Paragon Analytics

Radiochemistry Case Narrative
Isotopic Thorium

Kent & Sullivan Inc.

Ross Adams

PA WO 0405095

1. This report consists of the analytical results and supporting documentation for two water samples received by Paragon on 05/11/04.

2. These samples were prepared according to Paragon Analytics procedures PA SOP776R8 and PA SOP777R7.

3. The samples were analyzed for the presence of isotopic thorium according to Paragon Analytics procedure PA SOP714R8. The analyses were completed on 06/07/04.

4. The analysis results for these samples are reported in units of pCi/L. The water samples were not filtered prior to analysis.

5. 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 — 6/17/04

Skye Dobberstein — Date

Radiochemistry Instrumentation

Radiochemistry Final Data Review — 6/18/04

Date

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PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

SAMPLE RESULTS SUMMARY

Isotopic Thorium By Alpha Spectroscopy Sample Results Summary

Client Name: Kent & Sullivan Inc.
Client Project Name: Ross Adams
Client Project Number:

Laboratory Name: Paragon Analytics
PAI Work Order: 0405095

Page: 1 of 1
Reported on: Thursday, June 17, 2004 11:38:59 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0405095-4	SW-05	Sample	Th-228	0.174 +/- 0.074	0.087	pCi/l	WATER	AS040601-3	6/6/2004	LT
0405095-4	SW-05	Sample	Th-230	0.149 +/- 0.079	0.119	pCi/l	WATER	AS040601-3	6/6/2004	LT
0405095-4	SW-05	Sample	Th-232	0.103 +/- 0.049	0.048	pCi/l	WATER	AS040601-3	6/6/2004	LT
0405095-6	SW-07	Sample	Th-228	0.91 +/- 0.20	0.12	pCi/l	WATER	AS040601-3	6/6/2004	
0405095-6	SW-07	Sample	Th-230	0.91 +/- 0.20	0.12	pCi/l	WATER	AS040601-3	6/6/2004	
0405095-6	SW-07	Sample	Th-232	0.284 +/- 0.085	0.031	pCi/l	WATER	AS040601-3	6/6/2004	

Comments:

Data Package ID: *th0405095-1*

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

000003

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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: 0405095
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Lab ID: AS040601-3MB

Sample Matrix: WATER
Prep SOP: PAI 777 Rev 7
Date Collected: 01-Jun-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: AS040601-3
QCBatchID: AS040601-3-1
Run ID: AS040601-3a
Count Time: 420 minutes

Final Aliquot: 1000 ml
Result Units: pCi/l
File Name: T6013B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	-0.007 +/- 0.028	0.071	U
14269-63-7	Th-230	0.011 +/- 0.055	0.117	U
7440-29-1	Th-232	0.006 +/- 0.017	0.029	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	4.504	3.60	pCi/l	79.9	30 - 110 %	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

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

Data Package ID: *TH0405095-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Laboratory Control Sample(s)

Lab Name: Paragon Analytics
Work Order Number: 0405095
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Lab ID: AS040601-3LCS

Sample Matrix: WATER
Prep SOP: PAI 777 Rev 7
Date Collected: 01-Jun-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: AS040601-3
QCBatchID: AS040601-3-1
Run ID: AS040601-3a
Count Time: 420 minutes

Final Aliquot: 1000 ml
Result Units: pCi/l
File Name: T6013L

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14269-63-7	Th-230	5.25 +/- 0.90	0.12	4.59	114	85 - 121	P

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	4.504	3.46	pCi/l	76.8	30 - 110 %	

Comments:

Qualifiers/Flags:

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

Abbreviations:

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

Data Package ID: *TH0405095-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Duplicate Sample Results (DER)

Lab Name: Paragon Analytics
Work Order Number: 0405095
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Field ID: SW-05
Lab ID: 0405095-4DUP

Sample Matrix: WATER
Prep SOP: PAI 777 Rev 7
Date Collected: 06-May-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: AS040601-3
QCBatchID: AS040601-3-1
Run ID: AS040601-3a
Count Time: 420 minutes
Report Basis: Unfiltered

Final Aliquot: 1000 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: T50954D

CASNO	Analyte	Sample Result +/- 2 s TPU	Duplicate Result +/- 2 s TPU	DER	Control Limit	Lab Qualifiers
14274-82-9	Th-228	0.174 +/- 0.074	0.065 +/- 0.062	1.13	2.13	U
14269-63-7	Th-230	0.149 +/- 0.079	0.134 +/- 0.080	0.13	2.13	LT
7440-29-1	Th-232	0.103 +/- 0.049	0.078 +/- 0.044	0.36	2.13	LT

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: *TH0405095-1*

PARAGON ANALYTICS
Radiochemistry Data Package

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Section 3

INDIVIDUAL SAMPLE RESULTS

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Sample Results

Lab Name: Paragon Analytics
Work Order Number: 0405095
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Field ID: SW-05
Lab ID: 0405095-4

Sample Matrix: WATER
Prep SOP: PAI 777 Rev 7
Date Collected: 06-May-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: AS040601-3
QCBatchID: AS040601-3-1
Run ID: AS040601-3a
Count Time: 420 minutes
Report Basis: Unfiltered

Final Aliquot: 1000 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: T50954

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	0.174 +/- 0.074	0.087	LT
14269-63-7	Th-230	0.149 +/- 0.079	0.119	LT
7440-29-1	Th-232	0.103 +/- 0.049	0.048	LT

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	4.504	3.47	pCi/l	77.1	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: *TH0405095-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Sample Duplicate Results

Lab Name: Paragon Analytics
Work Order Number: 0405095
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Field ID: SW-05
Lab ID: 0405095-4DUP

Sample Matrix: WATER
Prep SOP: PAI 777 Rev 7
Date Collected: 06-May-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: AS040601-3
QCBatchID: AS040601-3-1
Run ID: AS040601-3a
Count Time: 420 minutes
Report Basis: Unfiltered

Final Aliquot: 1000 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: T50954D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	0.065 +/- 0.062	0.110	U
14269-63-7	Th-230	0.134 +/- 0.080	0.125	LT
7440-29-1	Th-232	0.078 +/- 0.044	0.042	LT

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	4.504	3.71	pCi/l	82.4	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.

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: *TH0405095-1*

Isotopic Thorium By Alpha Spectroscopy

PAI 714 Rev 8

Sample Results

Lab Name: Paragon Analytics
Work Order Number: 0405095
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Field ID: SW-07
Lab ID: 0405095-6

Sample Matrix: WATER
Prep SOP: PAI 777 Rev 7
Date Collected: 03-May-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: AS040601-3
QCBatchID: AS040601-3-1
Run ID: AS040601-3a
Count Time: 420 minutes
Report Basis: Unfiltered

Final Aliquot: 1000 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: T50956

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14274-82-9	Th-228	0.91 +/- 0.20	0.12	
14269-63-7	Th-230	0.91 +/- 0.20	0.12	
7440-29-1	Th-232	0.284 +/- 0.085	0.031	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	4.504	3.54	pCi/l	78.7	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: *TH0405095-1*

PARAGON ANALYTICS
Radiochemistry Data Package

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Section 4

RAW DATA

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: Paragon Analytics
PAI Work Order: 0405095

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Thursday, June 17, 2004
11:31:47 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
0405095-4	Th-228	5/6/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	37.820	31.28%	420	0.174	0.087	pCi/l	NA	
SMP	Trg. Analyte	11:45:00 AM	AS040601-3-1	NA	NA	NA	1000 ml	59	T50954	2:29 PM	29.000	1000	77.1%	0.074	NA	Unfiltered	NA	LT
0405095-4	Th-229	5/6/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	1012.330	31.28%	420	3.47	0.05	pCi/l	NA	
SMP	Tracer	11:45:00 AM	AS040601-3-1	NA	NA	NA	1000 ml	59	T50954	2:29 PM	13.500	1000	77.1%	0.55	NA	Unfiltered	NA	
0405095-4	Th-230	5/6/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	33.424	31.28%	420	0.149	0.119	pCi/l	NA	
SMP	Trg. Analyte	11:45:00 AM	AS040601-3-1	NA	NA	NA	1000 ml	59	T50954	2:29 PM	63.276	1000	77.1%	0.079	NA	Unfiltered	NA	LT
0405095-4	Th-232	5/6/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	23.060	31.28%	420	0.103	0.048	pCi/l	NA	
SMP	Trg. Analyte	11:45:00 AM	AS040601-3-1	NA	NA	NA	1000 ml	59	T50954	2:29 PM	7.000	1000	77.1%	0.049	NA	Unfiltered	NA	LT
0405095-4	Th-228	5/6/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	12.460	25.76%	420	0.065	0.110	pCi/l	1.13	
DUP	Trg. Analyte	11:45:00 AM	AS040601-3-1	NA	NA	NA	1000 ml	60	T50954D	2:30 PM	37.000	1000	82.4%	0.062	NA	Unfiltered	NA	U
0405095-4	Th-229	5/6/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	891.110	25.76%	420	3.71	0.04	pCi/l	NA	
DUP	Tracer	11:45:00 AM	AS040601-3-1	NA	NA	NA	1000 ml	60	T50954D	2:30 PM	4.500	1000	82.4%	0.60	NA	Unfiltered	NA	
0405095-4	Th-230	5/6/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	26.480	25.76%	420	0.134	0.125	pCi/l	0.13	
DUP	Trg. Analyte	11:45:00 AM	AS040601-3-1	NA	NA	NA	1000 ml	60	T50954D	2:30 PM	53.618	1000	82.4%	0.080	NA	Unfiltered	NA	LT
0405095-4	Th-232	5/6/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	15.530	25.76%	420	0.078	0.042	pCi/l	0.36	
DUP	Trg. Analyte	11:45:00 AM	AS040601-3-1	NA	NA	NA	1000 ml	60	T50954D	2:30 PM	3.500	1000	82.4%	0.044	NA	Unfiltered	NA	LT
0405095-6	Th-228	5/3/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	197.850	30.73%	420	0.91	0.12	pCi/l	NA	
SMP	Trg. Analyte	4:03:00 PM	AS040601-3-1	NA	NA	NA	1000 ml	61	T50956	2:30 PM	57.500	1000	78.7%	0.20	NA	Unfiltered	NA	
0405095-6	Th-229	5/3/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	1015.690	30.73%	420	3.54	0.03	pCi/l	NA	
SMP	Tracer	4:03:00 PM	AS040601-3-1	NA	NA	NA	1000 ml	61	T50956	2:30 PM	5.500	1000	78.7%	0.56	NA	Unfiltered	NA	
0405095-6	Th-230	5/3/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	204.131	30.73%	420	0.91	0.12	pCi/l	NA	
SMP	Trg. Analyte	4:03:00 PM	AS040601-3-1	NA	NA	NA	1000 ml	61	T50956	2:30 PM	63.974	1000	78.7%	0.20	NA	Unfiltered	NA	

Comments:

Data Package ID: *th0405095-1*

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 Recieved' while the Report Basis is 'Dry Weight'.

- Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Recieved'.

M - Requested MDC not met.

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

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

NC - Not Calculated for duplicate results less than 5 times MDC

B - Analyte concentration greater than MDC.

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

Notes:

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

2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

Abbreviations:

TR- Tracer TA - Target Analyte

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

00013

Isotopic Thorium By Alpha Spectroscopy Raw Data Report

Laboratory Name: Paragon Analytics
PAI Work Order: 0405095

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Thursday, June 17, 2004
11:31:47 AM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	Net Cnts Bkg Cnts	BaseEff Bkg(min)	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
0405095-6	Th-232	5/3/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	64.160	30.73%	420	0.284	0.031	pCi/l	NA	
SMP	Trg. Analyte	4:03:00 PM	AS040601-3-1	NA	NA	NA	1000 ml	61	T50956	2:30 PM	2.000	1000	78.7%	0.085	NA	Unfiltered	NA	
AS040601-3	Th-228	6/1/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	-1.560	29.63%	420	-0.007	0.071	pCi/l	NA	
MB	Trg. Analyte	11:55:55 AM	AS040601-3-1	NA	NA	NA	1000 ml	62	T6013B	2:30 PM	18.000	1000	79.9%	0.028	NA	Unfiltered	NA	U
AS040601-3	Th-229	6/1/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	994.160	29.63%	420	3.60	0.03	pCi/l	NA	
MB	Tracer	11:55:55 AM	AS040601-3-1	NA	NA	NA	1000 ml	62	T6013B	2:30 PM	2.000	1000	79.9%	0.57	NA	Unfiltered	NA	
AS040601-3	Th-230	6/1/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	2.345	29.63%	420	0.011	0.117	pCi/l	NA	
MB	Trg. Analyte	11:55:55 AM	AS040601-3-1	NA	NA	NA	1000 ml	62	T6013B	2:30 PM	58.703	1000	79.9%	0.055	NA	Unfiltered	NA	U
AS040601-3	Th-232	6/1/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	1.370	29.63%	420	0.006	0.029	pCi/l	NA	
MB	Trg. Analyte	11:55:55 AM	AS040601-3-1	NA	NA	NA	1000 ml	62	T6013B	2:30 PM	1.500	1000	79.9%	0.017	NA	Unfiltered	NA	U
AS040601-3	Th-229	6/1/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	949.370	29.44%	420	3.46	0.02	pCi/l	NA	
LCS	Tracer	11:55:55 AM	AS040601-3-1	NA	NA	NA	1000 ml	63	T6013L	2:30 PM	1.500	1000	76.8%	0.55	NA	Unfiltered	NA	
AS040601-3	Th-230	6/1/2004	AS040601-3	NA	NA	WATER	1000 ml	Alpha Spec	AS040601-3a	6/6/2004	1105.616	29.44%	420	5.25	0.12	pCi/l	NA	114
LCS	Trg. Analyte	11:55:55 AM	AS040601-3-1	NA	NA	NA	1000 ml	63	T6013L	2:30 PM	58.058	1000	76.8%	0.90	NA	Unfiltered	NA	P

Comments:

Data Package ID: *th0405095-1*

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 Recieved' while the Report Basis is 'Dry Weight'.

- Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Recieved'.

M - Requested MDC not met.

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

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

NC - Not Calculated for duplicate results less than 5 times MDC

B - Analyte concentration greater than MDC.

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

Notes:

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

2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

Abbreviations:

TR- Tracer TA - Target Analyte

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

00014

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/8/04 8:04:23 AM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0405095-4 TAS040601-3

Analysis Type: Thorium

Detector: MCB 8 Input 3

Date/Time of Count: 6/6/04 2:29:41 PM

Sample Volume: 1.000 Total, 1.000 Aliquot.

Live Time: **420.00 Minutes**

Chem. Yield: **77.06%**

Real Time: 422.05 Minutes

Total Eff.: 24.11 %

Dead Time: 0.5 %

Tracer Amount: 9.999 DPM, With Contaminate

Acquisition: 512 Channels

Efficiency: 31.28%

Analysis: Relative Region-Of-Interest

Original: 3,038 + 10.0408 * Chn + -0.00110 * Chn **2.

Spectrum Calibration: 3,038 + 10.0062 * Chn + -0.00110 * Chn **2.

Cal File:

Spectrum File: **C:\User\Alpha\ALPHA\T50954.SPC**

Background File: **C:\USER\ALPHA\BKGND\B4060159.SPC**

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

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	167.94	145	169	10.00	8.00	60.00	1.47	33.42	0.33
2	245.66	224	250	2.00	9.00	50.00	12.18	37.82	0.37
3	98.48	74	105	4.00	4.00	26.00	2.94	23.06	0.23
Tracer	184.30	170	210	16.00	67.00	1,018.00	5.67	1012.33	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	96.37	0.149	n/a	45.45 %
2	Th-228	5430.00	18.93	0.168	n/a	36.84 %
3	Th-232	4013.00	39.16	0.103	n/a	43.45 %
Tracer	Th-229	4845.00	153.61	4.504	n/a	6.14 %

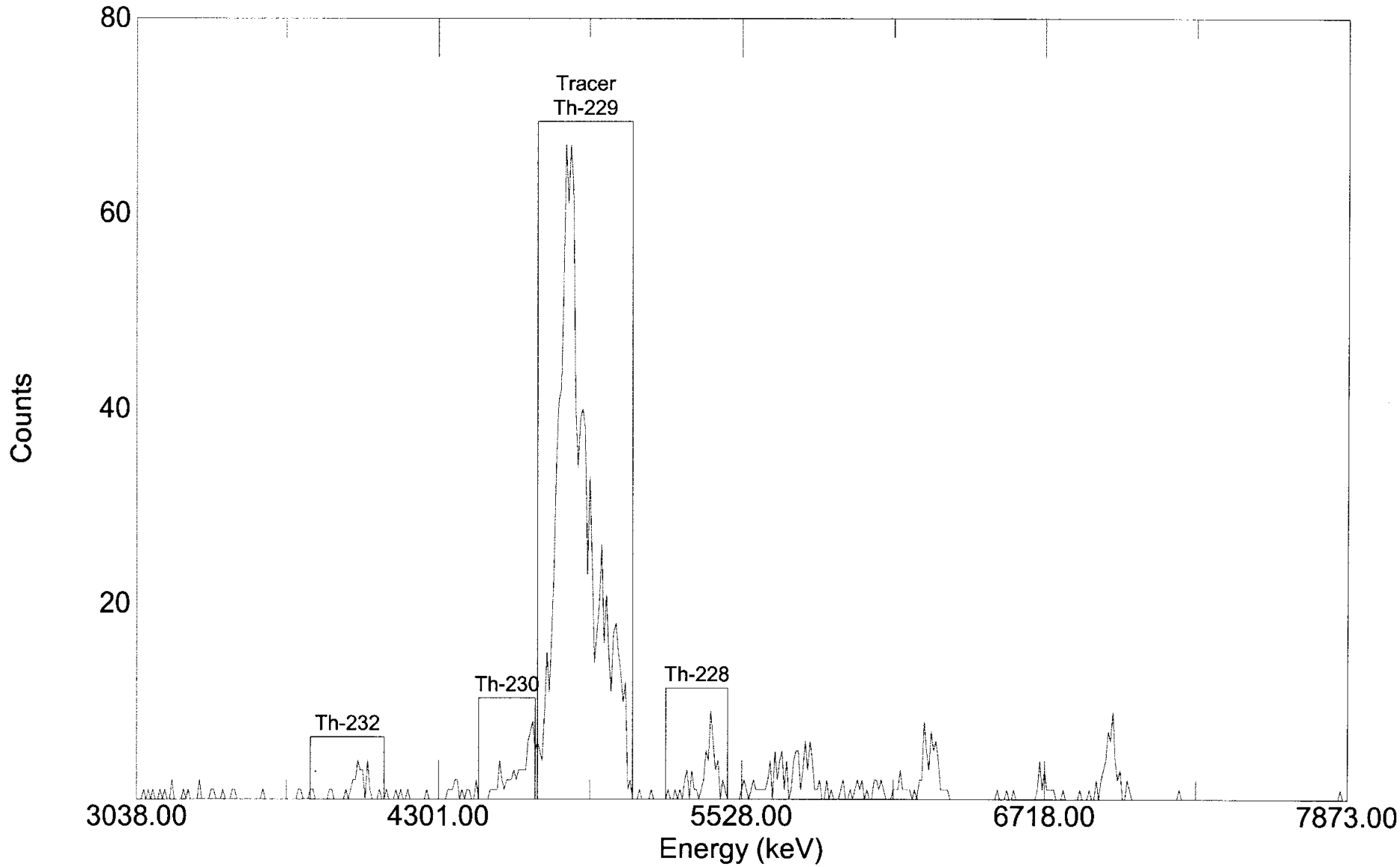
Totals

		% Total
Gross Count:	1,418.00	100.00
Net Area:	1,313.84	92.65
Background:	104.16	7.35
Composite Fit:	1,154.00	81.38
Residuals:	264.00	18.62

Analyzed By: Sm

Checked By: SD

T50954 AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 14:29:41 on 06-Jun-2004
File: C:\User\Alpha\ALPHA\T50954.SPC
Sample: 0405095-4 TAS040601-3

Real Time: 25323.16 s. Live Time: 25200.00 s.
Detector: #59 MCB 8 Input 3
Type: Thorium

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/6/04 9:32:22 PM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0405095-4D TAS040601-3
Analysis Type: Thorium

Detector: MCB 8 Input 4
Date/Time of Count: 6/6/04 2:30:14 PM
Sample Volume: 1.000 Total, 1.000 Aliquot.
Live Time: **420.00 Minutes**
Chem. Yield: **82.37%**
Real Time: 422.06 Minutes
Total Eff.: 21.22 %
Dead Time: 0.5 %
Tracer Amount: 9.999 DPM, With Contaminate
Acquisition: 512 Channels
Efficiency: 25.76%
Analysis: Relative Region-Of-Interest

Original: 3,005 + 10.1947 * Chn + -0.00130 * Chn **2.
Spectrum Calibration: 3,005 + 10.1734 * Chn + -0.00130 * Chn **2.
Cal File:

Spectrum File: **C:\USER\ALPHA\ALPHA\T50954D.SPC**
Background File: **C:\USER\ALPHA\BKGND\B4060160.SPC**
Library File: C:\User\Alpha\ALPHAVIS.ALB

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	169.01	147	170	2.00	6.00	49.00	0.42	26.48	0.30
2	246.06	224	249	2.00	5.00	28.00	15.54	12.46	0.14
3	100.33	76	107	2.00	3.00	17.00	1.47	15.53	0.17
Tracer	185.21	171	210	8.00	78.00	893.00	1.89	891.11	10.00

Analysis Results

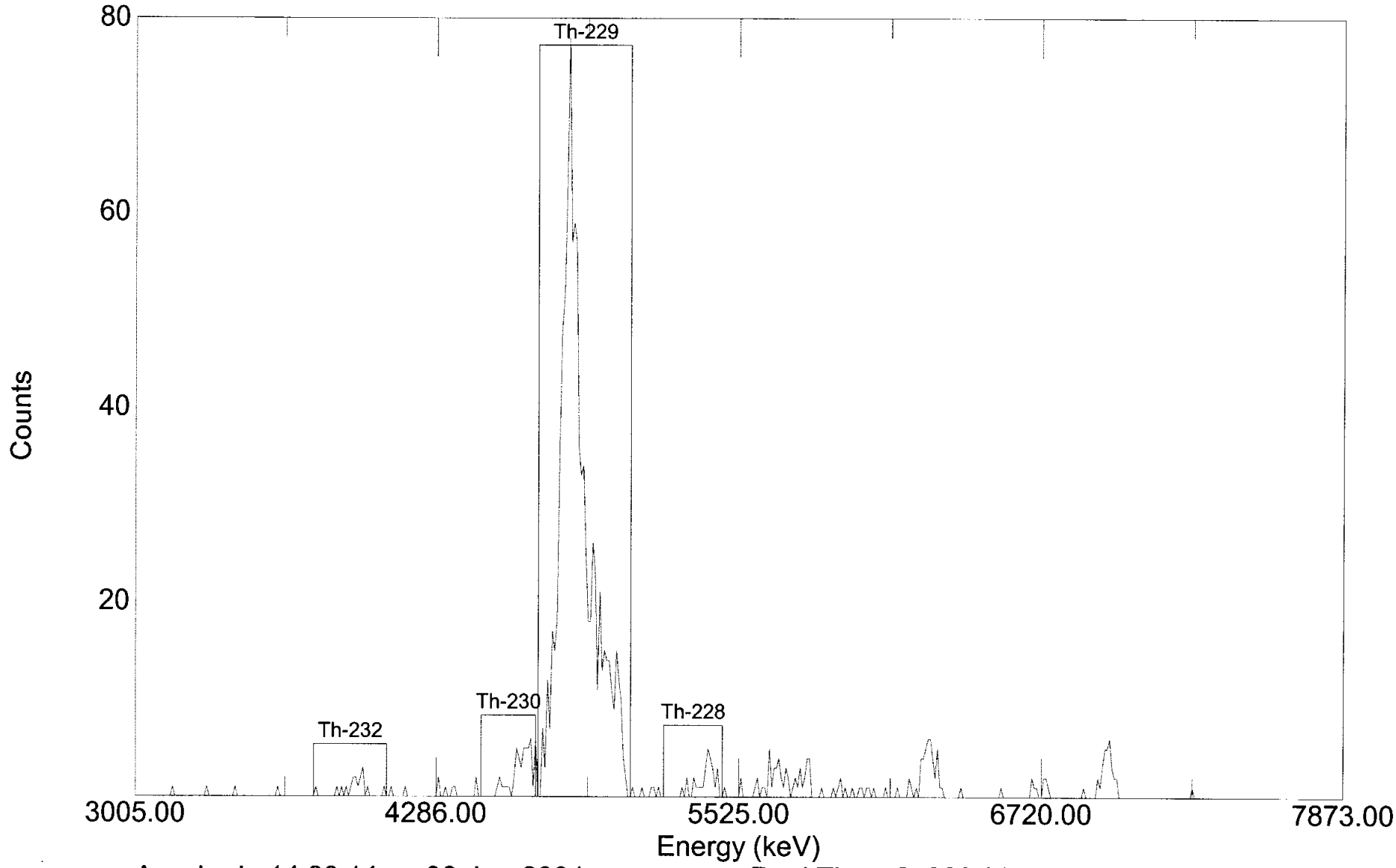
Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	19.47	0.134	n/a	51.82 %
2	Th-228	5430.00	19.07	0.063	n/a	84.25 %
3	Th-232	4013.00	19.83	0.078	n/a	52.14 %
Tracer	Th-229	4845.00	77.53	4.504	n/a	6.56 %

Totals

		% Total
Gross Count:	1,153.00	100.00
Net Area:	1,072.57	93.02
Background:	80.43	6.98
Composite Fit:	987.00	85.60
Residuals:	166.00	14.40

Analyzed By: Sm
Checked By: SD

T50954D AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 14:30:14 on 06-Jun-2004 Real Time: 25323.32 s. Live Time: 25200.00 s.
File: C:\USER\ALPHA\ALPHA\T50954D.SPC Detector: #60 MCB 8 Input 4
Sample: 0405095-4D TAS040601-3 Type: Thorium

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/6/04 9:32:37 PM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0405095-6 TAS040601-3

Analysis Type: Thorium

Detector: MCB 8 Input 5

Date/Time of Count: 6/6/04 2:30:29 PM

Sample Volume: 1.000 Total, 1.000 Aliquot.

Live Time: **420.00 Minutes**

Chem. Yield: **78.70%**

Real Time: 422.06 Minutes

Total Eff.: 24.19 %

Dead Time: 0.5 %

Tracer Amount: 9.999 DPM, With Contaminate

Acquisition: 512 Channels

Efficiency: 30.73%

Analysis: Relative Region-Of-Interest

Original: 3,062 + 9.8433 * Chn + -0.00045 * Chn **2.

Spectrum Calibration: 3,062 + 9.8367 * Chn + -0.00045 * Chn **2.

Cal File:

Spectrum File: **C:\USER\ALPHA\ALPHA\T50956.SPC**

Background File: **C:\USER\ALPHA\BKGND\B4060161.SPC**

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

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	166.54	145	168	2.00	26.00	231.00	1.68	204.13	2.01
2	243.45	221	246	2.00	29.00	222.00	24.15	197.85	1.95
3	97.10	73	104	2.00	10.00	65.00	0.84	64.16	0.63
Tracer	182.79	169	208	6.00	87.00	1,018.00	2.31	1015.69	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	19.37	0.905	n/a	14.60 %
2	Th-228	5430.00	19.23	0.877	n/a	14.80 %
3	Th-232	4013.00	19.50	0.285	n/a	24.64 %
Tracer	Th-229	4845.00	58.02	4.504	n/a	6.14 %

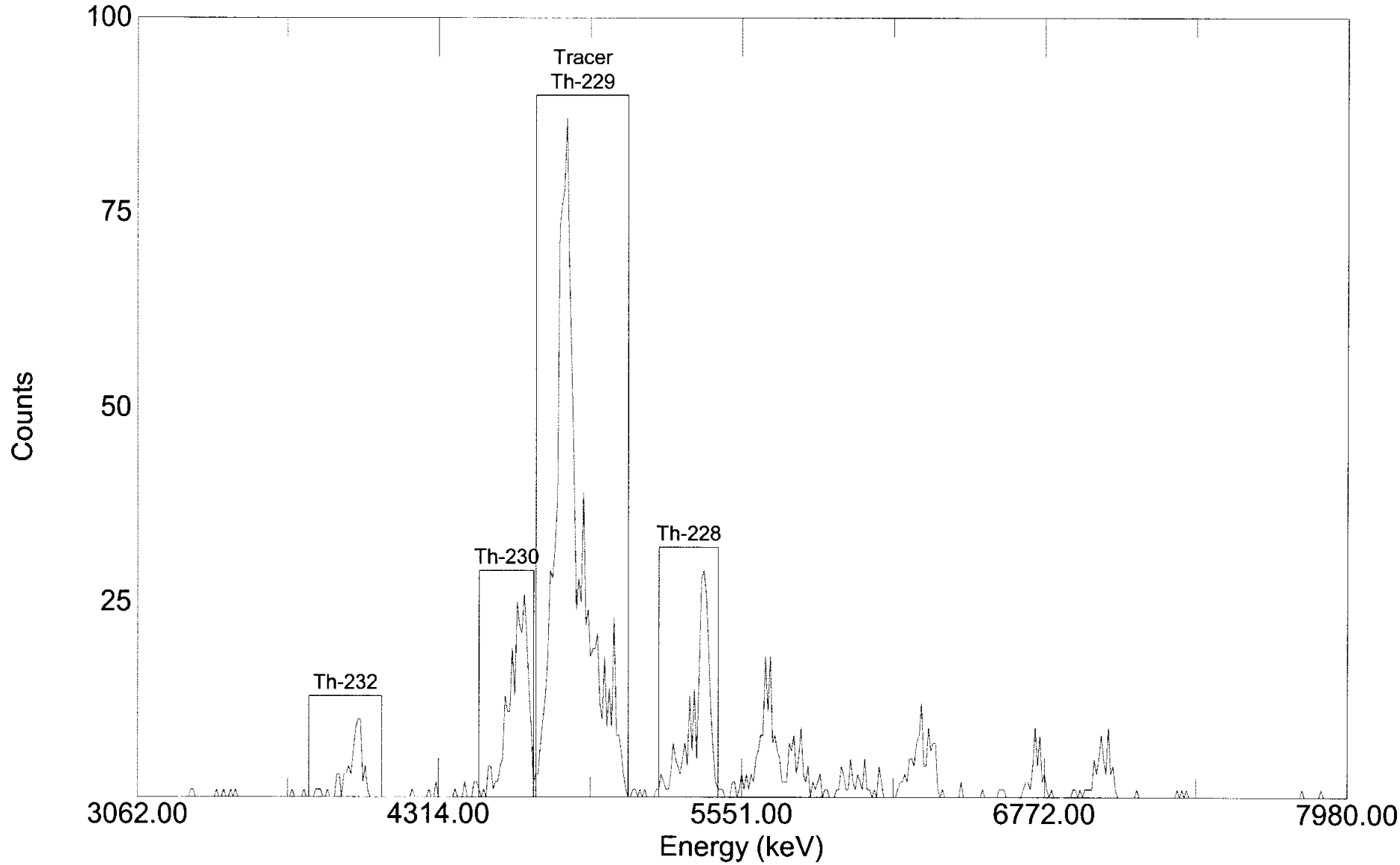
Totals

		% Total
Gross Count:	1,975.00	100.00
Net Area:	1,816.03	91.95
Background:	158.97	8.05
Composite Fit:	1,536.00	77.77
Residuals:	439.00	22.23

Analyzed By: Sm

Checked By: SD

T50956 AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 14:30:29 on 06-Jun-2004 Real Time: 25323.38 s. Live Time: 25200.00 s.
File: C:\USER\ALPHA\ALPHA\T50956.SPC Detector: #61 MCB 8 Input 5
Sample: 0405095-6 TAS040601-3 Type: Thorium

000020

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/6/04 9:32:52 PM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: AS040601-3MB TAS040601-3

Analysis Type: Thorium

Detector: MCB 8 Input 6

Date/Time of Count: 6/6/04 2:30:45 PM

Sample Volume: 1.000 Total, 1.000 Aliquot.

Live Time: **420.00 Minutes**

Chem. Yield: **79.89%**

Real Time: 422.06 Minutes

Total Eff.: 23.67 %

Dead Time: 0.5 %

Tracer Amount: 9.999 DPM, With Contaminate

Acquisition: 512 Channels

Efficiency: 29.63%

Analysis: Relative Region-Of-Interest

Original: 3,061 + 9.7795 * Chn + -0.00034 * Chn **2.

Spectrum Calibration: 3,061 + 9.7793 * Chn + -0.00034 * Chn **2.

Cal File:

Spectrum File: **C:\USER\ALPHA\ALPHA\T6013B.SPC**

Background File: **C:\USER\ALPHA\BKGND\B4060162.SPC**

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

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	167.31	145	169	6.00	4.00	27.00	0.00	2.34	0.02
2	244.31	222	247	2.00	2.00	6.00	7.56	-1.56	-0.02
3	97.68	74	105	2.00	1.00	2.00	0.63	1.37	0.01
Tracer	183.59	170	209	6.00	91.00	995.00	0.84	994.16	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	58.00	0.011	n/a	434.34 %
2	Th-228	5430.00	19.23	-0.007	n/a	-316.19 %
3	Th-232	4013.00	19.43	0.006	n/a	203.73 %
Tracer	Th-229	4845.00	57.93	4.504	n/a	6.21 %

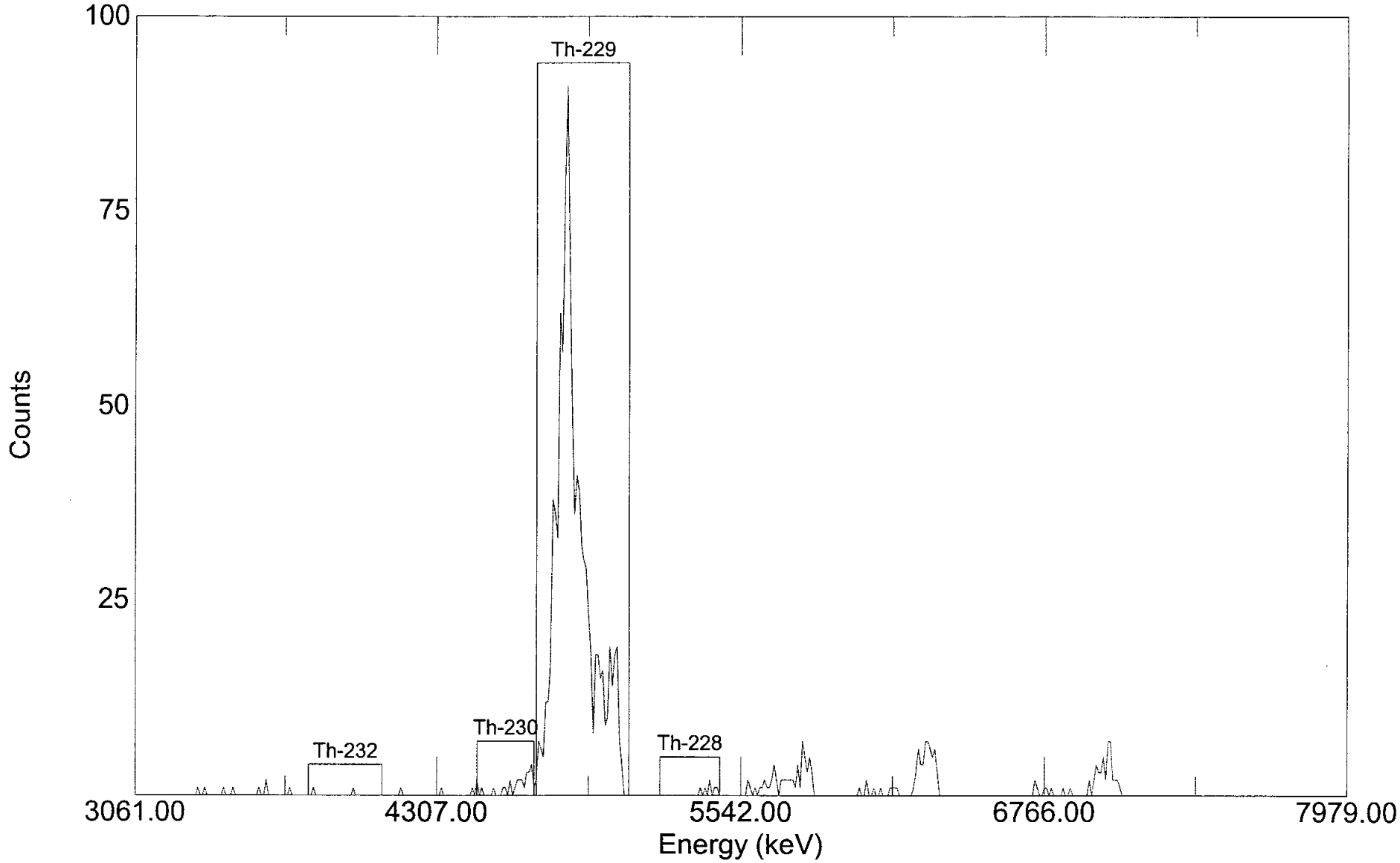
Totals

		% Total
Gross Count:	1,211.00	100.00
Net Area:	1,109.78	91.64
Background:	101.22	8.36
Composite Fit:	1,030.00	85.05
Residuals:	181.00	14.95

Analyzed By: Sm

Checked By: SD

T6013B AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 14:30:45 on 06-Jun-2004 Real Time: 25323.46 s. Live Time: 25200.00 s.
File: C:\USER\ALPHA\ALPHA\T6013B.SPC Detector: #62 MCB 8 Input 6
Sample: AS040601-3MB TAS040601-3 Type: Thorium

000022

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/8/04 8:07:03 AM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: AS040601-3LCS TAS040601-3

Analysis Type: Thorium

Detector: MCB 8 Input 7

Date/Time of Count: 6/6/04 2:30:57 PM

Sample Volume: 1.000 Total, 1.000 Aliquot.

Live Time: **420.00 Minutes**

Chem. Yield: **76.79%**

Real Time: 422.06 Minutes

Total Eff.: 22.61 %

Dead Time: 0.5 %

Tracer Amount: 9.999 DPM, With Contaminate

Acquisition: 512 Channels

Efficiency: 29.44%

Analysis: Relative Region-Of-Interest

Original: 3,043 + 9.9280 * Chn + -0.00068 * Chn **2.

Spectrum Calibration: 3,043 + 9.9192 * Chn + -0.00068 * Chn **2.

Cal File:

Spectrum File: **C:\User\Alpha\ALPHA\T6013L.SPC**

Background File: **C:\USER\ALPHA\BKGND\B4060163.SPC**

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

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	167.75	142	168	2.00	101.00	1,131.00	0.84	1106.62	11.66
2	244.76	223	248	2.00	3.00	19.00	10.29	8.71	0.09
3	98.47	74	105	2.00	1.00	4.00	0.42	3.58	0.04
Tracer	184.00	169	208	4.00	61.00	950.00	0.63	949.37	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	19.38	5.250	n/a	5.96 %
2	Th-228	5430.00	19.17	0.041	n/a	99.25 %
3	Th-232	4013.00	19.57	0.017	n/a	109.75 %
Tracer	Th-229	4845.00	38.68	4.504	n/a	6.36 %

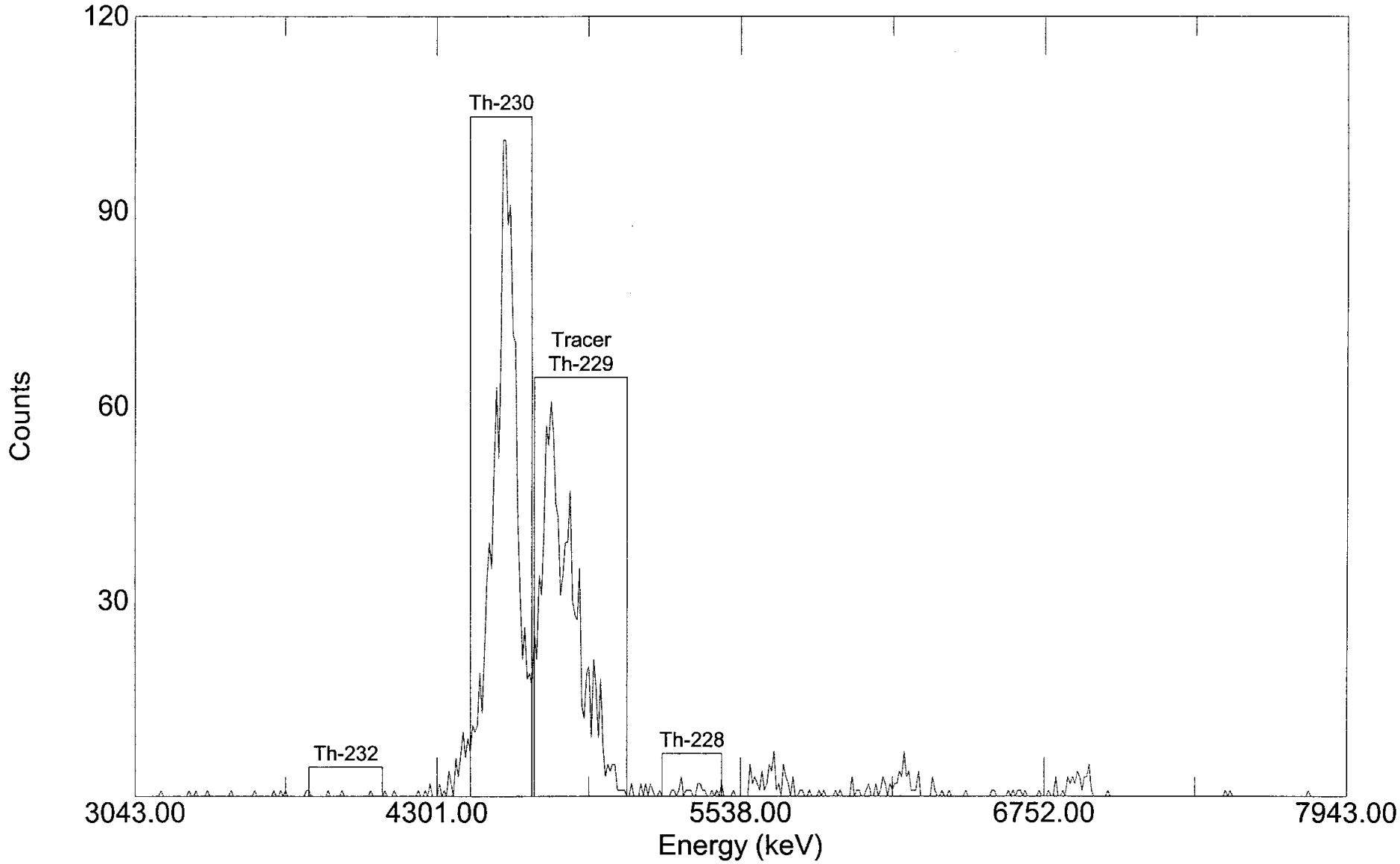
Totals

		% Total
Gross Count:	2,344.00	100.00
Net Area:	2,232.49	95.24
Background:	111.51	4.76
Composite Fit:	2,104.00	89.76
Residuals:	240.00	10.24

Analyzed By: Sm

Checked By: SD

T6013L AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 14:30:57 on 06-Jun-2004
File: C:\User\Alpha\ALPHA\T6013L.SPC
Sample: AS040601-3LCS TAS040601-3

Real Time: 25323.54 s. Live Time: 25200.00 s.
Detector: #63 MCB 8 Input 7
Type: Thorium

000024

Paragon Analytics

Alpha Spectrometer Instrument Run Log

FORM 746r6.xls (11/8/2000)

277763

Date: 6/6/04

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial	File ID/Comm.
1	P1040601-1	0405063-2	Po 210/S	300	JP	050632
2		-2D				2D
3		-3				3
4		-5				5
5		-7				7
7		-9				9
8		-11				11
49		P1040601-1MB				06011B
50		LCS				L
9	AS040601-2	0405086-8	U/W	300	JP	U50868
10	AS040601-6	0405135-1	U/S	300	JP	U51351
11		-2				2
12		-3				3
13		-3D				3D
15		-4				4
16		-5				5
17		-6				6
18		AS040601-6MB				U6016B
19		LCS				L
21	AS040527-5	0404254-11	U/S	300	JP	UR425411
22		-13				U425413
23		AS040527-5MB				U5275B
24		LCS				L
						JP 6/7/04

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial	File ID/Comm.
42	AS040601-3	0405086-1D	Th/W	420	JP	T50861D
43		-1D2				2
44		-23				3
45		-34				4
46		-45				5
47		-86				6
48		-67				7
57		-78				8
58		-89				9
59		0405095-4				T50954
60		0405095-4D				4D
61		-6				6
62		AS040601-3MB				T6013B
63		LCS				L
64	AS040526-10	0404121-1C	Th/Urine	2000	JP	T41211CD
						JP 6/7/04

JP 6/6/04

Notes:

Reviewed by: JP

Date: 6/7/04

000025

Paragon Analytics

FORM 746r6.xls (11/8/2000)

277764

Alpha Spectrometer Instrument Run Log

Date: 6-7-04

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial	File ID/Comm.
2	PL040601-1	0405063-11	Po/S	300	Sm	OR506311
9	AS040601-3	0405086-1	Th/S	300	Sm	T50861
10	↓	↓ -9	↓	↓	↓	TR50869
11	AS040527-5	AS040527-5LCS	U/S	300	Sm	UR5275L
12	AS040601-5	0405066-13RD2	U/S	300	Sm	U6015D2
13	↓	↓ -13R2	↓	↓	↓	R2
15	↓	AS040601-5MB	↓	↓	↓	B
16	↓	-5LCS	↓	↓	↓	L
17	↓	↓ -5LCSD	↓	↓	↓	LD
18	AS040601-4	0404219-1	U/S	180	Sm	U42191
19	↓	↓ -2	↓	↓	↓	-2
21	↓	↓ -3	↓	↓	↓	3
22	↓	↓ -4	↓	↓	↓	4
23	↓	↓ -4D	↓	↓	↓	4D
24	↓	↓ -5	↓	↓	↓	5
42	↓	↓ -6	↓	↓	↓	6
43	↓	↓ -7	↓	↓	↓	7
44	↓	↓ -8	↓	↓	↓	8
45	↓	AS040601-4MB	↓	↓	↓	U6014B
46	↓	↓ -4LCS	↓	↓	↓	↓ L
47	AS040528-1	040425-1	U/S	300	Sm	U42511
48	↓	↓ -1D	↓	↓	↓	1D
57	↓	↓ -2	↓	↓	↓	2
58	↓	↓ -3	↓	↓	↓	3

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial	File ID/Comm.
59	AS040528-1	0404251-4	U/S	300	Sm	U42514
60	↓	↓ -5	↓	↓	↓	5
61	↓	↓ -6	↓	↓	↓	6
62	↓	↓ -7	↓	↓	↓	7
63	↓	↓ -8	↓	↓	↓	8
9	AS040528-1	0404251-8	U/S	300	Sm	UR42518
10	↓	↓ -9	↓	↓	↓	U42519
11	↓	↓ -10	↓	↓	↓	10
12	↓	↓ -11	↓	↓	↓	11
13	↓	↓ -11D	↓	↓	↓	11D
15	↓	↓ -12	↓	↓	↓	12
16	↓	↓ -13	↓	↓	↓	13
17	↓	↓ -14	↓	↓	↓	14
18	↓	↓ -15	↓	↓	↓	15
19	↓	↓ -16	↓	↓	↓	16
21	↓	↓ -17	↓	↓	↓	17
22	↓	↓ -18	↓	↓	↓	18
23	↓	↓ -19	↓	↓	↓	↓ 19
24	↓	AS040528-1MB	↓	↓	↓	U52818
42	↓	↓ -1LCS	↓	↓	↓	↓ L
43	AS040528-2	0404251-1	~~TW~~/S		Sm	T42511
44	↓	↓ -2	↓	↓	↓	2
45	↓	↓ -2D	↓	↓	↓	2D
46	↓	↓ -3	↓	↓	↓	3

Notes: Cont. on page 277765 Sm 06-07-04

Reviewed by: SD

Date: 6/8/04

000026

PARAGON ANALYTICS
Radiochemistry Data Package

Section 5

QUALITY ASSURANCE SUMMARY REPORTS

5

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

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

LABORATORY BENCH SHEETS

6

Radiochemistry Instrument Worksheet

Paragon Analytics

Prep Batch: AS040601-3

Prep Procedure: ThISO

Analytical QASS / NCR? Y (N)

Prep Num	LabID	QC Type	Init Alq	Fin Alq	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	0405086-1	SMP	200	200	ml	T _50861	13D 6/6/04 41	9 dm	_50861			_50861			
1	0405086-1	DUP	200	200	ml	_50861D	15	42 JP	_50861D			_50861D			
1	0405086-2	SMP	500	500	ml	_50862	16	43	_50862			_50862			
1	0405086-3	SMP	500	500	ml	_50863	18	44	_50863			_50863			
1	0405086-4	SMP	500	500	ml	_50864	19	45	_50864			_50864			
1	0405086-5	SMP	500	500	ml	_50865	21	46	_50865			_50865			
1	0405086-6	SMP	500	500	ml	_50866	22	47	_50866			_50866			
1	0405086-7	SMP	500	500	ml	_50867 JP 6/6/04	24	48	_50867			_50867			
1	0405086-8	SMP	500	500	ml	_50868	42	57	_50868			_50868			
1	0405086-9	SMP	500	500	ml	_50869	43	58	TR-* 10 dm _50869			_50869			*Peak Shift JP 6/7/04
1	0405095-4	SMP	1000	1000	ml	_50954	44	59	_50954			_50954			
1	0405095-4	DUP	1000	1000	ml	_50954D	45	60	_50954D			_50954D			
1	0405095-6	SMP	1000	1000	ml	_50956	46	61	_50956			_50956			
1	AS040601-3	MB	1000	1000	ml	_6013B	47	62	_6013B			_6013B			
1	AS040601-3	LCS	1000	1000	ml	_6013L	48	63	_6013L			_6013L			SD 6/17/04

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	06/01/04	0.5	ml	AW004

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	TH-230	581.2613.24	20.381	DPM/ml	06/01/04	0.5	ml	AW00~~4~~ 9

– Benchsheet fixed.
SD 6/4/04

000003

Supersedes: NA

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS040601-3

Prep Procedure: ThISO

Reviewed By: gxc GC **Review Date:** 6/4/04 6/4/04

Non-Routine Pre-Treatment? Y (N) **Batch:** NA **Re-Prep?** Y (N) **Batch:** NA **Prep QASS / NCR?** (Y) / N 270454

Prep SOP: PAI 777 **Rev:** 7
Prep SOP: NONE
Matrix Class: liquid

Prep Analyst: Grace Campagnola
Prep Date: 6/1/04
Prep Dept: AP

Balance: NA
Balance: NA

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Micro Init	Micro Date	Standards	Prep Notes
1	1	0405086-1	SMP		200	200	Unfiltered	GC	6/3/04	T1	
2	1	0405086-1	DUP		200	200	Unfiltered			T1	
3	1	0405086-2	SMP		500	500	Unfiltered			T1	
4	1	0405086-3	SMP		500	500	Unfiltered			T1	
5	1	0405086-4	SMP		500	500	Unfiltered			T1	
6	1	0405086-5	SMP		500	500	Unfiltered			T1	
7	1	0405086-6	SMP		500	500	Unfiltered			T1	
8	1	0405086-7	SMP		500	500	Unfiltered			T1	
9	1	0405086-8	SMP		500	500	Unfiltered			T1	
10	1	0405086-9	SMP		500	500	Unfiltered			T1	
11	1	0405095-4	SMP		1000	1000	Unfiltered			T1	
12	1	0405095-4	DUP		1000	1000	Unfiltered			T1	
13	1	0405095-6	SMP		1000	1000	Unfiltered			T1	
14	1	AS040601-3	MB		1000	1000	Unfiltered			T1	
15	1	AS040601-3	LCS		1000	1000	Unfiltered			S1,T1	

6/4/04 GC

Spiked By: Grace Campagnola **Date:** 6/25/04
Witnessed By: Aaron Peterson **Date:** 9/26/04

Relinquished By: See previous
Date:
Received By:
Date:

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	06/01/04	0.5	ml	AW009

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	TH-230	581.2613.24	20.381	DPM/ml	06/01/04	0.5	ml	AW009

Comments
All samples received PEG treatment

000063

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS040601-3

Prep Procedure: ThISO

Reviewed By: GXC GC **Review Date:** 6/3/04 6/3/04

Non-Routine Pre-Treatment? Y / (N) **Batch:** NA **Re-Prep?** Y / (N) **Batch:** NA **Prep QASS / NCR?** (Y) / N 270454

Prep SOP: PAI 777 **Rev:** 7
Prep SOP: NONE
Matrix Class: liquid

Prep Analyst: Grace Campagnola
Prep Date: 6/1/04
Prep Dept: AP

Balance: NA
Balance: NA

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Micro Init	Micro Date	Standards	Prep Notes
1	1	0405086-1	SMP		200	200	Unfiltered	GC	6/3/04	T1	
2	1	0405086-1	DUP		200	200	Unfiltered			T1	
3	1	0405086-2	SMP		500	500	Unfiltered			T1	
4	1	0405086-3	SMP		500	500	Unfiltered			T1	
5	1	0405086-4	SMP		500	500	Unfiltered			T1	
6	1	0405086-5	SMP		500	500	Unfiltered			T1	
7	1	0405086-6	SMP		500	500	Unfiltered			T1	
8	1	0405086-7	SMP		500	500	Unfiltered			T1	
9	1	0405086-8	SMP		500	500	Unfiltered			T1	
10	1	0405086-9	SMP		500	500	Unfiltered			T1	
11	1	0405095-4	SMP		1000	1000	Unfiltered			T1	
12	1	0405095-4	DUP		1000	1000	Unfiltered			T1	
13	1	0405095-6	SMP		1000	1000	Unfiltered			T1	
14	1	AS040601-3	MB		1000	1000	Unfiltered			T1	
15	1	AS040601-3	LCS		1000	1000	Unfiltered			S1,T1	

6/3/04 GC

Spiked By: Grace Campagnola **Date:** 6/25/04
Witnessed By: Aaron Peterson **Date:** 9/26/04

Relinquished By: CDM
Date: 6/4/04
Received By: SD
Date: 6/4/04

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	06/01/04	0.5	ml	AW004

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	TH-230	581.2613.24	20.381	DPM/ml	06/01/04	0.5	ml	AW004

Comments
All samples received PEG treatment

000082

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS040601-3

Prep Procedure: ThISO

Prep Batch Not Validated!!!

Reviewed By: **Review Date:**

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

Prep SOP: PAI 777 **Rev:** 7
Prep SOP: NONE
Matrix Class: liquid

Prep Analyst: Grace Campagnola GC
Prep Date: 6/1/04 6/3/04
Prep Dept: AP

Balance: NA
Balance: NA

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Micro Init	Micro Date	Standards	Prep Notes (Funnel #)
1	1	0405086-1	SMP		200	1000	Unfiltered			T1	30
2	1	0405086-1	DUP		200	1000	Unfiltered			T1	21
3	1	0405086-2	SMP		500	1000	Unfiltered			T1	16
4	1	0405086-3	SMP		500	1000	Unfiltered			T1	22
5	1	0405086-4	SMP		500	1000	Unfiltered			T1	3
6	1	0405086-5	SMP		500	1000	Unfiltered			T1	31
7	1	0405086-6	SMP		500	1000	Unfiltered			T1	6
8	1	0405086-7	SMP		500	1000	Unfiltered			T1	2
9	1	0405086-8	SMP		500	1000	Unfiltered			T1	8
10	1	0405086-9	SMP		500	1000	Unfiltered			T1	25
11	1	0405095-4	SMP		1000	1000	Unfiltered			T1	28
12	1	0405095-4	DUP		1000	1000	Unfiltered			T1	29
13	1	0405095-6	SMP		1000	1000	Unfiltered			T1	35
14	1	AS040601-3	MB		1000	1000	Unfiltered			T1	38
15	1	AS040601-3	LCS		1000	1000	Unfiltered			S1,T1	39

Spiked By: GC **Date:** 6/2/04
Witnessed By: af **Date:** 6/2/04

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

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	06/01/04	0.5	ml	~~AW004~~ AW009 GC 6/1/04

exp 6/25/04

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	TH-230	581.2613.24	20.381	DPM/ml	06/01/04	0.5	ml	~~AW004~~ GC 6/2/04

exp 9/26/04 AW009

Comments

NA

Paragon Analytics
LIMS Version: 5.023A

Supersedes: _____

SAMPLE CONDITION FORM (LIQUID)

ANALYST: CDM

ANALYSIS DATE: 6/1/04 METHOD: Prep

WORK ORDER	SAMPLE ID	SAMPLE CONDITION pH	Color	Remarks
0405086	1	1.9	Clear	no visible sediment
	2			
	3			
	~~6~~ 4 CDM 6/1/04			
	5			
	6			
	7			
	8			
	9		yellow	
0405095	4	1.9	clear yellow	
	6	1.9	clear	
			6/3/04	

000034

PARAGON ANALYTICS
Radiochemistry Data Package

Section 7

STANDARDS TRACEABILITY DOCUMENTS

7

Th-229

Prepare a working level dilution of Th-229 630.2382.28 to 20 dpm/ml by diluting with 0.5M HNO_3 Lot K2966590L 183

1) Determine the density of 0.5M HNO_3

mass of 100 ml Class A volumetric flask	64.6096 g	bal 12
mass of flask and 100ml 0.5M HNO_3	165.7905 g	↓
net mass of 0.5M HNO_3	101.1809 g	

ρ = 1.0118 g/ml

2) Transfer approx 10g Th-229 (630.2382.28) into a 1L nalgene bottle

mass of 1L nalgene bottle without lid	74.9310 g	bal 12
mass of nalgene bottle + standard	85.5237 g	↓
net mass of standard transferred	10.5927 g	

3) Dilute to final volume with 0.5M HNO_3

mass of 1L nalgene bottle w/o lid from above	74.9310 g	
mass of nalgene bottle, standard, 0.5M HNO_3	957.6 g	bal 26
net mass of standard	882.67 g	

4) Final activity calculation

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

SD 6/26/03

Stnd 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

SD 6/26/03

SD 6/26/03

Continued on Page

Read and Understood By

Chuncavage 6/3/03 [signature] 6/26/03

Signed Date Signed Date

Prepare a 1° dilution of Analytics 64206-307 by transferring contents of the ampule to a ~~50 ml~~ 08/15/02 COA 250 ml Nalgene bottle & diluting to approx 150 ml w/ 0.5 N HNO_3. (Lot # K2933831 843 g/cm³)

1) Transfer contents of ampule to 250 ml bottle

Mass of empty Nalgene bottle (w/ lid)	23.9862 g (Bal 12)
Mass of opened ampule + 50 ml beaker	37.8921 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 + .5 N HNO_3	170.5635 g (Bal 12)
Net mass of std.	146.5773 g

3) Final Activity Calculation

$$\left(\frac{4.258 \times 10^7 \text{ dps}}{5.0424 \text{ g}}\right)\left(\frac{4.7388 \text{ g}}{146.5773 \text{ g}}\right)(60 \text{ s/m}) = 1647.2 \text{ dpm/g}$$

RG 9/16/02

Continued on Page ~~_____~~

Read and Understood By

Signed	Date	Signed	Date
[illegible]	8/15/02	Renee Vallejo	9/16/02

ANALYTICS

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

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: 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,

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.

PROJECT Th-230 working dilution 581.2613.24

Th-230
prepare a working level dilution of 581.1808.65 to 20 dpm/ml by diluting with 0.1M HNO_3

1) Determine the density of 0.1M HNO_3 Lot# K2965901133

mass of 100ml Class A Volumetric flask	67.7976 g (bal 12)
mass of flask + 100ml 0.1M HNO_3	167.6696 g ↓
Net mass of 0.1M HNO_3	99.8720 g
	ρ = 0.99872 g/ml

2) Transfer Th-230 std (581.1808.65) to a clean nalgene bottle.

Mass of nalgene bottle without lid	74.9174 g bal 12
Mass of bottle and standard	90.9270 g ↓
Net mass of standard	16.0096 g

3) Dilute to final volume with 0.1M HNO_3

Mass of nalgene bottle w/o lid from above	74.9174 g
Mass of bottle, standard, 0.1M HNO_3	986.9 g bal 26
Net mass of standard	911.9826 g

4) Final Activity Calculation

$$\frac{(1162.06\ dpm/ml)(16.0096\ g)}{911.9826\ g} = 20.40\ dpm/ml$$

SD 10/7/03

Stnd ID: 581.2613.24

Description: Th-230
Expiration: 9/26/04
Activity: 20.40 dpm/mL
2s Uncertainty: 0.44 dpm/mL
Ref. Date: 5/15/01
Ref Time: N/A
Prep Date: 9/11/03 Prep by: CDM
Matrix/Comp. 0.1 M HNO3
Half Life (y): 7.54E+04

SD 10/7/03

SD 10/7/03

SD 10/7/03

Continued on Page

Read and Understood By:

Chonce Nage — Signed — 9/11/03 Date

Signed — 10/7/03 Date

OJECT 581.1808.65 Th-230 Calibration Std.

10/01 Prepare a 1000 dpm/mL Solution of Th-230 by diluting RSD # 581 with 0.1 M HNO_3

1) Determine density of 0.1 M HNO_3 (6.25 mL conc. HNO_3 diluted to 1L with DI H_2O)

Mass of 100 mL volumetric flask	64.6110 g (balance #12)
Mass of flask + 0.1 M HNO_3	164.5707 g
Net mass of 0.1 M HNO_3	99.9597 g

$\rho = .99916$ 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	32.5073 g (balance #12)
Mass of 500 mL poly + standard	43.0529 g
Mass of Standard	10.5456 g

4) Bring Standard to final dilution with 0.1 M HNO_3

Mass of empty bottle (from above)	32.5073 g (balance #12)
Mass of bottle + Standard + 0.1 M HNO_3	233.16 g (balance #2e)
Net mass of std (diluted)	200.65 g DJS 5/10/01

5) Final Activity Calculation:

$$\frac{(18{,}390\ Bq)(60\ dpm/Bq)(0.99916\ g/mL)(10.5456\ g)}{(49.88438\ g)(200.65\ g)} = \cancel{1000.03}\ 1162.06\ dpm/mL$$

DJS 5/10/01

Stnd ID: 581.1808.65

Reverified 8/12/03.
New exp date = 8/7/04.
SD 8/13/03

DJS 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

DJS 6/15/02

ued on Page

Read and Understood By

R Fall — Signed — 5/10/01 Date

D. C. — 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

PAI ID 00581
Rec'd 5-02-01

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

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

ysical 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.

adioimpurities:

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

adionuclide 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

Paragon Analytics

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0405095
Client Name: Kent & Sullivan Inc.
Client Project Name: Ross Adams
Client Project Number:
Client PO Number:

Client Sample	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SW-01	0405095-1		WATER	05-May-04	16:40
SW-02	0405095-2		WATER	05-May-04	15:50
SW-04	0405095-3		WATER	04-May-04	17:52
SW-05	0405095-4		WATER	06-May-04	11:45
SW-06	0405095-5		WATER	06-May-04	8:50
SW-07	0405095-6		WATER	03-May-04	16:03
SW-08	0405095-7		WATER	03-May-04	16:59
SW-09	0405095-8		WATER	05-May-04	12:30
SW-10	0405095-9		WATER	05-May-04	14:57
SW-11	0405095-10		WATER	06-May-04	17:00
FR-01	0405095-11		WATER	06-May-04	8:00
FR-02	0405095-12		WATER	06-May-04	8:10

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

Chain-of-Custody

Accession Number (LAB ID) 0405095

Date _____ Page 1 of 9

Project Name / No.: Ross Adams Sampler(s): _____ (circle one) Turnaround: Standard or Rush (Due _____) Dispose or Return to Client

Report To: SUE KENT
Phone: 907 283-0949
Fax: 907 283-0947
Company: KENT & SULLIVAN INC
Address: 5345 THUNDER RD
KENAI AK 99611

circle method or specify under comments

Sample ID	Date	Time *	Lab ID	Matrix	No. of Containers	VOCs SW8260B E8260 E524.2 OLMO___	BTEX (only) SW8021B	SVOCs SW8270C E8270 OLMO___	OC Pesticides SW8081A E8081 E508 OLMO___	PCBs SW8082 E608 E508 OLMO___	OP Pesticides SW8141A E8141	Herbicides SW8151A E8151	TCLP Organics SW1311 8260B 8270C 8081A 8151A	TCLP Metals SW1311 6010B 7471	Total Metals SW6010B 7470 7471 E200 ILMO___	Dissolved Metals SW6010B 7470 E200 ILMO___	Reactive CN / S SW846 Chapter 7	Hexavalent Chromium SW7196A Alkaline Digest? Y / N	Inorganic Anions ** SW9056 E300.0	pH SW9040B 9045C	Oil & Grease SW9071A E413.2	TPH GRO DRO SW8015B (both)	TOX SW9020B	Gross Alpha / Beta SW9310 E900.0	Actinides by PAI SOP (circle) Pu / U / Am / Th / Cm	Total Uranium by KPA D5174-91	Tritium E906.0	Total Alpha-Emitting Radium SW9315 E903.0	Radium 226 SW9315 E903.0 Radium 228 SW9320 E904.0	Strontium 89 D5811-95 Strontium 90 D5811-95	Gamma Isotopes ** E901.1	Tc-99 isotopic	Pb 210
[illegible]	5/6/04	1640	1	SL	[illegible]										(B)									X					X				
[illegible]	5/6/04	[illegible]	2	[illegible]	[illegible]										(B)									X					X				
[illegible]	5/4/04	1152	3	[illegible]	5										(B)									X					X				
[illegible]	5/6/04	1145	4	[illegible]	[illegible]										X									X					X			X	X
[illegible]	5/6/04	0850	5	[illegible]	[illegible]										(B)									X					(X)				
[illegible]	[illegible]	16[illegible]	6	[illegible]	8										X									X					X			X	X
[illegible]	[illegible]	[illegible]	7	[illegible]	5										(B)									X					(X)				
[illegible]	[illegible]	[illegible]	8	[illegible]	5										(B)									X					(X)				
[illegible]	[illegible]	[illegible]	9	[illegible]	[illegible]										(B)									X					(X)				
[illegible]	5/6/04	1700	10	✓	[illegible]										(B)									X					(X)				

Comments:

(X) [illegible]

Relinquished By: (1)
Signature Gerald Warrick
Printed Name Gerald Warrick
Date 5-10-04 Time 10:00
Company Kent & Sullivan

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

Received By: (1)
Signature [illegible]
Printed Name Amy Wolf
Date 5/11/04 Time 1645
Company Paragon Analytics

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

Form 202i4.xls (1/3/01)

000045

* Time Zone (circle one): EST CST MST PST

** Indicate specific analytes under comments.

Distribution: white / yellow (Paragon); pink retained by originator.

Paragon Analytics, Inc.

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

Accession Number (LAB ID) 0405095

Chain-of-Custody

Date _____ Page 2 of 9

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

Report To:
Phone:
Fax:
Company:
Address: See page 1

circle method or specify under comments

Sample ID	Date 2004	Time *	Lab ID	Matrix	No. of Containers	VOCs SW8260B E624 E524.2 OLMO___	BTEX (only) SW8021B	SVOCs SW8270C E625 E525 OLMO___	OC Pesticides SW8081A E608 E508 OLMO___	PCBs SW8082 E608 E508 OLMO___	OP Pesticides SW8141A E614	Herbicides SW8151A E615	TCLP Organics SW1311 8260B 8270C 8081A 8151A	TCLP Metals SW 1311 6010B 7471	Total Metals SW6010B 7470 7471 E200 ILMO___	Dissolved Metals SW6010B 7470 E200 ILMO___	Reactive CN / S SW846 Chapter 7	Hexavalent Chromium SW7196A Alkaline Digest? Y / N	Inorganic Anions ** SW9056 E300.0	pH SW9040B 9045C	Oil & Grease SW9071A E413.2	TPH GRO DRO SW8015B (both)	TOX SW9020B	Gross Alpha / Beta SW9310 E900.0	Actinides by PAI SOP (circle): Pu / U / Am / Th / Cm	Uranium [redacted]	Tritium E906.0	Total Alpha-Emitting Radium SW9315 E903.0	Radium 226 SW9315 E903.0 Radium 228 SW9320 E904.0	Strontium 89 D5811-95 Strontium 90 D5811-95	Gamma Isotopes ** E901.1	Th-isotopic	U-isotopic
FR01	5-6-04	0800	11	W	2										B									X									
FR02	↓	0810	12	W	2										B									X									
MSED01 (*)	5-6	1300		SED	2										C											X			X			X	
MSED02	5-6	1310			3										C											X			X			X	
MSED03	5-6	1400			2¼										C											X			X			X	
MSED04	5-6	0910			3										C											X			X			X	X
MSED05	5-6	0920			3										C											X			X			X	
MSED06	5-7	0930			[redacted]										C											X			X			X	
MSED07	5-7	0900		↓	3										C											X			X			X	

Comments:
(B) Hold analyses pending metals analyses from samples [illegible] and [illegible]-07.
(C) Hold analyses pending metals results from samples DSH-01, 700-01, and 900-01.
(*) on WO# 0405016 on 5/12/04

Form 202r4.xls (1/3/01)

Relinquished By: (1)	Relinquished By: (2)
Signature: Gerald Warrick	Signature:
Printed Name: Gerald Warrick	Printed Name:
Date: 5-10-04 Time: 10:00	Date: Time:
Company: Kent + Sullivan	Company:

Received By: (1)	Received By: (2)
Signature: [illegible]	Signature:
Printed Name: Amy Wolf	Printed Name:
Date: 5/11/04 Time: 11:45	Date: Time:
Company: Paragon Analytics	Company:

* Time Zone (circle one): EST CST MST PST ** Indicate specific analytes under comments.

Distribution: white / yellow (Paragon); pink retained by originator.

000036

Paragon Analytics, Inc. -- Fort Collins, Colorado

CONDITION OF SAMPLE UPON RECEIPT FORM

CLIENT: Kent & Sullivan WORKORDER NO: 0405095

PROJECT MANAGER: Debbie Fazio INITIALS: DW DATE: 5/12/04

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

Cooler #'s	866	933	930	681	166	9	816	4	
Temperature	10°	10°	15°	10°	12°	12°	14°	11°	°C

Project Manager Signature / Date: Debbie Fazio 5/13/04

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, Inc. -- Fort Collins, Colorado

CONDITION OF SAMPLE UPON RECEIPT FORM

CLIENT: Kent & Sullivan WORKORDER NO: 0405095

PROJECT MANAGER: Debbie Fazzo INITIALS: DW DATE: 5/12/04

- X **Custody seals** broken (on outside of shipping container or on sample containers).
- No Chain-of-Custody (**COC**) present.
- **Number of samples** on the COC do not match the number of samples received.
- Aqueous samples **not preserved correctly** (see pH discussion below).
- SVOC samples contained **residual chlorine** (list sample IDs and affected containers below).
- X Samples received at **inappropriate temperature**.
- **Insufficient sample** to perform requested analyses.
- Extraction or analytical **holding times** expired in transit.
- **Broken/leaking bottles** and intact bottles received in same cooler (list affected sample IDs below).
- **No analyses requested.**
- **Incorrect sample type** received.
- VOAs, reactive CN/S, radon not **headspace** free (list sample IDs and affected vials below).
- **Airbills** not present and/or removable (record applicable shipper's tracking number below).
- X Other (describe below).

Describe discrepancy:

- Sample #1 - #10: 500 ml poly bottles are labeled for alkalinity analysis and were received at pH 7. Labels list preservative as HNO_3.
- Cooler #930 received with rear outside custody seal intact. Front custody seal was present but was not intact. All strapping tape was intact.
- All samples received between 10° - 15°C. Insufficient ice packed with samples. Refer to page 1 for cooler temperatures and refer to DOT ~~page~~ Survey pages for cooler contents.

DW 5/12/04

Was the client contacted? ___ No; ✓ Yes: Name Sue Kent Date/Time 5/13/04

Was the pH of any sample adjusted by the laboratory? ___ No; ___ Yes (see Table below):

NOTE: No pH adjustments shall be made without prior consent of Project Manager. After pH adjustment, hold metals and radchem samples ≥ 16 hr before analysis.

Sample ID	*Initial pH*	*Final pH (wait 30 min)*	*Type of Reagent Used*	*Lot No. of Reagent Used*	*Initials / Date / Time*

Was the laboratory directed to proceed with the analysis of any samples yielding the presence of residual chlorine? ___ No: ___ Yes (see notes above).

Project Manager Signature / Date: D 5/13/04

000048

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan Workorder No: 0405095

Project Manager: Debbie Fazio Initials: AW Date: 5/12/04

COOLER #: 866 External Micro R Meter Reading (μ R/hr): 50

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405095-6-5	SW-07	< background
0405095-8-2	SW-09	< background
0405095-8-3	SW-09	< background
0405095-8-4	SW-09	< background
0405095-8-5	SW-09	< background
0405095-10-2	SW-11	< background
0405095-10-3	SW-11	< background
0405095-10-4	SW-11	< background

COOLER #: 933 External Micro R Meter Reading (μ R/hr): 150

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405095-4-1	SW-05	< background
0405095-4-4	SW-05	< background
0405095-4-6	SW-05	< background
0405095-4-7	SW-05	< background
0405095-4-8	SW-05	< background

COOLER #: 930 External Micro R Meter Reading (μ R/hr): 380

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405095-2-1	SW-02	< background
0405095-2-2	SW-02	< background
0405095-2-3	SW-02	< background
0405095-6-8	SW-07	< background
0405095-7-4	SW-08	< background
0405095-7-5	SW-08	< background
0405095-8-1	SW-09	< background
0405095-9-3	SW-10	< background
0405095-10-1	SW-11	< background

If applicable, was the client contacted? **YES / NO / NA** Client Rep. Name: S. Kent Date/Time: 5/13/04

Project Manager Signature/ Date: 5/13/04

000049

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan Workorder No: 0405095

Project Manager: Debbie Fazio Initials: AW Date: 5/12/04

COOLER #: 681 External Micro R Meter Reading (μ R/hr): 70

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405095-1-1	SW-01	< background
0405095-1-2	SW-01	< background
0405095-1-3	SW-01	< background
0405095-1-4	SW-01	< background
0405095-1-5	SW-01	< background
0405095-3-2	SW-04	< background
0405095-6-1	SW-07	< background
0405095-9-1	SW-10	< background
0405095-9-2	SW-10	< background
0405095-9-5	SW-10	< background

COOLER #: 166 External Micro R Meter Reading (μ R/hr): 60

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405095-2-4	SW-02	< background
0405095-2-5	SW-02	< background
0405095-3-1	SW-04	< background
0405095-3-3	SW-04	< background
0405095-9-4	SW-10	< background
0405095-11-1	FR-01	< background
0405095-11-2	FR-01	< background
0405095-12-1	FR-02	< background
0405095-12-2	FR-02	< background

COOLER #: 9 External Micro R Meter Reading (μ R/hr): 80

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405095-3-4	SW-04	< background
0405095-3-5	SW-04	< background
0405095-4-2	SW-05	< background
0405095-4-3	SW-05	< background
0405095-4-5	SW-05	< background
0405095-5-1	SW-06	< background
0405095-5-2	SW-06	< background
0405095-5-3	SW-06	< background
0405095-5-5	SW-06	< background

If applicable, was the client contacted? YES / NO / NA Client Rep. Name: [illegible] Date/Time: 5/13/04

Project Manager Signature/ Date: [illegible] 5/13/04

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan Workorder No: 0405095

Project Manager: Debbie Fazio Initials: AW Date: 5/12/04

COOLER #: **816** External Micro R Meter Reading (μ R/hr): **50**

Paragon Sample ID:	**Client Sample ID:**	**Micro R Meter Reading (μ R/hr):**
0405095-5-4	SW-06	< background

COOLER #: **4** External Micro R Meter Reading (μ R/hr): **100**

Paragon Sample ID:	**Client Sample ID:**	**Micro R Meter Reading (μ R/hr):**
0405095-6-2	SW-07	< background
0405095-6-3	SW-07	< background
0405095-6-4	SW-07	< background
0405095-6-6	SW-07	< background
0405095-6-7	SW-07	< background
0405095-7-1	SW-08	< background
0405095-7-2	SW-08	< background
0405095-7-3	SW-08	< background
0405095-10-5	SW-11	< background

If applicable, was the client contacted? **YES / NO / NA** Client Rep. Name: Stuart Date/Time: 5/13/04

Project Manager Signature/ Date: 5/13/04

0405095

Air Cargo
Alaska Airlines
1-800-2ALASKA
Airbill Number
027 KTN 5436-6152 Box No. 0017
Destination
DEN
Pieces 17
Total Weight 865
Date 10-MAY-04
14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS
50 2 seals
#869
ARTIC 0-0410-3-1635

Air Cargo
Alaska Airlines
1-800-2ALASKA
Airbill Number
027 KTN 5436-6152 Box No. 0003
Destination
DEN
Pieces 17
Total Weight 865
Date 10-MAY-04
14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS
2 seals 150
#933
10oc
ARTIC 0-0410-3-1635

1-800-2ALASKA
027 KTN 5436-6152 Box No. 0012
Destination
DEN
Pieces 17
Total Weight 865
Date 10-MAY-04
14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS
#930 380
Back intact
Front Not
15oc
ARTIC 0-0410-3-1635

1-800-2ALASKA
027 KTN 5436-6152 Box No. 0004
Destination
DEN
Pieces 17
Total Weight 865
Date 10-MAY-04
14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS
70
10oc
#
68V
2 seals
ARTIC 0-0410-3-1635

000052

0405095

Air Cargo
Alaska Airlines
1-800-2ALASKA

Airbill Number: 027 KTN 5436-6152 Box No. 0013

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

60 12.0

8 2 seals

ARTIC 0-0410-3-1635

Air Cargo
Alaska Airlines
1-800-2ALASKA

027 KTN 5436-6152 Box No. 0016

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

80 12.0

9 2 seals

ARTIC 0-0410-3-1635

1-800-2ALASKA

027 KTN 5436-6152 Box No. 0005

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

100

4 2 seals

ARTIC 0-0410-3-1635

1-800-2ALASKA

027 KTN 5436-6152 Box No. 0014

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

50 14.0

8 2 seals

ARTIC 0-0410-3-1635

PARAGON ANALYTICS
Radiochemistry Data Package

Section 9

ADDITIONAL SUPPORTING DOCUMENTATION

9

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

Expires 3/31/05

The "Tracer Amount" field on theThorium raw data printouts show the activity amount, and the words "With Contamination". This is not actual contamination; it is the contribution of Th-229 counts to the Th-230 ROI. Using method blank data acquired from other Thorium analyses, a calculated percentage contribution of Th-229 counts to the Th-230 ROI was established to be 2.48%, 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

AlphaVision >> File >> Edit Nuclide Library... >> C:\User\Alpha\alphavis.alb

r:\forms\thcont.xls

Alpha Spectroscopy

Quality Control Data

Weekly Background, Energy, and Efficiency Calibrations

Calibration Data Summary

Laboratory Name: Paragon Analytics
PAI Work Order: 0405095

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Thursday, June 17, 2004
11:31:47 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
0405095-4	SMP	AS040601-3	ThISO	59	C4060159	6/1/2004	31.28	Pass	30.37	30.91	32.93	33.57
T50954		AS040601-3a			B4060159	6/2/2004	0.2480	Pass	0.0000	0.0500	0.4000	0.5000
6/6/2004					C4060159	6/1/2004	5536.6	Pass	5487.7	5497.7	5577.7	5587.7
0405095-4	DUP	AS040601-3	ThISO	60	C4060160	6/1/2004	25.76	Pass	24.46	24.90	26.60	27.04
T50954D		AS040601-3a			B4060160	6/2/2004	0.1915	Pass	0.0000	0.0500	0.4000	0.5000
6/6/2004					C4060160	6/1/2004	5530.1	Pass	5489.5	5499.5	5579.5	5589.5
0405095-6	SMP	AS040601-3	ThISO	61	C4060161	6/1/2004	30.73	Pass	29.44	29.97	31.92	32.54
T50956		AS040601-3a			B4060161	6/2/2004	0.3785	Pass	0.0000	0.0500	0.4000	0.5000
6/6/2004					C4060161	6/1/2004	5552.2	Pass	5529.6	5535.6	5559.6	5565.6
AS040601-3	MB	AS040601-3	ThISO	62	C4060162	6/1/2004	29.63	Pass	28.57	29.08	31.06	31.57
T6013B		AS040601-3a			B4060162	6/2/2004	0.2410	Pass	0.0000	0.0500	0.4000	0.5000
6/6/2004					C4060162	6/1/2004	5542.4	Pass	5493.0	5503.0	5583.0	5593.0
AS040601-3	LCS	AS040601-3	ThISO	63	C4060163	6/1/2004	29.44	Pass	28.32	28.83	30.79	31.30
T6013L		AS040601-3a			B4060163	6/2/2004	0.2655	Pass	0.0000	0.0500	0.4000	0.5000
6/6/2004					C4060163	6/1/2004	5539.9	Pass	5488.0	5498.0	5578.0	5588.0

Data Package ID: *th0405095-1*

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.

0057

Alpha Spec Calibration Source Re-Certification

R:\INSTI\ALPHA\CLCRT304.XLS

Primary Certified Source
Source PAI ID 190 was recalibrated by Isotope Products Laboratories on 03-01-2003 and recieved 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	Seqential #	Count Date	Am-241 net cts	U-234 net cts	count dur (s)	Combined cpm	Known dpm	detector efficiency
92MIX223027	190	97-19-103-09	3/22/04	7824.65	32919.75	2100	1164.126	3687.46	31.57%

Sources 1 through 8 activity determination

Source Serial #	PAI ID	Seqential #	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	13854.97	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	5752.75	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	7543.61	14571.72
92MIX2203023	188	97-19-103-07	3/22/04	46378.65	70560.76	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	Seqential #	Count Date	Am-241 net cts	U-234 net cts	count dur (s)	Combined cpm	Known dpm	detector efficiency	% difference from 1st count
92MIX223027	190	97-19-103-09	3/22/04	7548.69	32241.76	2100	1136.813	3687.46	30.83%	2.35%

Sources 1 through 8 activity re-verification

Source Serial #	PAI ID	Seqential #	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

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α·1

PAT 187
recalibrate 4-15-05

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 ± 0.006)E+05 years
Half Life (U-235): (7.037 ± 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.

Quality Control

15-May-03
Date Signed

IPL Ref. No.: 987-7

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α2

PAI 483
recalibrated 4-15-05

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 ± 0.006)E+05 years
Half Life (U-235): (7.037 ± 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 Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

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

Uncertainty of Measurement:

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

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

Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

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α3

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 ± 0.006)E+05 years
Half Life (U-235): (7.037 ± 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)	Am-241:	2.866	nCi	(106.0 Bq)
U-235:	0.05205	nCi	(1.926 Bq)	Total Activity:	6.145	nCi	(227.3 Bq)

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

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α 4

SAI I.D. 1 C 1 AS
rec'd from recalibrate
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.

Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α 5

#4 I-D 00186
Specification
received
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 ± 0.006)E+05 years
Half Life (U-235): (7.037 ± 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:	9.536	nCi	(352.8 Bq)

Physical description:

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

Radioimpurities: Not determined

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

Uncertainty of Measurement:

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

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

Daniel Lamont Dahlsten
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α 6

DATED, 00 187
Need to recalibrate
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.:	92MIX2203022
Half Life (Am-241):	432.17 ± 0.66 years		

Contained Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α 7

PAID 1858
rec'd 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 ± 0.006)E+05 years
Half Life (U-235): (7.037 ± 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)
U-235:	0.02502	nCi	(0.9257 Bq)
Am-241:	1.953	nCi	(72.26 Bq)
Total Activity:	4.873	nCi	(180.3 Bq)

Physical description:

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

Radioimpurities: Not determined

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

Uncertainty of Measurement:

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

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

Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α 8

PAI ID 189
recd 4-2-03
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 ± 0.006)E+05 years
Half Life (U-235): (7.037 ± 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)
U-235:	0.1771	nCi	(6.553 Bq)
Am-241:	1.433	nCi	(53.02 Bq)
Total Activity:	10.66	nCi	(394.4 Bq)

Physical description:

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

Radioimpurities: Not determined

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

Uncertainty of Measurement:

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

Notes:

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

Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7