



Paragon Analytics

Radiochemistry Case Narrative

Isotopic Thorium

New Horizons

CSMRI / 2135

PA WO 0404241

1. This report consists of the analytical results and supporting documentation for six soil samples received by Paragon on 04/23/04.
2. These samples were prepared according to Paragon Analytics procedures PA SOP721R10, PA SOP773R8, and PA SOP777R7. Modifications were made to the method as described on QASS 268111.
3. The samples were analyzed for the presence of isotopic thorium according to Paragon Analytics procedure PA SOP714R8. The analyses were completed on 05/10/04.
4. The isotopic analysis results for these samples are reported on a dry weight basis in units of pCi/gram.
5. Paragon Analytics follows the convention outlined in ANSI N42.23 for reporting significant digits in the TPU and MDC results. ANSI N42.23 states that the TPU result should be rounded to two significant digits and that the MDC result should be rounded to the same decimal place as the TPU result. In practice, this could result in an MDC result with a reported value of 0 for samples with significant activity, including the batch laboratory control sample.
6. Samples H07 and BB04 (PA ID 0404241-9 and 12) did not meet the requested MDC for Th-228 or Th-230. The reported activity in these samples exceeds the achieved MDC values. They are identified with an "M3" flag on the final reports.
7. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.

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

Skye Dobberstein
Radiochemistry Instrumentation

5/21/04
Date

Radiochemistry Final Data Review

5-21-04
Date

000001

PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

**SAMPLE RESULTS
SUMMARY**

Isotopic Thorium By Alpha Spectroscopy Sample Results Summary

Client Name: New Horizons
 Client Project Name: CSMRI
 Client Project Number: 2135

Laboratory Name: Paragon Analytics
 PAI Work Order: 0404241

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 Reported on: Friday, May 21, 2004
 9:20:46 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0404241-3	BI17	Sample	Th-228	1.39 +/- 0.29	0.08	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-3	BI17	Sample	Th-230	2.16 +/- 0.42	0.08	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-3	BI17	Sample	Th-232	1.36 +/- 0.28	0.04	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-5	BI37	Sample	Th-228	2.61 +/- 0.51	0.09	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-5	BI37	Sample	Th-230	6.4 +/- 1.2	0.1	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-5	BI37	Sample	Th-232	2.35 +/- 0.46	0.05	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-7	BI42	Sample	Th-228	2.37 +/- 0.47	0.01	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-7	BI42	Sample	Th-230	1.11 +/- 0.25	0.09	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-7	BI42	Sample	Th-232	2.12 +/- 0.42	0.03	pCi/g	SOIL	AS040428-6	5/10/2004	

Comments:

Data Package ID: Th0404241-1

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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Isotopic Thorium By Alpha Spectroscopy Sample Results Summary

Client Name: New Horizons
 Client Project Name: CSMRI
 Client Project Number: 2135

Laboratory Name: Paragon Analytics
 PAI Work Order: 0404241

Page: 2 of 2
 Reported on: Friday, May 21, 2004
 9:20:46 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0404241-9	H07	Sample	Th-228	1.48 +/- 0.31	0.11	pCi/g	SOIL	AS040428-6	5/10/2004	M3
0404241-9	H07	Sample	Th-230	25.6 +/- 4.5	0.1	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-9	H07	Sample	Th-232	1.24 +/- 0.27	0.03	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-11	H07S	Sample	Th-228	1.28 +/- 0.27	0.07	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-11	H07S	Sample	Th-230	48.6 +/- 8.4	0.1	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-11	H07S	Sample	Th-232	1.22 +/- 0.26	0.01	pCi/g	SOIL	AS040428-6	5/10/2004	
0404241-12	BB04	Sample	Th-228	18.1 +/- 3.3	0.1	pCi/g	SOIL	AS040428-6	5/10/2004	M3
0404241-12	BB04	Sample	Th-230	22.5 +/- 4.1	0.1	pCi/g	SOIL	AS040428-6	5/10/2004	M3
0404241-12	BB04	Sample	Th-232	17.3 +/- 3.2	0	pCi/g	SOIL	AS040428-6	5/10/2004	

Comments:

Data Package ID: Th0404241-1

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

Date Printed: Friday, May 21, 2004

Paragon Analytics
 LIMS Version: 5.018A

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PARAGON ANALYTICS
Radiochemistry Data Package

Section 2

**QC RESULTS
SUMMARY**

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Method Blank Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Lab ID: AS040428-6MB

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 28-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 10-May-04

Prep Batch: AS040428-6
QCBatchID: AS040428-6-1
Run ID: AS040428-6A
Count Time: 360 minutes

Final Aliquot: 2.00 g
Result Units: pCi/g
File Name: T4286B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	-0.007 +/- 0.021	0.057	U
14269-63-7	Th-230	0.075 +/- 0.048	0.076	U
7440-29-1	Th-232	0 +/- 0.013	0.010	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.252	1.37	pCi/g	60.8	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.

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: TH0404241-1

Date Printed: Friday, May 21, 2004

Paragon Analytics
LIMS Version: 5.018A

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Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Laboratory Control Sample(s)

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Lab ID: AS040428-8LCS

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 28-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 10-May-04

Prep Batch: AS040428-6
QCBatchID: AS040428-6-1
Run ID: AS040428-6A
Count Time: 360 minutes

Final Aliquot: 2.00 g
Result Units: pCi/g
File Name: T4286L

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14269-63-7	Th-230	2.48 +/- 0.46	0.08	2.25	110	85 - 121	P

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.252	1.29	pCi/g	57.2	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: TH0404241-1

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Duplicate Sample Results (DER)

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: H07
Lab ID: 0404241-9DUP

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 22-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 10-May-04

Prep Batch: AS040428-6
QCBatchID: AS040428-6-1
Run ID: AS040428-6A
Count Time: 360 minutes
Report Basis: Dry Weight

Final Aliquot: 2.02 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: T42419D

CASNO	Analyte	Sample Result +/- 2 s TPU	Duplicate Result +/- 2 s TPU	DER	Control Limit	Lab Qualifiers
14274-82-9	Th-228	1.48 +/- 0.31	1.49 +/- 0.32	0.04	2.13	
14269-63-7	Th-230	25.6 +/- 4.5	24.0 +/- 4.3	0.25	2.13	
7440-29-1	Th-232	1.24 +/- 0.27	1.19 +/- 0.26	0.14	2.13	

Comments:

Duplicate Qualifiers/Flags:

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

Abbreviations:

- TPU - Total Propagated Uncertainty (see PAI SOP 743)
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: TH0404241-1

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Radiochemistry Data Package

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Section 3

**INDIVIDUAL
SAMPLE RESULTS**

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Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8 Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: BI17	Sample Matrix: SOIL	Prep Batch: AS040428-6	Final Aliquot: 2.20 g
Lab ID: 0404241-3	Prep SOP: PAI 777 Rev 7	QC Batch ID: AS040428-6-1	Prep Basis: Dry Weight
	Date Collected: 19-Apr-04	Run ID: AS040428-6A	Moisture(%): NA
	Date Prepared: 28-Apr-04	Count Time: 360 minutes	Result Units: pCi/g
	Date Analyzed: 10-May-04	Report Basis: Dry Weight	File Name: T42413

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	1.39 +/- 0.29	0.08	
14269-63-7	Th-230	2.16 +/- 0.42	0.08	
7440-29-1	Th-232	1.36 +/- 0.28	0.04	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.049	0.83	pCi/g	40.4	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: TH0404241-1

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8
Sample Results

Lab Name: Paragon Analytics
Work Order Number: 0404241
Client Name: New Horizons
ClientProject ID: CSMRI 2135

Field ID: BI37	Sample Matrix: SOIL	Prep Batch: AS040428-6	Final Aliquot: 2.05 g
Lab ID: 0404241-5	Prep SOP: PAI 777 Rev 7	QC Batch ID: AS040428-6-1	Prep Basis: Dry Weight
	Date Collected: 19-Apr-04	Run ID: AS040428-6A	Moisture(%): NA
	Date Prepared: 28-Apr-04	Count Time: 360 minutes	Result Units: pCi/g
	Date Analyzed: 10-May-04	Report Basis: Dry Weight	File Name: T42415

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	2.61 +/- 0.51	0.09	
14269-63-7	Th-230	6.4 +/- 1.2	0.1	
7440-29-1	Th-232	2.35 +/- 0.46	0.05	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.197	0.82	pCi/g	37.4	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: TH0404241-1

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8 Sample Results

Lab Name: Paragon Analytics
Work Order Number: 0404241
Client Name: New Horizons
ClientProject ID: CSMRI 2135

Field ID: BI42	Sample Matrix: SOIL	Prep Batch: AS040428-6	Final Aliquot: 2.02 g
Lab ID: 0404241-7	Prep SOP: PAI 777 Rev 7	QCBatchID: AS040428-6-1	Prep Basis: Dry Weight
	Date Collected: 19-Apr-04	Run ID: AS040428-6A	Moisture(%): NA
	Date Prepared: 28-Apr-04	Count Time: 300 minutes	Result Units: pCi/g
	Date Analyzed: 10-May-04	Report Basis: Dry Weight	File Name: T42417

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	2.37 +/- 0.47	0.01	
14269-63-7	Th-230	1.11 +/- 0.25	0.09	
7440-29-1	Th-232	2.12 +/- 0.42	0.03	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.231	1.07	pCi/g	48.1	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: TH0404241-1

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8 Sample Results

Lab Name: Paragon Analytics
Work Order Number: 0404241
Client Name: New Horizons
ClientProject ID: CSMRI 2135

Field ID: H07	Sample Matrix: SOIL	Prep Batch: AS040428-6	Final Aliquot: 2.08 g
Lab ID: 0404241-9	Prep SOP: PAI 777 Rev 7	QC Batch ID: AS040428-6-1	Prep Basis: Dry Weight
	Date Collected: 22-Apr-04	Run ID: AS040428-6A	Moisture(%): NA
	Date Prepared: 28-Apr-04	Count Time: 360 minutes	Result Units: pCi/g
	Date Analyzed: 10-May-04	Report Basis: Dry Weight	File Name: T42419

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	1.48 +/- 0.31	0.11	M3
14269-63-7	Th-230	25.6 +/- 4.5	0.1	
7440-29-1	Th-232	1.24 +/- 0.27	0.03	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.170	0.84	pCi/g	38.7	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: TH0404241-1

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Sample Duplicate Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: H07
Lab ID: 0404241-9DUP

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 22-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 10-May-04

Prep Batch: AS040428-6
QC Batch ID: AS040428-6-1
Run ID: AS040428-6A
Count Time: 360 minutes
Report Basis: Dry Weight

Final Aliquot: 2.02 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: T42419D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	1.49 +/- 0.32	0.08	
14269-63-7	Th-230	24.0 +/- 4.3	0.1	
7440-29-1	Th-232	1.19 +/- 0.26	0.05	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.225	0.84	pCi/g	37.8	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.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13

Abbreviations:

- TPU - Total Propagated Uncertainty (see PAI SOP 743)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)
- BDL - Below Detection Limit

Data Package ID: TH0404241-1

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8
Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: H07S
Lab ID: 0404241-11

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 22-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 10-May-04

Prep Batch: AS040428-6
QCBatchID: AS040428-6-1
Run ID: AS040428-6A
Count Time: 360 minutes
Report Basis: Dry Weight

Final Aliquot: 2.04 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: T424111

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	1.28 +/- 0.27	0.07	
14269-63-7	Th-230	48.6 +/- 8.4	0.1	
7440-29-1	Th-232	1.22 +/- 0.26	0.01	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.206	1.01	pCi/g	45.8	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: TH0404241-1

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8
Sample Results

Lab Name: Paragon Analytics
Work Order Number: 0404241
Client Name: New Horizons
ClientProject ID: CSMRI 2135

Field ID: BB04	Sample Matrix: SOIL	Prep Batch: AS040428-6	Final Aliquot: 2.03 g
Lab ID: 0404241-12	Prep SOP: PAI 777 Rev 7	QCBatchID: AS040428-6-1	Prep Basis: Dry Weight
	Date Collected: 16-Apr-04	Run ID: AS040428-6A	Moisture(%): NA
	Date Prepared: 28-Apr-04	Count Time: 360 minutes	Result Units: pCi/g
	Date Analyzed: 10-May-04	Report Basis: Dry Weight	File Name: T424112

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	18.1 +/- 3.3	0.1	M3
14269-63-7	Th-230	22.5 +/- 4.1	0.1	M3
7440-29-1	Th-232	17.3 +/- 3.2	0	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.223	0.75	pCi/g	33.7	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: TH0404241-1

PARAGON ANALYTICS
Radiochemistry Data Package

Section 4

4

RAW DATA

000018

000017

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: Paragon Analytics
PAI Work Order: 0404241

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Friday, May 21, 2004
9:19:17 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC/BatchID	Matrix %Moist.	Decay Date/Time	Ingrwth Date /Time	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	Yield	CntDur(min)	Activity +/- 2 s TPU	MDC Decl.ev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
0404241-3 SMP	Th-228 Trg. Analyte	4/19/2004 11:00:00 AM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.2 g 2.2 g	58 58	AS040428-6A T42413	5/10/2004 12:42 PM	309,840 31,000	31.95% 1000	360 40.4%	360	1.39 0.29	0.08 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-3 SMP	Th-229 Tracer	4/19/2004 11:00:00 AM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.2 g 2.2 g	58 58	AS040428-6A T42413	5/10/2004 12:42 PM	485,040 11,000	31.95% 1000	360 40.4%	360	0.83 0.14	0.02 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-3 SMP	Th-230 Trg. Analyte	4/19/2004 11:00:00 AM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.2 g 2.2 g	58 58	AS040428-6A T42413	5/10/2004 12:42 PM	489,387 35,036	31.95% 1000	360 40.4%	360	2.16 0.42	0.08 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-3 SMP	Th-232 Trg. Analyte	4/19/2004 11:00:00 AM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.2 g 2.2 g	58 58	AS040428-6A T42413	5/10/2004 12:42 PM	307,560 4,000	31.95% 1000	360 40.4%	360	1.36 0.28	0.04 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-5 SMP	Th-228 Trg. Analyte	4/19/2004 2:15:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.05 g 2.05 g	59 59	AS040428-6A T42415	5/10/2004 12:42 PM	506,840 31,000	32.36% 1000	360 37.4%	360	2.61 0.51	0.09 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-5 SMP	Th-229 Tracer	4/19/2004 2:15:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.05 g 2.05 g	59 59	AS040428-6A T42415	5/10/2004 12:42 PM	435,120 8,000	32.36% 1000	360 37.4%	360	0.82 0.14	0.02 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-5 SMP	Th-230 Trg. Analyte	4/19/2004 2:15:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.05 g 2.05 g	59 59	AS040428-6A T42415	5/10/2004 12:42 PM	1265,689 36,975	32.36% 1000	360 37.4%	360	6.4 1.2	0.1 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-5 SMP	Th-232 Trg. Analyte	4/19/2004 2:15:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.05 g 2.05 g	59 59	AS040428-6A T42415	5/10/2004 12:42 PM	464,120 8,000	32.36% 1000	360 37.4%	360	2.35 0.46	0.05 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-7 SMP	Th-228 Trg. Analyte	4/19/2004 3:15:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.02 g 2.02 g	60 60	AS040428-6A T42417	5/10/2004 7:19 AM	456,000 0,000	30.42% 1000	300 48.1%	300	2.37 0.47	0.01 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-7 SMP	Th-229 Tracer	4/19/2004 3:15:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.02 g 2.02 g	60 60	AS040428-6A T42417	5/10/2004 7:19 AM	439,100 3,000	30.42% 1000	300 48.1%	300	1.07 0.19	0.02 NA	pCi/g Dry Weight	NA NA	NA NA
0404241-7 SMP	Th-230 Trg. Analyte	4/19/2004 3:15:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.02 g 2.02 g	60 60	AS040428-6A T42417	5/10/2004 7:19 AM	217,810 37,299	30.42% 1000	300 48.1%	300	1.11 0.25	0.09 NA	pCi/g Dry Weight	NA NA	NA NA

Comments:

Data Package ID: Th0404241-1

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'.
- 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
- 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.
83 - Analyte concentration greater than MDC but less than Requested MDC.

Date Printed: Friday, May 21, 2004

Paragon Analytics

LIMS Version: 5.018A

Page 1 of 4

0018

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: Paragon Analytics
 PAI Work Order: 0404241

Prep SOP: PAI 777
 Analytical SOP: PAI 714

Reported on: Friday, May 21, 2004
 9:19:17 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC/BatchID	Matrix %Moist.	Decay Date/Time	Ingrowth Date/Time	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CritDur(min) Yield	Activity +/- 2 s TPU	MDC DeclEv	Report/Units ReportBasis	DER RPD	%Spk Recov	Flags
0404241-7	Th-232 Trg. Analyte	4/19/2004 3:15:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.02 g 2.02 g	60 Alpha Spec	AS040428-6A T42417	5/10/2004 7:19 AM	415,700 1,000	30.42% 1000	300 48.1%	2.12 0.42	0.03 NA	pCi/g Dry Weight	NA NA	NA NA	
0404241-9	Th-228 Trg. Analyte	4/22/2004 1:00:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.08 g 2.08 g	61 Alpha Spec	AS040428-6A T42419	5/10/2004 12:42 PM	298,920 53,000	32.09% 1000	360 38.7%	1.48 0.31	0.11 NA	pCi/g Dry Weight	NA NA	NA M3	
0404241-9	Th-228 Tracer	4/22/2004 1:00:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.08 g 2.08 g	61 Alpha Spec	AS040428-6A T42419	5/10/2004 12:42 PM	447,560 4,000	32.09% 1000	360 38.7%	0.84 0.15	0.02 NA	pCi/g Dry Weight	NA NA	NA NA	
0404241-9	Th-230 Trg. Analyte	4/22/2004 1:00:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.08 g 2.08 g	61 Alpha Spec	AS040428-6A T42419	5/10/2004 12:42 PM	5284,460 34,832	32.09% 1000	360 38.7%	25.6 4.5	0.1 NA	pCi/g Dry Weight	NA NA	NA NA	
0404241-9	Th-232 Trg. Analyte	4/22/2004 1:00:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.08 g 2.08 g	61 Alpha Spec	AS040428-6A T42419	5/10/2004 12:42 PM	255,260 2,000	32.09% 1000	360 38.7%	1.24 0.27	0.03 NA	pCi/g Dry Weight	NA NA	NA NA	
0404241-9	Th-228 Trg. Analyte	4/22/2004 1:00:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.02 g 2.02 g	62 Alpha Spec	AS040428-6A T42419D	5/10/2004 12:42 PM	272,240 16,000	30.36% 1000	360 37.8%	1.49 0.32	0.08 NA	pCi/g Dry Weight	0.04 NA	NA NA	
0404241-9	Th-228 Tracer	4/22/2004 1:00:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.02 g 2.02 g	62 Alpha Spec	AS040428-6A T42419D	5/10/2004 12:42 PM	412,920 3,000	30.36% 1000	360 37.8%	0.84 0.15	0.02 NA	pCi/g Dry Weight	NA NA	NA NA	
0404241-9	Th-230 Trg. Analyte	4/22/2004 1:00:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.02 g 2.02 g	62 Alpha Spec	AS040428-6A T42419D	5/10/2004 12:42 PM	4458,760 28,446	30.36% 1000	360 37.8%	24.0 4.3	0.1 NA	pCi/g Dry Weight	0.25 NA	NA NA	
0404241-9	Th-232 Trg. Analyte	4/22/2004 1:00:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.02 g 2.02 g	62 Alpha Spec	AS040428-6A T42419D	5/10/2004 12:42 PM	220,200 5,000	30.36% 1000	360 37.8%	1.19 0.26	0.05 NA	pCi/g Dry Weight	0.14 NA	NA NA	
0404241-11	Th-228 Trg. Analyte	4/22/2004 1:05:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.04 g 2.04 g	63 Alpha Spec	AS040428-6A T424111	5/10/2004 12:42 PM	274,080 22,000	29.23% 1000	360 45.8%	1.28 0.27	0.07 NA	pCi/g Dry Weight	NA NA	NA NA	
0404241-11	Th-228 Tracer	4/22/2004 1:05:00 PM	AS040428-6 AS040428-6-1	SOIL NA	NA NA	NA NA	2.04 g 2.04 g	63 Alpha Spec	AS040428-6A T424111	5/10/2004 12:42 PM	482,000 0,000	29.23% 1000	360 45.8%	1.01 0.17	0.01 NA	pCi/g Dry Weight	NA NA	NA NA	

Comments:

Data Package ID: Th0404241-1

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'.

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

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.

Page 2 of 4

Date Printed: Friday, May 21, 2004

Paragon Analytics

LIMS Version: 5.018A

0019

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: Paragon Analytics

Prep SOP: PAI 777

Reported on: Friday, May 21, 2004

PAI Work Order: 0404241

Analytical SOP: PAI 714

9:19:17 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC Batch ID	Ingrrowth Date / Time	Decay Date/Time	Matrix %Moist.	Samp Aliq Analy Aliq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	Yield	Activity +/- 2 s TPU	MDC Decl.ev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
0404241-11	Th-230 Trg. Analyte	4/22/2004 1:05:00 PM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2.04 g 2.04 g	63	AS040428-6A T424111	5/10/2004 12:42 PM	10616.050 33.204	29.23% 1000	360 45.8%	48.6 8.4	0.1 NA	pCi/g Dry Weight	NA	NA
0404241-11	Th-232 Trg. Analyte	4/22/2004 1:05:00 PM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2.04 g 2.04 g	63	T424111	5/10/2004 12:42 PM	267.000 0.000	29.23% 1000	360 45.8%	1.22 0.26	0.01 NA	pCi/g Dry Weight	NA	NA
0404241-12	Th-228 Trg. Analyte	4/16/2004 1:10:00 PM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2.03 g 2.03 g	64	T424112	5/10/2004 12:42 PM	2961.800 45.000	30.73% 1000	360 33.7%	18.1 3.3	0.1 NA	pCi/g Dry Weight	NA	M3
0404241-12	Th-229 Tracer	4/16/2004 1:10:00 PM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2.03 g 2.03 g	64	T424112	5/10/2004 12:42 PM	373.280 2.000	30.73% 1000	360 33.7%	0.75 0.13	0.01 NA	pCi/g Dry Weight	NA	NA
0404241-12	Th-230 Trg. Analyte	4/16/2004 1:10:00 PM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2.03 g 2.03 g	64	T424112	5/10/2004 12:42 PM	3774.023 27.715	30.73% 1000	360 33.7%	22.5 4.1	0.1 NA	pCi/g Dry Weight	NA	M3
0404241-12	Th-232 Trg. Analyte	4/16/2004 1:10:00 PM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2.03 g 2.03 g	64	T424112	5/10/2004 12:42 PM	2901.920 3.000	30.73% 1000	360 33.7%	17.3 3.2	0 NA	pCi/g Dry Weight	NA	NA
AS040428-6	Th-228 Trg. Analyte	4/28/2004 7:59:06 AM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2 g 2 g	11	T42888	5/10/2004 2:36 PM	-1.920 22.000	28.93% 1000	360 60.8%	-0.007 0.021	0.057 NA	pCi/g Dry Weight	NA	U
AS040428-6	Th-229 Tracer	4/28/2004 7:59:06 AM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2 g 2 g	11	T42888	5/10/2004 2:36 PM	632.640 1.000	28.93% 1000	360 60.8%	1.37 0.23	0.01 NA	pCi/g Dry Weight	NA	NA
AS040428-6	Th-230 Trg. Analyte	4/28/2004 7:59:06 AM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2 g 2 g	11	T42888	5/10/2004 2:36 PM	20.951 44.582	28.93% 1000	360 60.8%	0.075 0.048	0.076 NA	pCi/g Dry Weight	NA	U
AS040428-6	Th-232 Trg. Analyte	4/28/2004 7:59:06 AM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2 g 2 g	11	T42888	5/10/2004 2:36 PM	0.000 0.000	28.93% 1000	360 60.8%	0 0.013	0.010 NA	pCi/g Dry Weight	NA	U
AS040428-6	Th-229 Tracer	4/28/2004 7:59:06 AM	AS040428-6 AS040428-6-1	NA	NA	SOIL NA	2 g 2 g	12	T4288L	5/10/2004 2:36 PM	611.200 5.000	28.67% 1000	360 57.2%	1.29 0.22	0.02 NA	pCi/g Dry Weight	NA	NA

Comments:

Data Package ID: Th0404241-1

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'.

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
 PAI Work Order: 0404241

Prep SOP: PAI 777
 Analytical SOP: PAI 714

Reported on: Friday, May 21, 2004
 9:19:17 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC Batch ID	Ingrowth Date / Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC Decl Lev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
AS040428-6 LCS	Th-230 Trg. Analyte	4/28/2004 7:59:06 AM	AS040428-6 AS040428-6-1	NA NA	NA NA	SOIL NA	2 g 2 g	Alpha Spec 12	AS040428-8A T4286L	5/10/2004 2:36 PM	674.122 44.105	29.67% 1000	360 57.2%	2.48 0.46	0.08 NA	pCi/g Dry Weight	NA NA	110 P

Comments:

Data Package ID: Th0404241-1

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
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Notes:

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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

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.

Date Printed: Friday, May 21, 2004

Paragon Analytics

LIMS Version: 5.018A

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/11/04 3:41:36 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0404241-3 TAS040428-6

Analysis Type: Thorium

Detector: MCB 8 Input 2

Date/Time of Count: 5/10/04 12:42:29 PM

Sample Volume: 2.198 Total, 2.198 Aliquot.

Live Time: 360.00 Minutes

Chem. Yield: 40.44%

Real Time: 360.03 Minutes

Total Eff.: 12.92 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminat

Acquisition: 512 Channels

Efficiency: 31.95%

Analysis: Relative Region-Of-Interest

Original: 3,033 + 10.0426 * Chn + -0.00110 * Chn **2.

Spectrum Calibration: 3,033 + 10.0124 * Chn + -0.00110 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T42413.SPC

Background File: C:\USER\ALPHA\BKGND\B4050558.SPC

Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	246.10	224	248	2.00	35.00	321.00	11.16	309.84	6.66
2	168.42	147	170	2.00	56.00	502.00	1.08	489.39	10.52
3	99.00	74	106	2.00	32.00	309.00	1.44	307.56	6.61
Tracer	184.77	171	210	8.00	39.00	469.00	3.96	465.04	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	18.94	1.365	n/a	11.36 %
2	Th-230	4687.70	19.28	2.157	n/a	8.97 %
3	Th-232	4013.00	19.59	1.355	n/a	11.21 %
Tracer	Th-229	4845.00	76.85	2.049	n/a	9.05 %

Totals

		% Total
Gross Count:	2,228.00	100.00
Net Area:	2,160.32	96.96
Background:	67.68	3.04
Composite Fit:	1,601.00	71.86
Residuals:	627.00	28.14

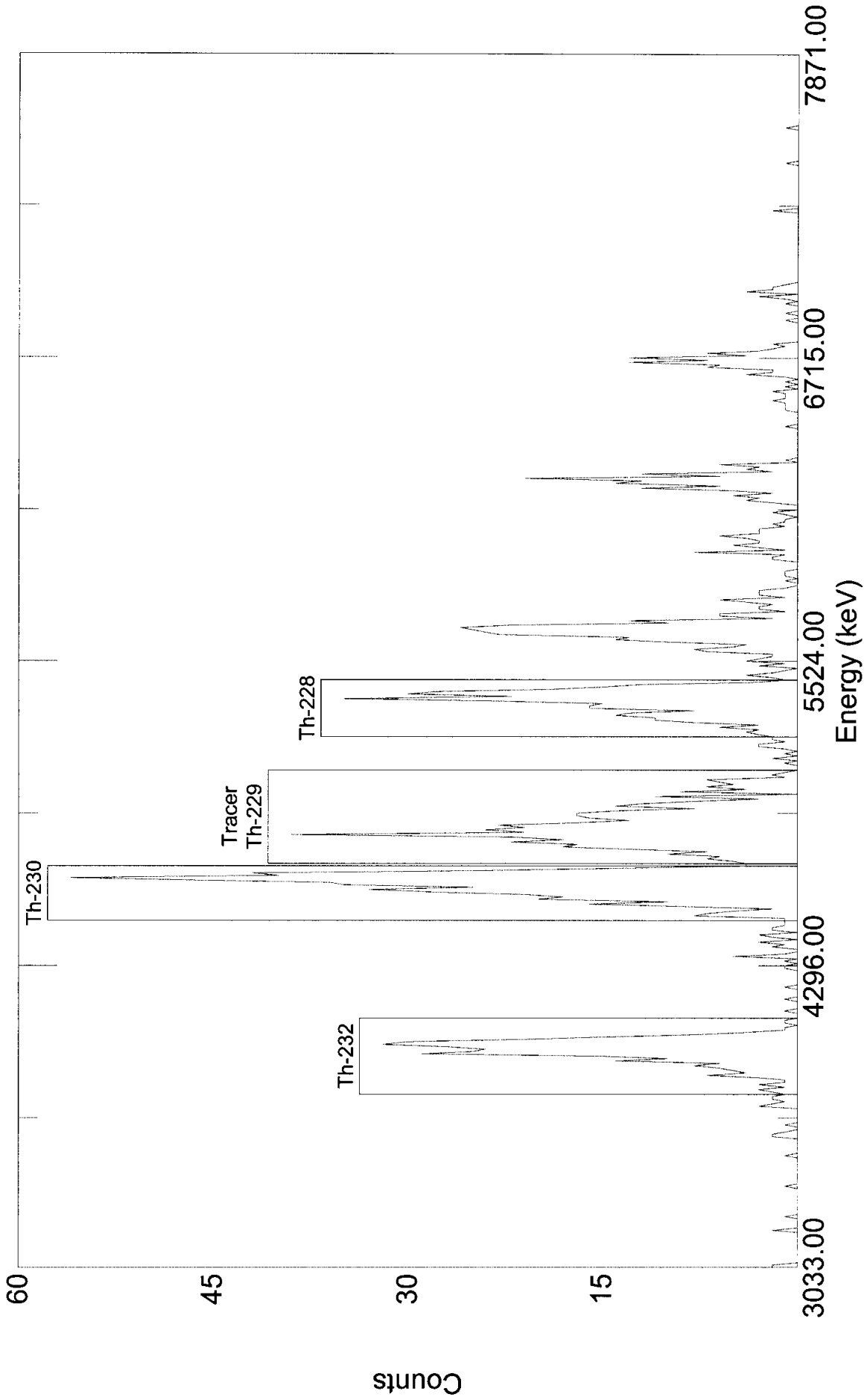
Analyzed By: *Lin JP*

Checked By: *RF*

000022

T42413

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 12:42:29 on 10-May-2004
File: C:\User\Alpha\ALPHA\T42413.SPC
Sample: 0404241-3 TAS040428-6

Real Time: 21601.62 s. Live Time: 21600.00 s.
Detector: #58 MCB 8 Input 2
Type: Thorium

000023

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/11/04 3:43:09 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0404241-5 TAS040428-6

Analysis Type: Thorium

Detector: MCB 8 Input 3

Date/Time of Count: 5/10/04 12:42:29 PM

Sample Volume: 2.050 Total, 2.050 Aliquot.

Live Time: 360.00 Minutes

Chem. Yield: 37.35%

Real Time: 360.03 Minutes

Total Eff.: 12.09 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminat

Acquisition: 512 Channels

Efficiency: 32.36%

Analysis: Relative Region-Of-Interest

Original: 3,036 + 9.9906 * Chn + -0.00098 * Chn **2.

Spectrum Calibration: 3,036 + 9.9682 * Chn + -0.00098 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T42415.SPC

Background File: C:\USER\ALPHA\BKGND\B4050459.SPC

Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	246.05	223	250	2.00	54.00	518.00	11.16	506.84	11.65
2	168.43	144	171	2.00	140.00	1,279.00	2.52	1265.69	29.09
3	98.93	74	105	2.00	53.00	467.00	2.88	464.12	10.67
Tracer	184.78	172	210	10.00	32.00	438.00	2.88	435.12	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	18.98	2.559	n/a	8.81 %
2	Th-230	4687.70	19.28	6.392	n/a	5.54 %
3	Th-232	4013.00	19.55	2.344	n/a	9.13 %
Tracer	Th-229	4845.00	96.08	2.197	n/a	9.37 %

Totals

% Total

Gross Count:	3,805.00	100.00
Net Area:	3,703.12	97.32
Background:	101.88	2.68
Composite Fit:	2,702.00	71.01
Residuals:	1,103.00	28.99

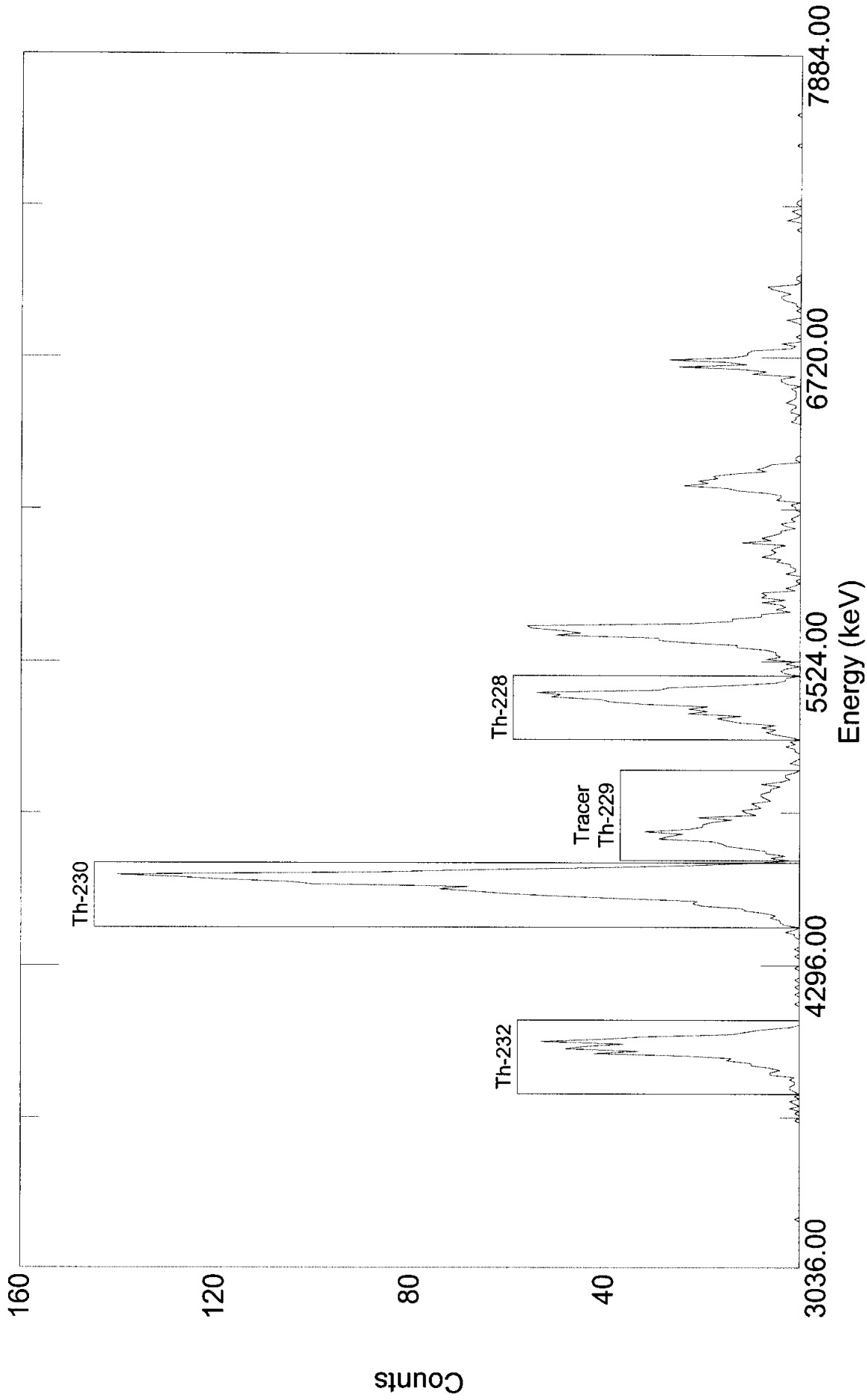
Analyzed By: _____

Checked By: _____

000024

T42415

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 12:42:29 on 10-May-2004
File: C:\User\Alpha\ALPHA\T42415.SPC
Sample: 0404241-5 TAS040428-6

Real Time: 21601.62 s. Live Time: 21600.00 s.
Detector: #59 MCB 8 Input 3
Type: Thorium

520000

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/11/04 3:44:56 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0404241-7 TAS040428-6

Analysis Type: Thorium

Detector: MCB 8 Input 4

Date/Time of Count: 5/10/04 7:19:21 AM

Sample Volume: 2.019 Total, 2.019 Aliquot.

Live Time: **300.00 Minutes**

Chem. Yield: **48.12%**

Real Time: 300.02 Minutes

Total Eff.: 14.64 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminat

Acquisition: 512 Channels

Efficiency: 30.42%

Analysis: Relative Region-Of-Interest

Original: 3,021 + 10.2767 * Chn + -0.00140 * Chn **2.

Spectrum Calibration: 3,021 + 10.2116 * Chn + -0.00140 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T42417.SPC

Background File: C:\USER\ALPHA\BKGND\B4050460.SPC

Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	244.07	223	248	2.00	49.00	456.00	0.00	456.00	10.38
2	167.04	148	168	2.00	28.00	229.00	0.30	217.81	4.96
3	98.47	75	105	2.00	46.00	416.00	0.30	415.70	9.47
Tracer	183.22	169	210	10.00	35.00	440.00	0.90	439.10	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	19.06	2.317	n/a	9.18 %
2	Th-230	4687.70	19.49	1.107	n/a	13.62 %
3	Th-232	4013.00	19.87	2.112	n/a	9.62 %
Tracer	Th-229	4845.00	96.99	2.231	n/a	9.34 %

Totals

% Total

Gross Count:	2,240.00	100.00
Net Area:	2,235.50	99.80
Background:	4.50	0.20
Composite Fit:	1,541.00	68.79
Residuals:	699.00	31.21

Analyzed By: _____

Sm JP

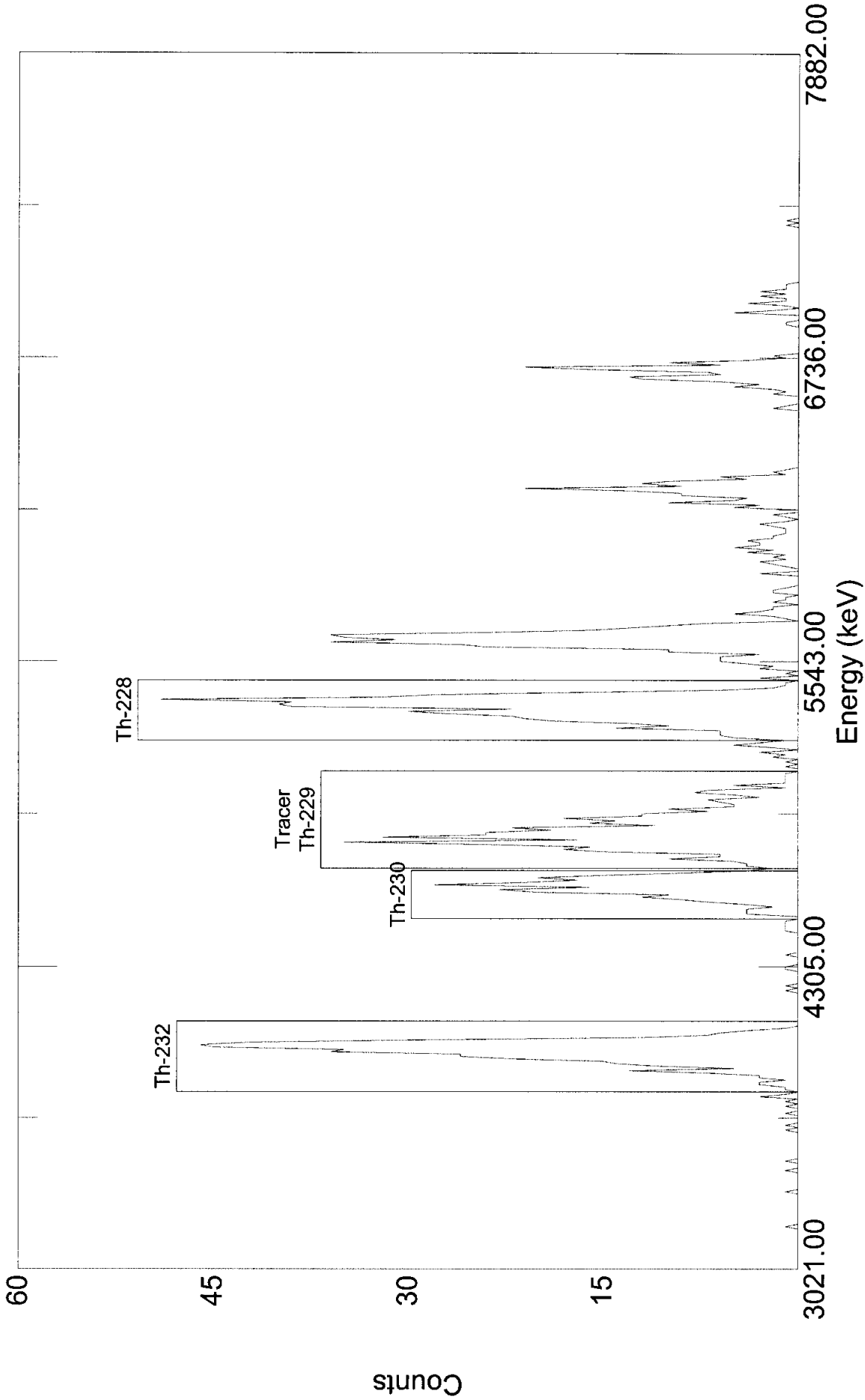
Checked By: _____

AK

000026

T42417

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 07:19:21 on 10-May-2004
File: C:\User\Alpha\ALPHA\T42417.SPC
Sample: 0404241-7 TAS040428-6

Real Time: 18001.28 s. Live Time: 18000.00 s.
Detector: #60 MCB 8 Input 4
Type: Thorium

20000

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/11/04 3:45:52 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0404241-9 TAS040428-6

Analysis Type: Thorium

Detector: MCB 8 Input 5

Date/Time of Count: 5/10/04 12:42:33 PM

Sample Volume: 2.076 Total, 2.076 Aliquot.

Live Time: 360.00 Minutes

Chem. Yield: 38.75%

Real Time: 360.03 Minutes

Total Eff.: 12.43 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminat

Acquisition: 512 Channels

Efficiency: 32.09%

Analysis: Relative Region-Of-Interest

Original: 3,043 + 9.9232 * Chn + -0.00075 * Chn **2.

Spectrum Calibration: 3,043 + 10.0089 * Chn + -0.00075 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T42419.SPC

Background File: C:\USER\ALPHA\BKGND\B4050461.SPC

Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	242.88	223	248	2.00	38.00	318.00	19.08	298.92	6.68
2	166.38	145	169	2.00	563.00	5,297.00	1.44	5284.46	118.06
3	97.62	74	105	2.00	26.00	256.00	0.72	255.28	5.70
Tracer	182.52	170	208	6.00	36.00	449.00	1.44	447.56	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	19.29	1.449	n/a	11.74 %
2	Th-230	4687.70	19.52	25.619	n/a	2.70 %
3	Th-232	4013.00	19.73	1.238	n/a	12.29 %
Tracer	Th-229	4845.00	58.42	2.170	n/a	9.25 %

Totals

		% Total
Gross Count:	7,461.00	100.00
Net Area:	7,364.16	98.70
Background:	96.84	1.30
Composite Fit:	6,320.00	84.71
Residuals:	1,141.00	15.29

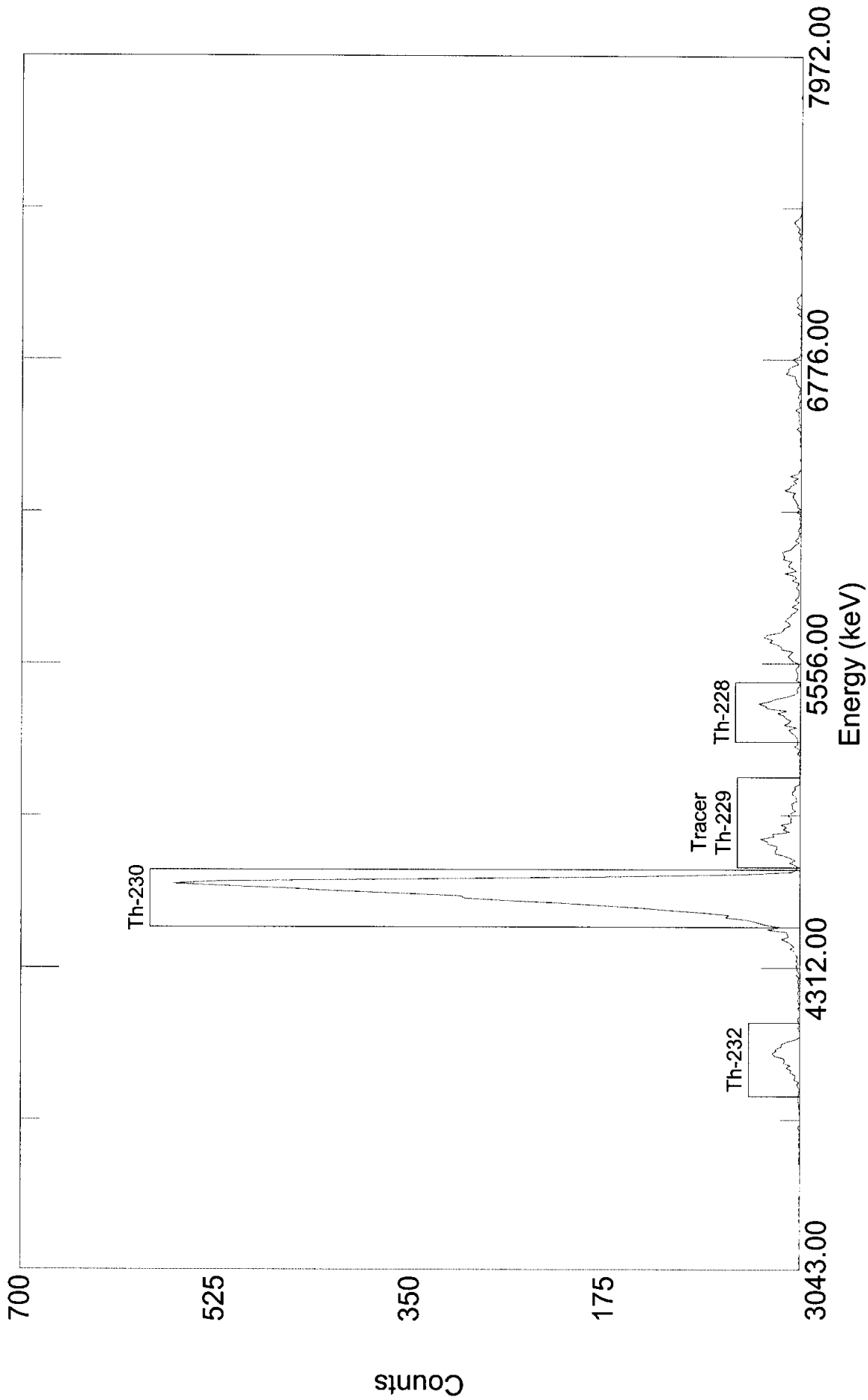
Analyzed By: Sm JP

Checked By: lf

000028

T42419

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 12:42:33 on 10-May-2004
File: C:\User\Alpha\ALPHA\T42419.SPC
Sample: 0404241-9 TAS040428-6

Real Time: 21601.62 s. Live Time: 21600.00 s.
Detector: #61 MCB 8 Input 5
Type: Thorium

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/11/04 3:46:53 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0404241-9D TAS040428-6

Analysis Type: Thorium

Detector: MCB 8 Input 6

Date/Time of Count: 5/10/04 12:42:33 PM

Sample Volume: 2.024 Total, 2.024 Aliquot.

Live Time: 360.00 Minutes

Chem. Yield: 37.76%

Real Time: 360.03 Minutes

Total Eff.: 11.47 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminat

Acquisition: 512 Channels

Efficiency: 30.38%

Analysis: Relative Region-Of-Interest

Original: 3,057 + 9.8739 * Chn + -0.00051 * Chn **2.

Spectrum Calibration: 3,057 + 9.8703 * Chn + -0.00051 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T42419D.SPC

Background File: C:\USER\ALPHA\BKGND\B4050462.SPC

Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	243.46	221	246	4.00	27.00	278.00	5.76	272.24	6.59
2	166.63	145	169	2.00	508.00	4,469.00	0.00	4458.76	107.97
3	97.34	73	104	4.00	27.00	222.00	1.80	220.20	5.33
Tracer	182.86	170	208	8.00	31.00	414.00	1.08	412.92	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	38.50	1.467	n/a	12.02 %
2	Th-230	4687.70	19.40	24.028	n/a	2.94 %
3	Th-232	4013.00	39.09	1.187	n/a	13.27 %
Tracer	Th-229	4845.00	77.48	2.225	n/a	9.63 %

Totals

		% Total
Gross Count:	6,366.00	100.00
Net Area:	6,295.44	98.89
Background:	70.56	1.11
Composite Fit:	5,383.00	84.56
Residuals:	983.00	15.44

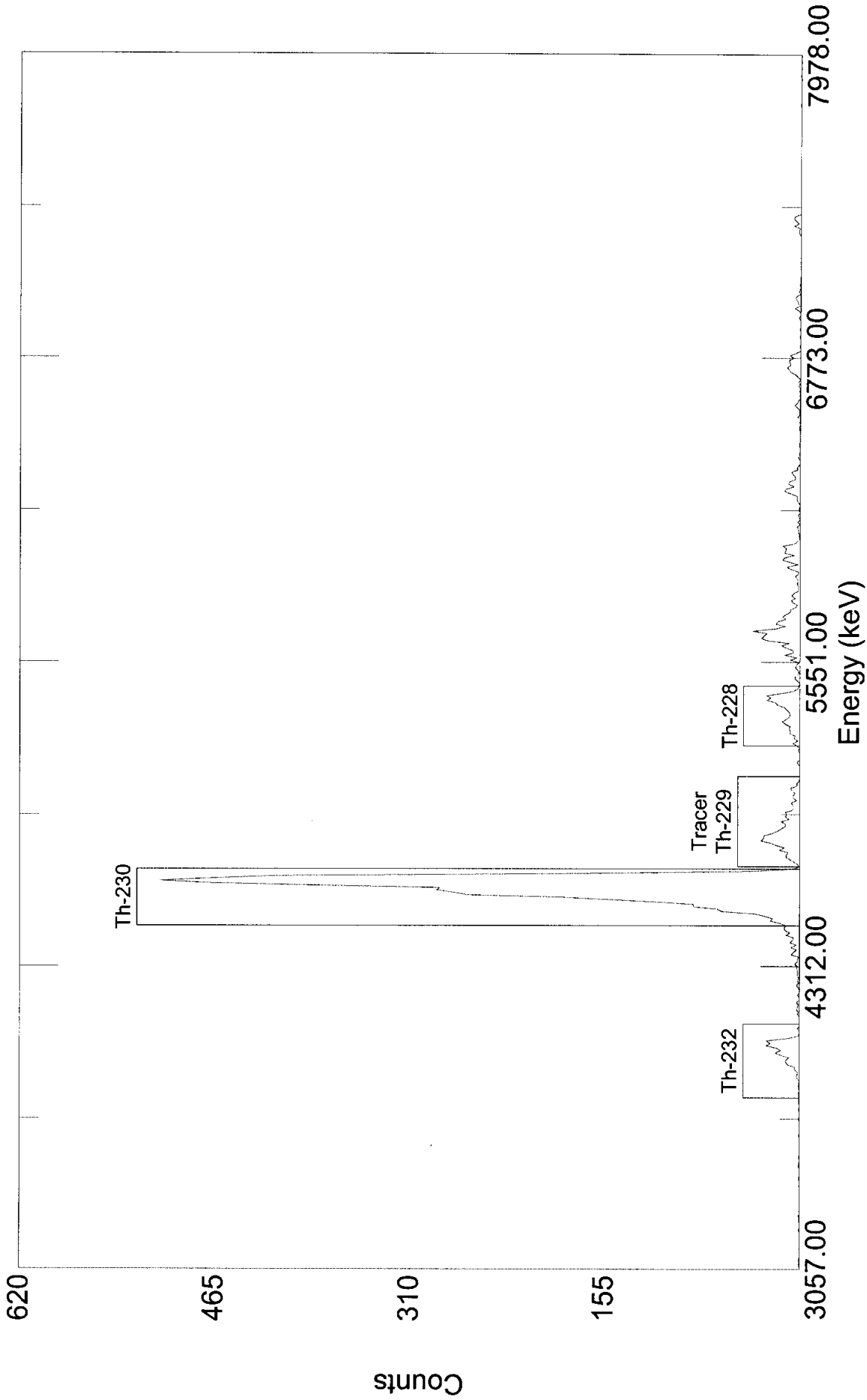
Analyzed By: Sm JP

Checked By: RK

000030

T42419D

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 12:42:33 on 10-May-2004

File: C:\User\Alpha\ALPHA\T42419D.SPC

Sample: 0404241-9D TAS040428-6

Real Time: 21601.64 s. Live Time: 21600.00 s.

Detector: #62 MCB 8 Input 6

Type: Thorium

000031

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/11/04 3:48:01 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0404241-11 TAS040428-6

Analysis Type: Thorium

Detector: MCB 8 Input 7

Date/Time of Count: 5/10/04 12:42:33 PM

Sample Volume: 2.042 Total, 2.042 Aliquot.

Live Time: 360.00 Minutes

Chem. Yield: 45.81%

Real Time: 360.03 Minutes

Total Eff.: 13.39 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminant

Acquisition: 512 Channels

Efficiency: 29.23%

Analysis: Relative Region-Of-Interest

Original: 3,019 + 10.1313 * Chn + -0.00110 * Chn **2.

Spectrum Calibration: 3,019 + 10.1013 * Chn + -0.00110 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T424111.SPC

Background File: C:\USER\ALPHA\BKGND\B4050463.SPC

Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	245.25	223	248	2.00	35.00	282.00	7.92	274.08	5.69
2	168.30	147	171	2.00	1481.00	10,628.00	0.00	10616.05	220.23
3	99.50	75	106	2.00	39.00	267.00	0.00	267.00	5.54
Tracer	184.49	172	209	8.00	47.00	482.00	0.00	482.00	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	19.12	1.254	n/a	12.03 %
2	Th-230	4687.70	19.46	48.583	n/a	1.90 %
3	Th-232	4013.00	19.76	1.222	n/a	12.00 %
Tracer	Th-229	4845.00	77.56	2.206	n/a	8.93 %

Totals

% Total

Gross Count:	12,982.00	100.00
Net Area:	12,921.16	99.53
Background:	60.84	0.47
Composite Fit:	11,659.00	89.81
Residuals:	1,323.00	10.19

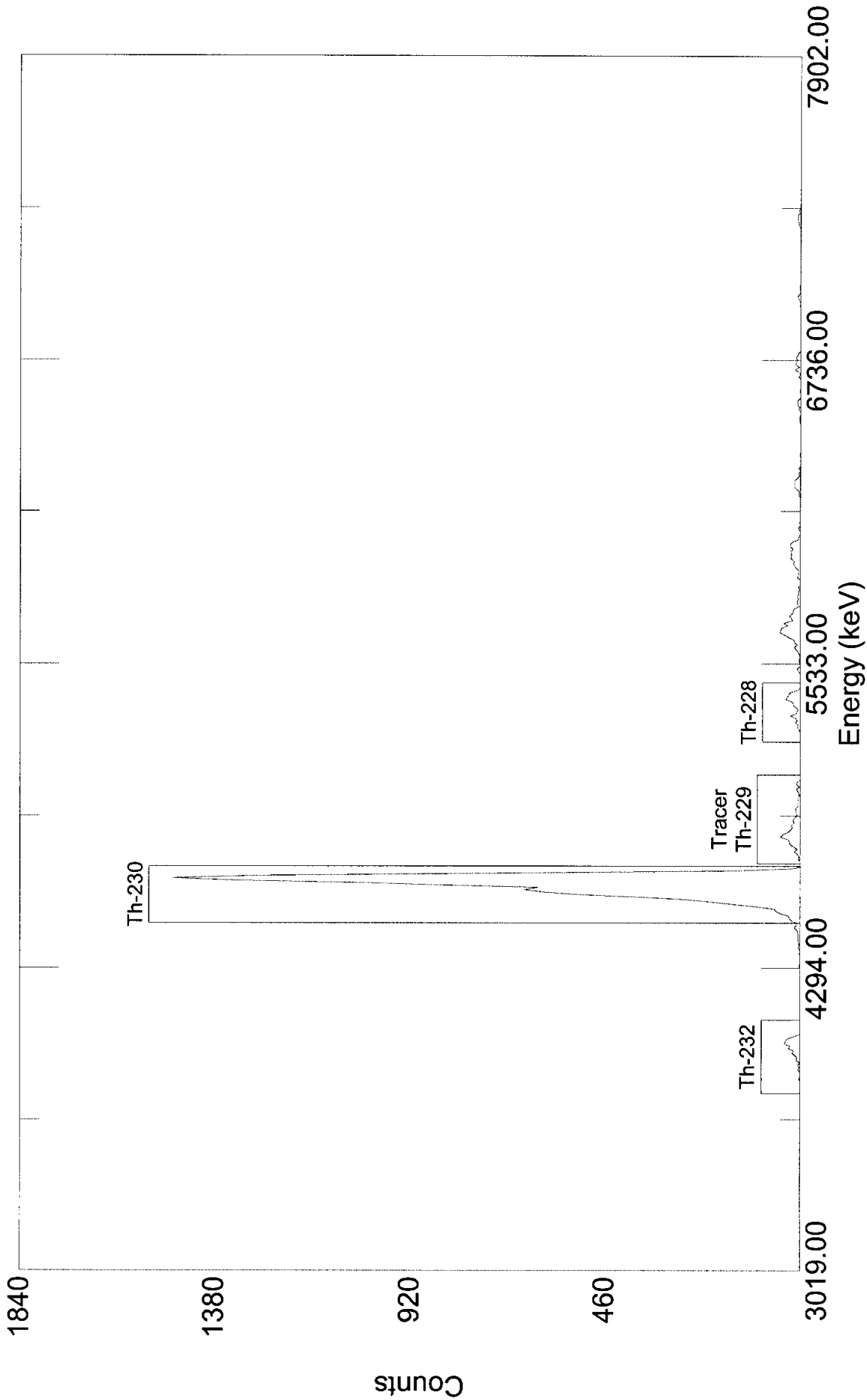
Analyzed By: *Sm JP*

Checked By: *LP*

000032

T424111

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 12:42:33 on 10-May-2004

File: C:\User\Alpha\ALPHA\T424111.SPC

Sample: 0404241-11 TAS040428-6

Real Time: 21601.62 s. Live Time: 21600.00 s.

Detector: #63 MCB 8 Input 7

Type: Thorium

000033

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/11/04 3:51:04 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0404241-12 TAS040428-6

Analysis Type: Thorium

Detector: MCB 8 Input 8

Date/Time of Count: 5/10/04 12:42:33 PM

Sample Volume: 2.026 Total, 2.026 Aliquot.

Live Time: 360.00 Minutes

Chem. Yield: 33.75%

Real Time: 360.03 Minutes

Total Eff.: 10.37 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminat

Acquisition: 512 Channels

Efficiency: 30.73%

Analysis: Relative Region-Of-Interest

Original: 3,019 + 10.2368 * Chn + -0.00140 * Chn **2.

Spectrum Calibration: 3,019 + 10.2070 * Chn + -0.00140 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T424112.SPC

Background File: C:\USER\ALPHA\BKGND\B4050464.SPC

Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	244.35	221	248	2.00	229.00	2,978.00	16.20	2961.80	79.34
2	167.28	143	174	4.00	283.00	3,784.00	0.72	3774.02	101.09
3	98.67	75	108	2.00	212.00	2,903.00	1.08	2901.92	77.73
Tracer	183.47	175	208	10.00	28.00	374.00	0.72	373.28	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	19.05	17.642	n/a	3.61 %
2	Th-230	4687.70	38.95	22.480	n/a	3.19 %
3	Th-232	4013.00	19.86	17.285	n/a	3.64 %
Tracer	Th-229	4845.00	96.93	2.223	n/a	10.13 %

Totals

		% Total
Gross Count:	15,189.00	100.00
Net Area:	15,094.32	99.38
Background:	94.68	0.62
Composite Fit:	10,039.00	66.09
Residuals:	5,150.00	33.91

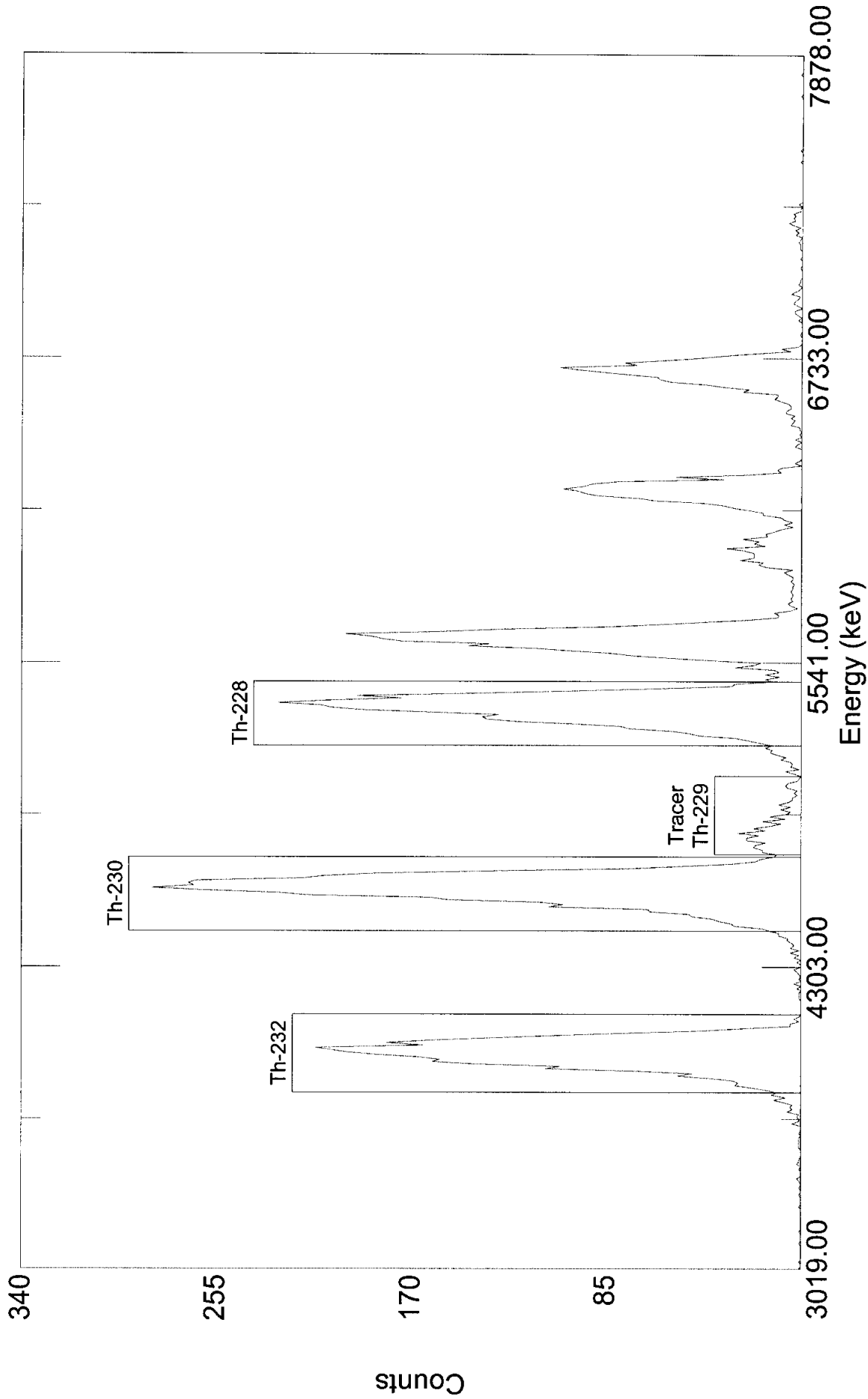
Analyzed By: _____

Checked By: _____

000034

T424112

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 12:42:33 on 10-May-2004
File: C:\User\Alpha\ALPHA\T424112.SPC
Sample: 0404241-12 TAS040428-6

Real Time: 21601.62 s. Live Time: 21600.00 s.
Detector: #64 MCB 8 Input 8
Type: Thorium

000035

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/13/04 1:19:31 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: AS040428-6MB TAS040428-6

Analysis Type: Thorium

Detector: MCB 2 Input 3

Date/Time of Count: 5/10/04 2:36:05 PM

Sample Volume: 2.000 Total, 2.000 Aliquot.

Live Time: **360.00 Minutes**

Chem. Yield: **60.75%**

Real Time: 360.01 Minutes

Total Eff.: 17.58 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminat

Acquisition: 512 Channels

Efficiency: 28.93%

Analysis: Relative Region-Of-Interest

Original: 2,973 + 10.2853 * Chn + -0.00120 * Chn **2.

Spectrum Calibration: 2,973 + 10.2883 * Chn + -0.00120 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T4286B.SPC

Background File: C:\User\Alpha\ALPHA\B4050411.SPC

Library File: C:\User\Alpha\ALPHA\VIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	245.82	224	249	2.00	2.00	6.00	7.92	-1.92	-0.03
2	170.00	149	175	2.00	7.00	37.00	0.36	20.95	0.33
3	102.27	78	109	0.00	0.00	0.00	0.00	0.00	0.00
Tracer	185.95	176	211	8.00	55.00	633.00	0.36	632.64	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	19.40	-0.007	n/a	-270.60 %
2	Th-230	4687.70	19.76	0.075	n/a	56.94 %
3	Th-232	4013.00	0.00	0.000	n/a	0.00 %
Tracer	Th-229	4845.00	78.74	2.252	n/a	7.79 %

Totals

% Total

Gross Count:	872.00	100.00
Net Area:	818.36	93.85
Background:	53.64	6.15
Composite Fit:	676.00	77.52
Residuals:	196.00	22.48

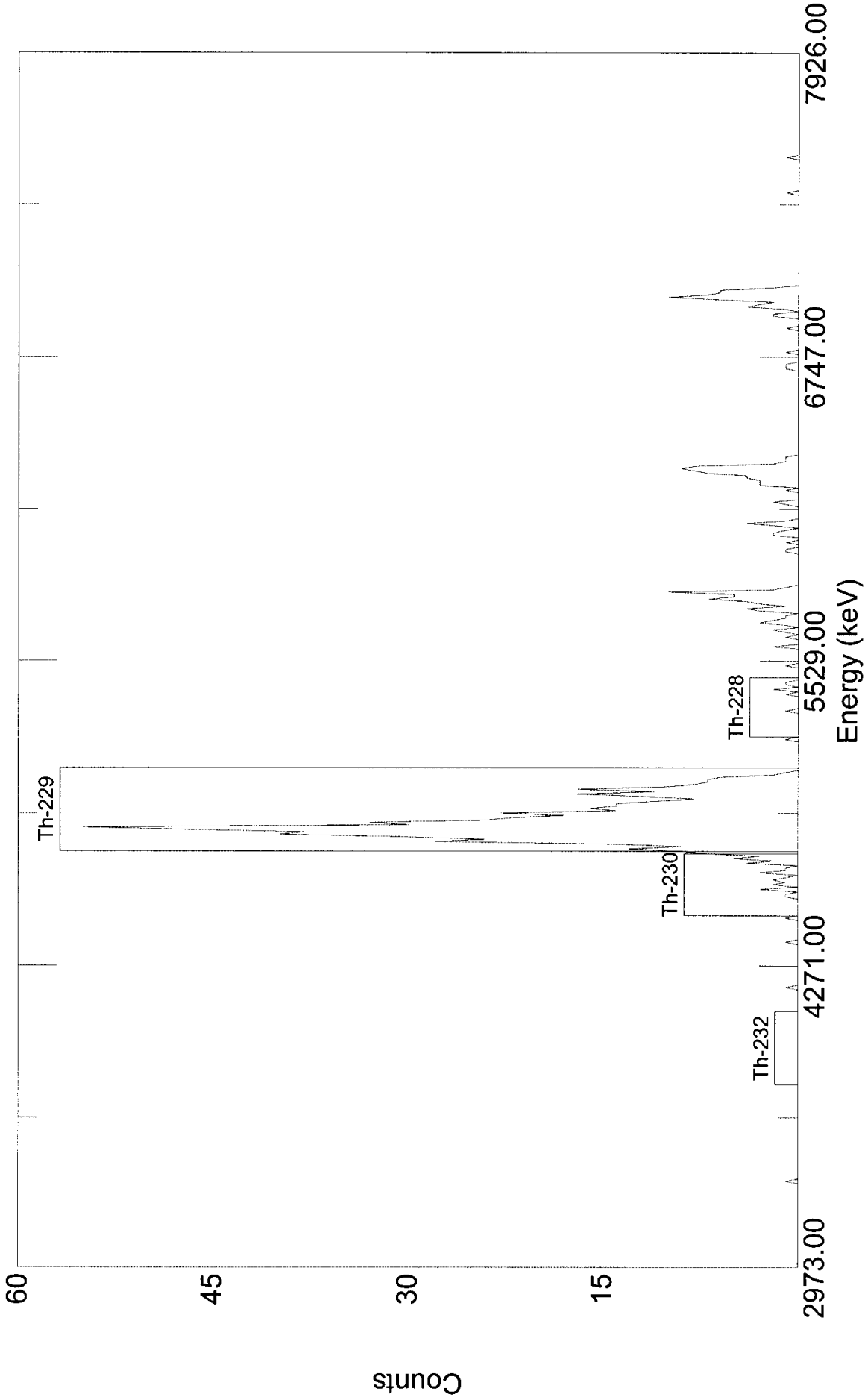
Analyzed By: JP

Checked By: lf

000036

T4286B

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 14:36:05 on 10-May-2004
File: C:\User\Alpha\ALPHA\T4286B.SPC
Sample: AS040428-6MB TAS040428-6

Real Time: 21600.32 s. Live Time: 21600.00 s.
Detector: #11 MCB 2 Input 3
Type: Thorium

000037

Paragon Analytics

Alpha Spectroscopy Analysis

Report Printed:
5/11/04 3:52:55 PM

Para0327.rpt
rev 11/13/03 KVG

Sample Name: AS040428-6LCS TAS040428-6

Analysis Type: Thorium

Detector: MCB 2 Input 4

Date/Time of Count: 5/10/04 2:36:21 PM

Sample Volume: 2.000 Total, 2.000 Aliquot.

Live Time: 360.00 Minutes

Chem. Yield: 57.23%

Real Time: 360.01 Minutes

Total Eff.: 16.98 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminant

Acquisition: 512 Channels

Efficiency: 29.67%

Analysis: Relative Region-Of-Interest

Original: 3,018 + 10.0524 * Chn + -0.00078 * Chn **2.

Spectrum Calibration: 3,018 + 10.0089 * Chn + -0.00078 * Chn **2.

Cal File:

Spectrum File: C:\User\Alpha\ALPHA\T4286L.SPC

Background File: C:\USER\ALPHA\BKGND\B4050412.SPC

Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	245.70	226	250	2.00	5.00	32.00	19.08	12.92	0.21
2	169.07	146	173	2.00	76.00	690.00	0.72	674.12	11.03
3	100.22	76	106	2.00	1.00	6.00	1.08	4.92	0.08
Tracer	185.23	174	211	8.00	49.00	613.00	1.80	611.20	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-228	5430.00	19.25	0.048	n/a	89.07 %
2	Th-230	4687.70	19.49	2.484	n/a	7.64 %
3	Th-232	4013.00	19.71	0.018	n/a	98.71 %
Tracer	Th-229	4845.00	77.77	2.252	n/a	7.92 %

Totals

% Total

Gross Count:	1,592.00	100.00
Net Area:	1,482.56	93.13
Background:	109.44	6.87
Composite Fit:	1,341.00	84.23
Residuals:	251.00	15.77

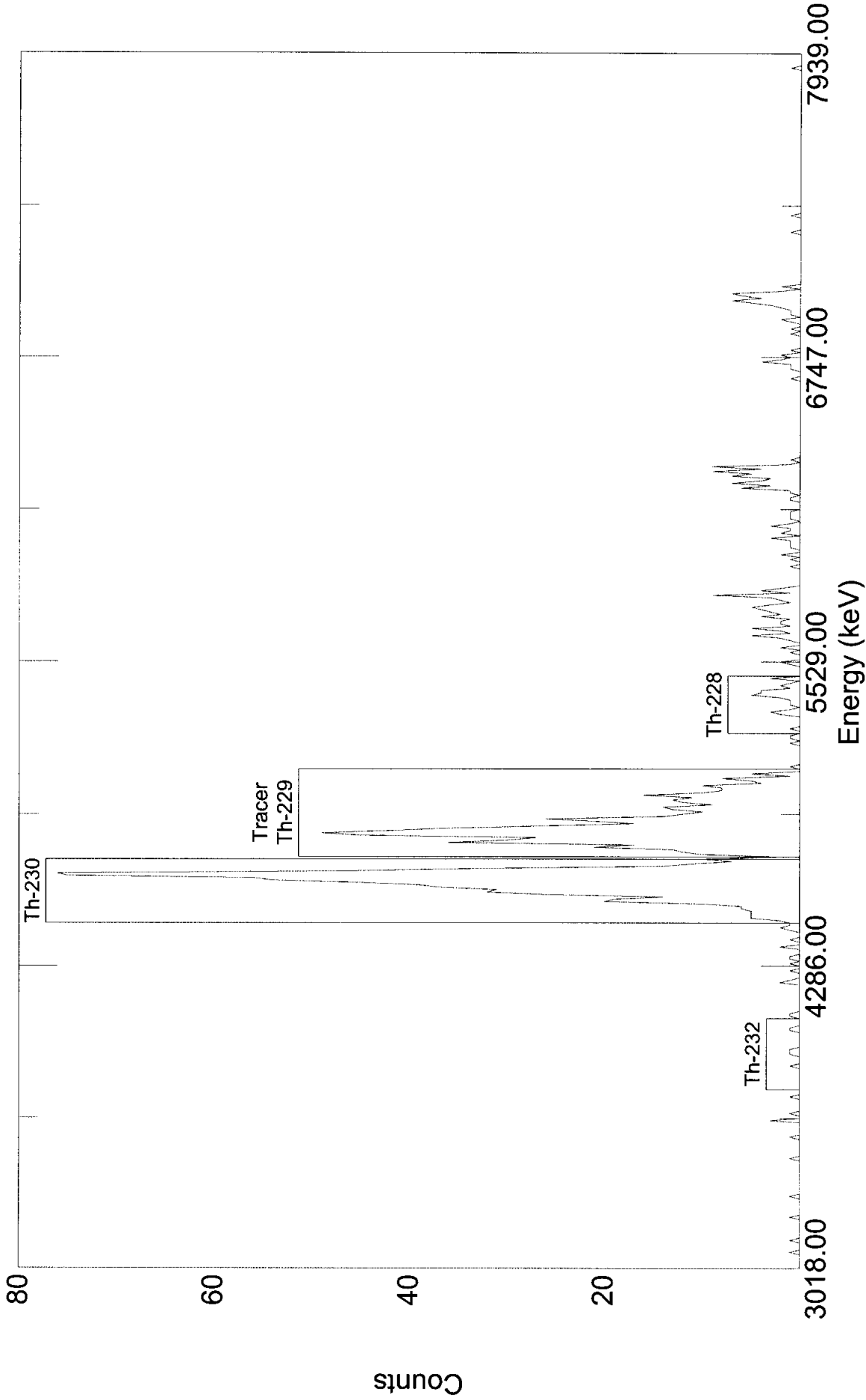
Analyzed By:

Checked By:

000038

T4286L

AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 14:36:21 on 10-May-2004
File: C:\User\Alpha\ALPHA\T4286L.SPC
Sample: AS040428-6LCS TAS040428-6
Real Time: 21600.32 s. Live Time: 21600.00 s.
Detector: #12 MCB 2 Input 4
Type: Thorium

680000

Paragon Analytics

Alpha Spectrometer Instrument Run Log

Date: 5/10/04

FORM 746r6.xls (1/18/2000)

277714

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial	File ID/Comm.
9	AS0404284	0404145-10	VIS	300	JP	UR414510
10	AS0404165	0404145-5	ThS	300	JP	T41455
11		-6				6
12		-7				7
13		-8				8
15		-9				9
16		-10				10
17		-11				11
19		-12				12
21		-12D				12D
22		-13				13
23		-14				14
24		-15				15
42		-16				16
43		-17				17
44		-18				18
45		-19				19
47		-20				20
48	AS0404165					T4165B
57		LOS				↓ L
58	AS0404286	0404241-3	ThS	360	JP	T42413
59		-5				5
60		-7				7
61		-9				9

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial	File ID/Comm.
62	AS0404286	0404241-9D	ThS	360	JP	T42419D
63		-11				11
64		-12				12
9	AS0404165	0404145-15	ThS	300	JP	TR414515
10		AS0404165	ThS	300	JP	TR4165B
11	AS0404286	AS0404286	ThS	360	JP	T4286B
12		LOS				↓ L
13	AS0404283	0404106-10	ThS	330	JP	TR410610
15	AS0404285	0404241-3	VIS	300	JP	U42413
16		-5				5
17		-7				7
18		-7D				7D
19		-9				9
21		-11				11
22		-12				12
23		AS0404285				U4285B
42		LOS				↓ L
43	AS0404293	0404199-3	VIS	300	JP	U41993
44		-3D				3D
45		-4				4
47		-5				5
48		-6				6
57		-8				8
58		AS0404293				U4293B
59		LOS				↓ L

Notes:

Cont. on page 277715. JP 5/10/04

Reviewed by: JP
Date: 5/11/04

000040

PARAGON ANALYTICS
Radiochemistry Data Package

Section 5

**QUALITY ASSURANCE
SUMMARY REPORTS**

5

000041

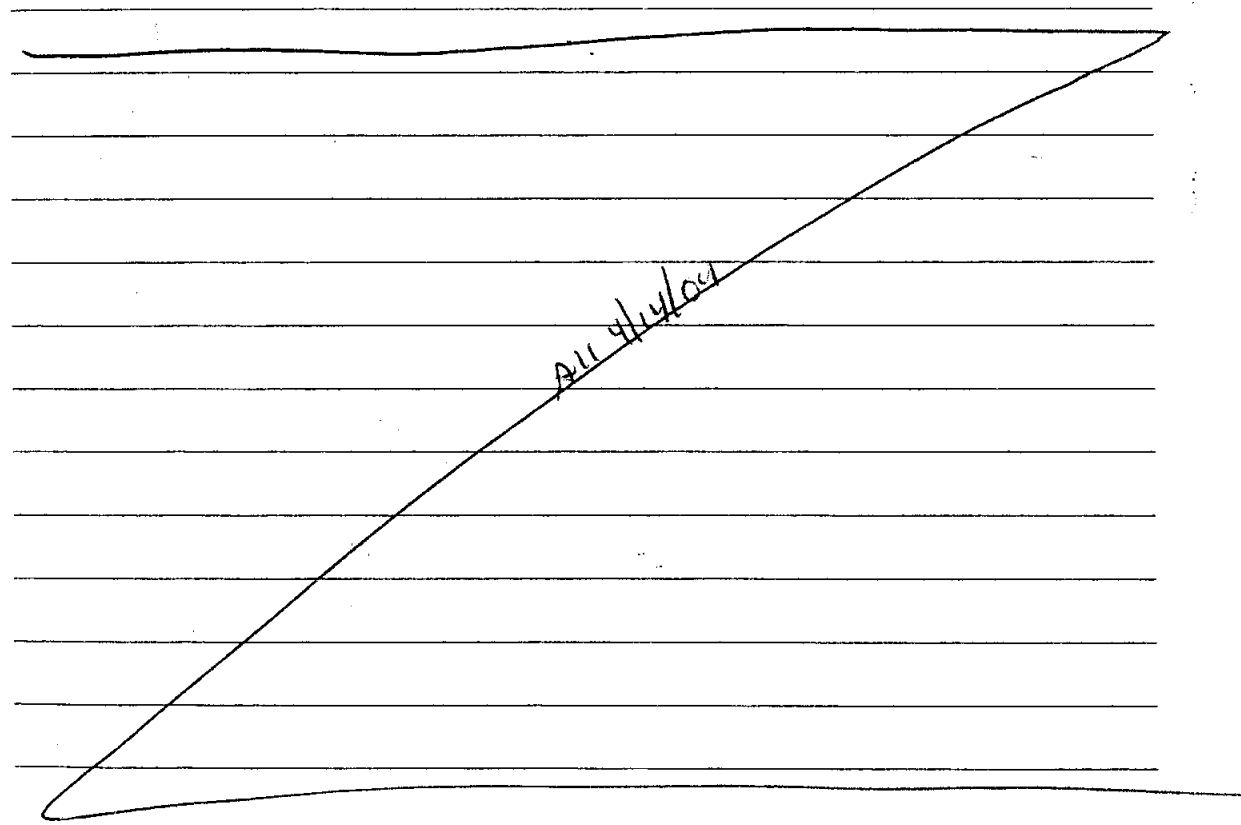
QUALITY ASSURANCE SUMMARY SHEET

268111

PAI W.O. #/ BATCH For all thorium batches
TEST Th-iso
METHOD 777/275
SOP/REV (PREP) Prep F
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.

All 4/14/04
1. A consistent 20-25 ml of ammonium hydroxide was used per sample in order All 4/14/04
All 4/14/04 to form the ferric hydroxide precipitate prior to running a All 4/14/04 chloride column.
All 4/14/04



TECHNICIAN/ANALYST A. Lawson DATE 4/14/04
DEPARTMENT MANAGER K. M. Mye DATE 4/14/04

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

**LABORATORY
BENCH SHEETS**

6

000043

Radiochemistry Instrument Worksheet

Paragon Analytics

Prep Batch: AS040428-6

Prep Procedure: THISO

Analytical QASS / NCR? Y N MA

Prep Num	LabID	QC Type	Init Aliq	Fin Aliq	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	0404241-3	SMP	2.1977	2.1977	g	58	58	JP	42413	42413	42413	42413	42413	42413	
1	0404241-5	SMP	2.0498	2.0498	g	59	59		42415	42415	42415	42415	42415	42415	
1	0404241-7	SMP	2.0189	2.0189	g	60	60		42417	42417	42417	42417	42417	42417	
1	0404241-9	SMP	2.0758	2.0758	g	61	61		42419	42419	42419	42419	42419	42419	
1	0404241-9	DUP	2.0241	2.0241	g	62	62		42419D	42419D	42419D	42419D	42419D	42419D	
1	0404241-11	SMP	2.0419	2.0419	g	63	63		424111	424111	424111	424111	424111	424111	
1	0404241-12	SMP	2.0257	2.0257	g	64	64		424112	424112	424112	424112	424112	424112	
1	AS040428-6	MB	2	2	g	11	11	JP	4286B	4286B	4286B	4286B	4286B	4286B	JP S/21/04
1	AS040428-6	LCS	2	2	g	12	12		4286L	4286L	4286L	4286L	4286L	4286L	

Tracer/Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units	Pipet ID
T1	TH-229	630.2613.03	19.998	DPM/ml	04/28/04	0.5 ml	AW004

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units	Pipet ID
S1	TH-230	581.2382.60	20.003	DPM/ml	04/28/04	0.5 ml	AW004

0000

Radiochemistry Prep Worksheet

Prep Batch: AS040428-6

Prep Batch: AS040428-6

Prep Procedure: THISO

Reviewed By: *cdm* 5/4/04 Review Date: 5/4/04

Non-Routine Pre-Treatment? Y N Batch: *N/A* Prep GASS NCR? Y N *268111*

Prep SOP: PAI 777 Rev: 7
 Prep SOP: NONE
 Matrix Class: solid

Prep Analyst: Carissa Moncavage
 Prep Date: 4/28/04
 Prep Dept: AP

Balance: 23
 Balance: N/A

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq	Fin Alq	Prep Basis	Micro Init	Micro Date	Standards	Prep Notes
1	1	0404241-3	SMP		2.1977	2.1977	Dry Weight	<i>cdm</i>	5/4/04	T1	
2	1	0404241-5	SMP		2.0498	2.0498	Dry Weight			T1	
3	1	0404241-7	SMP		2.0189	2.0189	Dry Weight			T1	
4	1	0404241-9	SMP		2.0758	2.0758	Dry Weight			T1	
5	1	0404241-9	DUP		2.0241	2.0241	Dry Weight			T1	<i>cdm 5/4/04</i>
6	1	0404241-11	SMP		2.0419	2.0419	Dry Weight			T1	
7	1	0404241-12	SMP		2.0257	2.0257	Dry Weight			T1	
8	1	AS040428-6	MB		2	2	Dry Weight			T1	
9	1	AS040428-6	LCS		2	2	Dry Weight			S1,T1	

Spiked By: Carissa Moncavage Date: 4/29/04
 Witnessed By: Grace Campagnola Date: 4/29/04

Relinquished By: *cdm*
 Date: 5/4/04
 Received By: *SD*
 Date: 5/5/04

Tracer/Carrier Solution Information						
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units
T1	TH-229	630.2613.03	19.998	DPM/ml	04/28/04	0.5 ml

Spike Solution Information						
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units
S1	TH-230	581.2382.60	20.003	DPM/ml	04/28/04	0.5 ml

Comments: ALL SAMPLES WERE MUFFLED. ALL SAMPLES RECEIVED PEG TREATMENT.

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS040428-6

Prep Procedure: **THISO**

Prep Batch Not Validated!!!

Reviewed By: _____

Review Date: _____

Non-Routine Pre-Treatment? Y / N Batch: _____

Prep QASS / NCR? Y / N _____

Prep SOP: PAI 777 Rev: 7
 Prep SOP: NONE
 Matrix Class: solid

Prep Analyst: Carissa Moncavage
 Prep Date: 4/28/04
 Prep Dept: AP

Balance:
 Balance:

Sample Num	Prep Num	QC Type	LabID	Dish No.	Init Alq	Fin Alq	Prep Basis	Micro Init	Micro Date	Standards	Prep Notes
3	1	1	0404241-3	SMP	2	2	Dry Weight	586	2.1977	T1	
2	1	1	0404241-5	SMP	2	2	Dry Weight	453	2.0498	T1	
1	3	1	0404241-7	SMP	2	2	Dry Weight	600	2.0189	T1	
4	1	1	0404241-9	SMP	2	2	Dry Weight	473	2.0758	T1	
2	5	1	0404241-9	DUP	2	2		506	2.0241	T1	
2	6	1	0404241-11	SMP	2	2	Dry Weight	568	2.0419	T1	
9	7	1	0404241-12	SMP	2	2	Dry Weight	469	2.0257	T1	
2	8	1	AS040428-6	MB	2	2		558	2.0	T1	
6	9	1	AS040428-6	LCS	2	2		560	2.0	S1,T1	

Spiked By: CPM Date: 4/29/04
 Witnessed By: OC Date: 4/29/04

Relinquished By: _____ Date: _____
 Received By: _____ Date: _____

Tracer/Carrier Solution Information						
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units
T1	TH-229	630.2613.03	19.998	DPM/ml	04/28/04	0.5 ml

Spike Solution Information						
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units
S1	TH-230	581.2382.60	20.003	DPM/ml	04/28/04	0.5 ml

exp 6/5/04

exp 2/10/05

0000 Comments

4/28/04 W.O. # 04-04-241 (Pb^{ISO}, Th^{ISO}, U^{ISO}, Pb 210L)

in oven - 4/27 @ 1100
out oven - 4/28 @ 1100

S.O.P. - 721-R10
balance # 15, oven # 1
5 balls, shake 15 min.

<u>Sample #</u>	<u>sample / can / balls (g)</u>	<u>can / balls (g)</u>	<u>ground sample (g)</u>	<u>TYPE sample</u>
04-04-241-3	126.6	96.4	30.2	SOIL
-5	126.5	96.3	30.2	
-7	126.8	96.4	30.4	
-9	127.0	96.9	30.1	
-11	127.1	96.7	30.4	
-12	125.7	96.5	29.2	

C.O. - 4/28/04

Continued on Page _____

Read and Understood By

Carson B. O'Dell 4/28/04
Signed Date

[Signature]
Signed

4/28/04 000048
Date

PARAGON ANALYTICS
Radiochemistry Data Package

Section 7

**STANDARDS
TRACEABILITY
DOCUMENTS**

7

000049

Th-229

Prepare a working level dilution of Th-229 630.2382.28 to 20 dpm/ml by diluting with 0.5M HNO₃ Lot K29665901183

- Determine the density of 0.5M HNO₃
 mass of 100ml class A volumetric flask
 mass of flask and 100ml 0.5M HNO₃
 net mass of 0.5M HNO₃

64.6096 g bal 12
 165.7905 g ↓
 101.1809 g

$$\rho = 1.0118 \text{ g/ml}$$

- Transfer approx 10g Th-229 (630.2382.28) into a 1L nalgene bottle
 mass of 1L nalgene bottle without lid
 mass of nalgene bottle + standard
 net mass of standard transferred

74.9310 g bal 12
 85.5237 g ↓
 10.5927 g

- Dilute to final volume with 0.5M HNO₃
 mass of 1L nalgene bottle w/o lid from above
 mass of nalgene bottle, standard, 0.5M HNO₃
 net mass of standard

74.9310 g
 957.6 g bal 26
 882.67 g

4) Final activity calculation:

$$\frac{(1,647.2 \text{ dpm/g})(10.5927 \text{ g})}{882.67 \text{ g}} (1.0118 \text{ g/ml}) = 20.00 \text{ dpm/ml}$$

SE 4/20/03

Std ID: 630.2613.03

Description: Th-229

Activity: 20.00 dpm/ml

2s Uncertainty: 0.47 dpm/ml

Ref. Date: 7/17/02

Ref Time: na

Prep Date: 6/3/03 Prep by: CDM

Expiration: 6/25/04

Matrix/Comp: 0.5M HNO₃

Half Life (y): 7.34E+03

6/26/03

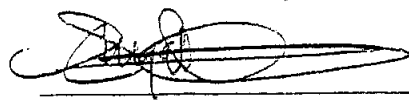
6/26/03

Continued on Page

Read and Understood By

Choncavage
 Signed

6/3/03
 Date



Signed

6/26/03

Date 000050

Prepare a 1^o dilution of Analytes 64206-3107 by transferring contents of the ampule to a ~~50 ml~~ 250 ml Nalgene bottle + diluting to approx 150 ml w/ 0.5 N HNO₃. (Lot # K29338361 08/3 9/16/02)

1) Transfer contents of ampule to 250 ml bottle

Mass of empty Nalgene bottle (40 ml)	23.9862 g	(Bal 12)
Mass of opened ampule + 50 ml beaker	37.8911 g	
Mass of empty ampule + beaker.	33.1523 g	↓
Net mass of std. transferred	4.7388 g	

2) Dilute std in Nalgene bottle

Mass of empty bottle (from above)	23.9862 g	
Mass of bottle + std + 0.5 N HNO ₃	170.5635 g	(Bal 12)
Net mass of std.	146.5773 g	

3) Final Activity Calculation

$$\left(\frac{4.258 \times 10^3 \text{ dps}}{5.01424 \text{ g}} \right) \left(\frac{4.7388 \text{ g}}{146.5773 \text{ g}} \right) (60 \text{ s/min}) = 1647.2 \text{ dps/g}$$

BB 9/16/02

Continued on Page _____

Read and Understood By

Will Ben

Signed

8/15/02

Date

Renee Kellogg

Signed

9/16/02 00051

Date

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

PAID 00630
rec'd 7-19-02

64206-307

Th-229 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-229
ACTIVITY (dps):	4.258 E3
HALF-LIFE:	7340 years
CALIBRATION DATE:	July 17, 2002 12:00 EST
TOTAL UNCERTAINTY*:	3.5%
SYSTEMATIC:	2.6%
RANDOM:	0.9%

*99% confidence level.

Impurities: Th-228 26.9 dps
Th-230 26.5 dps
Th-232 1.8 dps

5.01424 grams 0.5M HNO₃ solution.

P O NUMBER 001620, Item 1

SOURCE PREPARED BY:

M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED:

M. R. Ty 7-18-02



U.S. DEPARTMENT OF COMMERCE
National Institute of Standards & Technology
Gaithersburg, MD 20899

Certificate of Participation

Analytics, Incorporated
Atlanta, Georgia

is a participant for the period January 1, 2002, through December 31, 2002, in a radioactivity measurements assurance program conducted by the National Institute of Standards and Technology, in cooperation with the Nuclear Energy Institute. Continued participation is evidenced by dated Reports of Traceability issued for particular radionuclides, which indicate the deviation of the participant's reported value from that measured by the National Institute of Standards and Technology. The significance of these Reports is addressed below.*

For the Director,

A handwritten signature in cursive script that reads "Bert M. Coursey".

Bert M. Coursey, Acting Group Leader
Radioactivity Group
Physics Laboratory

* As guidance for the proper use of Reports of Traceability, it should be emphasized that the National Institute of Standards and Technology is concerned only with fostering good measurements capability and consistency with the national measurements system. The assurance of the proper application of that capability to the ultimate consumer products is the responsibility of each manufacturer of these products and of the Federal regulatory agencies.

A continuing traceability program in radioactivity demonstrates, to the degree established by the periodic assays of calibrated radioactivity samples, a continuing competence to maintain the methods and standards necessary for accurate measurement. Such a program cannot, however, endorse each and every measurement nor the final product, any more than a spot check can vouch for every unchecked item. Care should be taken, therefore, not to imply such endorsement. The proper use of this Report is governed by section 200.114 of Title 15 of the Code of Federal Regulations. These regulations may be met if Reports are quoted only in their entirety. Excerpts out of context may be misleading.

000053

Th-230

Prepare a working level dilution of Th-230 (581.1808.65) to 20 dpm/ml by diluting w/ 0.1M HNO₃ (Lot #42270)

1) Determine the density of 0.1M HNO₃
 mass of empty 100 ml volumetric flask 64.6140 g (Bal 12)
 mass of flask + 0.1M HNO₃ 164.5730 g ↓
 net mass of 0.1M HNO₃ 99.959 g
 $\rho = 0.9996 \text{ g/ml}$

2) Transfer approx 17g of Th-230 (581.1808.65) to a 1L Nalgene bottle
 mass of empty 1L nalgene bottle w/o lid 74.4414 g (Bal 12)
 mass of bottle + std 91.5530 g ↓
 net mass of std transferred 17.1116 g

3) Dilute to final volume w/ 0.1M HNO₃
 mass of empty 1L nalgene bottle (from above) 74.4414 g
 mass of bottle + std + 0.1M HNO₃ 1068.5 g (Bal 26)
 net mass of std 994.06 g

4) Final activity calc

$$\frac{(1162.00 \text{ dpm/ml}) (17.1116 \text{ g})}{994.06 \text{ g}} = 20.00 \text{ dpm/ml}$$

RG 2/11/03
 Stnd ID: 581.2382.60
 Description: Th-230
 Activity: 20.00 dpm/ml
 2s Uncertainty: 0.427-0.64 dpm/ml
 Ref. Date: 5/15/01
 Ref Time: na
 Prep Date: 2/2/03 Prep by: CDM
 Expiration: 2/5/04
 Matrix/Comp. 0.1M HNO₃
 Half Life (y): 7.54E+04
 RG 2/11/03

50 3/5/04
 Reverification of std: 50 3/5/04
 Stnd ID: 581.2382.60
 Description: Th-230
 Expiration: 2/10/05
 Activity: 20.00 dpm/mL
 2s Uncertainty: 0.43 dpm/mL
 Ref. Date: 5/15/01
 Ref Time: N/A
 Prep Date: 1/20/03 Prep by: CDM
 Matrix/Comp. 0.1 M HNO₃
 Half Life (y): 7.54E+04
 50 3/5/04
 Continued on Page

Read and Understood By

Signed Carissa Moncalvo Date 1/20/03

Signed Renee Kelley Date 1/30/03

Date 00005

5/10/01 Prepare a 1000 dpm/ml solution of Th-230 by diluting RSO # 581 with 0.1 M HNO₃

1) Determine density of 0.1 M HNO₃ (6.25 ml conc. HNO₃ diluted to 1L with DI H₂O)

Mass of 100 ml volumetric flask	64.6110g (balance #12)
Mass of flask + 0.1 M HNO ₃	104.5707g
Net mass of 0.1 M HNO ₃	99.9597g
	$\rho = .9996 \text{ g/ml}$

2) Directly transfer approximately 40 ml to VOA vial - No dilution

3) Transfer remaining standard in ampule to 500 ml poly

Mass of 500 ml poly minus lid	32.5073g (balance #12)
Mass of 500 ml poly + standard	43.0529g
Mass of standard	10.5456g

4) Bring standard to final dilution with 0.1 M HNO₃

Mass of empty bottle (from above)	32.5073g (balance #12)
Mass of bottle + standard + 0.1 M HNO ₃	233.16g (balance #2e)
Net mass of std (diluted)	200.65g <i>DSS std/49</i>

5) Final Activity Calculation:

$$\frac{(18,390 \text{ Bq}) (600 \text{ dpm/Bq}) (0.9996 \text{ g/ml}) (10.5456 \text{ g})}{(49.88438 \text{ g}) \left(\frac{233.16 \text{ g}}{200.65 \text{ g}} \right)} = 1162.06 \text{ dpm/ml}$$

DSS std/49

Std ID: 581.1808.65

6/15/02
 Description: Th-230
 Activity: 1162.00 dpm/ml
 Uncertainty: 37.000 dpm/ml
 Ref. Date: 5/15/01
 Ref Time: na
 Prep Date: 5/10/01 Prep by: RLF
 Expiration: 5/22/03
 Matrix/Comp. 0.1 M HNO₃
 Half Life (y): 7.54E+04

ued on Page

Read and Understood By

R. Faul

Signed

5/10/01
Date

Signed

D. R. B.

Signed

5/10/01
Date



**Isotope Products
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

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

*PAID 00581
Recd 5-07-01*

CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

Radionuclide: Th-230	Customer: PARAGON ANALYTICS, INC.
Half-life: (7.54 ± 0.03)E+04 years	P.O. No.: 001295
Catalog No.: 7230	Reference Date: 15-May-01 12:00 PST
Source No.: 758-93	Contained Radioactivity: 0.4969 μCi 18.39 kBq (Th-230 only)

Physical Description:

- | | |
|----------------------|--|
| A. Mass of solution: | 49.88438 g in 50 mL flame-sealed ampoule |
| B. Chemical form: | Th(NO ₃) ₄ in 0.1M HNO ₃ |
| C. Carrier content: | 10 μg Th/mL of solution |
| D. Density: | 1.0016 g/mL @ 20°C. |

Radioimpurities:

Am-241 = 0.110%; Ra-226 daughter = 0.400% on 15 May 01

Radionuclide Concentration: 0.009961 μCi/g, 0.3686 kBq/g

Method of Calibration:

This source was prepared from a weighed aliquot of solution whose activity in μCi/g was determined using a liquid scintillation counter.

Uncertainty of Measurement:

- | | |
|---|---------|
| A. Type A (random) uncertainty: | ± 1.2 % |
| B. Type B (systematic) uncertainty: | ± 3.0 % |
| 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 solution has a working life of 5 years.

Daniel James Van Dalsem
Quality Control

26-Apr-01
Date Signed

IPL Ref. No.: 758-93

PARAGON ANALYTICS
Radiochemistry Data Package

Section 8

CHAIN OF CUSTODY

8

000057

Paragon Analytics

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0404241

Client Name: New Horizons

Client Project Name: CSMRI

Client Project Number: 2135

Client PO Number:

Client Sample	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
BB04	0404241-1		SOIL	16-Apr-04	13:10
BI17	0404241-2		SOIL	19-Apr-04	11:00
BI17	0404241-3		SOIL	19-Apr-04	11:00
BI37	0404241-4		SOIL	19-Apr-04	14:15
BI37	0404241-5		SOIL	19-Apr-04	14:15
BI42	0404241-6		SOIL	19-Apr-04	15:15
BI42	0404241-7		SOIL	19-Apr-04	15:15
H07	0404241-8		SOIL	22-Apr-04	13:00
H07	0404241-9		SOIL	22-Apr-04	13:00
H07S	0404241-10		SOIL	22-Apr-04	13:05
H07S	0404241-11		SOIL	22-Apr-04	13:05
BB04	0404241-12		SOIL	16-Apr-04	13:10
H07	0404241-13		LEACHAT	22-Apr-04	13:00
H07S	0404241-14		LEACHAT	22-Apr-04	13:05



Paragon Analyticals, Inc.

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

Accession Number (LAB ID) 0409241

Chain-of-Custody

Date 4/23/04 Page 1 of 1

Project Name / No.: CSMRI/2135 Sampler(s): see comments (circle one) Turnaround: (Standard or Rush Due) Standard Dispose or Return to Client

Report To: Sally Cuffin
 Phone: 303 945 3590
 Fax: 303 973 8906 (call first)
 Company: NHEC
 Address: 21 Dawn Health Drive
Littleton, CO 80127

Sample ID	Date	Time*	Lab ID	Matrix	No. of Containers	circle method or specify under comments
B804	4/16/04	1310	1	S	1	
B117	4/19/04	1100	2/3	S	2	
B137	↓	1415	4/5	S	2	
B142	↓	1515	6/7	S	2	
H07	4/22/04	1300	8/9	S	2	
H07S	↓	1305	10/11	S	2	

Sample ID	TOX	TPH	Oil & Grease	pH	Hexavalent Chromium	Reactive CN / S	Dissolved Metals	Total Metals	TCLP Metals	TCLP Organics	Herbicides	OP Pesticides	PCBs	OC Pesticides	SVOCs	BTEX (only)	VOCs
B804	SW9020B	GRO DRO SW8015B (both)	SW9071A E4132	SW9040B 9045C	SW7196A Alkaline Digest? Y / N	SW846 Chapter 7	SW6010B 7470 E200 ILMO	SW6010B 7470 7471 E200 ILMO	SW1311 6010B 7471	SW1311 8260B 8270C 8081A 8151A	SW8151A E615	SW8147A E614	SW8082 E608 E508 OLMO	SW8081A E608 E508 OLMO	SW8270C E625 E525 OLMO	SW8021B	SW8260B E624 E524 OLMO
B117																	
B137																	
B142																	
H07									*								
H07S									*								

Sample ID	Gamma Isotopes **	Strontium 89	Radium 226	Total Alpha-Emitting Radium	Tritium	Total Uranium by KPA	Actinides by PAI SOP	Gross Alpha / Beta
B804	E901.1	SW9811-95	SW9315 E903.0	SW9315 E903.0	E906.0	D5174-91	(circle) Pu / U / Am / Th / Cm	SW9310 E900.0
B117								
B137								
B142								
H07								
H07S								

Relinquished By: (1) Sally M Cuffin
 Signature: Sally M Cuffin
 Printed Name: Sally M Cuffin
 Date: 4/23/04 Time: 11:00
 Company: NHEC

Relinquished By: (2) _____
 Signature: _____
 Printed Name: _____
 Date: _____ Time: _____
 Company: _____

Received By: (1) George
 Signature: George
 Printed Name: George
 Date: 4/23/04 Time: 1530
 Company: Paragon Analyticals

Received By: (2) _____
 Signature: _____
 Printed Name: _____
 Date: _____ Time: _____
 Company: _____

Comments:
 * Drew Pitzer
 Elaine Aquino
 Sally TIPP
 George
 ** Rush gamma screen - then do alpha spec for Isotopic Th, U, Pb-210, Po-210
 * Perform TCLP metals - arsenic, cadmium, chromium, lead, selenium, silver, vanadium, zinc, mercury, molybdenum - use alpha spec Form 2024.xls (1/3/01) substrate

CONDITION OF SAMPLE UPON RECEIPT FORM

CLIENT: New Horizons WORKORDER NO: 0404241

PROJECT MANAGER: Deb Fazio INITIALS: DF DATE: 4/23/04

1. Does this project require any special handling in addition to standard Paragon procedures? IS PRE-SCREENING REQUIRED? (radiochemistry, DOE, etc.)	Yes	<input checked="" type="radio"/> No
2. Are custody seals on shipping containers intact? How many custody seals are provided? _____	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> No
3. Are the custody seals on sample containers intact?	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> No
4. Is there a Chain-of-Custody (COC) or other representative documents, letters, or shipping memos?	<input checked="" type="radio"/> Yes	<input checked="" type="radio"/> No
5. Is the COC complete? Relinquished: Yes ___ No <input checked="" type="checkbox"/> Analyses Requested: Yes ___ No <input checked="" type="checkbox"/>	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> Yes
6. Is the COC in agreement with the samples received? No. of Samples: Yes ___ No <input checked="" type="checkbox"/> Sample ID's: Yes ___ No <input checked="" type="checkbox"/> Matrix: Yes ___ No <input checked="" type="checkbox"/> No. of Containers: Yes ___ No <input checked="" type="checkbox"/>	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> Yes
7. Were COC (if applicable) and sample labels legible?	<input checked="" type="radio"/> Yes	<input checked="" type="radio"/> No
8. Were airbills present and/or removable?	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> No
9. Are all aqueous samples requiring chemical preservation preserved correctly (excluding volatile organics)? Are all aqueous non-preserved samples at the correct pH?	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> Yes
10. Is there enough sample for requested analyses? If so, were samples placed in the proper containers?	<input checked="" type="radio"/> Yes	<input checked="" type="radio"/> No
11. Are all samples within holding times for the requested analyses?	<input checked="" type="radio"/> Yes	<input checked="" type="radio"/> No
12. Were all sample containers received intact? (not broken or leaking, etc.)	<input checked="" type="radio"/> Yes	<input checked="" type="radio"/> No
13. Are samples requiring no headspace (volatiles, reactive cyanide/sulfide, radon), headspace free? Size of bubble: ___ < green pea; ___ > green pea (List sample IDs and affected containers on Page 2)	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> No
14. Were samples checked for and free from the presence of residual chlorine?	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> No
15. Were the sample(s) shipped on ice?	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> No
16. Were cooler temperatures measured at 0.1 - 6 °C? IR Gun Used*: 1 2	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> No
17. Were all samples cooled that should have been cooled?	<input checked="" type="radio"/> N/A	<input checked="" type="radio"/> No

Cooler #'s 1
 Temperature Ambient °C
 Project Manager Signature/Date: Debby Fazio 4/26/04

A NO RESPONSE TO ANY QUESTION EXCEPT # 1 REQUIRES THE COMPLETION OF PAGE 2 OF THIS FORM

* IR Gun #1 (original): Raytek, SN SC-PM3/T29403
 IR Gun #2 (newer): Oakton, SN 2SCIR1201

PARAGON ANALYTICS
Radiochemistry Data Package

Section 9

**ADDITIONAL
SUPPORTING
DOCUMENTATION**

9

000061

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

Expires 3/31/05

The "Tracer Amount" field on the Thorium 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 2.48%, shown below. During Thorium analyses, 2.48% 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 2.48% 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 2.48% of the Th-229 counts.

Sample ID	Th-230 Counts	Th-229 Counts	% Ratio
AS031203-4MB	11.400	439.400	2.59%
AS031210-4MB	32.440	1232.440	2.63%
AS031216-MMB	47.000	951.000	4.94%
AS031216-4PMB	30.000	865.000	3.47%
AS031218-2MB	19.800	537.900	3.68%
AS031218-3MMB	18.000	847.000	2.13%
AS031218-3PMB	8.000	778.000	1.03%
AS031221-2MB	14.800	574.800	2.57%
AS031222-1MB	31.000	992.800	3.12%
AS0312230-3MB	32.000	1949.000	1.64%
AS031229-2MB	34.000	1511.000	2.25%
AS040108-1MB	13.000	667.000	1.95%
AS040110-2MB	9.920	620.560	1.60%
AS040110-3MB	22.280	686.960	3.24%
AS040114-4MB	18.000	1023.000	1.76%
AS040207-2MB	17.000	906.000	1.88%
AS040111-3MB	29.000	795.020	3.65%
AS040110-3MB	17.380	964.140	1.80%
AS040325-2MB	14.740	717.960	2.05%
AS040319-3MB	18.200	943.600	1.93%
AS040319-1MB	20.320	682.220	2.98%
AS040311-3MB	27.470	972.390	2.82%
AS040312-2MB	7.400	554.400	1.33%
AS040305-3MB	23.000	707.000	3.25%
AS040302-2MB	28.580	730.220	3.91%
AS040217-2MB	12.640	806.640	1.57%
AS040210-2MB	17.400	1229.800	1.41%
AS040207-2MB	11.000	673.520	1.63%
AS040203-2MB	16.700	566.100	2.95%
	AVERAGE=		2.48%

Th-229 contribution factor updated in alphavis.alb by: JP

Date: 3/31/04

Alpha Spectroscopy

Quality Control Data

Weekly Background, Energy, and
Efficiency Calibrations

Calibration Data Summary

Laboratory Name: Paragon Analytics
PAI Work Order: 0404241

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Friday, May 21, 2004
9:19:17 AM

Lab Sample ID Spectrum Analysis Date	QC Type	Batch ID Analysis Run	Test Name	Detector Id	Eff Spectrum Bkg Spectrum Egy Spectrum	Eff Date Bkg Date Egy Date	RESULTS %Efficiency Bkg CPM Energy keV	FLAGS Efficiency Background Energy	LCL %Efficiency Bkg CPM Energy keV	LWL %Efficiency Bkg CPM Energy keV	UWL %Efficiency Bkg CPM Energy keV	UCL %Efficiency Bkg CPM Energy keV
0404241-3 T42413 5/10/2004	SMP	AS040428-6 AS040428-6A	THISO	58	C4050558 B4050558 C4050558	5/5/2004 5/6/2004 5/5/2004	31.95 0.1880 5531.4	Pass Pass Pass	30.35 0.0000 5484.4	30.90 0.0500 5494.4	33.00 0.4000 5574.4	33.55 0.5000 5584.4
0404241-5 T42415 5/10/2004	SMP	AS040428-6 AS040428-6A	THISO	59	C4050459 B4050459 C4050459	5/4/2004 5/5/2004 5/4/2004	32.36 0.2830 5530.1	Pass Pass Pass	30.37 0.0000 5487.7	30.91 0.0500 5497.7	32.93 0.4000 5577.7	33.57 0.5000 5587.7
0404241-7 T42417 5/10/2004	SMP	AS040428-6 AS040428-6A	THISO	60	C4050460 B4050460 C4050460	5/4/2004 5/5/2004 5/4/2004	30.42 0.0150 5560.1	Pass Warning Pass	29.42 0.0000 5508.2	29.90 0.0500 5518.2	31.42 0.4000 5598.2	31.94 0.5000 5608.2
0404241-9 T42419 5/10/2004	SMP	AS040428-6 AS040428-6A	THISO	61	C4050461 B4050461 C4050461	5/4/2004 5/5/2004 5/4/2004	32.09 0.2690 5534.4	Warning Pass Warning	29.44 0.0000 5529.6	29.97 0.0500 5535.6	31.92 0.4000 5559.6	32.54 0.5000 5565.6
0404241-9 T42419D 5/10/2004	DUP	AS040428-6 AS040428-6A	THISO	62	C4050462 B4050462 C4050462	5/4/2004 5/5/2004 5/4/2004	30.38 0.1960 5551.6	Pass Pass Pass	28.57 0.0000 5493.0	29.08 0.0500 5503.0	31.06 0.4000 5583.0	31.57 0.5000 5593.0
0404241-11 T424111 5/10/2004	SMP	AS040428-6 AS040428-6A	THISO	63	C4050463 B4050463 C4050463	5/4/2004 5/5/2004 5/4/2004	29.23 0.1690 5540.4	Pass Pass Pass	28.32 0.0000 5488.0	28.83 0.0500 5498.0	30.79 0.4000 5578.0	31.30 0.5000 5588.0
0404241-12 T424112 5/10/2004	SMP	AS040428-6 AS040428-6A	THISO	64	C4050464 B4050464 C4050464	5/4/2004 5/5/2004 5/4/2004	30.73 0.2630 5548.4	Pass Pass Pass	29.04 0.0000 5520.0	29.56 0.0500 5530.0	31.49 0.4000 5610.0	32.10 0.5000 5620.0
AS040428-6 T4286B 5/10/2004	MB	AS040428-6 AS040428-6A	THISO	11	C4050411 B4050411 C4050411	5/4/2004 5/5/2004 5/4/2004	28.93 0.1490 5527.8	Pass Pass Pass	26.79 0.0000 5484.4	27.27 0.0500 5494.4	28.13 0.4000 5574.4	29.61 0.5000 5584.4
AS040428-6 T4286L 5/10/2004	LCS	AS040428-6 AS040428-6A	THISO	12	C4050412 B4050412 C4050412	5/4/2004 5/5/2004 5/4/2004	29.67 0.3040 5540.2	Pass Pass Pass	27.56 0.0000 5493.9	28.05 0.0500 5503.9	29.97 0.4000 5583.9	30.46 0.5000 5593.9

Data Package ID: Th0404241-1

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.

Date Printed: Friday, May 21, 2004

Paragon Analytics

LIMS Version: 5.018A

Page 1 of 1

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Alpha Spec Calibration Source Re-Certification

R:\INSTALPHACALC\RT304.XLS

Primary Certified Source

Source PAI ID 190 was recalibrated by isotope Products Laboratories on 03-01-2003 and received by PAI on 03-04-2003.

Source ID: 92MIX223027; PAI ID 190 (Labled #9)

Total Activity: 3754 dpm
 Ref. Date: 3/1/03
 Count Date: 3/22/04

U-234 Activity: 79.06% = 2967.90 dpm (decay corrected)
 Am-241 Activity: 19.20% = 719.56 dpm (decay corrected)
 Combined Activity: = 3687.46 dpm (decay corrected)

Detector 13 Efficiency Determination

Source Serial #	PAI ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	count dur (s)	Combined Known cpm	detector efficiency
92MIX223027	190	97-19-103-09	3/22/04	7824.65	32919.75	2100	1164.126	3687.46

Sources 1 through 8 activity determination

Source Serial #	PAI ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	count dur (s)	detector efficiency	Am-241 dpm	U-234 dpm	combined dpm
92MIX2203026	182	97-19-103-01	3/22/04	13674.65	81078.76	2100	31.57%	1237.59	7337.81	8575.40
92MIX2203028	183	97-19-103-02	3/22/04	15497.65	153089.76	2100	31.57%	1402.57	13654.97	15257.54
92MIX2203024	184	97-19-103-03	3/22/04	72039.65	74346.76	2100	31.57%	6519.75	6728.55	13248.30
92MIX2203021	185	97-19-103-04	3/22/04	22309.65	63564.76	2100	31.57%	2019.07	5752.76	7771.83
92MIX2203025	186	97-19-103-05	3/22/04	102504.65	126055.76	2100	31.57%	9276.90	11408.33	20685.23
92MIX2203022	187	97-19-103-06	3/22/04	77656.69	83352.76	2100	31.57%	7028.11	7643.61	14571.72
92MIX2203023	188	97-19-103-07	3/22/04	46378.65	70580.76	2100	31.57%	4197.37	6387.72	10585.09
92MIX2203029	189	97-19-103-08	3/22/04	34881.65	219992.76	2100	31.57%	3156.87	19909.84	23066.71

Detector 13 Efficiency Verification

Source Serial #	PAI ID	Sequential #	Count Date	Am-241 net cts	U-234 net cts	count dur (s)	Combined Known cpm	detector efficiency	% difference from 1st count	
92MIX223027	190	97-19-103-09	3/22/04	7546.89	32241.76	2100	1136.813	3687.46	30.83%	2.35%

Sources 1 through 8 activity re-verification

Source Serial #	PAI ID	Sequential #	Combined Observed dpm	Combined Certified dpm*	Percent Difference %	Within 5% of Certified value Yes/No
92MIX2203026	182	97-19-103-01	8575.40	8730.07	1.77%	Yes
92MIX2203028	183	97-19-103-02	15257.54	15767.93	3.24%	Yes
92MIX2203024	184	97-19-103-03	13248.30	13517.34	1.99%	Yes
92MIX2203021	185	97-19-103-04	7771.83	8130.72	4.41%	Yes
92MIX2203025	186	97-19-103-05	20685.23	20951.92	1.27%	Yes
92MIX2203022	187	97-19-103-06	14571.72	15242.25	4.40%	Yes
92MIX2203023	188	97-19-103-07	10585.09	10755.77	1.59%	Yes
92MIX2203029	189	97-19-103-08	23066.71	23263.22	0.84%	Yes

*Sources 185, 186, 187, & 188 decay corrected to 04/01/03.
 *Sources 182, 183, 184, & 189 decay corrected to 05/01/03.

OK - RG
 EXP 3/22/05

000065



**Isotope Products
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

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

α-1

PAI 187
recalibrated 4-15-03

**CERTIFICATE OF CALIBRATION
MIXED ALPHA STANDARD SOURCE**

Radionuclide A: U-234
Radionuclide B: U-235
Radionuclide C: Am-241
Half Life (U-234): $(2.454 \pm 0.006)E+05$ years
Half Life (U-235): $(7.037 \pm 0.011)E+08$ years
Half Life (Am-241): 432.17 ± 0.66 years

Customer: PARAGON ANALYTICS, INC.
P.O. No.: EW040203/R2193
Catalog No.: MISC-STD
Reference Date: 1-May-03 12:00 PST
Source No.: 92MIX2203026

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.

Donald James Lee Davidson
Quality Control

10-H-03
Date Signed

IPL Ref. No.: 987-7

000066



Isotope Products Laboratories

An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

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

α2

PAI 783
Recalibrated 4-15-03

CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

Radionuclide A: U-234
 Radionuclide B: U-235
 Radionuclide C: Am-241
 Half Life (U-234): $(2.454 \pm 0.008)E+05$ years
 Half Life (U-235): $(7.037 \pm 0.011)E+08$ years
 Half Life (Am-241): 432.17 ± 0.66 years

Customer: PARAGON ANALYTICS, INC.
 P.O. No.: EW040203/R2193
 Catalog No.: MISC-STD
 Reference Date: 1-May-03 12:00 PST
 Source No.: 92MIX2203028

Contained Radionuclide:

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.

David James Van Dalsen
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

ISO 9001 CERTIFIED

Medical Imaging Laboratory
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory
1800 North Keystone Street Burbank, California 91504

000067



Isotope Products Laboratories

An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

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

$\alpha 3$

PAT I.D 184
recalibrated 4-15-03

CERTIFICATE OF CALIBRATION MIXED ALPHA STANDARD SOURCE

Radionuclide A: U-234
 Radionuclide B: U-235
 Radionuclide C: Am-241
 Half Life (U-234): $(2.454 \pm 0.006)E+05$ years
 Half Life (U-235): $(7.037 \pm 0.011)E+08$ years
 Half Life (Am-241): 432.17 ± 0.66 years

Customer: PARAGON ANALYTICS, INC.
 P.O. No.: EW040203/R2193
 Catalog No.: MISC-STD
 Reference Date: 1-May-03 12:00 PST
 Source No.: 92MIX2203024

Contained Radioactivity:
 U-234: 3.227 nCi (119.4 Bq)
 U-235: 0.05205 nCi (1.926 Bq)
 Am-241: 2.866 nCi (106.0 Bq)
 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: $\pm 0.6\%$
 B. Type B (systematic) uncertainty: $\pm 3.0\%$
 C. Uncertainty in aliquot weighing: $\pm 0.0\%$
 D. Total uncertainty at the 99% confidence level: $\pm 3.1\%$

- 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 2 π on 11 Apr 03.

David James Van Dusen
 Quality Control

15-11-01-03
 Date Signed

IPL Ref. No.: 987-7

000068



**Isotope Products
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An Eckert & Ziegler Company

24937 Avenue Tibbitts
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24

PAI 40 0185
Rec'd from recalibrator
3-25-03

**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.

David Thomas Van Der...
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory
1000 Avenue Tibbitts, Valencia, California 91355

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

000069



Isotope Products Laboratories

An Eckert & Ziegler Company

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Valencia, California 91355

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

25

PAID 06-186
Specification
received 196
3-28-03

CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

Radionuclide A: U-234
Radionuclide B: U-235
Radionuclide C: Am-241
Half Life (U-234): $(2.454 \pm 0.006)E+05$ years
Half Life (U-235): $(7.037 \pm 0.011)E+08$ years
Half Life (Am-241): 432.17 ± 0.66 years

Customer: PARAGON ANALYTICS, INC.
P.O. No.: EW030603/R2155
Catalog No.: MISC-STD
Reference Date: 1-Apr-03 12:00 PST
Source No.: 92MIX2203025

Contained Radioactivity:

U-234: 5.486 nCi (203.0 Bq)
U-235: 0.09221 nCi (3.412 Bq)

Am-241: 3.958 nCi (146.4 Bq)
Total Activity: 8.536 nCi (352.8 Bq)

Physical description:

- A. Capsule type:
- B. Nature of active deposit:
- C. Active Diameter:
- D. Backing:
- E. Cover:

Disk (22 mm OD X 0.79 mm THK)
Electrodeposited and diffusion bonded oxides
19 mm
Stainless steel
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: $\pm 0.8\%$
- B. Type B (systematic) uncertainty: $\pm 3.1\%$
- C. Uncertainty in aliquot weighing: $\pm 0.0\%$
- D. Total uncertainty at the 99% confidence level: $\pm 3.2\%$

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 Kenneth Dalton
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory
1800 North Keystone Street Burbank, California 91504

000070

**Isotope Products
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

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

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✓ A110, GC 187
level for recalibrate
3-25-03

CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

Radionuclide A: U-234
Radionuclide B: U-235
Radionuclide C: Am-241
Half Life (U-234): $(2.454 \pm 0.006)E+05$ years
Half Life (U-235): $(7.037 \pm 0.011)E+08$ years
Half Life (Am-241): 432.17 ± 0.66 years

Customer: PARAGON ANALYTICS, INC.
P.O. No.: EW030603/R2155
Catalog No.: MISC-STD
Reference Date: 1-Apr-03 12:00 PST
Source No.: 92MIX2203022

Contained Radioactivity:

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

Physical description:

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

Radioimpurities:

Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel James Van Der Kolk
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory
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Industrial Gauging Laboratory
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**Isotope Products
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PA ID 188
Spec for recalibration
3-28-03

**CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOURCE**

Radionuclide A: U-234
Radionuclide B: U-235
Radionuclide C: Am-241
Half Life (U-234): $(2.454 \pm 0.006)E+05$ years
Half Life (U-235): $(7.037 \pm 0.011)E+08$ years
Half Life (Am-241): 432.17 ± 0.66 years

Customer: PARAGON ANALYTICS, INC.
P.O. No.: EW030603/R2155
Catalog No.: MISC-STD
Reference Date: 1-Apr-03 12:00 PST
Source No.: 92MIX2203023

Contained Radioactivity:

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

Physical description:

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

Radioimpurities:

Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

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 2 π on 18 Mar 03.

Daniel James Van Dalsen
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

ISO 9001 CERTIFIED

Medical Imaging Laboratory
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000072



**Isotope Products
Laboratories**

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PAI ID 189
rec'd 4-21-03
recalibrated 4-15-03

**CERTIFICATE OF CALIBRATION
MIXED ALPHA STANDARD SOURCE**

Radionuclide A: U-234
Radionuclide B: U-235
Radionuclide C: Am-241
Half Life (U-234): $(2.454 \pm 0.006)E+05$ years
Half Life (U-235): $(7.037 \pm 0.011)E+08$ years
Half Life (Am-241): 432.17 ± 0.66 years

Customer: PARAGON ANALYTICS, INC.
P.O. No.: EW040203/R2193
Catalog No.: MISC-STD
Reference Date: 1-May-03 12:00 PST
Source No.: 92MIX2203029

Contained Radioactivity:
U-234: 9.048 nCi (334.8 Bq) Am-241: 1.433 nCi (53.02 Bq)
U-235: 0.1771 nCi (6.553 Bq) Total Activity: 10.66 nCi (394.4 Bq)

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

Radioimpurities: Not determined

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

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

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

Daniel James Van Dalen
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

000073