TPU(2 sigma)

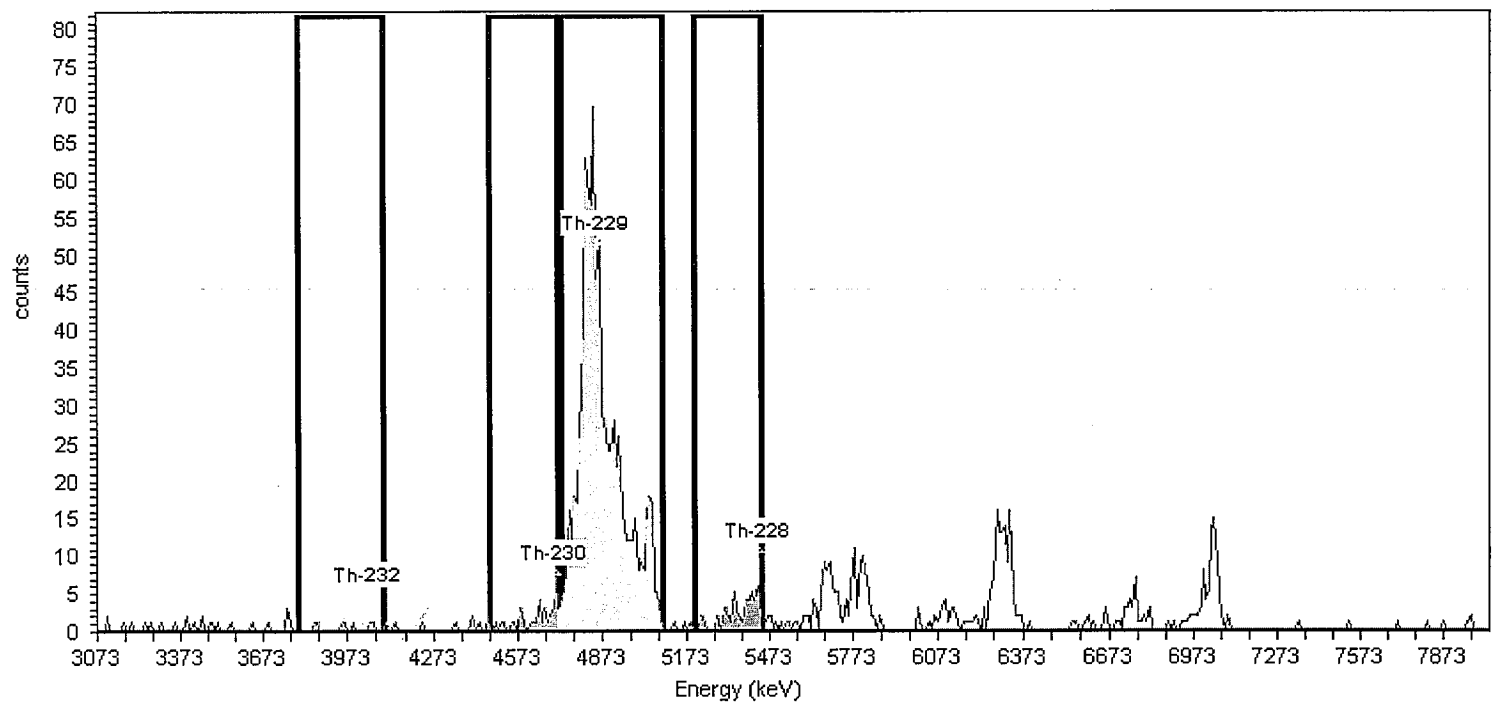
Energy Calibration: C08061027

Energy Cal: Gain = 9.7289 keV / Ch
Offset = 3,063.30 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 52.27%



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
Th-232	4036.2	3793.0	4094.6	118.4	100.2	7.00	8.00	-1.00	-5.8E-004	4.5E-003	3.8E-003	9.2E-003
Th-230	4697.7	4474.0	4717.2	20.6	100.1	36.00	7.00	8.29	4.8E-003	7.7E-003	3.6E-003	8.7E-003
Th-229	4853.4	4726.9	5086.9	89.1	99.6	842.00	9.00	833.00	2.5E-001	1.8E-002	4.1E-003	9.7E-003
Th-228	5427.4	5203.6	5446.9	24.6	100.0	54.00	67.00	-13.00	-7.5E-003	1.3E-002	1.1E-002	2.4E-002

Reviewed By: GB DS

Print Date: 6/16/2008 10:25:38AM

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

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-4
Spectrum #1 Analysis #1

Sample Size : 2.26

Acquisition

Detector: 28
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:40:01PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08061028; Det: 28; Spectrum #1; Jun-10-2008 14:12

Calibration Date: 6/10/2008 12:26:00PM

Efficiency Calibration: C08061028

Efficiency: 28.60% +/- 0.20% TPU(2 sigma)

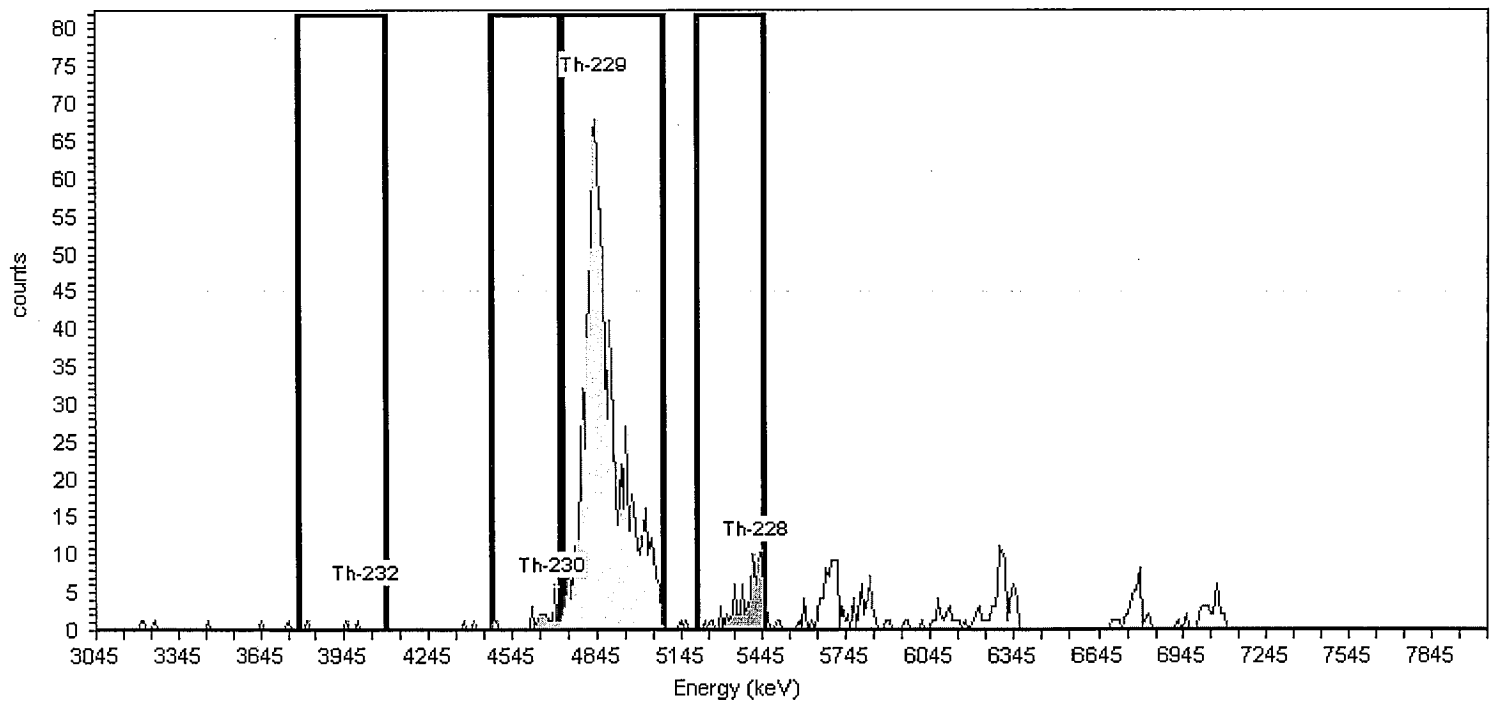
Energy Calibration: C08061028

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 52.71%



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
Th-228	5418.6	5202.9	5448.0	23.6	100.0	75.00	45.00	30.00	4.0E-002	2.9E-002	2.1E-002	4.5E-002
Th-232	4016.5	3781.2	4085.1	200.2	100.2	3.00	3.00	0.00	0.0E+000	6.5E-003	5.3E-003	1.4E-002
Th-230	4683.2	4467.5	4712.6	16.3	100.1	22.00	2.00	0.02	3.2E-005	1.3E-002	4.3E-003	1.2E-002
Th-229	4840.1	4722.4	5085.2	92.3	99.6	812.00	3.00	809.00	5.7E-001	4.0E-002	5.3E-003	1.4E-002

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-5
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 29
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:40:03PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08061029; Det: 29; Spectrum #1; Jun-10-2008 14:12

Calibration Date: 6/10/2008 12:26:15PM

Efficiency Calibration: C08061029

Efficiency: 29.25% +/- 0.13% TPU(2 sigma)

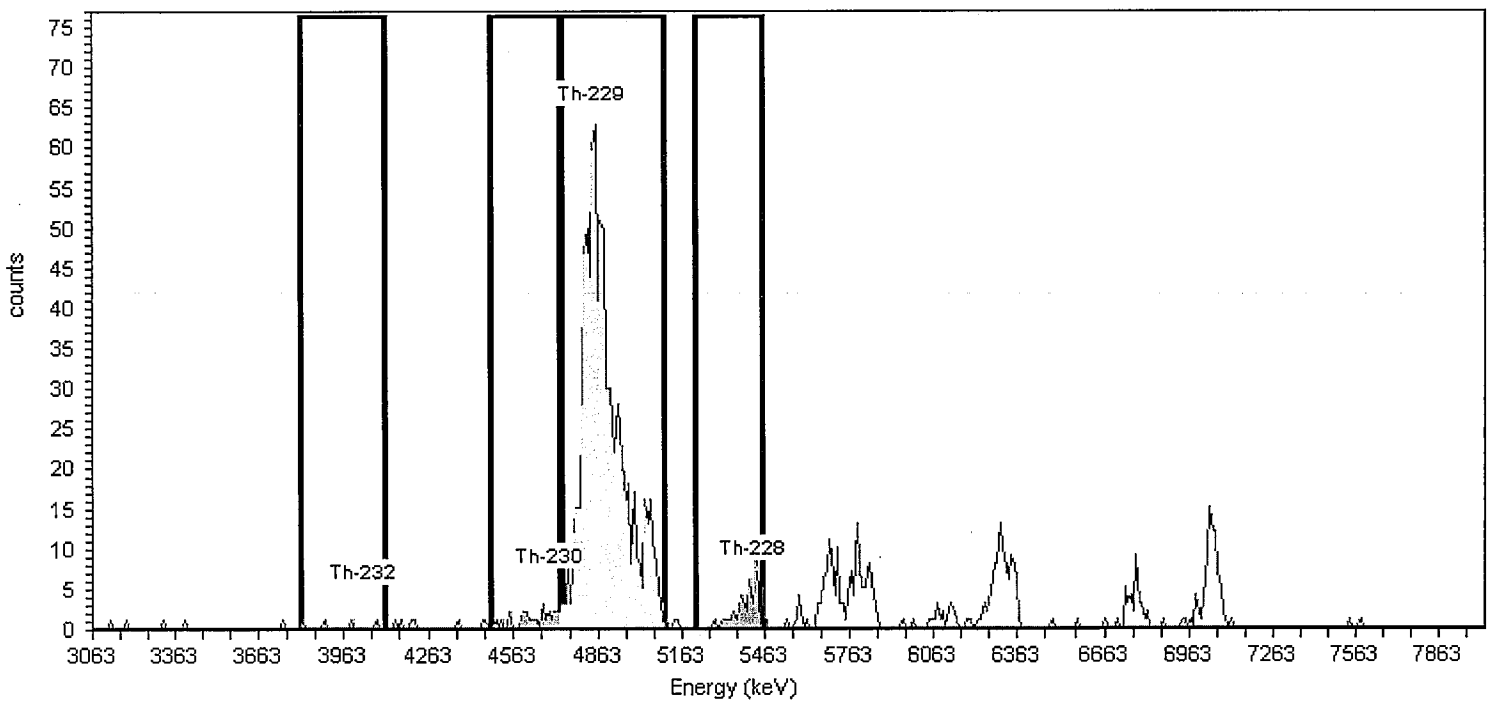
Energy Calibration: C08061029

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 52.50%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4036.2	3802.7	4104.3	14.4	100.2	4.00	1.00	3.00	1.8E-003	2.6E-003	1.4E-003	4.3E-003
Th-230	4697.7	4483.7	4726.9	65.9	100.1	26.00	3.00	2.63	1.5E-003	6.4E-003	2.4E-003	6.3E-003
Th-229	4853.4	4736.7	5096.6	111.3	99.6	828.00	4.00	824.00	2.5E-001	1.8E-002	2.7E-003	7.1E-003
Th-228	5427.4	5213.4	5456.6	20.9	100.0	50.00	52.00	-2.00	-1.2E-003	1.2E-002	9.8E-003	2.1E-002

Reviewed By: GB DS

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-8
Spectrum #1 Analysis #1

Sample Size : 2.36

Acquisition

Detector: 30
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:40:03PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08061030; Det: 30; Spectrum #1; Jun-10-2008 14:12

Calibration Date: 6/10/2008 12:26:28PM

Efficiency Calibration: C08061030

Efficiency: 28.60% +/- 0.15% TPU(2 sigma)

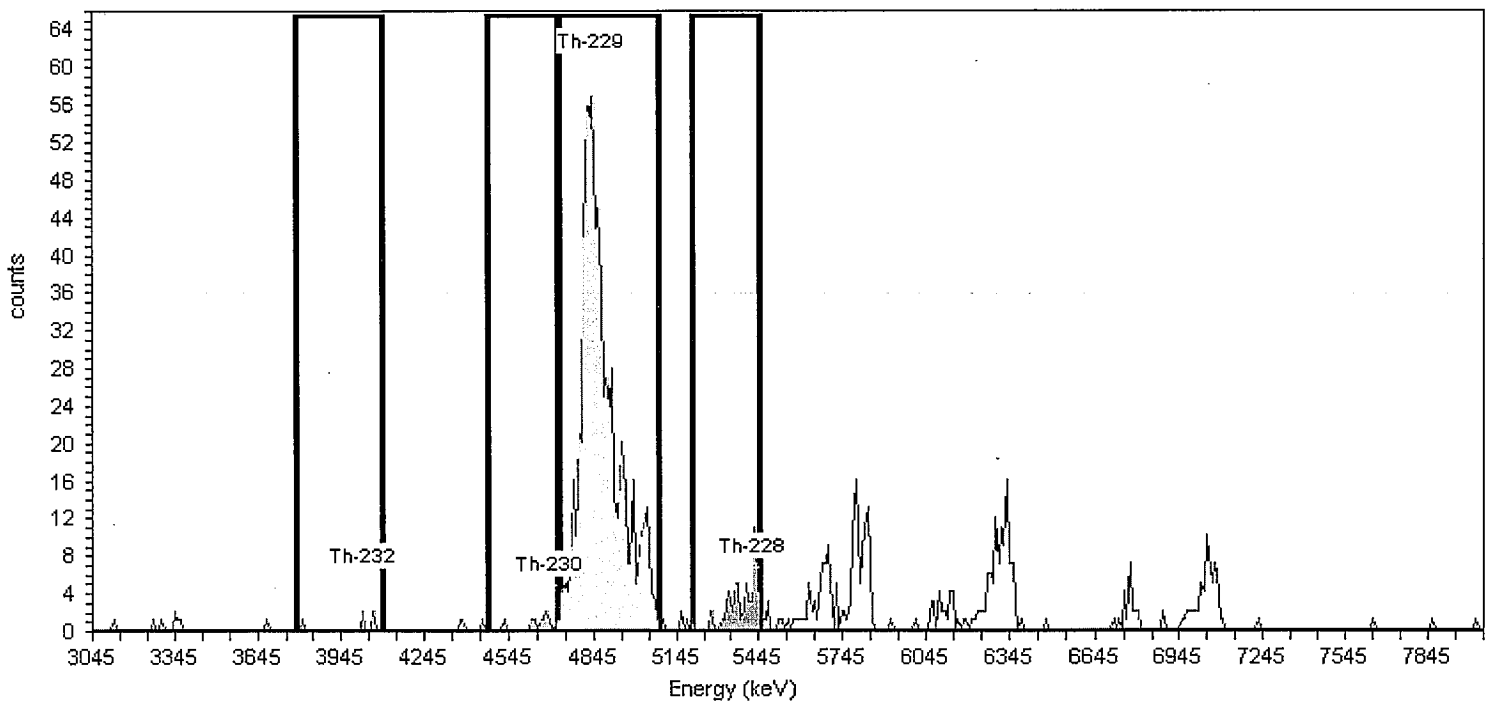
Energy Calibration: C08061030

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 45.15%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4016.5	3781.2	4085.1	234.4	100.2	5.00	2.00	3.00	4.4E-003	7.8E-003	4.9E-003	1.4E-002
Th-230	4683.2	4467.5	4712.6	62.3	100.1	9.00	1.00	-9.22	-1.4E-002	9.7E-003	3.4E-003	1.1E-002
Th-229	4840.1	4722.4	5085.2	94.8	99.6	700.00	7.00	693.00	4.6E-001	3.6E-002	9.1E-003	2.2E-002
Th-228	5418.6	5202.9	5448.0	20.6	100.0	57.00	41.00	16.00	2.4E-002	2.9E-002	2.2E-002	4.8E-002

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-9
Spectrum #1 Analysis #1

Sample Size : 3.70

Acquisition

Detector: 31
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:40:04PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08061031; Det: 31; Spectrum #1; Jun-10-2008 14:12

Calibration Date: 6/10/2008 12:26:48PM

Efficiency Calibration: C08061031

Efficiency: 29.43% +/- 0.18% TPU(2 sigma)

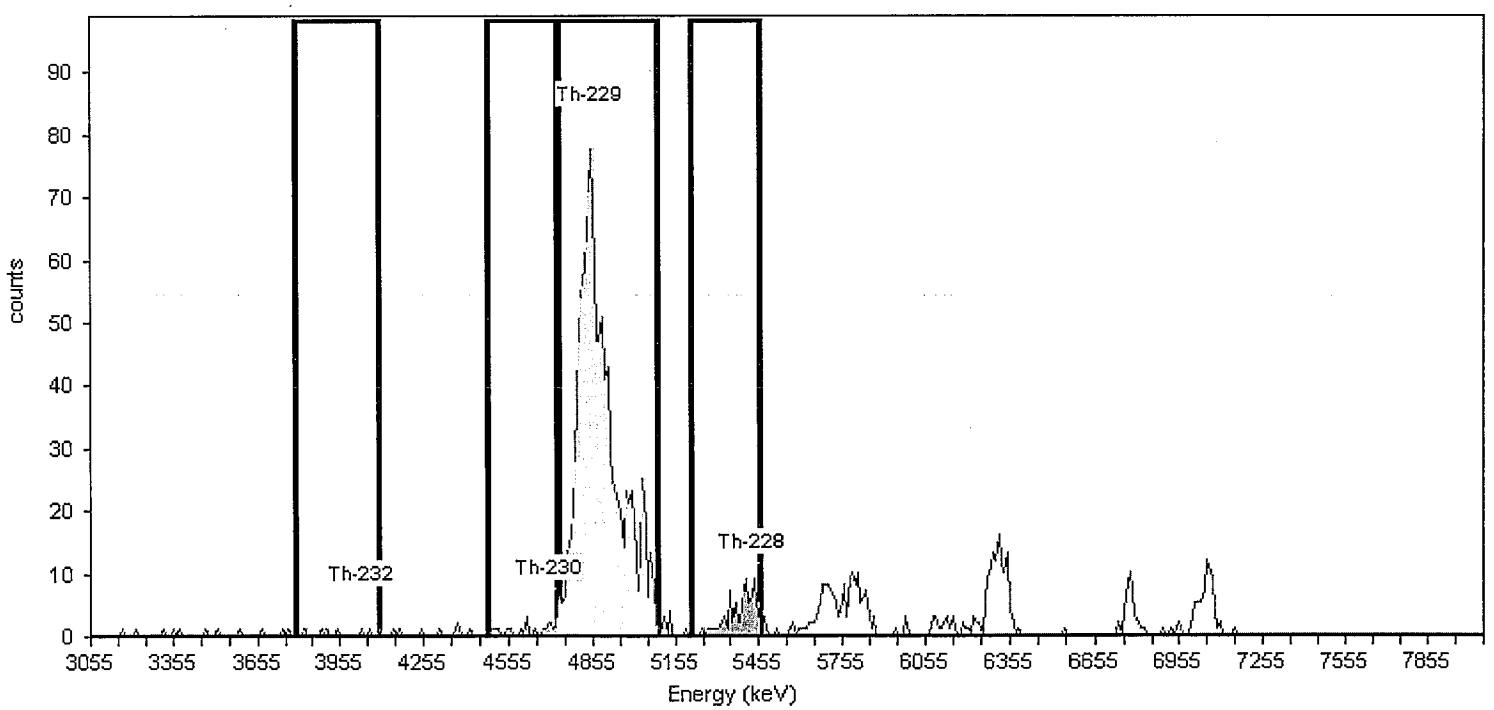
Energy Calibration: C08061031

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 65.67%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4026.3	3791.0	4094.9	.4	100.2	7.00	3.00	4.00	2.5E-003	4.0E-003	2.5E-003	6.8E-003
Th-230	4693.0	4477.3	4722.4	19.3	100.1	20.00	5.00	-10.95	-6.9E-003	6.4E-003	3.3E-003	8.3E-003
Th-229	4849.9	4732.2	5095.0	125.1	99.6	1,055.00	18.00	1,037.00	4.3E-001	2.7E-002	6.2E-003	1.4E-002
Th-228	5428.4	5212.7	5457.8	21.3	100.0	73.00	78.00	-5.00	-3.2E-003	1.6E-002	1.3E-002	2.8E-002

Reviewed By: GB

Print Date: 6/16/2008 10:26:00AM

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

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-12
Spectrum #1 Analysis #1

Sample Size : 2.15

Acquisition

Detector: 32
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:40:04PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08061032; Det: 32; Spectrum #1; Jun-10-2008 14:12

Calibration Date: 6/10/2008 12:27:09PM

Efficiency Calibration: C08061032

Efficiency: 29.78% +/- 0.12% TPU(2 sigma)

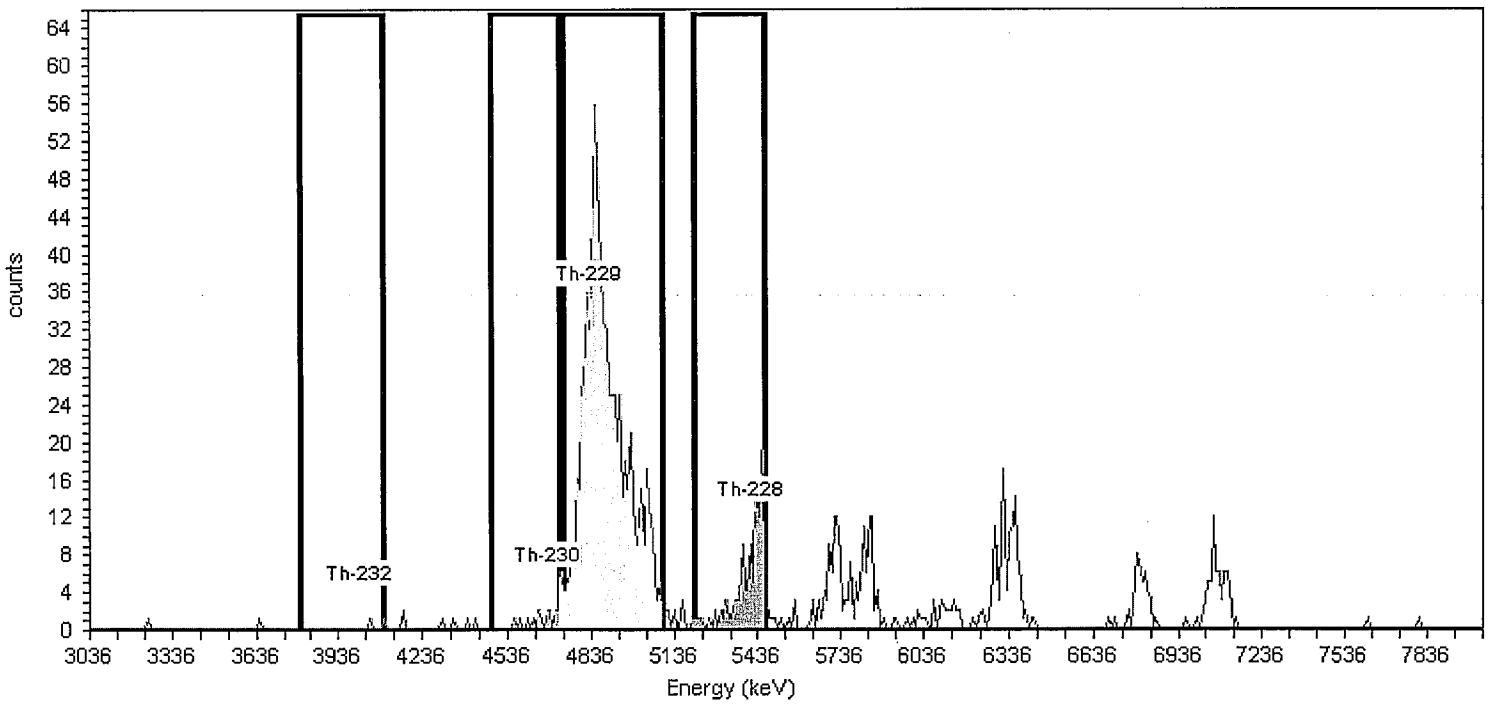
Energy Calibration: C08061032

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 45.50%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4026.3	3791.0	4094.9	23.8	100.2	2.00	2.00	0.00	0.0E+000	6.2E-003	5.1E-003	1.4E-002
Th-230	4693.0	4477.3	4722.4	15.3	100.1	21.00	1.00	1.97	3.0E-003	1.5E-002	3.6E-003	1.1E-002
Th-229	4849.9	4732.2	5095.0	119.4	99.6	733.00	6.00	727.00	5.1E-001	3.8E-002	8.8E-003	2.2E-002
Th-228	5428.4	5212.7	5457.8	37.9	100.0	110.00	45.00	65.00	1.0E-001	4.1E-002	2.4E-002	5.2E-002

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-13
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 57
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:39:57PM
Live Time: 1,000.00 min.
Real Time: 1,000.32 min.
Dead Time: 0.03 %

Calibration

Bkgd Info: Sample: B08061057; Det: 57; Spectrum #1; Jun-10-2008 14:14

Calibration Date: 6/10/2008 12:31:36PM

Efficiency Calibration: C08061057

Efficiency: 29.42% +/- 0.20% TPU(2 sigma)

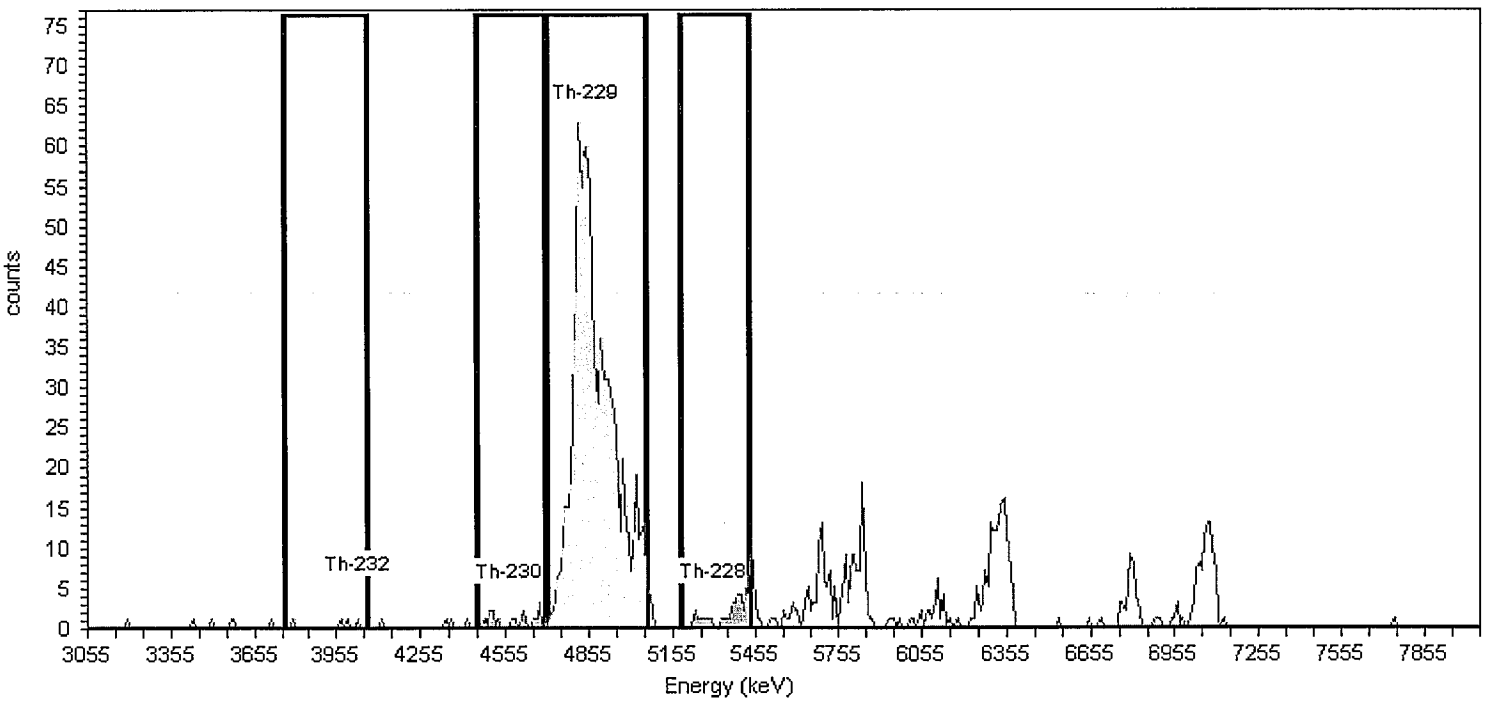
Energy Calibration: C08061057

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 56.63%



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
Th-232	3996.9	3761.6	4065.5	.0	100.2	4.00	4.00	0.00	0.0E+000	3.1E-003	2.5E-003	6.5E-003
Th-230	4663.6	4447.9	4693.0	214.3	100.1	17.00	5.00	-10.09	-5.4E-003	5.2E-003	2.8E-003	7.1E-003
Th-229	4820.5	4702.8	5065.6	130.5	99.6	898.00	4.00	894.00	2.7E-001	1.9E-002	2.5E-003	6.5E-003
Th-228	5398.9	5183.2	5428.4	20.4	100.0	39.00	44.00	-5.00	-2.7E-003	9.9E-003	8.3E-003	1.8E-002

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-16
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 58
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:39:57PM
Live Time: 1,000.00 min.
Real Time: 1,000.32 min.
Dead Time: 0.03 %

Calibration

Bkgd Info: Sample: B08061058; Det: 58; Spectrum #1; Jun-10-2008 14:14

Calibration Date: 6/10/2008 12:31:52PM

Efficiency Calibration: C08061058

Efficiency: 31.92% +/- 0.15% TPU(2 sigma)

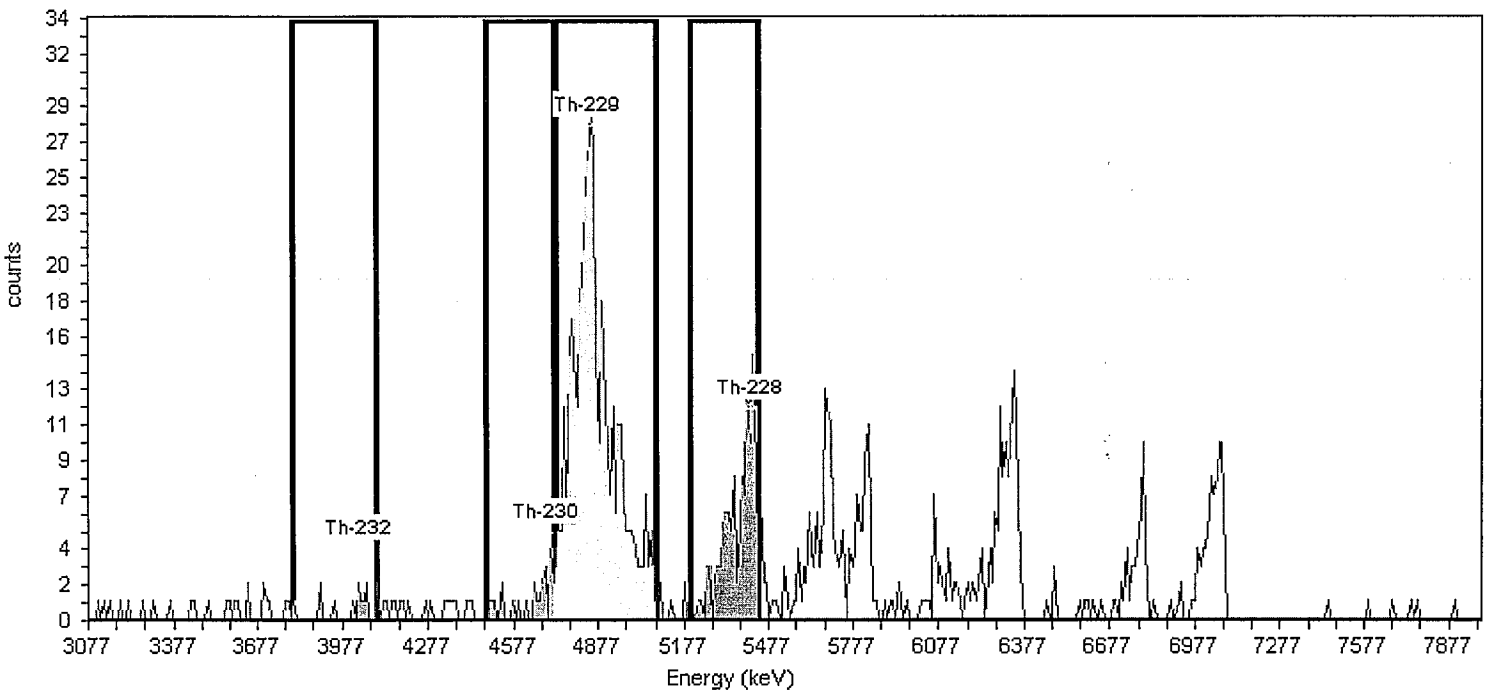
Energy Calibration: C08061058

Energy Cal: Gain = 9.6368 keV / Ch
Offset = 3,067.69 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 22.24%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4031.4	3800.1	4098.8	.4	100.2	13.00	5.00	8.00	1.0E-002	1.1E-002	6.6E-003	1.7E-002
Th-230	4686.7	4474.7	4715.6	19.9	100.1	22.00	9.00	3.26	4.1E-003	1.4E-002	8.8E-003	2.1E-002
Th-229	4840.9	4725.2	5081.8	115.8	99.6	396.00	15.00	381.00	1.1E-001	1.1E-002	1.1E-002	2.6E-002
Th-228	5409.4	5197.4	5438.3	23.9	100.0	120.00	60.00	60.00	7.6E-002	3.6E-002	2.3E-002	4.9E-002

<400. OK MC 6/16/08.

Reviewed By: GB

Print Date: 6/16/2008 10:26:17AM

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

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-17
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 59
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:39:58PM
Live Time: 1,000.00 min.
Real Time: 1,000.32 min.
Dead Time: 0.03 %

Calibration

Bkgd Info: Sample: B08061059; Det: 59; Spectrum #1; Jun-10-2008 14:14

Calibration Date: 6/10/2008 12:32:12PM

Efficiency Calibration: C08061059

Efficiency: 31.26% +/- 0.16% TPU(2 sigma)

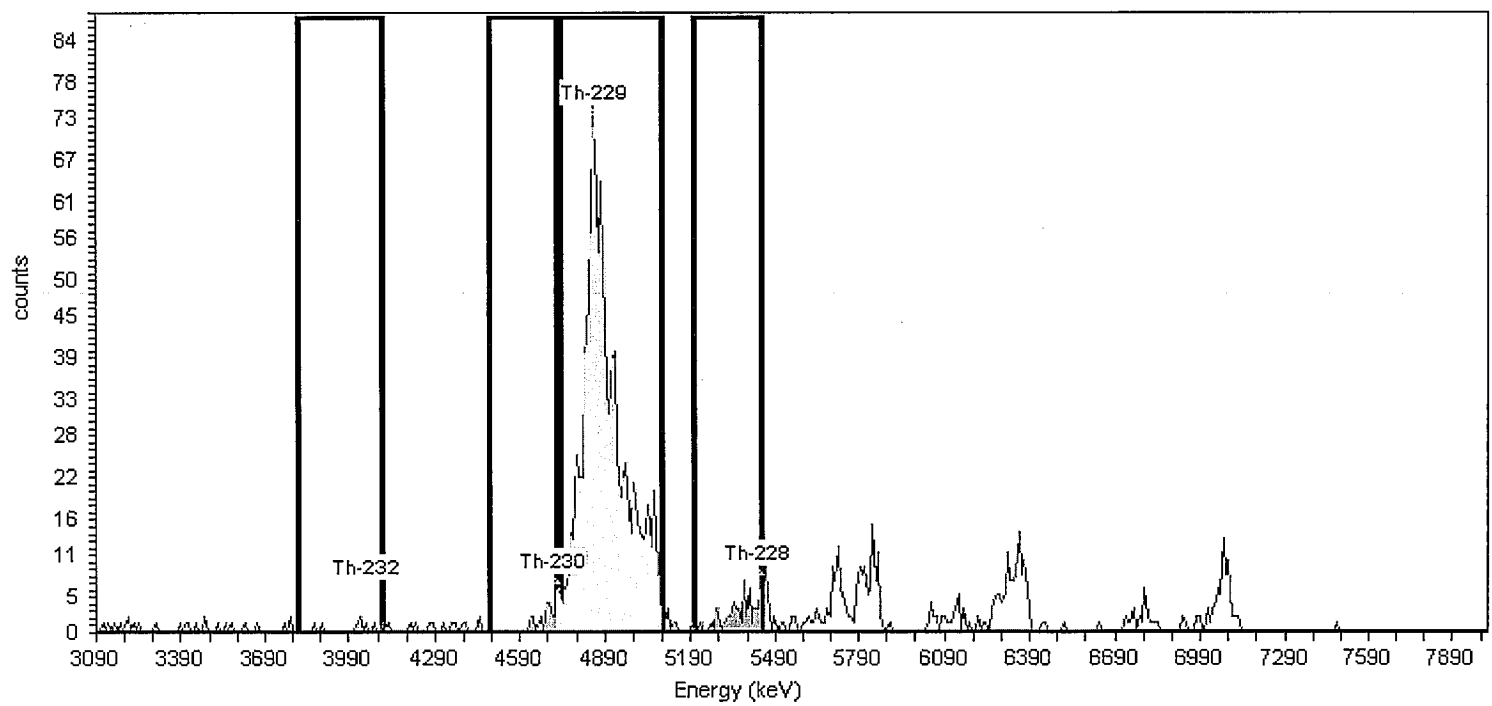
Energy Calibration: C08061059

Energy Cal: Gain = 9.6533 keV / Ch
Offset = 3,080.66 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 58.12%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4036.3	3804.7	4103.9	97.3	100.2	8.00	2.00	6.00	3.0E-003	3.1E-003	1.6E-003	4.6E-003
Th-230	4692.8	4480.4	4721.7	48.2	100.1	25.00	2.00	-1.23	-6.1E-004	5.2E-003	1.6E-003	4.6E-003
Th-229	4847.2	4731.4	5088.6	105.7	99.6	985.00	10.00	975.00	2.8E-001	1.8E-002	3.7E-003	8.7E-003
Th-228	5416.8	5204.4	5445.7	40.6	100.0	61.00	56.00	5.00	2.5E-003	1.1E-002	8.6E-003	1.9E-002

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-20
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 60
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:39:58PM
Live Time: 1,000.00 min.
Real Time: 1,000.32 min.
Dead Time: 0.03 %

Calibration

Bkgd Info: Sample: B08061060; Det: 60; Spectrum #1; Jun-10-2008 14:14

Calibration Date: 6/10/2008 1:46:13PM

Efficiency Calibration: C08061060A

Efficiency: 30.83% +/- 0.21% TPU(2 sigma)

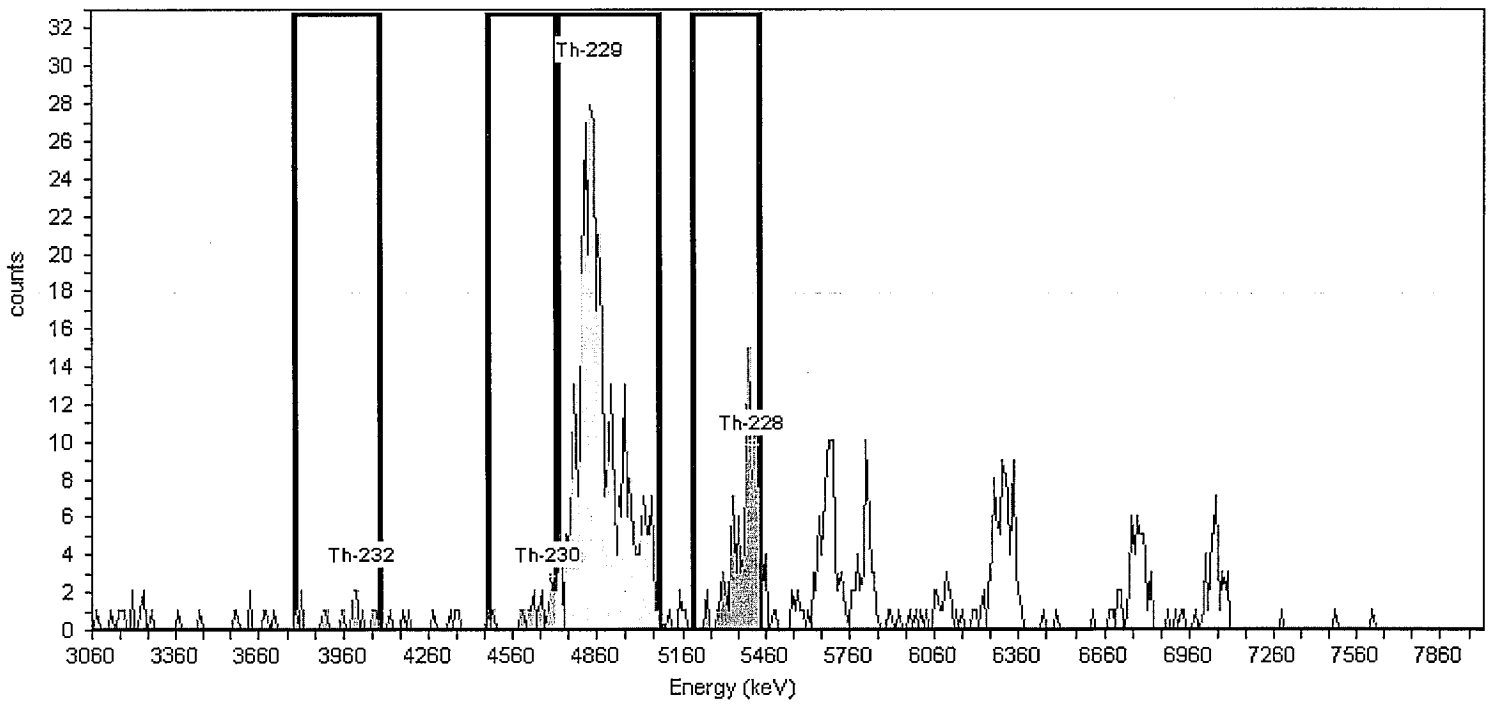
Energy Calibration: C08061060A

Energy Cal: Gain = 9.7108 keV / Ch
Offset = 3,050.49 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 20.07%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4021.6	3788.5	4089.5	186.8	100.2	13.00	7.00	6.00	8.7E-003	1.3E-002	8.9E-003	2.2E-002
Th-230	4681.9	4468.3	4711.0	38.5	100.1	19.00	9.00	1.22	1.8E-003	1.5E-002	1.0E-002	2.4E-002
Th-229	4837.3	4720.8	5080.1	90.3	99.6	357.00	25.00	332.00	9.7E-002	1.1E-002	1.7E-002	3.8E-002
Th-228	5410.2	5196.6	5439.4	45.2	100.0	95.00	60.00	35.00	5.1E-002	3.7E-002	2.6E-002	5.6E-002

<400. OK MG 6/16/08

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-21
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 61
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:39:59PM
Live Time: 1,000.00 min.
Real Time: 1,000.32 min.
Dead Time: 0.03 %

Calibration

Bkgd Info: Sample: B08061061; Det: 61; Spectrum #1; Jun-10-2008 14:14

Calibration Date: 6/10/2008 12:32:52PM

Efficiency Calibration: C08061061

Efficiency: 31.21% +/- 0.13% TPU(2 sigma)

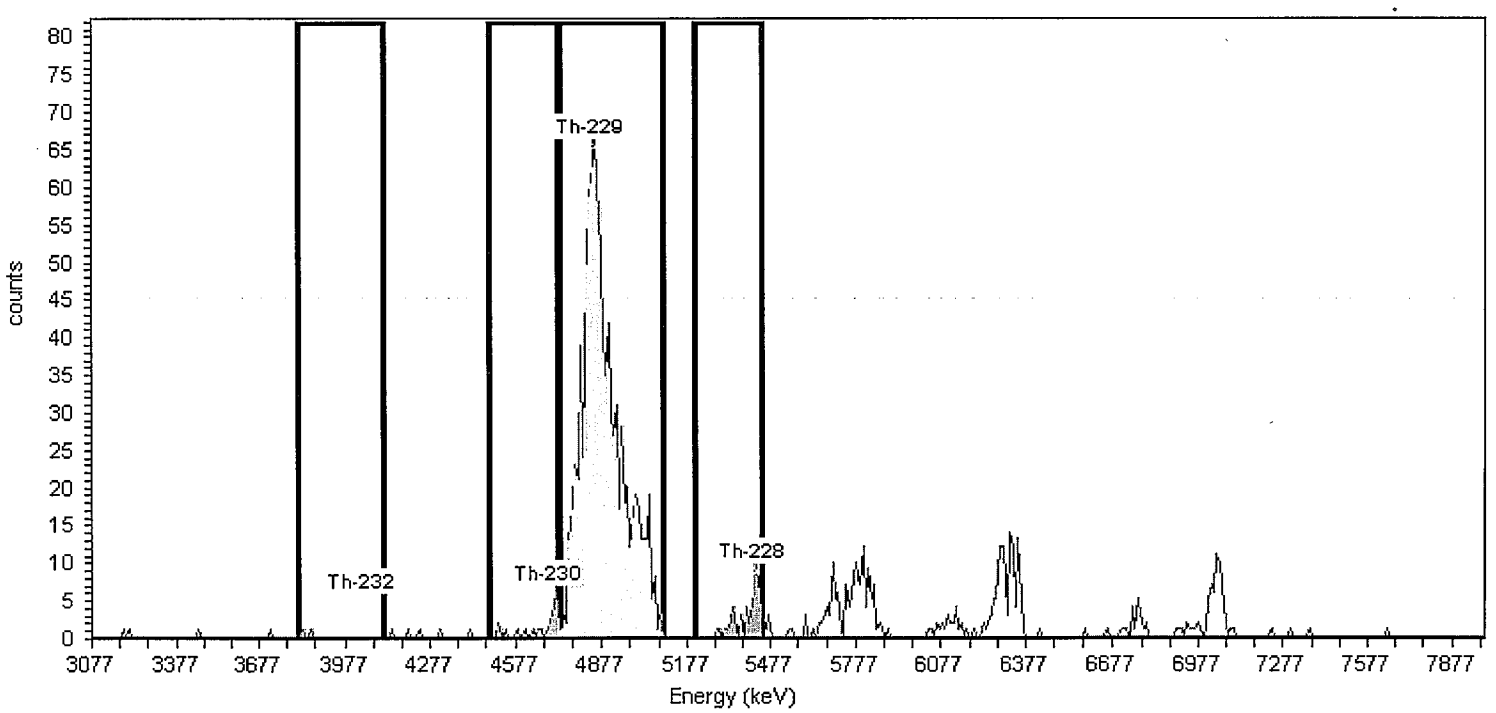
Energy Calibration: C08061061

Energy Cal: Gain = 9.6368 keV / Ch
Offset = 3,067.69 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 55.11%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4041.0	3809.7	4108.5	21.4	100.2	2.00	0.00	2.00	1.0E-003	1.8E-003	0.0E+000	1.4E-003
Th-230	4696.3	4484.3	4725.2	3.4	100.1	25.00	3.00	-0.80	-4.2E-004	5.6E-003	2.1E-003	5.6E-003
Th-229	4850.5	4734.9	5091.4	111.4	99.6	927.00	4.00	923.00	2.7E-001	1.8E-002	2.4E-003	6.3E-003
Th-228	5419.1	5207.1	5448.0	27.0	100.0	53.00	42.00	11.00	5.8E-003	1.0E-002	7.9E-003	1.7E-002

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-24
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 62
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:39:59PM
Live Time: 1,000.00 min.
Real Time: 1,000.32 min.
Dead Time: 0.03 %

Calibration

Bkgd Info: Sample: B08061062; Det: 62; Spectrum #1; Jun-10-2008 14:14

Calibration Date: 6/10/2008 12:33:09PM

Efficiency Calibration: C08061062

Efficiency: 29.27% +/- 0.15% TPU(2 sigma)

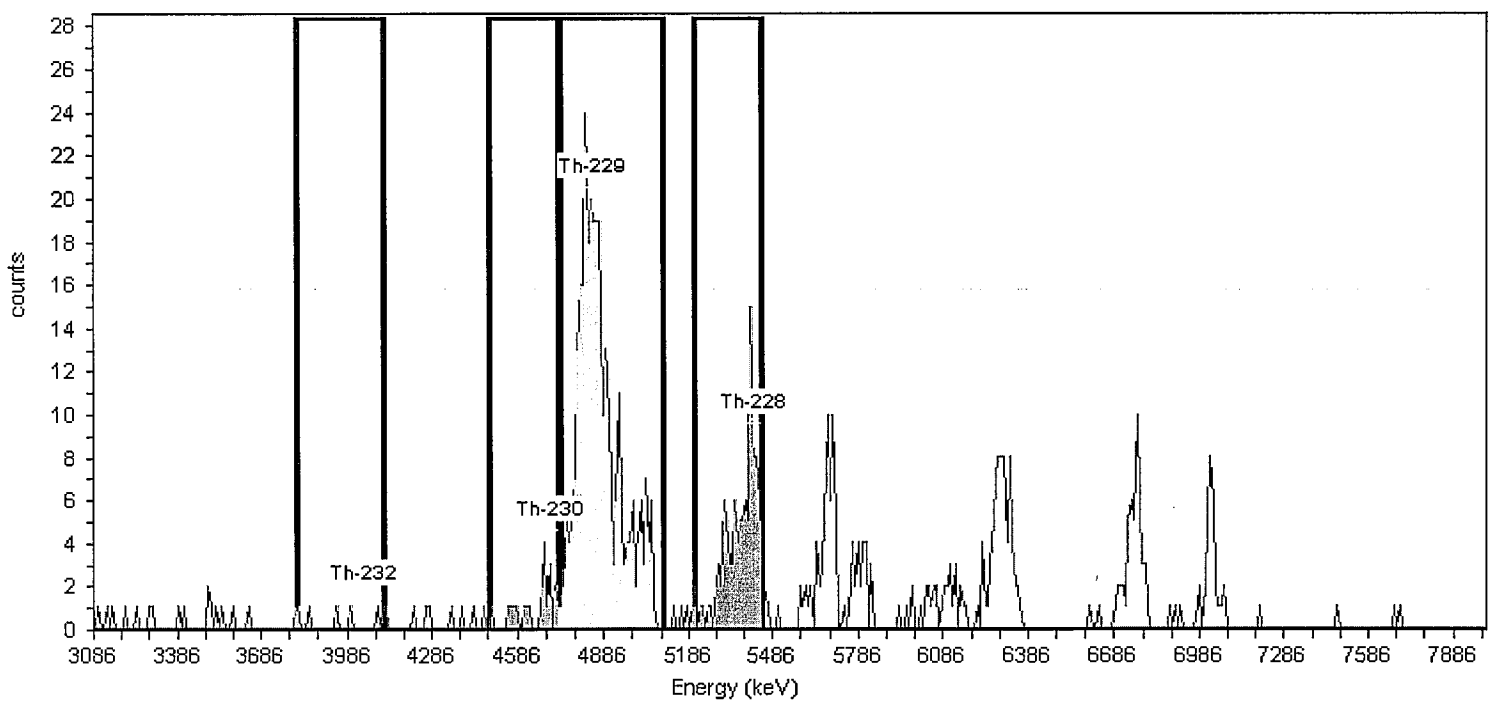
Energy Calibration: C08061062

Energy Cal: Gain = 9.6368 keV / Ch
Offset = 3,077.33 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 18.53%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4041.0	3809.7	4108.5	20.2	100.2	6.00	1.00	5.00	8.3E-003	8.9E-003	3.9E-003	1.2E-002
Th-230	4696.3	4484.3	4725.2	32.2	100.1	21.00	4.00	9.47	1.6E-002	1.7E-002	7.7E-003	2.0E-002
Th-229	4850.5	4734.9	5091.4	107.3	99.6	306.00	15.00	291.00	9.0E-002	1.1E-002	1.5E-002	3.5E-002
Th-228	5419.1	5207.1	5448.0	51.6	100.0	102.00	66.00	36.00	6.0E-002	4.4E-002	3.1E-002	6.7E-002

→ < 400. OK MG 6/16/08

Reviewed By: GB DJ

Print Date: 6/16/2008 10:26:38AM

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

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-25
Spectrum #1 Analysis #1

Sample Size : 2.00

Acquisition

Detector: 63
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:40:00PM
Live Time: 1,000.00 min.
Real Time: 1,000.32 min.
Dead Time: 0.03 %

Calibration

Bkgd Info: Sample: B08061063; Det: 63; Spectrum #1; Jun-10-2008 14:14

Calibration Date: 6/10/2008 12:33:23PM

Efficiency Calibration: C08061063

Efficiency: 31.25% +/- 0.18% TPU(2 sigma)

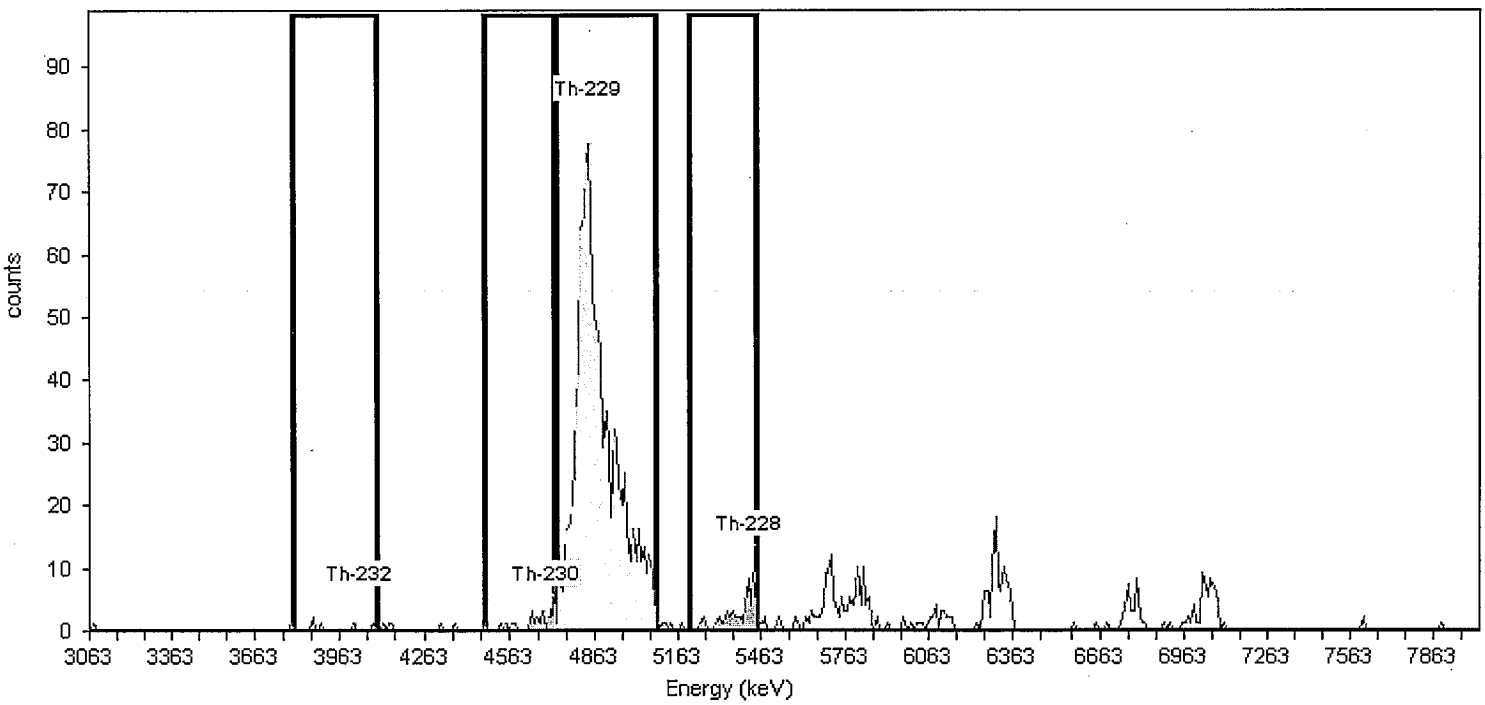
Energy Calibration: C08061063

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 60.05%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4026.5	3793.0	4094.6	230.4	100.2	5.00	2.00	3.00	3.6E-003	6.4E-003	3.9E-003	1.1E-002
Th-230	4688.0	4474.0	4717.2	1.2	100.1	26.00	1.00	0.15	1.8E-004	1.3E-002	2.8E-003	8.8E-003
Th-229	4843.7	4726.9	5086.9	97.4	99.6	1,010.00	3.00	1,007.00	7.3E-001	4.6E-002	4.9E-003	1.3E-002
Th-228	5417.7	5203.6	5446.9	25.6	100.0	53.00	73.00	-20.00	-2.4E-002	2.7E-002	2.4E-002	5.1E-002

Reviewed By: AB AS

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-26
Spectrum #1 Analysis #1

Sample Size : 5.00

Acquisition

Detector: 64
Batch Name: TAS080607-1_A
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/13/2008 2:40:00PM
Live Time: 1,000.00 min.
Real Time: 1,000.32 min.
Dead Time: 0.03 %

Calibration

Bkgd Info: Sample: B08061064; Det: 64; Spectrum #1; Jun-10-2008 14:14

Calibration Date: 6/10/2008 1:44:03PM

Efficiency Calibration: C08061064

Efficiency: 32.21% +/- 0.13% TPU(2 sigma)

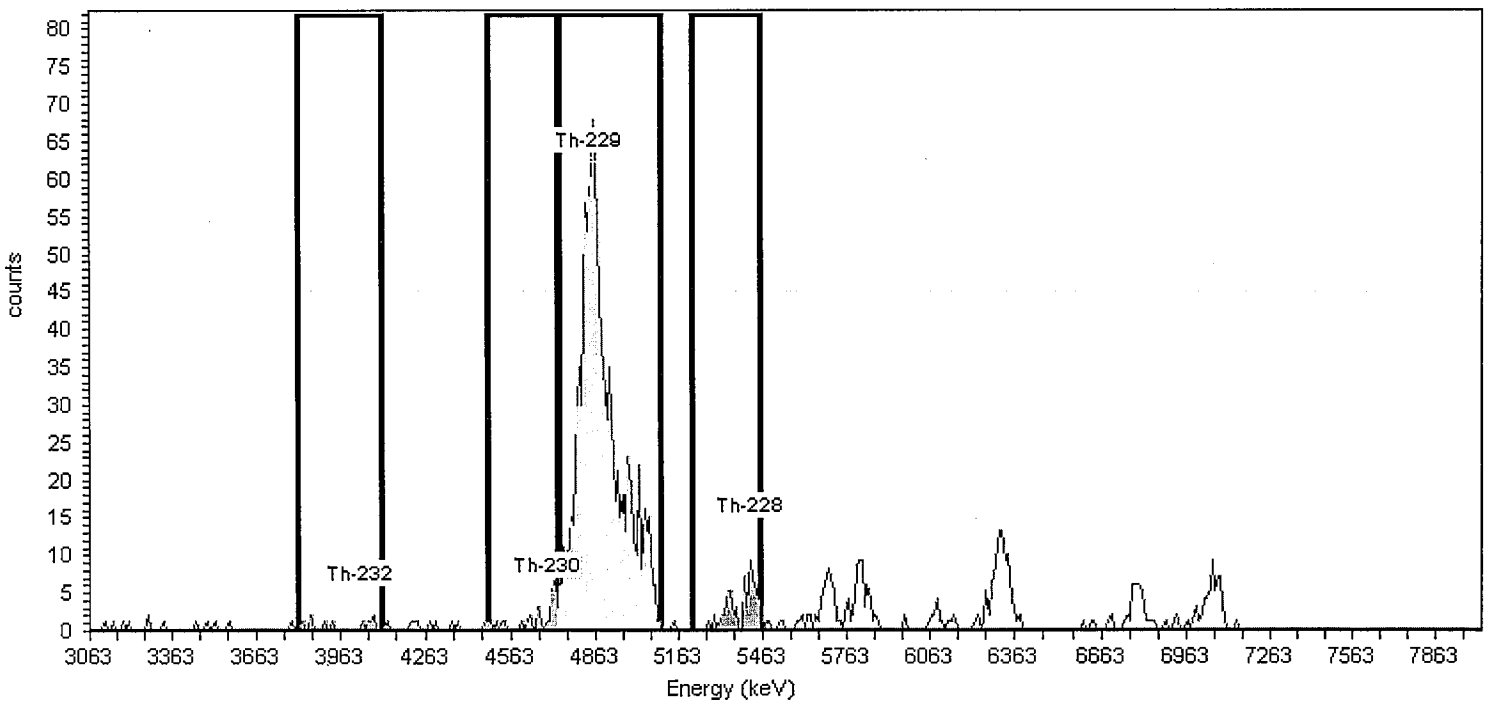
Energy Calibration: C08061064

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 52.30%



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
Th-232	4036.2	3802.7	4104.3	16.1	100.2	10.00	7.00	3.00	1.6E-003	4.4E-003	3.3E-003	8.0E-003
Th-230	4697.7	4483.7	4726.9	.0	100.1	30.00	2.00	5.64	3.0E-003	6.1E-003	1.8E-003	5.0E-003
Th-229	4853.4	4736.7	5096.6	103.2	99.6	909.00	5.00	904.00	2.5E-001	1.7E-002	2.8E-003	7.0E-003
Th-228	5427.4	5213.4	5456.6	28.9	100.0	63.00	46.00	17.00	9.1E-003	1.1E-002	8.4E-003	1.8E-002

Reviewed By: AB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-29
Spectrum #1 Analysis #1

Sample Size : 3.29

Acquisition

Detector: 17
Batch Name: TAS080607-1_B
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/14/2008 11:39:09AM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08060917; Det: 17; Spectrum #1; Jun-09-2008 12:17

Calibration Date: 6/9/2008 9:40:22AM

Efficiency Calibration: C08060917

Efficiency: 30.93% +/- 0.20% TPU(2 sigma)

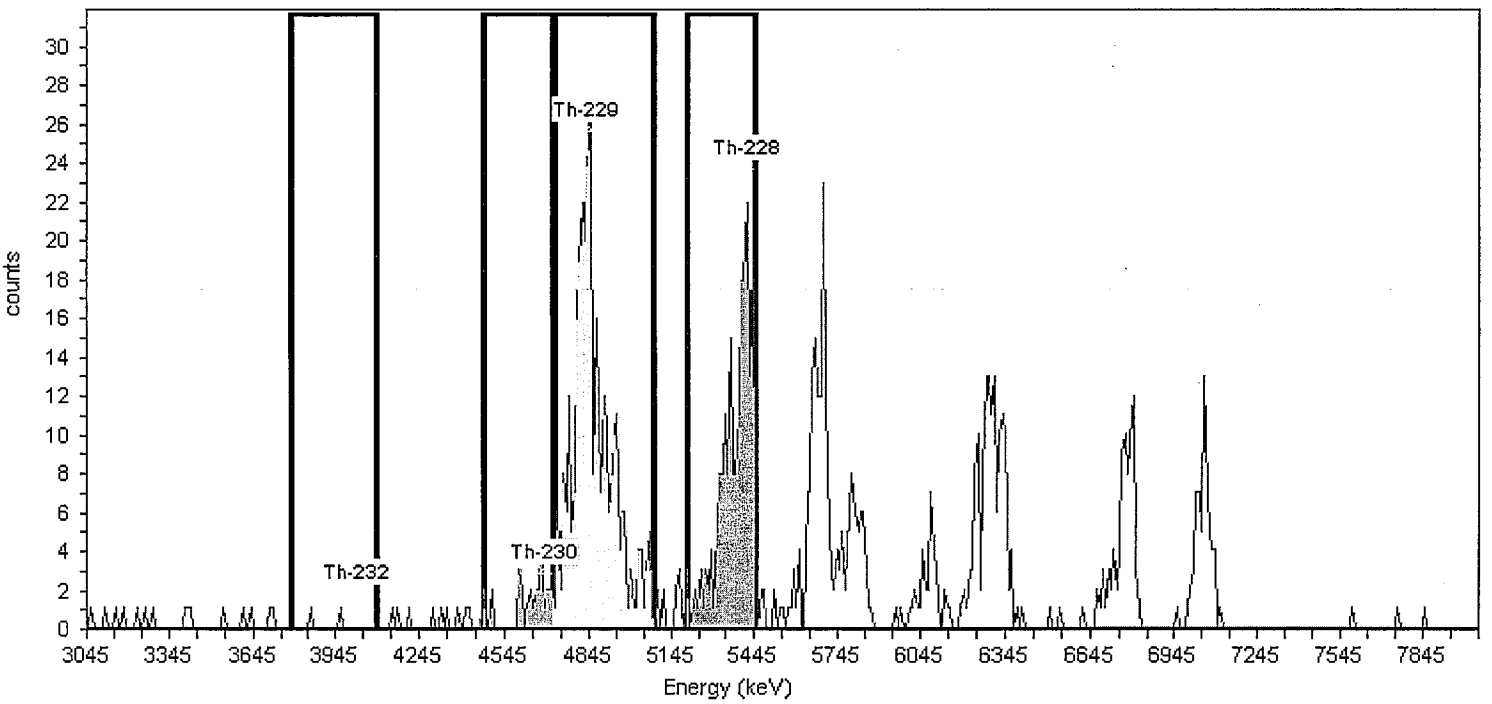
Energy Calibration: C08060917

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 18.07%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4016.5	3781.2	4085.1	24.0	100.2	2.00	6.00	-4.00	-9.8E-003	1.4E-002	1.4E-002	3.4E-002
Th-230	4683.2	4467.5	4712.6	207.0	100.1	28.00	5.00	15.28	3.7E-002	2.9E-002	1.3E-002	3.2E-002
Th-229	4840.1	4722.4	5085.2	94.1	99.6	314.00	14.00	300.00	1.3E-001	1.6E-002	2.1E-002	4.9E-002
Th-228	5418.6	5202.9	5448.0	44.5	100.0	199.00	69.00	130.00	3.2E-001	9.4E-002	4.7E-002	1.0E-001

→ <400. OK MG 6/16/08

Reviewed By: GB

Print Date: 6/16/2008 10:33:42AM

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

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-30
Spectrum #1 Analysis #1

Sample Size : 5.02

Acquisition

Detector: 18
Batch Name: TAS080607-1_B
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/14/2008 11:39:09AM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08060918; Det: 18; Spectrum #1; Jun-09-2008 12:17

Calibration Date: 6/9/2008 9:40:37AM

Efficiency Calibration: C08060918

Efficiency: 30.17% +/- 0.15% TPU(2 sigma)

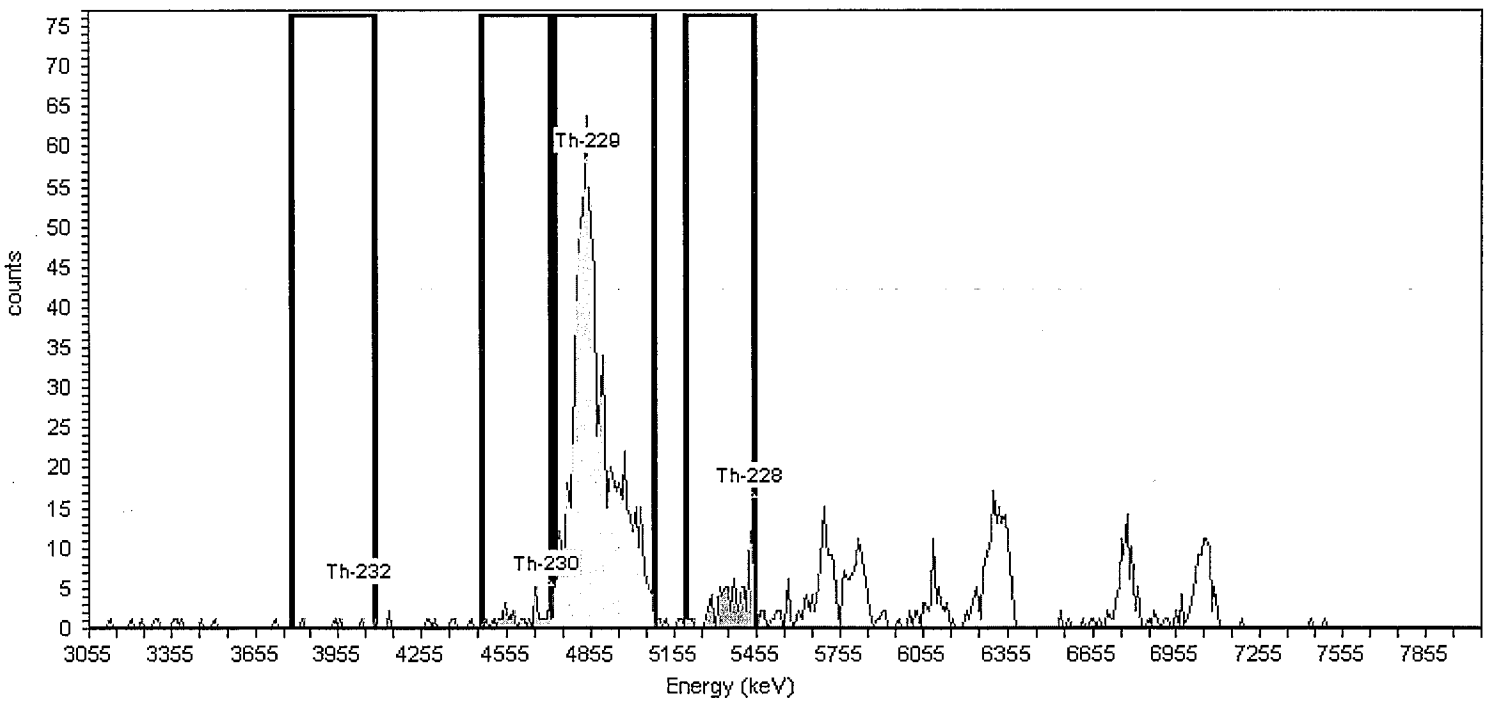
Energy Calibration: C08060918

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 50.89%



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
Th-232	4016.5	3781.2	4085.1	13.2	100.2	5.00	7.00	-2.00	-1.2E-003	4.0E-003	3.6E-003	8.8E-003
Th-230	4683.2	4467.5	4712.6	16.3	100.1	27.00	10.00	-3.49	-2.0E-003	7.2E-003	4.3E-003	1.0E-002
Th-229	4840.1	4722.4	5085.2	95.0	99.6	833.00	9.00	824.00	2.5E-001	1.7E-002	4.1E-003	9.8E-003
Th-228	5418.6	5202.9	5448.0	20.9	100.0	84.00	71.00	13.00	7.6E-003	1.5E-002	1.1E-002	2.5E-002

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-33
Spectrum #1 Analysis #1

Sample Size : 4.87

Acquisition

Detector: 19
Batch Name: TAS080607-1_B
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/14/2008 11:39:10AM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08060919; Det: 19; Spectrum #1; Jun-09-2008 12:17

Calibration Date: 6/9/2008 9:40:53AM

Efficiency Calibration: C08060919

Efficiency: 29.35% +/- 0.16% TPU(2 sigma)

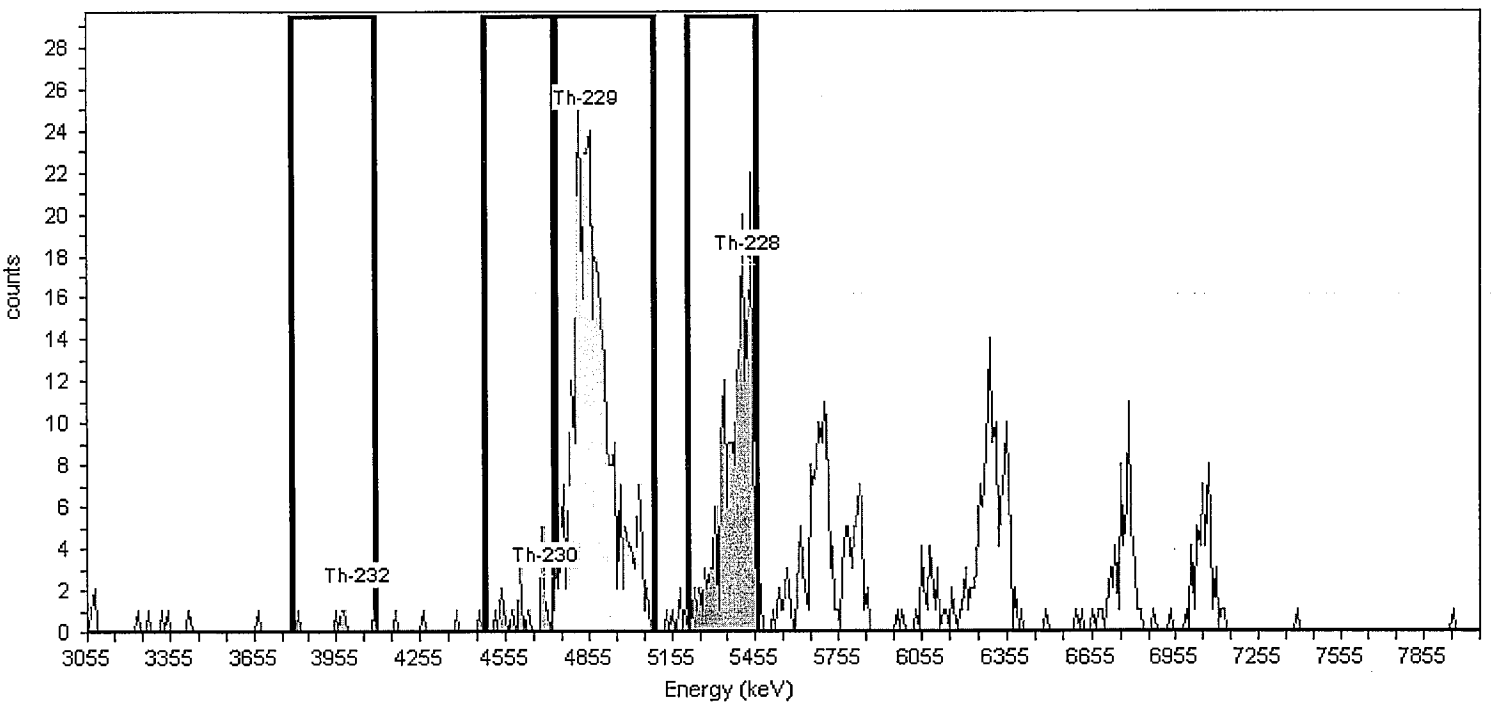
Energy Calibration: C08060919

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 20.83%



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
Th-232	4026.3	3791.0	4094.9	122.5	100.2	5.00	1.00	4.00	6.0E-003	7.5E-003	3.5E-003	1.1E-002
Th-230	4693.0	4477.3	4722.4	101.2	100.1	17.00	5.00	3.73	5.6E-003	1.4E-002	7.9E-003	2.0E-002
Th-229	4849.9	4732.2	5095.0	125.2	99.6	336.00	8.00	328.00	1.0E-001	1.2E-002	1.0E-002	2.4E-002
Th-228	5428.4	5212.7	5457.8	19.0	100.0	183.00	66.00	117.00	1.8E-001	5.5E-002	2.9E-002	6.1E-002

<400. OK MC 6/16/08

Reviewed By: GB DS

Print Date: 6/16/2008 10:33:55AM

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

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-34
Spectrum #1 Analysis #1

Sample Size : 5.14

Acquisition

Detector: 21
Batch Name: TAS080607-1_B
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/14/2008 11:39:10AM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08060921; Det: 21; Spectrum #1; Jun-09-2008 12:17

Calibration Date: 6/9/2008 9:41:11AM

Efficiency Calibration: C08060921

Efficiency: 28.81% +/- 0.13% TPU(2 sigma)

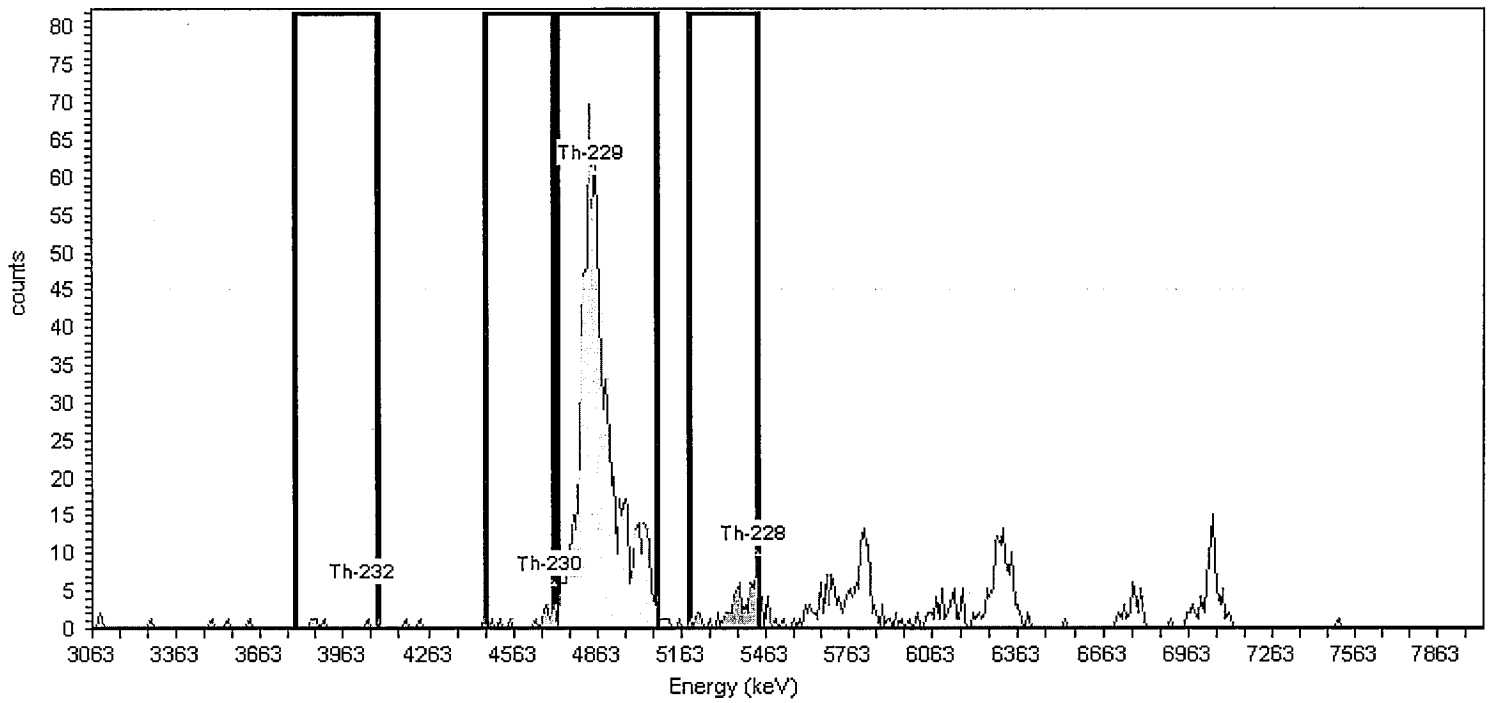
Energy Calibration: C08060921

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 51.88%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4016.7	3783.2	4084.8	249.0	100.2	6.00	3.00	3.00	1.8E-003	3.5E-003	2.4E-003	6.3E-003
Th-230	4678.3	4464.3	4707.5	19.6	100.1	15.00	5.00	-9.75	-5.7E-003	5.4E-003	3.0E-003	7.7E-003
Th-229	4833.9	4717.2	5077.2	93.4	99.6	803.00	1.00	802.00	2.5E-001	1.7E-002	1.4E-003	4.3E-003
Th-228	5407.9	5193.9	5437.1	28.9	100.0	61.00	43.00	18.00	1.1E-002	1.2E-002	9.0E-003	1.9E-002

Reviewed By: GB

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: 0805200-37
Spectrum #1 Analysis #1

Sample Size : 3.73

Acquisition

Detector: 22
Batch Name: TAS080607-1_B
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/14/2008 11:39:11AM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08060922; Det: 22; Spectrum #1; Jun-09-2008 12:17

Calibration Date: 6/9/2008 9:41:34AM

Efficiency Calibration: C08060922

Efficiency: 28.19% +/- 0.15% TPU(2 sigma)

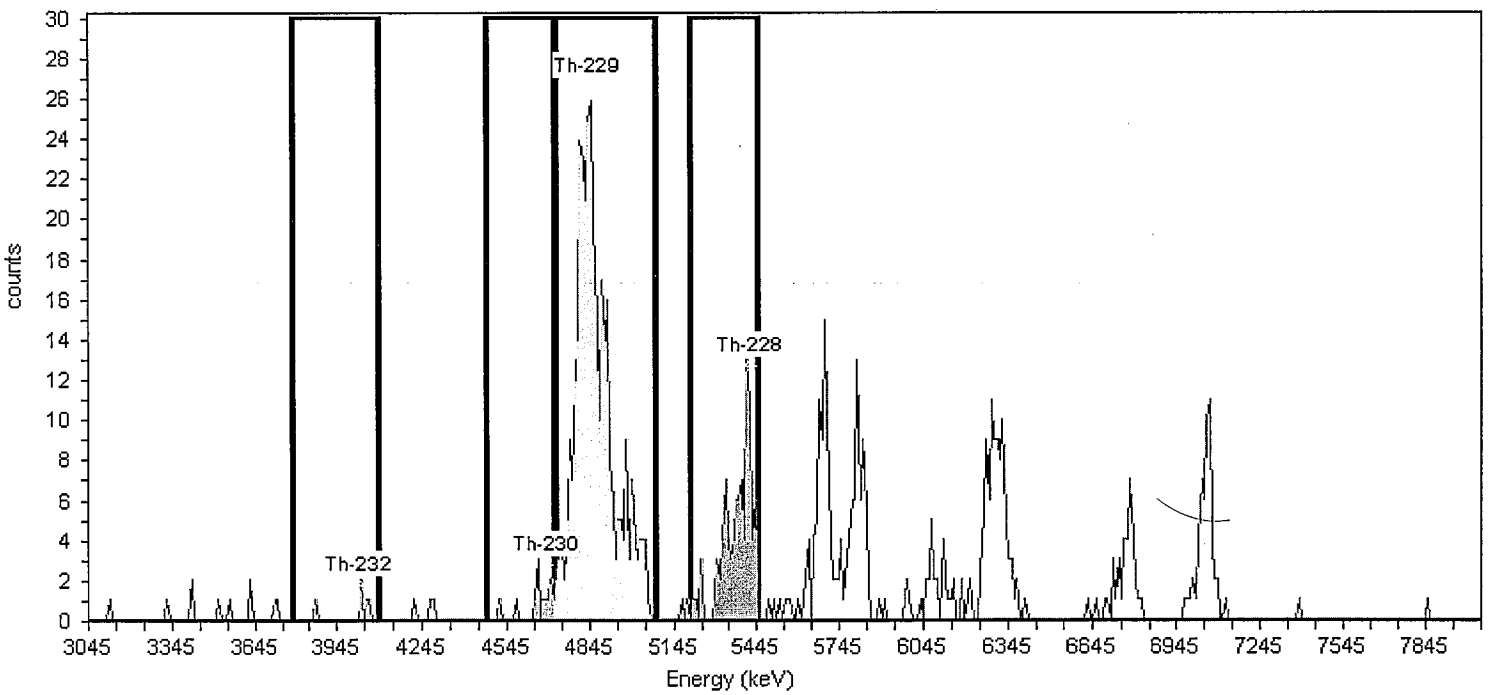
Energy Calibration: C08060922

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 22.21%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4016.5	3781.2	4085.1	204.9	100.2	5.00	0.00	5.00	9.6E-003	9.5E-003	0.0E+000	5.2E-003
Th-230	4683.2	4467.5	4712.6	65.4	100.1	12.00	5.00	-1.34	-2.6E-003	1.6E-002	1.0E-002	2.5E-002
Th-229	4840.1	4722.4	5085.2	110.4	99.6	339.00	3.00	336.00	1.4E-001	1.6E-002	7.8E-003	2.1E-002
Th-228	5418.6	5202.9	5448.0	127.0	100.0	93.00	32.00	61.00	1.2E-001	4.7E-002	2.5E-002	5.6E-002

→ < 400. OK MC 6/16/08

Reviewed By: GB

Print Date: 6/16/2008 10:34:08AM

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

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: AS080607-1MB
Spectrum #1 Analysis #1

Sample Size : 4.00

Acquisition

Detector: 23
Batch Name: TAS080607-1_B
Nuclide Library: Thorium
Analysis Method: Absolute ROI Analysis, Set Name = Thorium
ROI Set: Thorium

Acquisition Start Date: 6/14/2008 11:39:11AM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08060923; Det: 23; Spectrum #1; Jun-09-2008 12:17

Calibration Date: 6/9/2008 9:41:53AM

Efficiency Calibration: C08060923

Efficiency: 28.76% +/- 0.18% TPU(2 sigma)

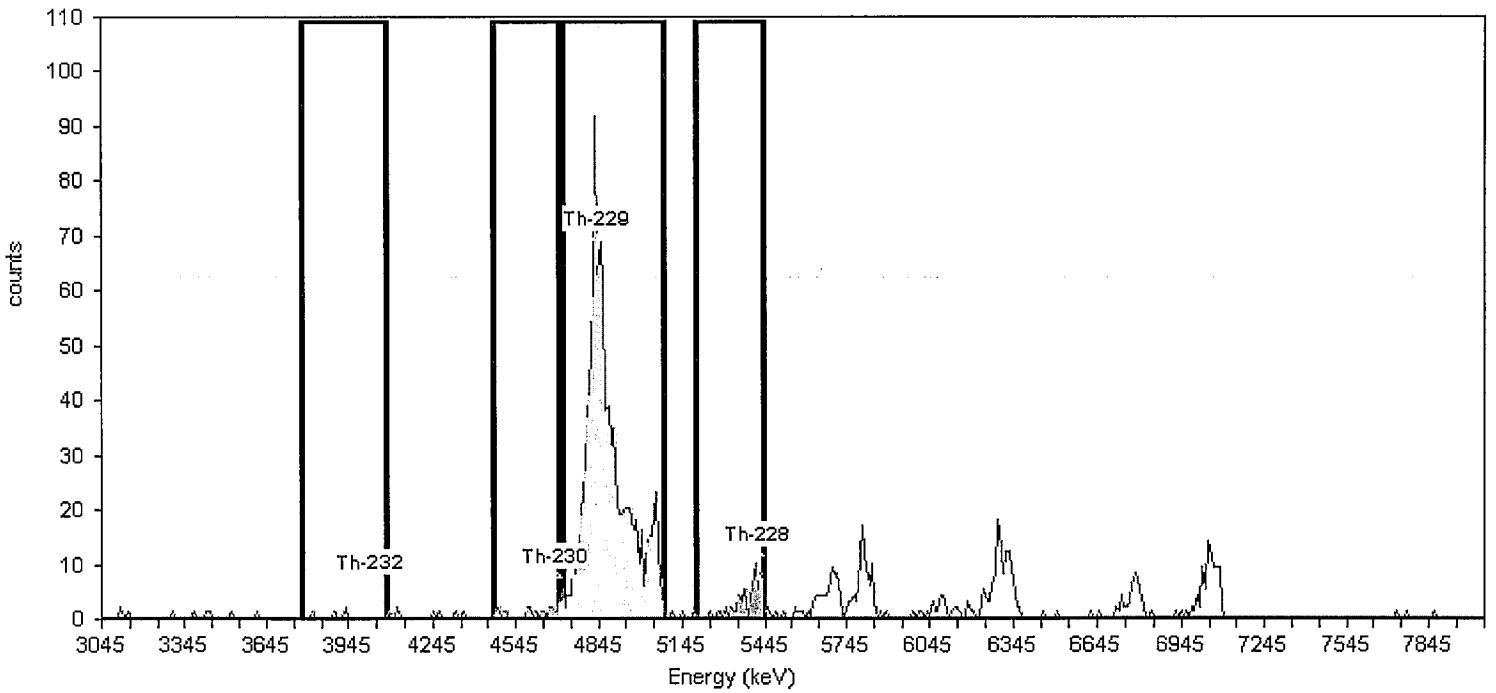
Energy Calibration: C08060923

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

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 59.75%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4006.7	3771.4	4075.3	160.6	100.2	4.00	8.00	-4.00	-2.6E-003	4.5E-003	4.3E-003	1.0E-002
Th-230	4673.4	4457.7	4702.8	.6	100.1	21.00	2.00	-3.88	-2.5E-003	6.4E-003	2.2E-003	6.1E-003
Th-229	4830.3	4712.6	5075.4	91.2	99.6	930.00	8.00	922.00	3.6E-001	2.4E-002	4.3E-003	1.0E-002
Th-228	5408.8	5193.0	5438.2	24.1	100.0	60.00	64.00	-4.00	-2.6E-003	1.5E-002	1.2E-002	2.6E-002

Reviewed By: GB

Print Date: 6/16/2008 10:34:14AM

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

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: AS080607-1LCS
Spectrum #1 Analysis #1

Sample Size : 4.00

Acquisition

Detector: 24
Batch Name: TAS080607-1_B
Nuclide Library: Thorium
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Thorium

Acquisition Start Date: 6/14/2008 11:39:12AM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08060924; Det: 24; Spectrum #1; Jun-09-2008 12:17

Calibration Date: 6/9/2008 9:42:11AM

Efficiency Calibration: C08060924

Efficiency: 29.32% +/- 0.12% TPU(2 sigma)

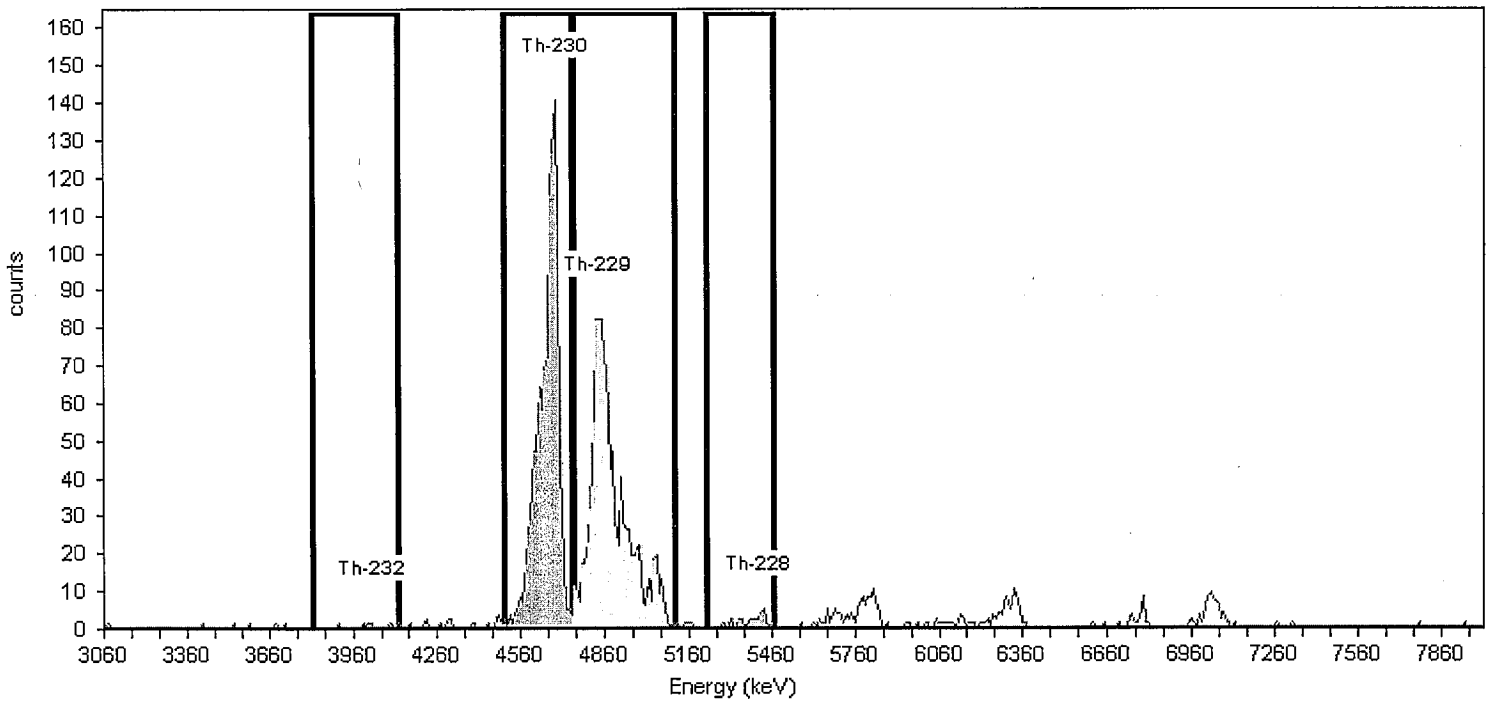
Energy Calibration: C08060924

Energy Cal: Gain = 9.7108 keV / Ch
Offset = 3,050.49 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 63.11%



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/g	2.00Sigma TPU pCi/g	Critical Level pCi/g	MDA pCi/g
Th-232	4021.6	3817.6	4118.7	106.1	100.2	6.00	2.00	4.00	2.4E-003	3.4E-003	2.0E-003	5.6E-003
Th-230	4681.9	4497.4	4740.2	50.6	100.1	1,023.00	3.00	995.37	6.0E-001	8.2E-002	2.4E-003	6.5E-003
Th-229	4837.3	4749.9	5109.2	84.8	99.6	1,001.00	8.00	993.00	3.8E-001	2.5E-002	4.0E-003	9.7E-003
Th-228	5410.2	5225.7	5468.5	30.9	100.0	28.00	21.00	7.00	4.3E-003	8.5E-003	6.5E-003	1.5E-002

Reviewed By: GB ES

Paragon Analytics

Alpha-Spectroscopy Analysis Report

Sample

Sample: AS080607-1LCSD
Spectrum #1 Analysis #1

Sample Size : 4.00

Acquisition

Detector: 25
Batch Name: TAS080607-1
Nuclide Library: Thorium
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Thorium

Acquisition Start Date: 6/14/2008 11:30:11AM
Live Time: 1,000.00 min.
Real Time: 1,000.02 min.
Dead Time: 0.00 %

Calibration

Bkgd Info: Sample: B08061025; Det: 25; Spectrum #1; Jun-10-2008 14:12

Calibration Date: 6/10/2008 12:25:06PM

Efficiency Calibration: C08061025

Efficiency: 29.29% +/- 0.20% TPU(2 sigma)

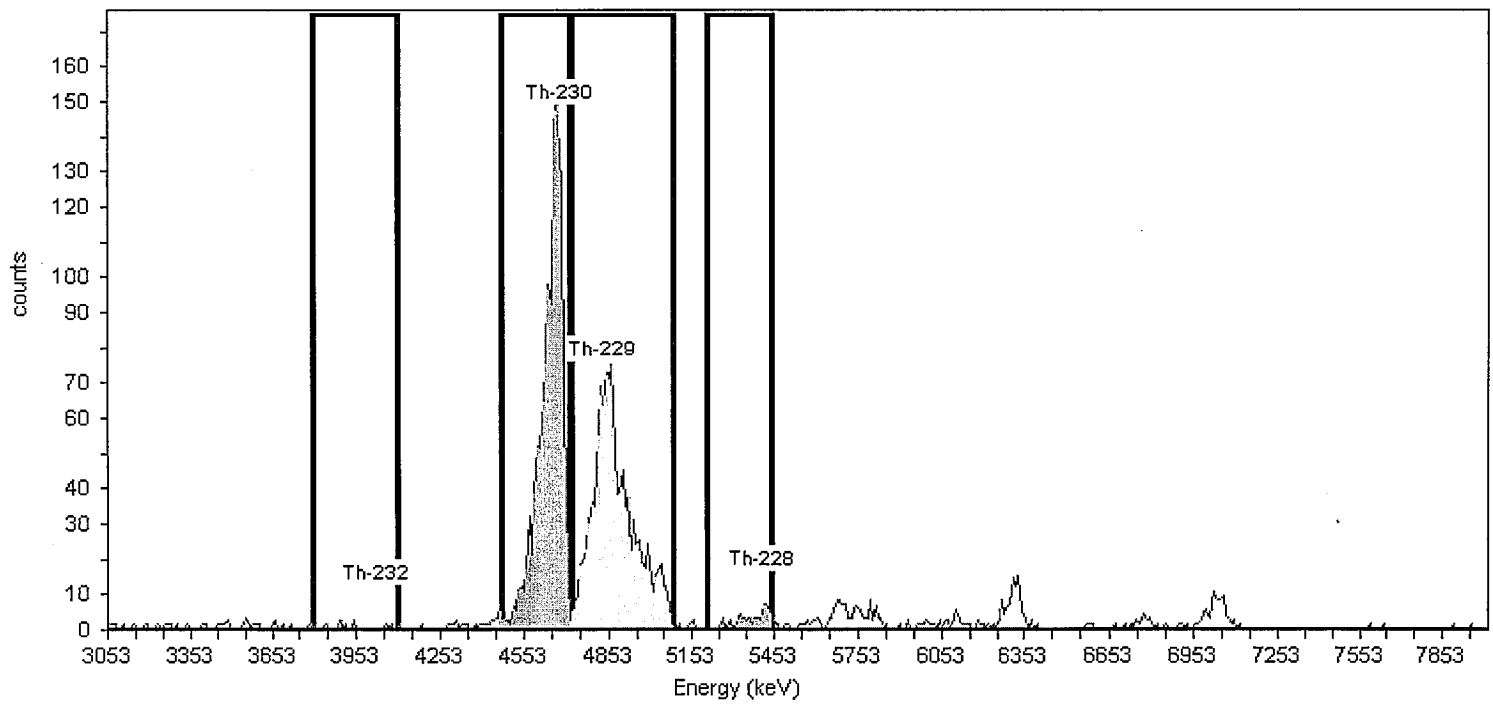
Energy Calibration: C08061025

Energy Cal: Gain = 9.7289 keV / Ch
Offset = 3,043.84 keV
Quadratic = 0.0000 keV / Ch^2

Tracer

Tracer Name: 858.3020.94 With Contamination
Tracer Activity: 21.54 DPM/mL x (Vol.)0.25 mL = 5.39 DPM

Tracer Nuclide: Th-229
Tracer Recovery: 70.06%



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
Th-232	4016.7	3793.0	4094.6	201.8	100.2	9.00	10.00	-1.00	-5.5E-004	4.8E-003	4.0E-003	9.5E-003
Th-230	4678.3	4474.0	4717.2	76.7	100.1	1,228.00	6.00	1,194.77	6.5E-001	8.7E-002	3.1E-003	7.7E-003
Th-229	4833.9	4726.9	5086.9	113.2	99.6	1,107.00	6.00	1,101.00	4.2E-001	2.6E-002	3.1E-003	7.8E-003
Th-228	5407.9	5203.6	5446.9	35.8	100.0	55.00	59.00	-4.00	-2.2E-003	1.2E-002	9.8E-003	2.1E-002

Reviewed By: AB

Print Date: 6/16/2008 10:26:57AM

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

FORM 746r8.xls (10/2/07)

366028

Paragon Analytics

Alpha Spectrometer Instrument Run Log

Date: 6/13/08

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
33	PL0806006-2_C	08016009-1	Po/s	300	GB
34		-2			
35		-3			
36		-4			
37		-5			
39		PL0806006-2MB			
40		-2LCS			
42		-2LCSD			
25	UAS0806006-3_C	AS0806006-3LCSD	U/W	800	GB
17	TAS0806009-1_A	08016041-6	Th/s	600	GB
18		-7			
19		-8			
21		-8D			
22		-9			
23		-10			
24		AS0806009-1MB			
26		-1LCS			
27	TAS0806007-1_A	0805200-1	Th/s	1000	GB
28		-4			
29		-5			
30		-8			
31		-9			
32		-12			
57		-13			

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
58	TAS0806007-1_A	0805200-16	Th/s	1000	GB
59		-17			
60		-20			
61		-21			
62		-24			
63		-25			
64		-26			
1	NAS0806004-1_D	0805247-21	Np/s	360	GB
2	NAS0806004-5_C	0805247-12	Np/s	1006	GB
4		-12SYS			
5		AS0806004-5SYS			
6		-5MB			
35	PL0806006-3_A	0805200-1	Po/s	1000	GB
36		-2			
37		-3			
39		-5			
40		-6			
42		-7			
43		-9			
45		-10			
46		-11			
47		-13			
7	PL0806006-4_A	0805200-28	Po/s	1000	GB
8		-30			

Notes:

Reviewed by: GB

Date: 6/16/08

Paragon Analytics

FORM 746r8.xls (10/2/07)

366030

Alpha Spectrometer Instrument Run Log

Date: 6/14/08

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
17	TAS080607-1_B	0805200-29	Th/S	1000	JH
18		-30			
19		-33			
21		-34			
22		-37			
23		AS080607-1MB			
24		-1LCS			
25		-1LCSD			
26	TAS080612-1_A	0806061-1	Th/W	1000	JH
27		-2			
28		-3			
29		-4			
30		-5			
31		-6			
32		-7			
57		AS080612-1MB			
58		-1LCS			
59		-1LCSD			
60	TAS080611-6_A	0805237-23	Th/W	360	JH
61		AS080611-6MB			
62		-6LCS			
63		-6LCSD			
1	PAS080606-3_B	0805200 ~~-13~~ 14	Po/S	1000	JH
2		~~-14~~ 15 JH 6/14/08			

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial
4	PAS080606-3_B	0805200 ~~-15~~ 17	Po/S	1000	JH
5		-17 18			
6		-18 19			
7		-19 21			
8		-21 22			
49		-22 23			
50		-23 26			
51		-26 27			
52		PL080606-3 ~~-27 MB~~ JH 6/14/08			
53		PL080606-3 ~~-MB~~ LCS			
54		-3LCSD			
33	AAS080611-4_A	~~0806024-23LCSD~~ JH 6/14/08	Am/W	420 JH 6/14/08	
34		-5		420	JH
35		0806053-2			
36		-20			
37		AS080611-4MB			
39		-4LCS			
42	NAS080611-7_A	0805237-23	Np/W	600	JH
40		-23SYS			
43		AS080611-7SYS			
45		-7MB			
46		-7LCS			
47		-7LCSD			
			JH 6/15/08		

Notes:

366031

Reviewed by: GB

Date: 6/16/08

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

QUALITY ASSURANCE SUMMARY REPORTS

6

NCR #: 10702

PARAGON ANALYTICS

225 Commerce Drive ◆ Fort Collins, CO 80524 ◆ (800) 443-1511 ◆ (970) 490-1511 ◆ FAX (970) 490-1522

CONTROLLED
NON-CONFORMANCE REPORT

Non-Conformance

Initiated By: Emily M. Bitler on 6/16/2008

Event Type: Lab QC Criteria Not Met -- Chemical Yield

Event Explanation: The chemical yield of samples 0805200-16, -20, -24, -29, -33, and -37 in this batch are below the 30% lower control limit at 18%-22.2%. Matrix interference is suspected. Spectral quality is adequate for accurate quantification. All remaining quality control criteria have been met for this batch.

Action To Prevent Reccurence: N/A - matrix issue

Corrective Action

Corrective Action: Document in Narrative

Department Manager Approval: Mike B. Clemmer

Approval Date: 6/17/2008

Corrective Action Comments: Note that all of these were bone samples with 5 gram aliquots. Bone samples <5 grams were apparently OK.

Workorders Affected

Workorder -- Procedure		Approved By	Approval Date
0805200 -- ThISO	No client contact information.	Lance R. Steere	6/16/2008

Associated Batches

The samples were originally associated with the following Batch(es):

AS080607-1A prepared on 6/16/2008

All rework was completed in the following Batch(es):

Not Applicable

NCR Approval

Project Manager Approval: LRS on 6/16/2008

Department Manager Approval: Mike B. Clemmer on 6/17/2008

QA Manager Approval: Deb Scheib on 6/18/2008

Paragon Analytics

QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0805200
TEST various
METHOD Prep
SOP/REV (PREP) Various
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.

TE 6/7/08

The following applies to animal tissue samples 0805200-1 to –37:

1. The entire sample was placed in a drying oven for %moisture analysis.
2. The entire dried sample was then placed into a 220mL polypropylene cup.
3. A common digestion was performed by adding 25mL each of HCl and HNO_3 to the sample cups. The samples were capped, placed on the steambath, uncapped after four hours, and allowed to dry.
4. Step 3 was repeated to ensure a total digestion of the samples.
5. After the second digestion, the dried samples were brought up in 10mL HNO_3 and ~80mL DI water and placed on the steambath for 30minutes.
6. The samples were removed from the steambath and diluted with DI water to a total volume of 100ml. TE 6/7/08
7. At this time, Paragon received extra volume from the client for bone samples 4, 8, 12, 16, 20, and 24. Steps 1-6 were performed on the extra volumes. These extra sample volumes were then combined with the original sample. The samples were evaporated to less than 100ml on the steambath and then brought to a total volume of 100ml with DI water. TE 6/7/08
8. The sample digestates were then split to target the necessary analyses aliquots provided by the project manager using the following equation:

$$\text{Sample Size(g)} = \frac{\text{(Original Sample Wet Weight(g))} * \text{(Digestate Volume Taken for Analysis(ml))}}{\text{(Total Volume of Digestate(ml))}}$$

All wet weights and digestate splits are listed on the "Animal Tissue Digestate Splits" spreadsheets.

9. All samples were spike/traced for the individual analyses following the digestate splits.
10. Two sets of reagent blanks, LCS's, and LCSD's were created at step 3 for analyses containing more than 20 samples. As all samples were prepped together, the QC are interchangeable. Due to limited sample volume, the LCSD's were created to meet QC requirements.

TE 6/7/08

TECHNICIAN/ANALYST T Elliot DATE 6/7/08

DEPARTMENT MANAGER [signature] DATE 6/7/08

365713 FORM 302r6.doc (4/22/04)

Paragon Analytics

QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0805200
TEST Th
METHOD Prep
SOP/REV (PREP) 777/r9
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.

CLS 6/11/08

CLS 6/11/08

Some samples in W.O. 0805200 did not form a precipitate after the addition of 2 ml of Fe carrier and 25 ml of ammonium hydroxide. All the samples were placed into the centrifuge and spun down for 12 min. Samples 0805200-4, -8, -12, -16, -20, -24, -29, -33, and –37 were bone matrices and properly formed a plug at the bottom of the centrifuge bottles. However, all the soft animal tissue and carcass samples did not form a plug. The samples were poured into a clean glass beaker and brought up to ~1000 ml using DI water. They were then placed on hotplates where heat was applied and spun for a minimum of 1 hour. This allowed a precipitate to form. The samples were then poured back into the proper centrifuge bottle and spun for 12 min. minimum. All samples were then run per SOP 777/r9.

CLS 6/11/08

CLS 6/11/08

CLS 6/11/08

TECHNICIAN/ANALYST Crystal Sheaffer DATE 6/11/08

DEPARTMENT MANAGER [signature] DATE 6/11/08

365603

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

PARAGON ANALYTICS
Radiochemistry Data Package

Section 7

LABORATORY BENCH SHEETS

7

Radiochemistry Instrument Worksheet

Paragon Analytics

Prep Batch: AS080607-1

Prep Procedure: ThISO

10702

Analytical QASS / NCR? (Y) ~~(N)~~ ~~NA~~ GB 6/16/08

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	0805200-1	SMP	5.0256	5.0256	g	pCi/g	_52001	27	JH	_52001			_52001			
1	0805200-4	SMP	2.2568	2.2568	g	pCi/g	_52004	28		_52004			_52004			
1	0805200-5	SMP	5	5	g	pCi/g	_52005	29		_52005			_52005			
1	0805200-8	SMP	2.3632	2.3632	g	pCi/g	_52008	30		_52008			_52008			
1	0805200-9	SMP	3.696	3.696	g	pCi/g	_52009	31		_52009			_52009			
1	0805200-12	SMP	2.1504	2.1504	g	pCi/g	_520012	32		_520012			_520012			
1	0805200-13	SMP	5.0283	5.0283	g	pCi/g	_520013	57		_520013			_520013			
1	0805200-16	SMP	5.0424	5.0424	g	pCi/g	_520016	58		_520016			_520016			
1	0805200-17	SMP	5.076	5.076	g	pCi/g	_520017	59		_520017			_520017			
1	0805200-20	SMP	4.97301	4.9730	g	pCi/g	_520020	60		_520020			_520020			
1	0805200-21	SMP	5.1352	5.1352	g	pCi/g	_520021	61		_520021			_520021			
1	0805200-24	SMP	5.1651	5.1651	g	pCi/g	_520024	62		_520024			_520024			
1	0805200-25	SMP	2.0025	2.0025	g	pCi/g	_520025	63		_520025			_520025			
1	0805200-26	SMP	5.1766	5.1766	g	pCi/g	_520026	64		_520026			_520026			
1	0805200-29	SMP	3.29154	3.2915	g	pCi/g	_520029	17	JH	_520029			_520029		B	
1	0805200-30	SMP	5.0175	5.0175	g	pCi/g	_520030	18		_520030			_520030			
1	0805200-33	SMP	4.86591	4.8659	g	pCi/g	_520033	19		_520033			_520033			
1	0805200-34	SMP	5.1356	5.1356	g	pCi/g	_520034	21		_520034			_520034			
1	0805200-37	SMP	3.72708	3.7271	g	pCi/g	_520037	22		_520037			_520037			
1	AS080607-1	MB	4	4	g	pCi/g	_6071B	23		_6071B			_6071B			
1	AS080607-1	LCS	4	4	g	pCi/g	_6071L	24		_6071L			_6071L			
1	AS080607-1	LCSD	4	4	g	pCi/g	_6071LD	25		_6071LD GB 6/16/08			_6071LD			GB 6/16/08

Tracer/Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	Th-229	858.3020.94	21.541	DPM/ml	06/07/08	0.25	ml	AW016

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Th-230	760.3020.54	22.706	DPM/ml	06/07/08	0.25	ml	AW016

Radiochemistry Instrument Worksheet

Paragon Analytics

Prep Batch: AS080607-1

Sample Barcodes

0805200-1 AS080607-1PS1	0805200-4 AS080607-1PS2
0805200-5 AS080607-1PS3	0805200-8 AS080607-1PS4
0805200-9 AS080607-1PS5	0805200-12 AS080607-1PS6
0805200-13 AS080607-1PS7	0805200-16 AS080607-1PS8
0805200-17 AS080607-1PS9	0805200-20 AS080607-1PS10
0805200-21 AS080607-1PS11	0805200-24 AS080607-1PS12
0805200-25 AS080607-1PS13	0805200-26 AS080607-1PS14
0805200-29 AS080607-1PS15	0805200-30 AS080607-1PS16
0805200-33 AS080607-1PS17	0805200-34 AS080607-1PS18
0805200-37 AS080607-1PS19	AS080607-1MB AS080607-1PS20
AS080607-1LCS AS080607-1PS21	AS080607-1LCSD AS080607-1PS22

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS080607-1

Prep Procedure: ThISO

Reviewed By: jdd CLS for JDD **Review Date:** 6/9/2008

Non-Routine Pre-Treatment? (Y) / N **Batch:** See QASS **Re-Prep?** Y / (N) **Batch:** N/A **Prep QASS / NCR?** (Y) / N 365713, 365403

Prep SOP: PAI 777 **Rev:** 9
Prep SOP: NONE
Matrix Class: solid

Prep Analyst: Crystal Shaeffer
Prep Date: 6/7/2008
Prep Dept: AP

Balance: 19
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	0805200-1	SMP		5.0256	5.0256	As Received	100	36	CLS	6/11/08	T1	
2	1	0805200-4	SMP		2.2568	2.2568	As Received	100	28			T1	
3	1	0805200-5	SMP		5	5	As Received	100	40			T1	
4	1	0805200-8	SMP		2.3632	2.3632	As Received	100	28			T1	
5	1	0805200-9	SMP		3.696	3.696	As Received	100	48			T1	
6	1	0805200-12	SMP		2.1504	2.1504	As Received	100	28			T1	
7	1	0805200-13	SMP		5.0283	5.0283	As Received	100	37			T1	
8	1	0805200-16	SMP		5.0424	5.0424	As Received	100	33			T1	
9	1	0805200-17	SMP		5.076	5.076	As Received	100	27			T1	
10	1	0805200-20	SMP		4.97301	4.97301	As Received	100	35.7			T1	
11	1	0805200-21	SMP		5.1352	5.1352	As Received	100	28			T1	
12	1	0805200-24	SMP		5.1651	5.1651	As Received	100	27			T1	
13	1	0805200-25	SMP		2.0025	2.0025	As Received	100	25			T1	
14	1	0805200-26	SMP		5.1766	5.1766	As Received	100	22			T1	
15	1	0805200-29	SMP		3.29154	3.29154	As Received	100	35.7			T1	
16	1	0805200-30	SMP		5.0175	5.0175	As Received	100	25			T1	
17	1	0805200-33	SMP		4.86591	4.86591	As Received	100	35.7			T1	
18	1	0805200-34	SMP		5.1356	5.1356	As Received	100	37			T1	
19	1	0805200-37	SMP		3.72708	3.72708	As Received	100	35.7			T1	
20	1	AS080607-1	MB		4	4	As Received	100	20			T1	
21	1	AS080607-1	LCS		4	4	As Received	100	20			S1,T1	
22	1	AS080607-1	LCSD		4	4	As Received	100	20			S1,T1	

6/10/08 CLS for all samples

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS080607-1

Prep Procedure: ThISO

Reviewed By: jdd **Review Date:** 6/9/2008

Non-Routine Pre-Treatment? (Y) / N **Batch:** See QASS **Re-Prep?** Y / (N) **Batch:** N/A **Prep QASS / NCR?** (Y) / N 3605713, 3605603

Prep SOP: PAI 777 **Rev:** 9
Prep SOP: NONE
Matrix Class: solid

Prep Analyst: Crystal Shaeffer
Prep Date: 6/7/2008
Prep Dept: AP

Balance: 19
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

Comments
A PEG treatment was performed on all samples.

Spiked By: Crystal Shaeffer **Date:** 6/9/2008

Witnessed By: Joe D. Dauner **Date:** 6/9/2008

Tracer/Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	Th-229	858.3020.94	21.541	DPM/ml	06/07/08	0.25	ml	AW016

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Th-230	760.3020.54	22.706	DPM/ml	06/07/08	0.25	ml	AW016

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS080607-1

Prep Procedure: ThISO

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

Prep Analyst: Crystal Shaeffer
Prep Date: 6/7/2008
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	0805200-1	SMP		5.0256	5.0256	As Received	100	36			T1	
2	1	0805200-4	SMP		2.2568	2.2568	As Received	100	28			T1	
3	1	0805200-5	SMP		5	5	As Received	100	40			T1	
4	1	0805200-8	SMP		2.3632	2.3632	As Received	100	28			T1	
5	1	0805200-9	SMP		3.696	3.696	As Received	100	48			T1	
6	1	0805200-12	SMP		2.1504	2.1504	As Received	100	28			T1	
7	1	0805200-13	SMP		5.0283	5.0283	As Received	100	37			T1	
8	1	0805200-16	SMP		5.0424	5.0424	As Received	100	33			T1	
9	1	0805200-17	SMP		5.076	5.076	As Received	100	27			T1	
10	1	0805200-20	SMP		4.97301	4.97301	As Received	100	35.7			T1	
11	1	0805200-21	SMP		5.1352	5.1352	As Received	100	28			T1	
12	1	0805200-24	SMP		5.1651	5.1651	As Received	100	27			T1	
13	1	0805200-25	SMP		2.0025	2.0025	As Received	100	25			T1	
14	1	0805200-26	SMP		5.1766	5.1766	As Received	100	22			T1	
15	1	0805200-29	SMP		3.29154	3.29154	As Received	100	35.7			T1	
16	1	0805200-30	SMP		5.0175	5.0175	As Received	100	25			T1	
17	1	0805200-33	SMP		4.86591	4.86591	As Received	100	35.7			T1	
18	1	0805200-34	SMP		5.1356	5.1356	As Received	100	37			T1	
19	1	0805200-37	SMP		3.72708	3.72708	As Received	100	35.7			T1	
20	1	AS080607-1	MB		4	4	As Received	100	20			T1	
21	1	AS080607-1	LCS		4	4	As Received	100	20			S1,T1	
22	1	AS080607-1	LCSD		4	4	As Received	100	20			S1,T1	

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS080607-1

Prep Procedure: ThISO

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

Prep Analyst: Crystal Shaeffer CS
Prep Date: 6/7/2008
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

Comments
A PEG treatment was performed on all samples.

Spiked By: Crystal Shaeffer CS **Date:** 6/9/08
Witnessed By: JOO **Date:** 6/9/08

Tracer/Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	Th-229	858.3020.94	21.541	DPM/ml	06/07/08	0.25	ml	AW016

T1 exp: 5/1/09

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Th-230	760.3020.54	22.706	DPM/ml	06/07/08	0.25	ml	AW016

S1 exp: 10/4/08

Paragon Analytics

Radiochemistry Prep Worksheet

Prep Batch: AS080607-1

Prep Procedure: ThISO

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

Prep Analyst: Crystal Shaeffer
Prep Date: 6/7/2008
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	0805200-1	SMP		13.96	5.0256	As Received	100	36			T1	
2	1	0805200-4	SMP		8.06	2.2568	As Received	100	28			T1	
3	1	0805200-5	SMP		12.5	5	As Received	100	40			T1	
4	1	0805200-8	SMP		8.44	2.3632	As Received	100	28			T1	
5	1	0805200-9	SMP		7.7	3.696	As Received	100	48			T1	
6	1	0805200-12	SMP		7.68	2.1504	As Received	100	28			T1	
7	1	0805200-13	SMP		13.59	5.0283	As Received	100	37			T1	
8	1	0805200-16	SMP		15.28	5.0424	As Received	100	33			T1	
9	1	0805200-17	SMP		18.8	5.076	As Received	100	27			T1	
10	1	0805200-20	SMP		13.93	4.97301	As Received	100	35.7			T1	
11	1	0805200-21	SMP		18.34	5.1352	As Received	100	28			T1	
12	1	0805200-24	SMP		19.13	5.1651	As Received	100	27			T1	
13	1	0805200-25	SMP		8.01	2.0025	As Received	100	25			T1	
14	1	0805200-26	SMP		23.53	5.1766	As Received	100	22			T1	
15	1	0805200-29	SMP		9.22	3.29154	As Received	100	35.7			T1	
16	1	0805200-30	SMP		20.07	5.0175	As Received	100	25			T1	
17	1	0805200-33	SMP		13.63	4.86591	As Received	100	35.7			T1	
18	1	0805200-34	SMP		13.88	5.1356	As Received	100	37			T1	
19	1	0805200-37	SMP		10.44	3.72708	As Received	100	35.7			T1	
20	1	AS080607-1	MB		20	4	As Received	100	20			T1	
21	1	AS080607-1	LCS		20	4	As Received	100	20			S1,T1	
22	1	AS080607-1	LCSD		20	4	As Received	100	20			S1,T1	

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS080607-1

Prep Procedure: ThISO

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

Prep Analyst: Crystal Shaeffer
Prep Date: 6/7/2008
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

Comments
A PEG treatment was performed on all samples.

Spiked By: Crystal Shaeffer **Date:** _____

Witnessed By: _____ **Date:** _____

Tracer/Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	Th-229	858.3020.94	21.541	DPM/ml	06/07/08	0.25	ml	AW016

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Th-230	760.3020.54	22.706	DPM/ml	06/07/08	0.25	ml	AW016

SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TE

ANALYSIS DATE: 5/30/08 METHOD: Prep

WORK ORDER	SAMPLE ID	SAMPLE CONDITION		
		Dry/Wet	TEXTURE	Remarks
0805200	1	wet	As Rec'd	soft animal tissue
	2			↓
	3			
	4			bone
	5			soft animal tissue
	6			↓
	7			
	8			bone
	9			soft animal tissue
	10			↓
	11			
	12			bone
	13			soft animal tissue
	14			↓
	15			
	16			bone
	17			soft animal tissue
	18			↓
	19			
✓	20	✓	✓	bone

SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TE

ANALYSIS DATE: 5/30/08 METHOD: Prep

WORK ORDER	SAMPLE ID	SAMPLE CONDITION		
		Dry/Wet	TEXTURE	Remarks
0805200	21	wet	As Rec'd	soft animal tissue
	22			↓
	23			
	24			bone
	25			carcass
	26			soft animal tissue
	27			↓
	28			
	29			bone
	30			soft animal tissue
	31			↓
	32			
	33			bone
	34			soft animal tissue
	35			↓
	36			
	37	✓	✓	bone
			TE 5/30/08	

Percent Moisture

Method SOP642M Revision 0

Lab Name: Paragon Analytics

Date Extracted: 06/02/2008
Date Analyzed: 06/02/2008
Analyst: Tambrae Elhart

Balance ID: 25
Oven ID: 18
In Oven: 5/30/2008 @ 6:00:00 PM
Out of Oven: 6/1/2008 @ 12:00:00 PM

Validated By: tde
Validation Date: 06/02/2008
Validation Time: 5:30:37 PM

Run ID	Prep Batch ID	QC Batch ID	Lab ID	QC Type	Dish Wt	Wet Wt	Dry Wt	Dry Wt-Dish Wt	Percent Moisture	Percent Solids	RPD
MOI080602-1A	MOI080602-1	MOI080602-1-1	MOI080602-1	MB	0	2.22	2.22	2.22	0.0	100.0	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-1	SMP	2.25	13.96	5.93	3.68	73.6	26.4	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-2	SMP	2.25	4.6	3.28	1.03	77.6	22.4	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-3	SMP	2.24	21.08	7.16	4.92	76.7	23.3	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-4	SMP	2.23	1.18	2.95	0.72	39.0	61.0	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-5	SMP	2.23	12.5	5.49	3.26	73.9	26.1	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-6	SMP	2.22	3.74	2.97	0.75	79.9	20.1	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-7	SMP	2.24	26.79	8.91	6.67	75.1	24.9	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-8	SMP	2.24	1.2	2.96	0.72	40.0	60.0	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-9	SMP	2.24	7.7	4.06	1.82	76.4	23.6	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-10	SMP	2.23	7.85	3.76	1.53	80.5	19.5	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-11	SMP	2.25	26.77	8.59	6.34	76.3	23.7	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-12	SMP	2.22	1.45	2.97	0.75	48.3	51.7	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-13	SMP	2.25	13.59	5.82	3.57	73.7	26.3	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-14	SMP	2.25	12.64	5.05	2.80	77.8	22.2	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-15	SMP	2.26	33.65	10.31	8.05	76.1	23.9	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-16	SMP	2.26	4.1	4.69	2.43	40.7	59.3	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-17	SMP	2.25	18.8	7.08	4.83	74.3	25.7	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-18	SMP	2.25	11.43	4.87	2.62	77.1	22.9	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-19	SMP	2.26	42.59	12.87	10.61	75.1	24.9	
MOI080602-1A	MOI080602-1	MOI080602-1-1	0805200-20	SMP	2.25	3.48	4.42	2.17	37.6	62.4	

Percent Moisture

Method SOP642M Revision 0

Lab Name: Paragon Analytics

Date Extracted: 06/02/2008
Date Analyzed: 06/02/2008
Analyst: Tambrae Elhart

Balance ID: 25
Oven ID: 18
In Oven: 5/30/2008 @ 6:00:00 PM
Out of Oven: 6/1/2008 @ 12:00:00 PM

Validated By: tde
Validation Date: 06/02/2008
Validation Time: 5:30:37 PM

Run ID	Prep Batch ID	QC Batch ID	Lab ID	QC Type	Dish Wt	Wet Wt	Dry Wt	Dry Wt-Dish Wt	Percent Moisture	Percent Solids	RPD

QC Types

CAR	Carrier reference sample
LCS	Laboratory Control Sample
MB	Method Blank
MSD	Laboratory Matrix Spike Duplicate
SMP	Field Sample

DUP	Laboratory Duplicate
LCSD	Laboratory Control Sample Duplicate
MS	Laboratory Matrix Spike
REP	Sample replicate
SYS	Sample Yield Spike

Comments:

DUP = Sample Duplicate
Wet Wt = Sample Wet Wt - Dish Wt
Dry Wt = Sample Dry Wt + Dish Wt
Dry Wt - Dish Wt = Sample Dry Wt - Dish Wt
All weight values shown above are expressed in grams.

$$RPD = \frac{(\text{Sample Value - Duplicate Value})}{2} \times 100$$

$$\% \text{ Solids} = \frac{\text{Dry Weight}}{\text{Wet Weight}} \times 100$$

$$\% \text{ Moisture} = \frac{(\text{Wet Weight - Dry Weight})}{\text{Wet Weight}} \times 100$$

Percent Moisture

Method SOP642M Revision 0

Lab Name: Paragon Analytics

Date Extracted: 06/02/2008
Date Analyzed: 06/02/2008
Analyst: Tambrae Elhart

Balance ID: 25
Oven ID: 18
In Oven: 5/30/2008 @ 6:00:00 PM
Out of Oven: 6/1/2008 @ 12:00:00 PM

Validated By: tde
Validation Date: 06/02/2008
Validation Time: 5:49:18 PM

Run ID	Prep Batch ID	QC Batch ID	Lab ID	QC Type	Dish Wt	Wet Wt	Dry Wt	Dry Wt-Dish Wt	Percent Moisture	Percent Solids	RPD
MOI080602-3A	MOI080602-3	MOI080602-3-1	MOI080602-3	MB	0	2.25	2.25	2.25	0.0	100.0	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-21	SMP	2.2	18.34	6.89	4.69	74.4	25.6	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-22	SMP	2.25	15.44	5.44	3.19	79.3	20.7	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-23	SMP	2.21	44.29	12.69	10.48	76.3	23.7	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-24	SMP	2.21	4.04	4.89	2.68	33.7	66.3	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-25	SMP	2.21	8.01	4.16	1.95	75.7	24.3	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-26	SMP	2.21	23.53	7.33	5.12	78.2	21.8	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-27	SMP	2.23	11.89	4.92	2.69	77.4	22.6	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-28	SMP	2.23	26.13	5.42	3.19	87.8	12.2	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-29	SMP	2.26	9.22	9.88	7.62	17.4	82.6	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-30	SMP	2.25	20.07	7.54	5.29	73.6	26.4	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-31	SMP	2.26	15.71	5.34	3.08	80.4	19.6	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-32	SMP	2.25	19.9	6.3	4.05	79.6	20.4	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-33	SMP	2.22	13.63	12.52	10.30	24.4	75.6	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-34	SMP	2.22	13.88	5.09	2.87	79.3	20.7	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-35	SMP	2.26	14.96	5.11	2.85	80.9	19.1	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-36	SMP	2.24	25.8	7.5	5.26	79.6	20.4	
MOI080602-3A	MOI080602-3	MOI080602-3-1	0805200-37	SMP	2.22	10.44	10.66	8.44	19.2	80.8	

QC Types

CAR	Carrier reference sample
LCS	Laboratory Control Sample
MB	Method Blank
MSD	Laboratory Matrix Spike Duplicate
SMP	Field Sample

DUP	Laboratory Duplicate
LCSD	Laboratory Control Sample Duplicate
MS	Laboratory Matrix Spike
REP	Sample replicate
SYS	Sample Yield Spike

Comments:

DUP = Sample Duplicate
Wet Wt = Sample Wet Wt - Dish Wt
Dry Wt = Sample Dry Wt + Dish Wt
Dry Wt - Dish Wt = Sample Dry Wt - Dish Wt
All weight values shown above are expressed in grams.

$$RPD = \frac{(\text{Sample Value - Duplicate Value})}{2} \times 100$$

$$\% \text{ Solids} = \frac{\text{Dry Weight}}{\text{Wet Weight}} \times 100$$

$$\% \text{ Moisture} = \frac{(\text{Wet Weight - Dry Weight})}{\text{Wet Weight}} \times 100$$

Percent Moisture

Method SOP642M Revision 0

Lab Name: Paragon Analytics

Balance ID: 25

Date Extracted: 06/05/2008
Date Analyzed: 06/05/2008
Analyst: Tambrae Elhart

Oven ID: 5
In Oven: 6/5/2008 @ 9:35:00 AM
Out of Oven: 6/6/2008 @ 5:15:00 AM

Validated By: tde
Validation Date: 06/06/2008
Validation Time: 8:47:06 AM

Run ID	Prep Batch ID	QC Batch ID	Lab ID	QC Type	Dish Wt	Wet Wt	Dry Wt	Dry Wt-Dish Wt	Percent Moisture	Percent Solids	RPD
MOI080606-1A	MOI080606-1	MOI080606-1-1	MOI080606-1	MB	0	2.24	2.24	2.24	0.0	100.0	
MOI080606-1A	MOI080606-1	MOI080606-1-1	0805200-4	SMP	2.25	6.88	6.89	4.64	32.6	67.4	
MOI080606-1A	MOI080606-1	MOI080606-1-1	0805200-8	SMP	2.26	7.24	6.68	4.42	39.0	61.0	
MOI080606-1A	MOI080606-1	MOI080606-1-1	0805200-12	SMP	2.24	6.23	5.95	3.71	40.4	59.6	
MOI080606-1A	MOI080606-1	MOI080606-1-1	0805200-16	SMP	2.24	11.18	9.85	7.61	31.9	68.1	
MOI080606-1A	MOI080606-1	MOI080606-1-1	0805200-20	SMP	2.21	10.45	10.03	7.82	25.2	74.8	
MOI080606-1A	MOI080606-1	MOI080606-1-1	0805200-24	SMP	2.24	15.09	13.06	10.82	28.3	71.7	

QC Types

CAR	Carrier reference sample
LCS	Laboratory Control Sample
MB	Method Blank
MSD	Laboratory Matrix Spike Duplicate
SMP	Field Sample

DUP	Laboratory Duplicate
LCSD	Laboratory Control Sample Duplicate
MS	Laboratory Matrix Spike
REP	Sample replicate
SYS	Sample Yield Spike

Comments:

DUP = Sample Duplicate
Wet Wt = Sample Wet Wt - Dish Wt
Dry Wt = Sample Dry Wt + Dish Wt
Dry Wt - Dish Wt = Sample Dry Wt - Dish Wt
All weight values shown above are expressed in grams.

$$RPD = \frac{(\text{Sample Value - Duplicate Value})}{2} \times 100$$

$$\% \text{ Solids} = \frac{\text{Dry Weight}}{\text{Wet Weight}} \times 100$$

$$\% \text{ Moisture} = \frac{(\text{Wet Weight - Dry Weight})}{\text{Wet Weight}} \times 100$$

Animal Tissue Digestate Splits

Sample ID	Original Wet Wt (g)	Total Digest. Volume (ml)	Digestate Volume Taken for Analysis (ml)				
			Po-210	Pb-210	Th-ISO	Ra-226	U6020
0805200-1	13.96	100	4	36	36	NA	NA
0805200-2	4.6	100	10	90	NA	NA	NA
0805200-3	21.08	100	3	NA	NA	NA	24
0805200-4	8.06	100	NA	5	28	50	17
0805200-5	12.5	100	4	40	40	NA	NA
0805200-6	3.74	100	10	90	NA	NA	NA
0805200-7	26.79	100	2	NA	NA	NA	19
0805200-8	8.44	100	NA	5	28	50	17
0805200-9	7.7	100	4	48	48	NA	NA
0805200-10	7.85	100	7	64	NA	NA	NA
0805200-11	26.77	100	2	NA	NA	NA	19
0805200-12	7.68	100	NA	5	28	50	17
0805200-13	13.59	100	4	37	37	NA	NA
0805200-14	12.64	100	4	40	NA	NA	NA
0805200-15	33.65	100	2	NA	NA	NA	15
0805200-16	15.28	100	NA	7	33	33	20
0805200-17	18.8	100	3	27	27	NA	NA
0805200-18	11.43	100	5	44	NA	NA	NA
0805200-19	42.59	100	2	NA	NA	NA	12
0805200-20*	13.93	100	NA	7.1	35.7	35.7	21.5
0805200-MB	20	100	2.5	20	20	20	20
0805200-LCS	20	100	2.5	20	20	20	20
0805200-LCSD	20	100	2.5	20	20	20	20

1. *=sample not enough to take full aliquots, analysis aliquot adjusted proportionally
2. Samples split using graduated cylinder or calibrated pipet

Animal Tissue Digestate Splits

Sample ID	Original Wet Wt (g)	Total Digest. Volume (ml)	Digestate Volume Taken for Analysis (ml)				
			Po-210	Pb-210	Th-ISO	Ra-226	U6020
0805200-21	18.34	100	3	28	28	NA	NA
0805200-22	15.44	100	4	33	NA	NA	NA
0805200-23	44.29	100	2	NA	NA	NA	12
0805200-24	19.13	100	NA	6	27	27	16
0805200-25	8.01	100	NA	25	25	25	25
0805200-26	23.53	100	3	22	22	NA	NA
0805200-27	11.89	100	5	43	NA	NA	NA
0805200-28	26.13	100	2	NA	NA	NA	20
0805200-29*	9.22	100	NA	7.1	35.7	35.7	21.5
0805200-30	20.07	100	3	25	25	NA	NA
0805200-31	15.71	100	4	32	NA	NA	NA
0805200-32	19.9	100	3	NA	NA	NA	26
0805200-33*	13.63	100	NA	7.1	35.7	35.7	21.5
0805200-34	13.88	100	4	37	37	NA	NA
0805200-35	14.96	100	4	34	NA	NA	NA
0805200-36	25.8	100	2	NA	NA	NA	20
0805200-37*	10.44	100	NA	7.1	35.7	35.7	21.5
0805200-MB	20	100	2.5	20	20	20	20
0805200-LCS	20	100	2.5	20	20	20	20
0805200-LCSD	20	100	2.5	20	20	20	20

1. *=sample not enough to take full aliquots, analysis aliquot adjusted proportionally
2. Samples split using graduated cylinder or calibrated pipet

PARAGON ANALYTICS
Radiochemistry Data Package

Section 8

STANDARDS TRACEABILITY DOCUMENTS

8

PROJECT ~~856~~ 858.3020.94 Th-229 JDD 2/5/08 Notebook No. 3020

Continued From Page

Prepare a working dilution ~20.0 dpm/ml of Th-229 from 250 ~~#~~ ~~856~~ 858 9B 5/13/08

balance 1) Determine density of diluent 0.5N HNO_3 lot # 070648

12 Mass of 100 ml volumetric flask 62.4719 g

1 Mass of flask and 100 ml 0.5 N HNO_3 163.7549 g

Net Mass of 100 ml 0.5 N HNO_3

$\rho = 1.012825$ g/ml

2) Transfer Standard

12 Mass of open standard vial, beaker, and standard 37.8930 g

1 Mass of empty standard vial, and beaker 32.9440 g

Mass of standard transferred 4.9490 g

3) ~~Dilute~~ Dilute with 0.5 N HNO_3 to final volume

12 Mass of empty 1 L Nalgene (No lid) 74.5877 g

26 Mass of Nalgene, Standard and diluent (No lid) 1161.0 g

Net mass of final standard ~~1086.4123 g~~ JDD 2/5/08

1086.4 g

4) Final Activity Calculation

$$\frac{(3.91\times10^2\ Bq)\left(\frac{60\,sec}{1\,min}\right)(4.949\ g)(1.012825\ g/ml)}{(5.02478\ g)\cdot(1086.4\ g)} = 21.54\ dpm/ml$$

Stnd ID: **858.3020.94** MC 5/13/08

Description: **Th-229**

Expiration: **5/1/2009**

Activity: **21.54** **dpm/mL** MC 5/13/08

2s Uncertainty: **0.75** **dpm/mL**

Ref. Date: **1/28/2008**

Ref Time: **N/A**

Prep Date: **2/5/2008** **Prep by:** **JD**

Matrix/Comp. **0.5N HNO3**

Half Life (y): **7.34E+03**

Reverification Log		
Analysis Date	Initials	Expiration Date

MC 5/13/08

MC 5/13/08

Continued on Page

Read and Understood By

Signed 2/5/08 Date

Signed 5/13/08 Date

Eckert & Ziegler
Analytics

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

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

RSO# ~~856~~ 858 Cal 2-5-08

76663-307

Th-229 5 mL Liquid in Flame Sealed Vial

Customer: Paragon Analytics / Fort Collins, CO
P.O. No.: 73625, Item 1

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:	Th-229
Activity (Bq):	3.910 E2
Half-Life:	7340 years
Calibration Date:	January 28, 2008 12:00 EST
Relative Expanded Uncertainty (k=2):	3.5%

Comments:
Impurities: γ-impurities <0.1%, Th-228 0.32 Bq, Th-230 2.4 Bq, Th-232 0.16 Bq.
5.02478 grams 0.5M HNO3 solution.

Source Prepared By: M Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved: QA 127
D. M. Montgomery, QA Manager

Date: 1/31/08

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

RSO#760 Rec'd 7/16/04 gcB

ANALYTICS

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

68750-307

Th-230 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:	Th-230
ACTIVITY (dps):	1.832 E4
HALF-LIFE:	7.538 E4 years
CALIBRATION DATE:	July 13, 2004 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	3.3%

Impurities: γ-impurities <0.1%, α-impurities <0.01%

5.08447 grams 0.5M HNO_3 solution.

P O NUMBER 70635, Item 1

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: [illegible] 7/13/04

Prepare a working level dilution of 760.3020.08 of approx. 20dpm/mL in 0.5M HNO_3

① Determine the density of 0.5M HNO_3 Lot # 063544
Mass of empty class A volumetric flask (100mL): 56.4449 g Bal 2
Mass of flask + 100mL 0.5M HNO_3: 157.6620 g
Net mass of 100mL 0.5M HNO_3: 101.2171 g
$\rho = 1.012171$ g/mL

② Transfer 760.3020.08 to a 1L Nalgene bottle
Mass of empty nalgene w/o lid: 74.3769 g
Mass of nalgene + standard: 75.2830 g
Net mass of standard transferred: 0.9061 g

③ Dilute with 0.5M HNO_3
Mass of empty nalgene w/o lid (from above): 74.3769 g
Mass of nalgene, standard + 0.5M HNO_3: 1146.1 g
Net mass of standard + 0.5M HNO_3: 1071.7231 g

④ Final calculation of Activity:

$$\frac{(26534.43\ dpm/g)(0.9061\ g)(1.012171\ g/mL)}{1071.7231\ g} = 22.71\ dpm/mL$$

RG 2/6/07

Stnd ID: 760.3020.54

Description: Th-230
Expiration: 11/30/2007
Activity: 22.71 dpm/mL

2s Uncertainty: 0.75 dpm/mL
Ref. Date: 7/13/2004
Ref Time: N/A
Prep Date: 11/29/2006 Prep by: AB
Matrix/Comp. 0.5M HNO3
Half Life (y): 7.54E+04

RG 2/6/07

Reverification Log		
Analysis Date	Initials	Expiration Date
10/4/07	MC	10/4/08

RG 2/6/07

RG 2/6/07

Continued on Page

Read and Understood By

Signed	Date	Signed	Date
A Barlay	11/29/06	Renee Wallenborg	2/6/07 RG

Prepare a primary dilution of RSO #760 (Analytics # 68750-307) in 0.5 M HNO_3 to a concentration of approx 30,000 dpm/mL.

1) Prepare 0.5M HNO_3 by diluting 31 mL of conc. (16M) HNO_3 (EMD lot # 44287) to a final volume of 1000 mL.

2) Determine density of 0.5M HNO_3

Mass of 100mL volumetric flask	=	66.4289g (Bal 12)
Mass of flask + 0.5M HNO_3	=	167.5792g
Net mass of solution	=	101.1503g HB 1/24/06
÷ 100mL = density	=	1.0115 g/mL

3) Tranfer #760 to a 40 mL VOA vile.

Mass of bottle w/out lid	=	21.5801g (Bal 12)
Mass of std + bottle		26.5278g
Net mass of std transfered		4.9477g

4) Dilute to volume w/ 0.5M HNO_3

Mass of bottle + std + soln	=	61.8912g (Bal 12)
Mass of bottle (from above)		21.5801g
Net mass of std		40.3111g

5) Final activity calc.

HB 1/24/06

$$\frac{(1.832\times10^4\ d/sec)(\frac{60sec}{1min})(4.9477g)(1.0115\ g/mL)}{(5.08447)(40.3111g)} = 26{,}534.43\ \frac{dpm}{g}$$

Continued on Page

Read and Understood By

Olivia Baker — Signed — 1/24/06 — Date

[signature] — Signed — 1/27/06 — Date

RSO#760 Rec'd 7/16/04 DB

ANALYTICS

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

68750-307

Th-230 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:	Th-230
ACTIVITY (dps):	1.832 E4
HALF-LIFE:	7.538 E4 years
CALIBRATION DATE:	July 13, 2004 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	3.3%

Impurities: γ-impurities <0.1%, α-impurities <0.01%

5.08447 grams 0.5M HNO_3 solution.

P O NUMBER 70635, Item 1

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: 7/13/04

PARAGON ANALYTICS
Radiochemistry Data Package

Section 9

ADDITIONAL SUPPORTING DOCUMENTATION

9

Th-229 contribution to Th-230 Region-Of-Interest

Expires 04/16/09

The "Tracer Amount" field on theThorium raw data printouts show the activity amount, and the words "With Contamination". This is not actual contamination; it is the contribution of Th-229 counts to the Th-230 ROI. Using method blank data acquired from other Thorium analyses, a calculated percentage contribution of Th-229 counts to the Th-230 ROI was established to be 2.46%, as shown on the attached page. During Thorium analyses, 2.46% of the counts in the Th-229 ROI are subtracted from the Th-230 net counts and become Th-230 background counts. Therefore, on the raw data printouts, the sum of the calibrated background counts and the Th-230 net counts does not equal the Th-230 Gross Counts. Correctly calculating the Th-230 gross counts requires the sum of the calibrated Th-230 background counts, the net Th-230 counts, and the 2.46% of the Th-229 counts. Furthermore, the Th-230 total background counts used in calculations can be found on the raw data summary. Th-230 total background counts are equal to the sum of the calibrated background counts and the 2.46% of the Th-229 counts. Finally, due to limitations in the current AlphaVision (version 5.32) software the 2.46% correction is made from the Th-229 gross counts, rather than the net counts. Given the very low background count rate for this system the difference is not believed to be significant and results are to be reported without further qualification.

Th-229 contribution factor updated in AlphaVision 5.32 by: 98

Date: 4/16/08

OK
MC
4/18/08

R:\INST\alphspec\Th-229-230 Correction\THCONT6

Th-229/230 Counts Correction Report

Sample Description	ROI Set Name	Date Acquired	Th-229 Net Counts	Th-230 Net Counts	Percent Crossover
AS070515-2MB TAS070515-2	Thorium	5/24/2007 3:52:22 PM	1336.8	36.2	2.64%
AS070515-6MB TAS070515-6	Thorium	5/23/2007 2:12:53 PM	807.24	11	1.34%
AS070525-5MB TAS070525-5	Th-227	6/5/2007 10:09:05 AM	1068.54	21	1.93%
AS070613-1MB TAS070613-1	Th-227	6/16/2007 3:08:45 PM	1327.7	21.9	1.62%
AS070621-5MB TAS070621-5	Thorium	6/27/2007 9:38:51 AM	1151.1	31.8	2.69%
AS070726-6MB TAS070726-6	Thorium	8/7/2007 4:14:47 PM	2162	80	3.57%
AS070730-1MB TAS070730-1	Thorium	8/6/2007 4:04:06 PM	2034	57	2.73%
AS070823-3MB TAS070823-3	Th-227	8/30/2007 4:51:33 PM	1193.75	44.5	3.59%
AS070827-4MB TAS070827-4	Thorium	9/2/2007 2:37:36 PM	1007.8	39.6	3.78%
AS070828-2MB TAS070828-2	Thorium	8/31/2007 3:03:22 PM	885.38	21	2.32%
AS070925-4MB AS070925-4	Thorium	9/29/2007 11:25:20 AM	703	22.8	3.14%
AS070925-8MB AS070925-8	Thorium	9/29/2007 11:20:59 AM	1079.16	36	3.23%
AS080130-1MB TAS080130-1	Th-232/Th-230	2/7/2008 4:21:14 PM	594.02	18	2.94%
AS080130-8MB TAS080130-8	Thorium	2/7/2008 4:22:23 PM	1993	75	3.63%
AS080123-4MB TAS080123-4	Th-230/232	2/1/2008 4:12:35 PM	670	11.28	1.66%
AS071013-4MB TAS071013-4	Th-232/Th-230	11/14/2007 4:37:35 PM	974.5	34.8	3.45%
AS071228-3MB TAS071228-3	Thorium	1/4/2008 2:54:22 PM	1119.41	29.47	2.57%
AS071031-3MB TAS071031-3	Th-232/Th-230	11/2/2007 3:29:01 PM	770.44	11.06	1.42%
AS071128-3MB TAS071128-3	Thorium	12/1/2007 3:30:32 PM	747.56	13.56	1.78%
AS071128-4MB TAS071128-4	Thorium	12/1/2007 3:32:19 PM	1084	32	2.87%
AS071212-3MB TAS071212-3	Thorium	12/13/2007 1:42:25 PM	737.84	15	1.99%
AS071219-2MB TAS071219-2	Thorium	12/28/2007 2:50:38 PM	1570.12	46.4	2.87%
AS080221-7MB TAS080221-7	Thorium	3/3/2008 3:50:08 PM	3947	106	2.62%
AS080226-2MB TAS080226-2	Thorium	3/12/2008 2:24:31 PM	899	17	1.86%
AS080303-1MB TAS080303-1	Thorium	3/6/2008 3:59:45 PM	1933.5	45.5	2.30%
AS080318-4MB TAS080318-4	Th-232/Th-230	4/1/2008 4:21:49 PM	934	10	1.06%
AS080320-2MB TAS080320-2	Thorium	4/8/2008 4:01:11 PM	816	23	2.74%
AS080401-5MB TAS080401-5	Thorium	4/4/2008 8:35:50 AM	1258.2	24.1	1.88%
AS080409-6MB TAS080409-6A	Thorium	4/13/2008 3:35:12 PM	856.2	17.55	2.01%
AS080410-3MB TAS080410-3	Thorium	4/12/2008 1:22:23 PM	2025	32	1.56%
				Average Th-229 Net Counts found in the Th-230 ROI:	**2.46%**

Paragon Analytics

Date Printed: Wednesday, April 16, 2008

A Division of Datachem Laboratories

Alpha Spectroscopy

Quality Control Data

Weekly Background, Energy, and Efficiency Calibrations

Calibration Data Summary

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Monday, June 16, 2008
1:31:11 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** %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
0805200-1	SMP	AS080607-1	ThISO	27	C08061027	6/10/2008	29.70	Pass	28.26	28.76	30.74	31.24
Spectrum #1		AS080607-1A			B08061027	6/10/2008	0.4230	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061027	6/10/2008	5553.9	Pass	5494.2	5504.2	5584.2	5594.2
0805200-4	SMP	AS080607-1	ThISO	28	C08061028	6/10/2008	28.60	Pass	27.32	27.80	29.72	30.20
Spectrum #1		AS080607-1A			B08061028	6/10/2008	0.1790	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061028	6/10/2008	5546.0	Pass	5513.0	5523.0	5603.0	5613.0
0805200-5	SMP	AS080607-1	ThISO	29	C08061029	6/10/2008	29.25	Pass	27.50	27.99	29.92	30.40
Spectrum #1		AS080607-1A			B08061029	6/10/2008	0.3000	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061029	6/10/2008	5544.2	Pass	5486.0	5496.0	5576.0	5586.0
0805200-8	SMP	AS080607-1	ThISO	30	C08061030	6/10/2008	28.60	Pass	26.99	27.46	29.36	29.83
Spectrum #1		AS080607-1A			B08061030	6/10/2008	0.3160	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061030	6/10/2008	5546.0	Pass	5514.0	5524.0	5604.0	5614.0
0805200-9	SMP	AS080607-1	ThISO	31	C08061031	6/10/2008	29.43	Pass	28.09	28.58	30.56	31.05
Spectrum #1		AS080607-1A			B08061031	6/10/2008	0.4370	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061031	6/10/2008	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
0805200-12	SMP	AS080607-1	ThISO	32	C08061032	6/10/2008	29.78	Pass	27.99	28.48	30.44	30.93
Spectrum #1		AS080607-1A			B08061032	6/10/2008	0.3630	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061032	6/10/2008	5536.2	Pass	5488.0	5498.0	5578.0	5588.0
0805200-13	SMP	AS080607-1	ThISO	57	C08061057	6/10/2008	29.42	Pass	28.44	28.94	30.94	31.44
Spectrum #1		AS080607-1A			B08061057	6/10/2008	0.3300	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061057	6/10/2008	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
0805200-16	SMP	AS080607-1	ThISO	58	C08061058	6/10/2008	31.92	Pass	29.36	29.87	31.93	32.45
Spectrum #1		AS080607-1A			B08061058	6/10/2008	0.4510	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061058	6/10/2008	5534.7	Pass	5482.6	5492.6	5572.6	5582.6
0805200-17	SMP	AS080607-1	ThISO	59	C08061059	6/10/2008	31.26	Pass	30.14	30.67	32.79	33.32
Spectrum #1		AS080607-1A			B08061059	6/10/2008	0.3770	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061059	6/10/2008	5551.9	Pass	5494.3	5504.3	5584.3	5594.3

Data Package ID: *TH0805200-1*

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.

Calibration Data Summary

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Monday, June 16, 2008
1:31:11 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** %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
0805200-20	SMP	AS080607-1	ThISO	60	C08061060A	6/10/2008	30.83	Pass	28.99	29.50	31.54	32.05
Spectrum #1		AS080607-1A			B08061060	6/10/2008	0.2860	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061060A	6/10/2008	5536.5	Pass	5476.7	5486.7	5566.7	5576.7
0805200-21	SMP	AS080607-1	ThISO	61	C08061061	6/10/2008	31.21	Pass	29.94	30.47	32.57	33.10
Spectrum #1		AS080607-1A			B08061061	6/10/2008	0.2540	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061061	6/10/2008	5534.7	Pass	5496.2	5506.2	5586.2	5596.2
0805200-24	SMP	AS080607-1	ThISO	62	C08061062	6/10/2008	29.27	Pass	27.42	27.90	29.82	30.30
Spectrum #1		AS080607-1A			B08061062	6/10/2008	0.3120	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061062	6/10/2008	5544.3	Pass	5496.2	5506.2	5586.2	5596.2
0805200-25	SMP	AS080607-1	ThISO	63	C08061063	6/10/2008	31.25	Pass	29.41	29.93	31.99	32.51
Spectrum #1		AS080607-1A			B08061063	6/10/2008	0.2830	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061063	6/10/2008	5544.2	Pass	5486.5	5506.2	5586.2	5596.2
0805200-26	SMP	AS080607-1	ThISO	64	C08061064	6/10/2008	32.21	Pass	30.88	31.42	33.58	34.13
Spectrum #1		AS080607-1A			B08061064	6/10/2008	0.2380	Pass	0.0000	0.0500	0.5000	0.7500
6/13/2008					C08061064	6/10/2008	5544.2	Pass	5494.2	5504.2	5584.2	5594.2
0805200-29	SMP	AS080607-1	ThISO	17	C08060917	6/9/2008	30.93	Pass	28.99	29.50	31.54	32.05
Spectrum #1		AS080607-1A			B08060917	6/9/2008	0.3980	Pass	0.0000	0.0498	0.4980	0.7500
6/14/2008					C08060917	6/9/2008	5546.0	Pass	5486.5	5496.5	5576.5	5586.5
0805200-30	SMP	AS080607-1	ThISO	18	C08060918	6/9/2008	30.17	Pass	28.65	29.15	31.17	31.67
Spectrum #1		AS080607-1A			B08060918	6/9/2008	0.4570	Pass	0.0000	0.0498	0.4980	0.7500
6/14/2008					C08060918	6/9/2008	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
0805200-33	SMP	AS080607-1	ThISO	19	C08060919	6/9/2008	29.35	Pass	27.99	28.48	30.44	30.93
Spectrum #1		AS080607-1A			B08060919	6/9/2008	0.3610	Pass	0.0000	0.0498	0.4980	0.7500
6/14/2008					C08060919	6/9/2008	5555.8	Pass	5496.0	5506.0	5586.0	5596.0
0805200-34	SMP	AS080607-1	ThISO	21	C08060921	6/9/2008	28.81	Pass	27.48	27.97	29.89	30.38
Spectrum #1		AS080607-1A			B08060921	6/9/2008	0.3330	Pass	0.0000	0.0498	0.4980	0.7500
6/14/2008					C08060921	6/9/2008	5544.2	Pass	5496.0	5506.0	5586.0	5596.0

Data Package ID: *TH0805200-1*

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.

Calibration Data Summary

Laboratory Name: **Paragon Analytics**
PAI Work Order: 0805200

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Monday, June 16, 2008
1:31:11 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** %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
0805200-37	SMP	AS080607-1	ThISO	22	C08060922	6/9/2008	28.19	Pass	26.66	27.12	29.00	29.46
Spectrum #1		AS080607-1A			B08060922	6/9/2008	0.2810	Pass	0.0000	0.0498	0.4980	0.7500
6/14/2008					C08060922	6/9/2008	5546.0	Pass	5494.2	5504.2	5584.2	5594.2
AS080607-1	MB	AS080607-1	ThISO	23	C08060923	6/9/2008	28.76	Pass	27.37	27.85	29.77	30.25
Spectrum #1		AS080607-1A			B08060923	6/9/2008	0.3760	Pass	0.0000	0.0498	0.4980	0.7500
6/14/2008					C08060923	6/9/2008	5546.0	Pass	5503.7	5513.7	5593.7	5603.7
AS080607-1	LCS	AS080607-1	ThISO	24	C08060924	6/9/2008	29.32	Pass	28.06	28.56	30.52	31.02
Spectrum #1		AS080607-1A			B08060924	6/9/2008	0.2110	Pass	0.0000	0.0498	0.4980	0.7500
6/14/2008					C08060924	6/9/2008	5536.5	Pass	5491.8	5501.8	5581.8	5591.8
AS080607-1	LCSD	AS080607-1	ThISO	25	C08061025	6/10/2008	29.29	Pass	26.95	27.42	29.32	29.79
Spectrum #1		AS080607-1A			B08061025	6/10/2008	0.3220	Pass	0.0000	0.0500	0.5000	0.7500
6/14/2008					C08061025	6/10/2008	5534.4	Pass	5496.0	5506.0	5586.0	5596.0

Data Package ID: *TH0805200-1*

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.

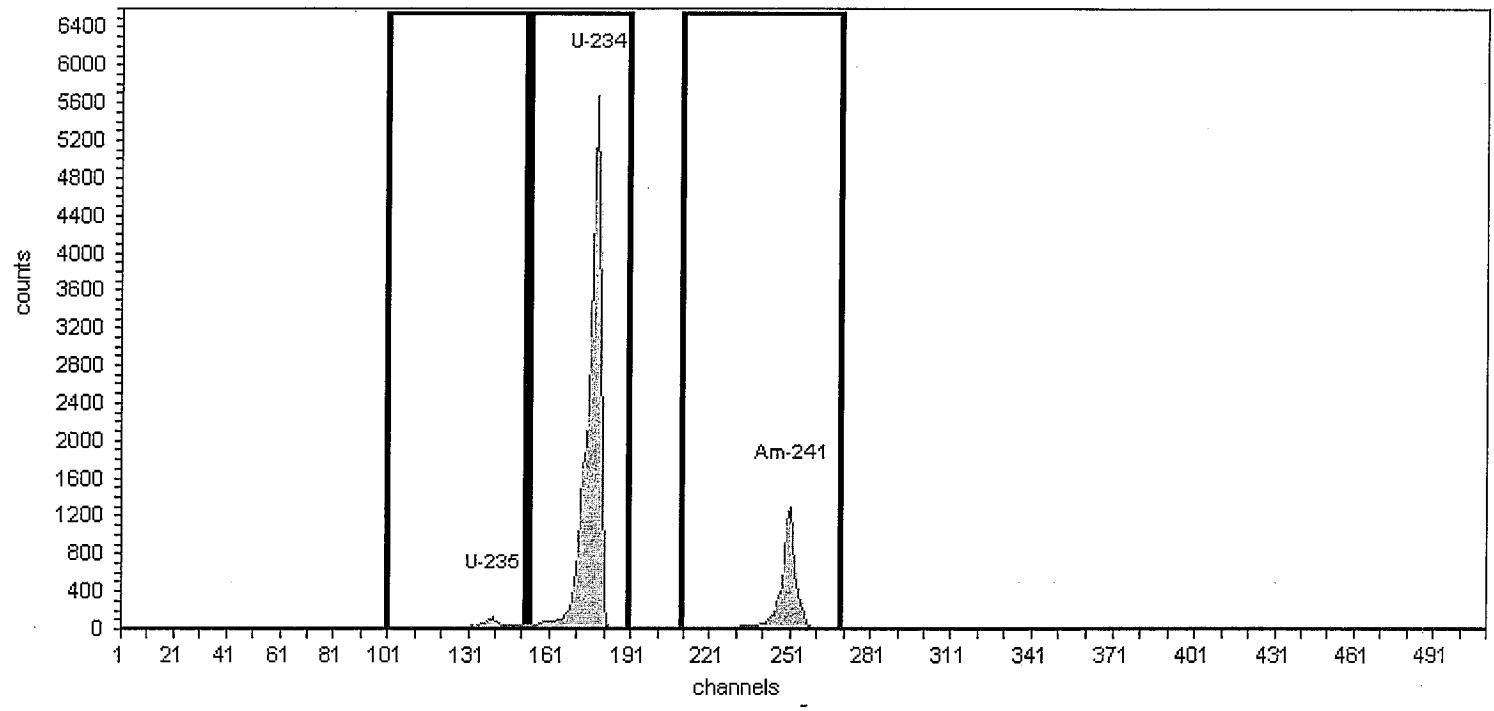
Efficiency Calibration Name: RSO (Source 9)

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

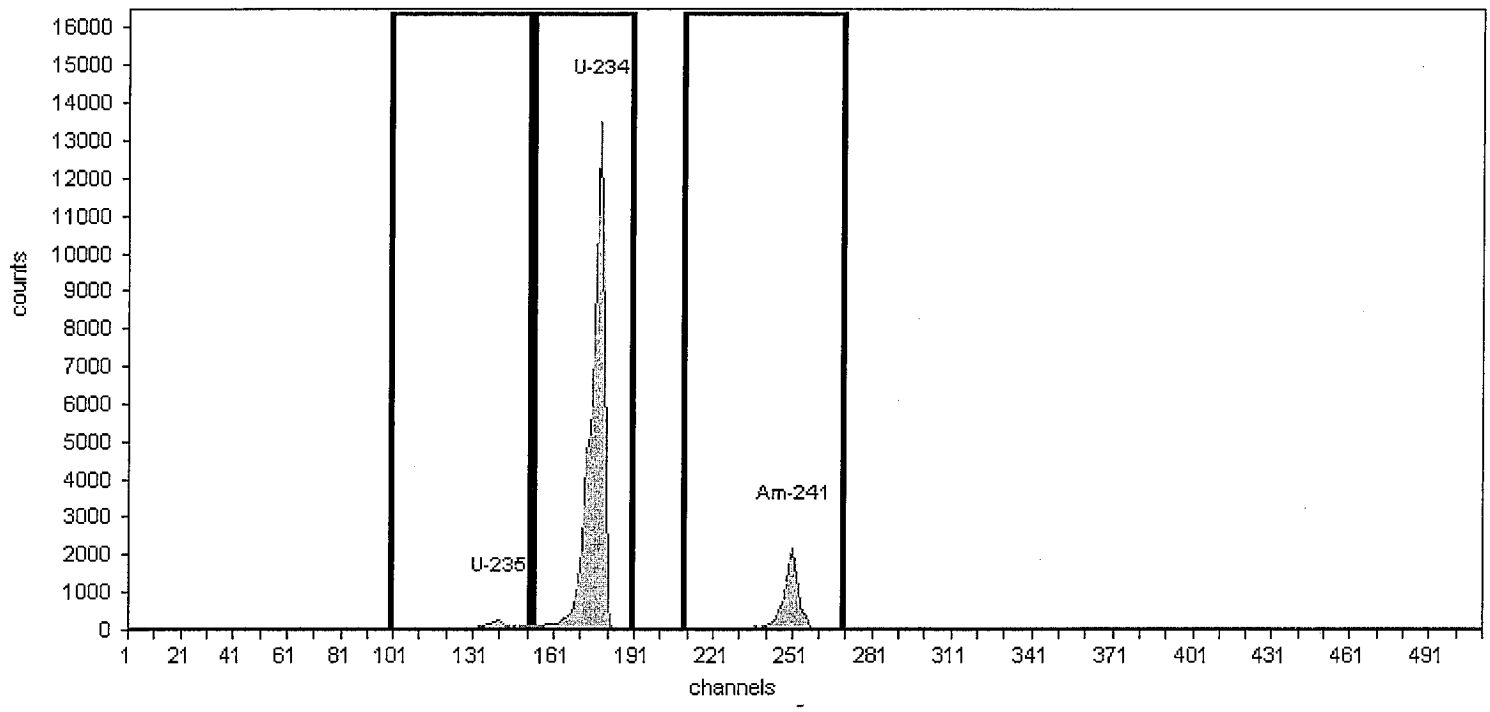
Detector: 25 , SN:
Acquisition Start Date: 5/20/2008 11:35:12AM

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.

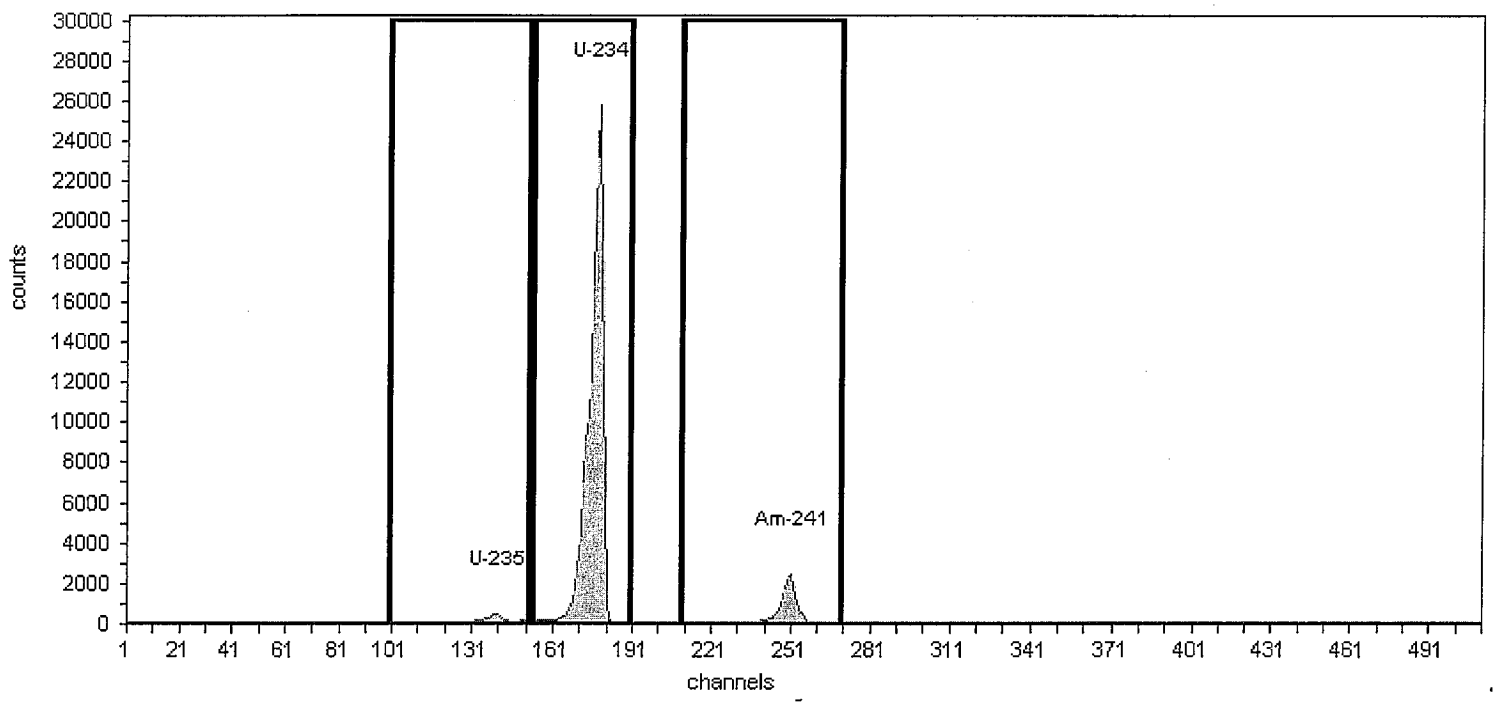
Efficiency Calibration Name: RSO 183 (Source 2)

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.

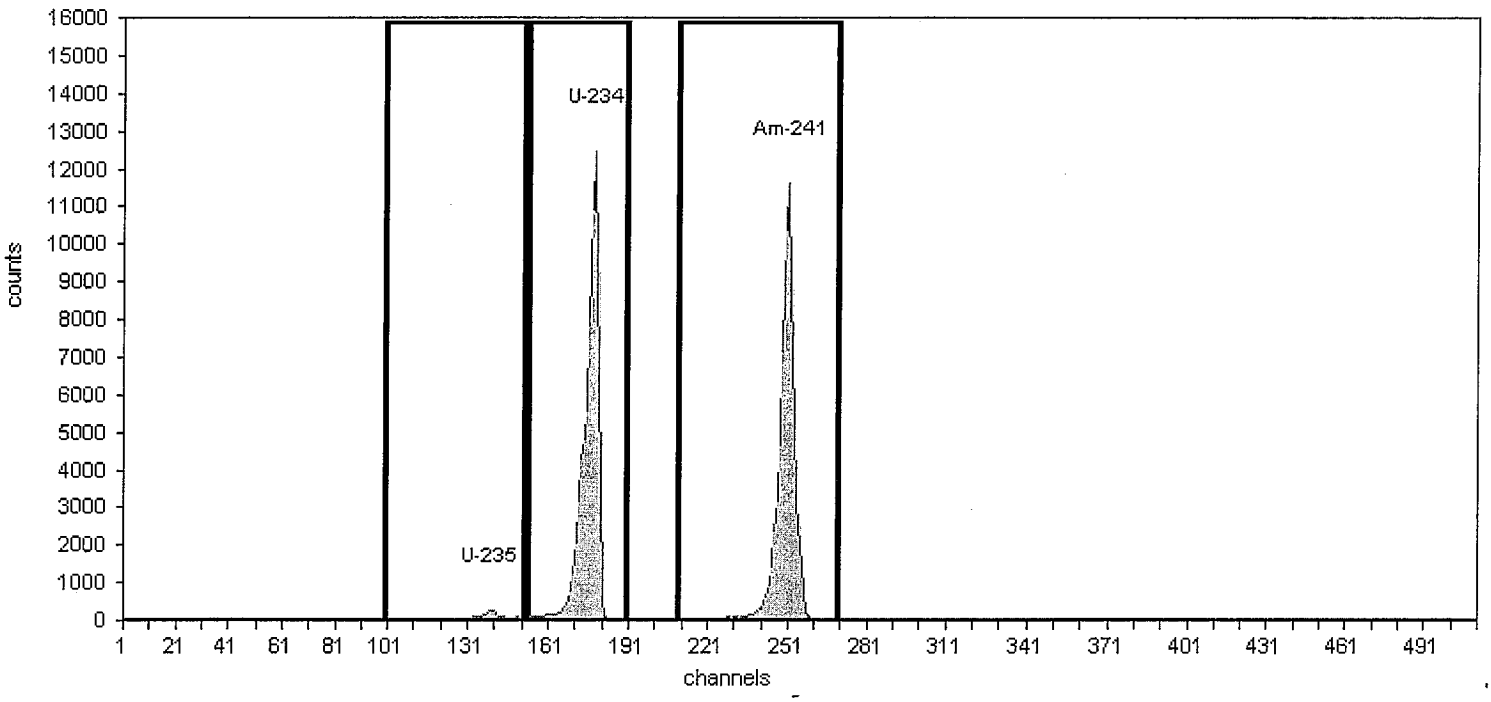
Efficiency Calibration Name: RSO 184 (Source 3)

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
Prepared by: IPL
Description:

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

Acquisition

Detector: 25 , SN:
Acquisition Start Date: 5/20/2008 1:45:05PM

Live Time: 35.00 min.
Real Time: 35.02 min.

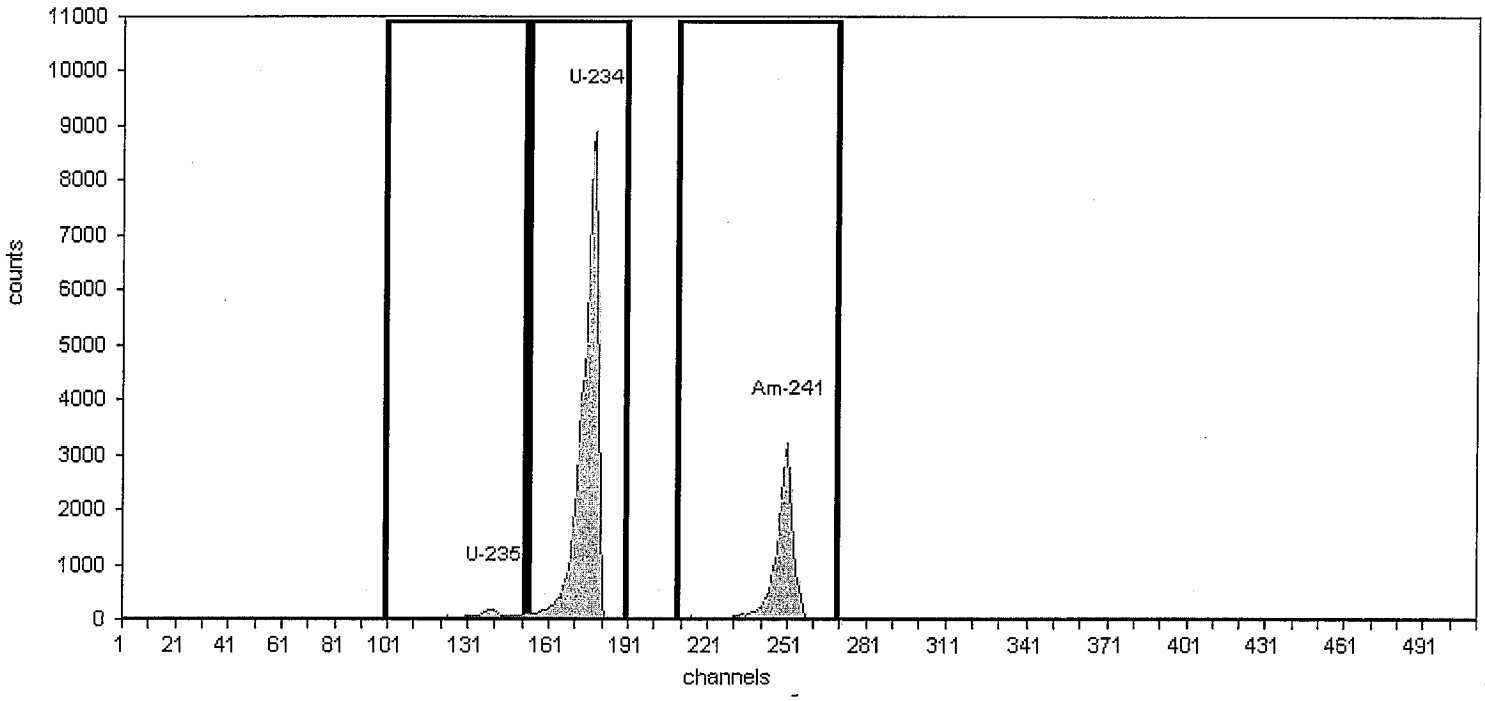
Efficiency Calibration Name: RSO 185 (Source 4)

Energy Calibration Equation:
Gain = 9.8047 keV / Ch

Offset = 3,026.20 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.92% +/- 0.20% 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	1,507.00	43.06
U-234	178	4.78	153	190	58,470.00	1,670.57
Am-241	251	5.49	210	270	20,822.00	594.91

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

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

Analyst: ORTEC
Detector: 25

9:21:22AM 5/21/2008

Calibration

Energy Calibration: RSO 186 (Source 5)
Description:

Analysis Date: 5/20/2008 3:26:01PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: A5 RSO#186
Prepared by: IPL
Description:

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

Acquisition

Detector: 25 , SN:
Acquisition Start Date: 5/20/2008 2:41:31PM

Live Time: 35.00 min.
Real Time: 35.06 min.

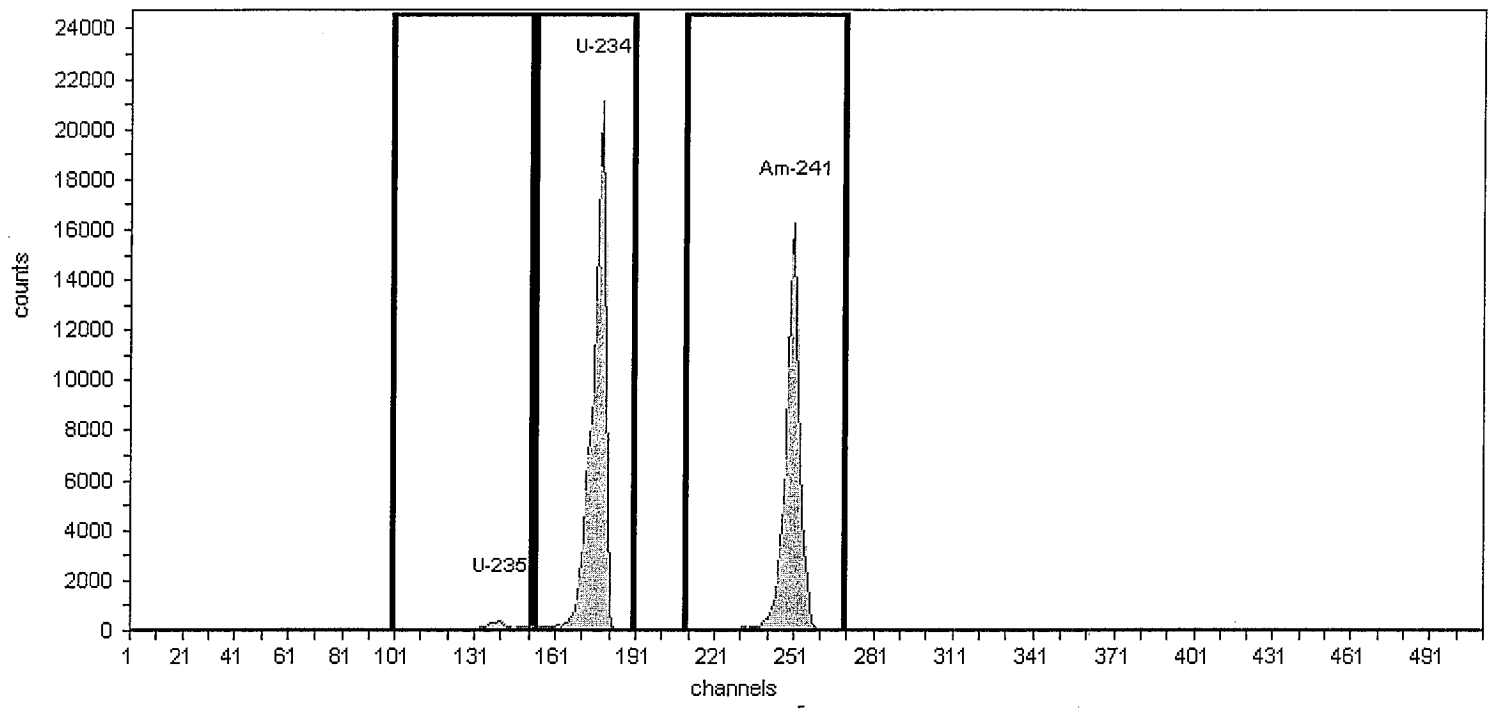
Efficiency Calibration Name: RSO 186 (Source 5)

Energy Calibration Equation:
Gain = 9.8047 keV / Ch

Offset = 3,026.20 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.47% +/- 0.13% 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	2,491.00	71.17
U-234	178	4.78	153	190	114,792.00	3,279.77
Am-241	251	5.49	210	270	94,084.00	2,688.11

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

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

Analyst: ORTEC
Detector: 25

9:20:21AM 5/21/2008

Calibration

Energy Calibration: RSO 187 (Source 6)
Description:

Analysis Date: 5/20/2008 4:02:57PM
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

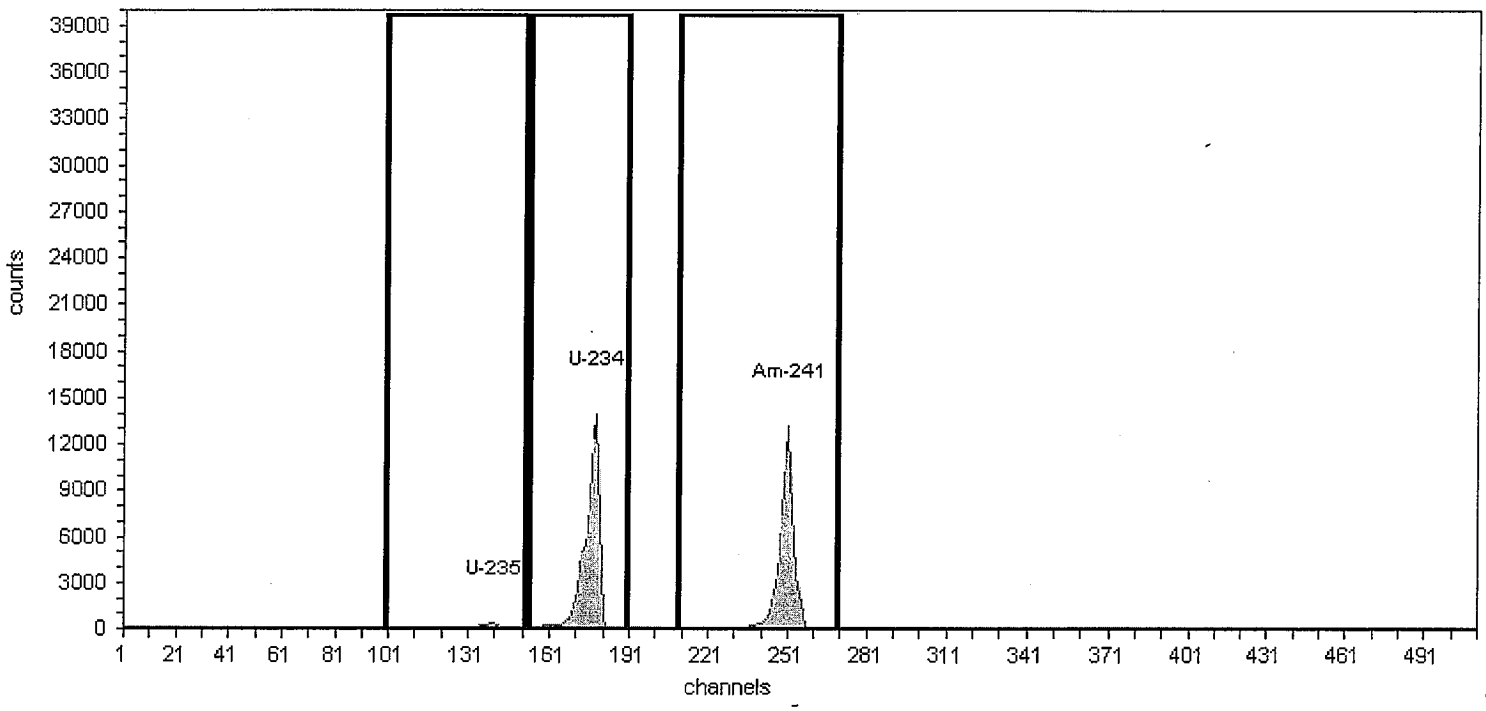
Detector: 25 , SN:
Acquisition Start Date: 5/20/2008 3:26:48PM

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

Efficiency Calibration Name: RSO 187 (Source 6)

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

Efficiency: 27.69% +/- 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	1,663.00	47.51
U-234	178	4.78	153	190	75,877.00	2,167.91
Am-241	251	5.49	210	270	71,430.00	2,040.86

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

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
9:20:28AM 5/21/2008

Analyst: ORTEC
Detector: 25

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.

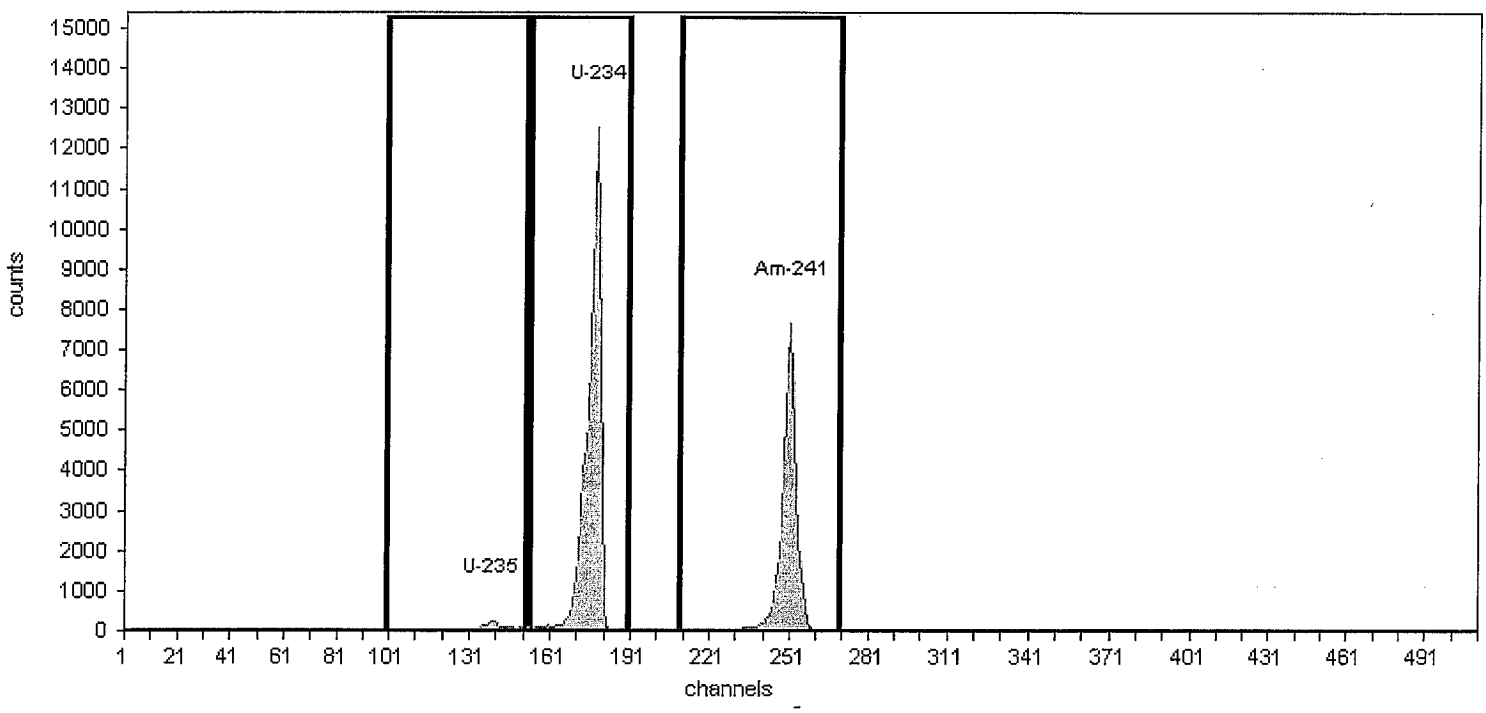
Efficiency Calibration Name: RSO 188 (Source 7)

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.

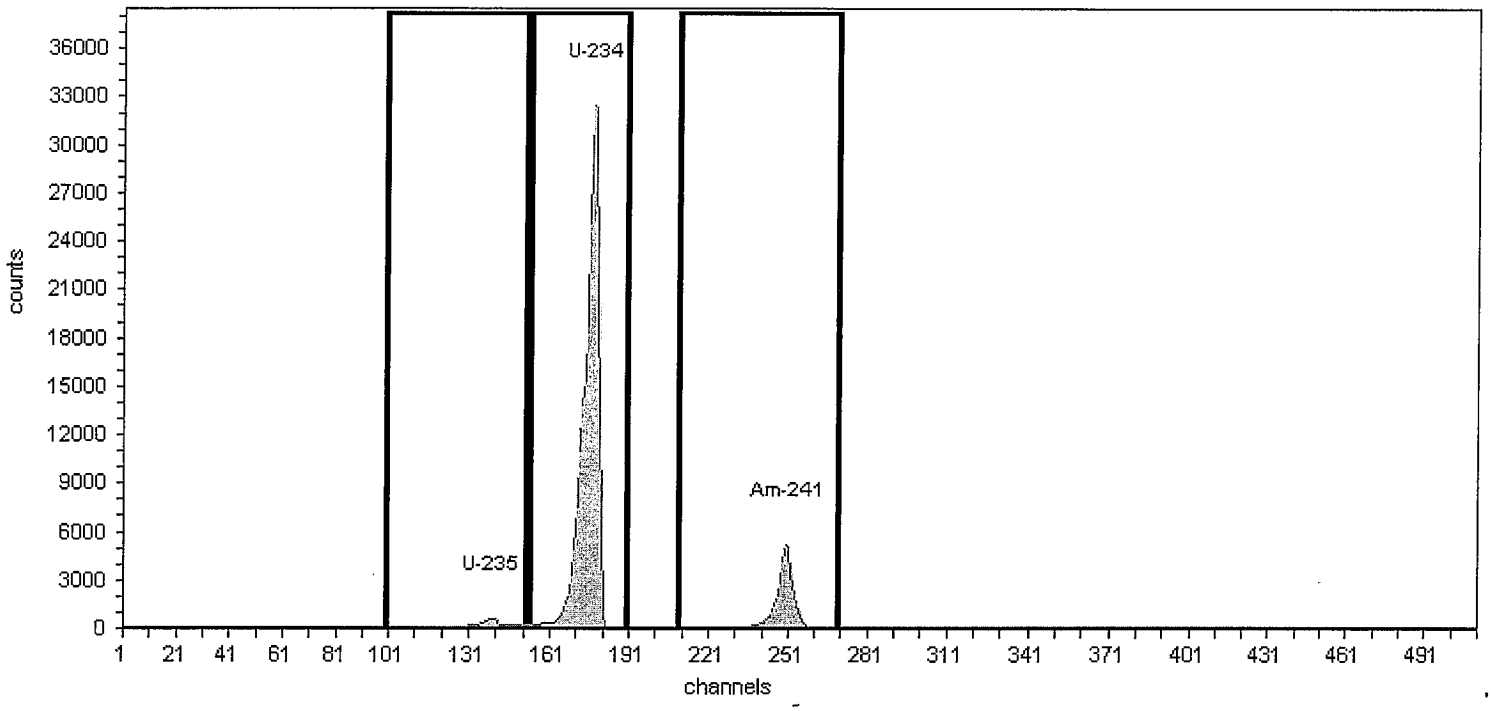
Efficiency Calibration Name: RSO 189 (Source 8)

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

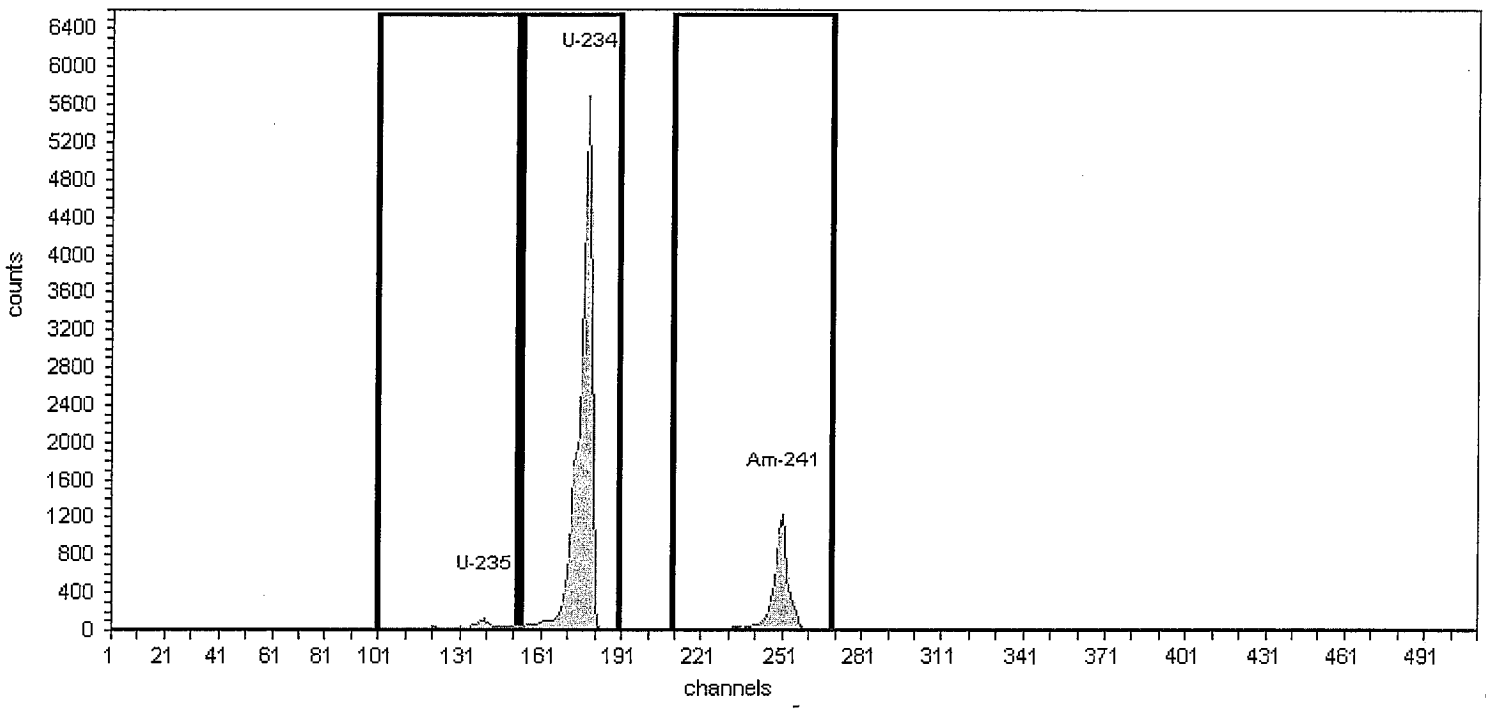
Detector: 25 , SN:
Acquisition Start Date: 5/21/2008 8:31:01AM

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

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

PAI 187
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.:**	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

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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 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.

Daniel James Van Dalsem
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

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α3

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

PAT I.D 184
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.:**	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 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.

Daniel James Van Dalsem
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

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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
PAID 00187
recd 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.:**	92MIX2203022
Half Life (Am-241):	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 Dalsem
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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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
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: ± 0.9 %
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 1909 α/min in 2π on 22-May-07

Quality Control

24 May 07
Date

IPL Ref. No.: 1143-19