Paragon Analytics

Radiochemistry Case Narrative
Isotopic Thorium & Ac-227

Kent & Sullivan Inc.

Ross Adams

PA WO 0405096

1. This report consists of the analytical results and supporting documentation for one soil sample received by Paragon on 05/11/04.

2. The sample was prepared according to Paragon Analytics procedures PA SOP773R8, PA SOP777R7, and PA SOP721R10. Modifications were made to the method as described on QASS 268111.

3. The sample was analyzed for the presence of isotopic thorium and Ac-227 according to Paragon Analytics procedure PA SOP714R8. The analysis was completed on 06/11/04.

4. At the client's request, Ac-227 activity is reported in this analysis based on the alpha emissions of the first decay product, Th-227. The spectral "region-of-interest" for these alpha emissions is from approximately 5916 keV to 6038 keV, comprising 54.58% of the total emitted particles. This 54.58% alpha abundance is combined with the Th-227/Ac-227 branching ratio of 98.62% to produce a final abundance correction of 53.83%. This analytical approach assumes that Th-227 is fully ingrown with the Ac-227 parent nuclide. In addition, a decay correction factor is needed based on the date of Th-227 separation from Ac-227. For this purpose an 18.718 day half-life is used to decay correct the Th-227 activity to the date of preparation.

5. The isotopic analysis results for this sample is reported on a dry weight basis in units of pCi/gram.

6. The requested MDC of 0.1 pCi/gram for Th-230 was not achieved. However, the amount of Th-230 reportable activity exceeds the achieved MDC values. It is identified by an "M3" flag on the final report.

7. No further anomalous situations were encountered during the preparation or analysis of this sample. All remaining quality control criteria were met.

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

Sharon Muller — 7-30-04

Sharon Muller
Radiochemistry Instrumentation
Date

John Petro — 7/30/04

Radiochemistry Final Data Review
Date

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PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

SAMPLE RESULTS SUMMARY

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Isotopic Thorium By Alpha Spec w/Ac-227 Sample Results Summary

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

Laboratory Name: Paragon Analytics
PAI Work Order: 0405096

Reported on: Friday, July 30, 2004
8:15:43 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0405096-4	MSED-04	Sample	Ac-227	0.37 +/- 0.14	0.03	pCi/g	SOIL	AS040607-2	6/11/2004	
0405096-4	MSED-04	Sample	Th-228	2.19 +/- 0.44	0.08	pCi/g	SOIL	AS040607-2	6/11/2004	
0405096-4	MSED-04	Sample	Th-230	3.16 +/- 0.62	0.11	pCi/g	SOIL	AS040607-2	6/11/2004	M3
0405096-4	MSED-04	Sample	Th-232	2.25 +/- 0.45	0.06	pCi/g	SOIL	AS040607-2	6/11/2004	

Comments:

Data Package ID: *ThAc0405096-1*

Qualifiers/Flags:

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

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

BDL - Below Detection Limit

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PARAGON ANALYTICS

Radiochemistry Data Package

Section 2

QC RESULTS SUMMARY

Isotopic Thorium By Alpha Spec w/Ac-227

PAI 714 Rev 9

Method Blank Results

Lab Name: Paragon Analytics
Work Order Number: 0405096
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Lab ID: AS040607-2MB

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 07-Jun-04
Date Prepared: 07-Jun-04
Date Analyzed: 11-Jun-04

Prep Batch: AS040607-2
QCBatchID: AS040607-2-1
Run ID: AS040607-2A
Count Time: 300 minutes

Final Aliquot: 2.00 g
Result Units: pCi/g
File Name: TA6072B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14952-40-0	Ac-227	0.021 +/- 0.037	0.076	U
14274-82-9	Th-228	0 +/- 0.023	0.057	U
14269-63-7	Th-230	0.001 +/- 0.035	0.081	U
7440-29-1	Th-232	0.008 +/- 0.014	0.027	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.252	1.40	pCi/g	62.2	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: *THAC0405096-1*

Isotopic Thorium By Alpha Spec w/Ac-227

PAI 714 Rev 9

Laboratory Control Sample(s)

Lab Name: Paragon Analytics
Work Order Number: 0405096
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Lab ID: AS040607-2LCS

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 07-Jun-04
Date Prepared: 07-Jun-04
Date Analyzed: 11-Jun-04

Prep Batch: AS040607-2
QCBatchID: AS040607-2-1
Run ID: AS040607-2A
Count Time: 300 minutes

Final Aliquot: 2.00 g
Result Units: pCi/g
File Name: TA6072L

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14269-63-7	Th-230	2.40 +/- 0.43	0.07	2.30	104	85 - 121	P

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.252	1.76	pCi/g	77.9	30 - 110 %	

Comments:

Qualifiers/Flags:

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

Abbreviations:

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

Data Package ID: *THAC0405096-1*

Isotopic Thorium By Alpha Spec w/Ac-227

PAI 714 Rev 9

Duplicate Sample Results (DER)

Lab Name: Paragon Analytics
Work Order Number: 0405096
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Field ID: MSED-04
Lab ID: 0405096-4DUP

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 06-May-04
Date Prepared: 07-Jun-04
Date Analyzed: 11-Jun-04

Prep Batch: AS040607-2
QCBatchID: AS040607-2-1
Run ID: AS040607-2A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 2.01 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: TA50964D

CASNO	Analyte	Sample Result +/- 2 s TPU	Duplicate Result +/- 2 s TPU	DER	Control Limit	Lab Qualifiers
14952-40-0	Ac-227	0.37 +/- 0.14	0.217 +/- 0.092	0.90		
14274-82-9	Th-228	2.19 +/- 0.44	2.16 +/- 0.40	0.04	2.13	
14269-63-7	Th-230	3.16 +/- 0.62	3.01 +/- 0.54	0.19	2.13	
7440-29-1	Th-232	2.25 +/- 0.45	2.41 +/- 0.44	0.25	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: *THAC0405096-1*

PARAGON ANALYTICS
Radiochemistry Data Package

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Section 3

INDIVIDUAL SAMPLE RESULTS

Isotopic Thorium By Alpha Spec w/Ac-227

PAI 714 Rev 9

Sample Results

Lab Name: Paragon Analytics
Work Order Number: 0405096
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Field ID: MSED-04
Lab ID: 0405096-4

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 06-May-04
Date Prepared: 07-Jun-04
Date Analyzed: 11-Jun-04

Prep Batch: AS040607-2
QCBatchID: AS040607-2-1
Run ID: AS040607-2A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 2.01 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: TZ50964

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14952-40-0	Ac-227	0.37 +/- 0.14	0.03	
14274-82-9	Th-228	2.19 +/- 0.44	0.08	
14269-63-7	Th-230	3.16 +/- 0.62	0.11	M3
7440-29-1	Th-232	2.25 +/- 0.45	0.06	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.239	1.11	pCi/g	49.4	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: *THAC0405096-1*

Isotopic Thorium By Alpha Spec w/Ac-227

PAI 714 Rev 9

Sample Duplicate Results

Lab Name: Paragon Analytics
Work Order Number: 0405096
Client Name: Kent & Sullivan Inc.
ClientProject ID: Ross Adams

Field ID: MSED-04
Lab ID: 0405096-4DUP

Sample Matrix: SOIL
Prep SOP: PAI 777 Rev 7
Date Collected: 06-May-04
Date Prepared: 07-Jun-04
Date Analyzed: 11-Jun-04

Prep Batch: AS040607-2
QCBatchID: AS040607-2-1
Run ID: AS040607-2A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 2.01 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: TA50964D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
14952-40-0	Ac-227	0.217 +/- 0.092	0.085	
14274-82-9	Th-228	2.16 +/- 0.40	0.08	
14269-63-7	Th-230	3.01 +/- 0.54	0.08	
7440-29-1	Th-232	2.41 +/- 0.44	0.03	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.235	1.66	pCi/g	74.4	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: *THAC0405096-1*

PARAGON ANALYTICS
Radiochemistry Data Package

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Section 4

RAW DATA

Isotopic Thorium By Alpha Spec w/Ac-227 Raw Data Report

Laboratory Name: Paragon Analytics
PAI Work Order: 0405096

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Friday, July 30, 2004
7:28:49 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
0405096-4	Ac-227	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	34.000	28.82%	300	0.37	0.03	pCi/g	NA	
SMP	Trg. Analyte	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	9	TZ50964	12:51 PM	0.000	1000	49.4%	0.14	NA	Dry Weight	NA	
0405096-4	Th-228	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	402.100	28.82%	300	2.19	0.08	pCi/g	NA	
SMP	Trg. Analyte	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	9	TZ50964	12:51 PM	23.000	1000	49.4%	0.44	NA	Dry Weight	NA	
0405096-4	Th-229	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	426.800	28.82%	300	1.11	0.05	pCi/g	NA	
SMP	Tracer	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	9	TZ50964	12:51 PM	44.000	1000	49.4%	0.19	NA	Dry Weight	NA	
0405096-4	Th-230	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	602.915	28.82%	300	3.16	0.11	pCi/g	NA	
SMP	Trg. Analyte	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	9	TZ50964	12:51 PM	50.282	1000	49.4%	0.62	NA	Dry Weight	NA	M3
0405096-4	Th-232	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	429.000	28.82%	300	2.25	0.06	pCi/g	NA	
SMP	Trg. Analyte	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	9	TZ50964	12:51 PM	10.000	1000	49.4%	0.45	NA	Dry Weight	NA	
0405096-4	Ac-227	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	30.922	29.31%	300	0.217	0.085	pCi/g	0.90	
DUP	Trg. Analyte	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	12	TA50964D	7:03 AM	13.592	1000	74.4%	0.092	NA	Dry Weight	NA	
0405096-4	Th-228	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	610.233	29.31%	300	2.16	0.08	pCi/g	0.04	
DUP	Trg. Analyte	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	12	TA50964D	7:03 AM	59.223	1000	74.4%	0.40	NA	Dry Weight	NA	
0405096-4	Th-229	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	653.835	29.31%	300	1.66	0.02	pCi/g	NA	
DUP	Tracer	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	12	TA50964D	7:03 AM	3.883	1000	74.4%	0.28	NA	Dry Weight	NA	
0405096-4	Th-230	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	880.329	29.31%	300	3.01	0.08	pCi/g	0.19	
DUP	Trg. Analyte	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	12	TA50964D	7:03 AM	58.905	1000	74.4%	0.54	NA	Dry Weight	NA	
0405096-4	Th-232	5/6/2004	AS040607-2	NA	6/08/2004	SOIL	2.01 g	Alpha Spec	AS040607-2A	6/11/2004	704.544	29.31%	300	2.41	0.03	pCi/g	0.25	
DUP	Trg. Analyte	9:10:00 AM	AS040607-2-1	NA	7:00:00 PM	NA	2.01 g	12	TA50964D	7:03 AM	4.854	1000	74.4%	0.44	NA	Dry Weight	NA	
AS040607-2	Ac-227	6/7/2004	AS040607-2	NA	6/08/2004	SOIL	2 g	Alpha Spec	AS040607-2A	6/11/2004	2.670	31.73%	300	0.021	0.076	pCi/g	NA	
MB	Trg. Analyte	10:41:50 AM	AS040607-2-1	NA	7:00:00 PM	NA	2 g	13	TA6072B	7:03 AM	7.767	1000	62.2%	0.037	NA	Dry Weight	NA	U

Comments:

Data Package ID: *ThAc0405096-1*

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

Isotopic Thorium By Alpha Spec w/Ac-227 Raw Data Report

Laboratory Name: Paragon Analytics
PAI Work Order: 0405096

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Friday, July 30, 2004
7:28:49 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
AS040607-2	Th-228	6/7/2004	AS040607-2	NA	6/08/2004	SOIL	2 g	Alpha Spec	AS040607-2A	6/11/2004	0.010	31.73%	300	0	0.057	pCi/g	NA	
MB	Trg. Analyte	10:41:50 AM	AS040607-2-1	NA	7:00:00 PM	NA	2 g	13	TA6072B	7:03 AM	23.301	1000	62.2%	0.023	NA	Dry Weight	NA	U
AS040607-2	Th-229	6/7/2004	AS040607-2	NA	6/08/2004	SOIL	2 g	Alpha Spec	AS040607-2A	6/11/2004	591.922	31.73%	300	1.40	0.03	pCi/g	NA	
MB	Tracer	10:41:50 AM	AS040607-2-1	NA	7:00:00 PM	NA	2 g	13	TA6072B	7:03 AM	13.592	1000	62.2%	0.23	NA	Dry Weight	NA	
AS040607-2	Th-230	6/7/2004	AS040607-2	NA	6/08/2004	SOIL	2 g	Alpha Spec	AS040607-2A	6/11/2004	0.155	31.73%	300	0.001	0.081	pCi/g	NA	
MB	Trg. Analyte	10:41:50 AM	AS040607-2-1	NA	7:00:00 PM	NA	2 g	13	TA6072B	7:03 AM	52.816	1000	62.2%	0.035	NA	Dry Weight	NA	U
AS040607-2	Th-232	6/7/2004	AS040607-2	NA	6/08/2004	SOIL	2 g	Alpha Spec	AS040607-2A	6/11/2004	2.126	31.73%	300	0.008	0.027	pCi/g	NA	
MB	Trg. Analyte	10:41:50 AM	AS040607-2-1	NA	7:00:00 PM	NA	2 g	13	TA6072B	7:03 AM	2.913	1000	62.2%	0.014	NA	Dry Weight	NA	U
AS040607-2	Th-229	6/7/2004	AS040607-2	NA	6/08/2004	SOIL	2 g	Alpha Spec	AS040607-2A	6/11/2004	704.631	30.14%	300	1.76	0.03	pCi/g	NA	
LCS	Tracer	10:41:50 AM	AS040607-2-1	NA	7:00:00 PM	NA	2 g	15	TA6072L	7:04 AM	14.563	1000	77.9%	0.29	NA	Dry Weight	NA	
AS040607-2	Th-230	6/7/2004	AS040607-2	NA	6/08/2004	SOIL	2 g	Alpha Spec	AS040607-2A	6/11/2004	750.360	30.14%	300	2.40	0.07	pCi/g	NA	104
LCS	Trg. Analyte	10:41:50 AM	AS040607-2-1	NA	7:00:00 PM	NA	2 g	15	TA6072L	7:04 AM	62.133	1000	77.9%	0.43	NA	Dry Weight	NA	P

Comments:

Data Package ID: *ThAc0405096-1*

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

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/16/04 1:30:06 PM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0405096-4 TAS040607-2

Analysis Type: Th/Ac

Detector: MCB 2 Input 1

Date/Time of Count: 6/11/04 12:51:47 PM

Sample Volume: 2.000 Total, 2.000 Aliquot.

Live Time: **300.00 Minutes**

Chem. Yield: **49.37%**

Real Time: 300.02 Minutes

Total Eff.: 14.23 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminate

Acquisition: 512 Channels

Efficiency: 28.82%

Analysis: Relative Region-Of-Interest

Original: 3,008 + 10.0719 * Chn + -0.00080 * Chn **2.

Spectrum Calibration: 3,008 + 10.0473 * Chn + -0.00080 * Chn **2.

Cal File:

Spectrum File: **C:\User\Alpha\ALPHA\TZ50964.SPC**

Background File: **C:\User\Alpha\ALPHA\B4060909.SPC**

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

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	169.44	147	171	2.00	68.00	618.00	4.50	602.92	14.13
2	100.82	77	108	2.00	48.00	432.00	3.00	429.00	10.05
3	309.17	294	312	4.00	5.00	34.00	0.00	34.00	0.80
4	245.84	223	248	2.00	48.00	409.00	6.90	402.10	9.42
Tracer	185.55	172	210	4.00	35.00	440.00	13.20	426.80	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	19.55	3.181	n/a	8.08 %
2	Th-232	4013.00	19.77	2.264	n/a	9.50 %
3	Ac-227	6038.21	38.22	0.179	n/a	33.61 %
4	Th-228	5430.00	19.31	2.122	n/a	9.87 %
Tracer	Th-229	4845.00	39.00	2.252	n/a	9.34 %

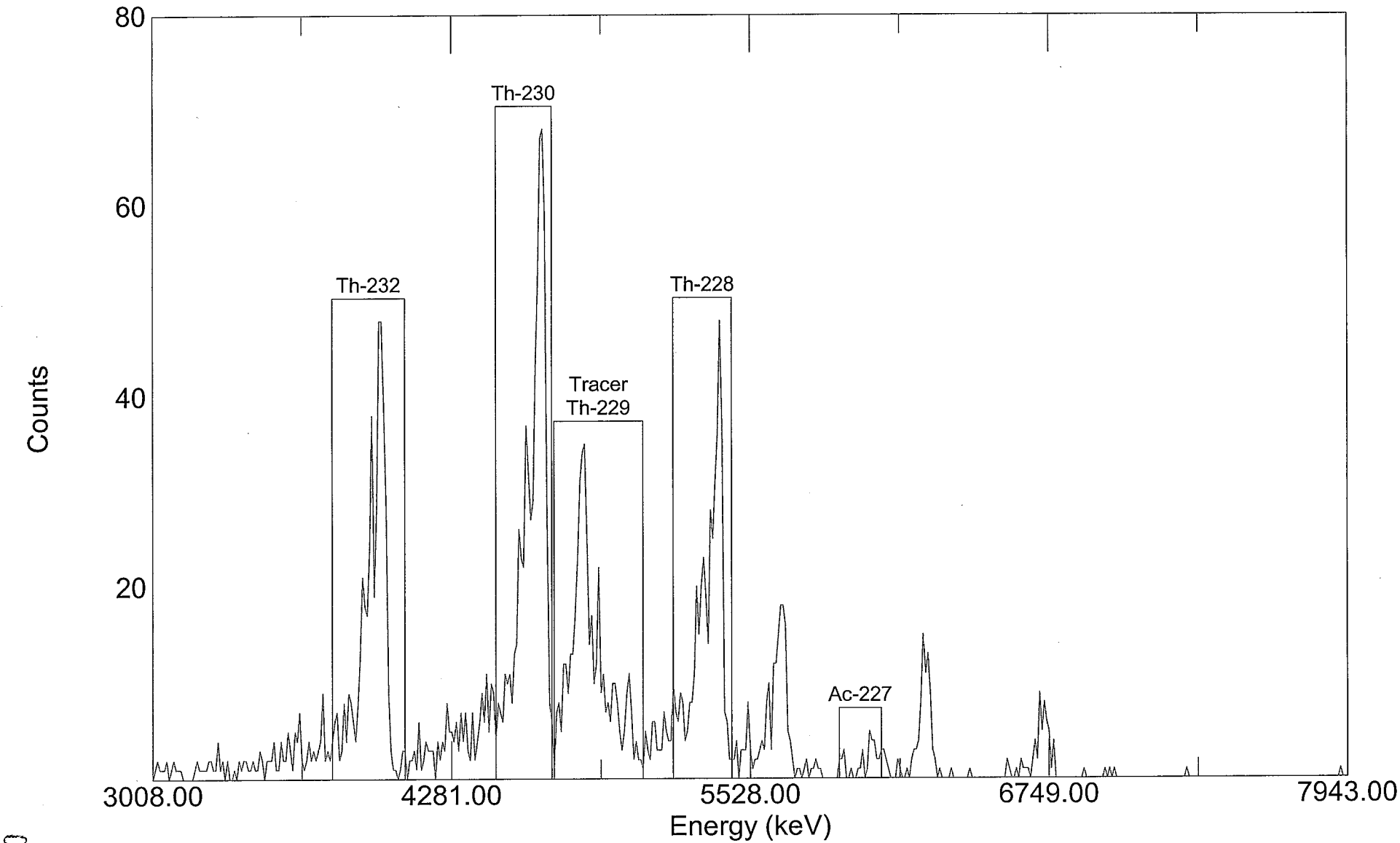
Totals

		% Total
Gross Count:	2,611.00	100.00
Net Area:	2,560.00	98.05
Background:	51.00	1.95
Composite Fit:	1,933.00	74.03
Residuals:	678.00	25.97

Analyzed By: Sm

Checked By: SD

TZ50964 AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 12:51:47 on 11-Jun-2004
File: C:\User\Alpha\ALPHA\TZ50964.SPC
Sample: 0405096-4 TAS040607-2

Real Time: 18001.14 s. Live Time: 18000.00 s.
Detector: #9 MCB 2 Input 1
Type: Th/Ac

000017

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/16/04 1:31:49 PM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: 0405096-4D TAS040607-2

Analysis Type: Th/Ac

Detector: MCB 2 Input 4

Date/Time of Count: 6/11/04 7:03:02 AM

Sample Volume: 2.000 Total, 2.000 Aliquot.

Live Time: **300.00 Minutes**

Chem. Yield: **74.37%**

Real Time: 300.01 Minutes

Total Eff.: 21.80 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminate

Acquisition: 512 Channels

Efficiency: 29.31%

Analysis: Relative Region-Of-Interest

Original: 3,050 + 9.7185 * Chn + -0.00000 * Chn **2.

Spectrum Calibration: 3,050 + 9.6871 * Chn + -0.00000 * Chn **2.

Cal File:

Spectrum File: **C:\User\Alpha\ALPHA\TA50964D.SPC**

Background File: **C:\User\Alpha\ALPHA\B4060812.SPC**

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

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	169.06	150	173	2.00	103.00	898.00	1.46	880.33	13.46
2	99.41	75	106	6.00	84.00	706.00	1.46	704.54	10.77
3	308.47	293	311	2.00	5.00	35.00	4.08	30.92	0.47
4	245.69	226	251	2.00	74.00	628.00	17.77	610.23	9.33
Tracer	185.30	174	212	12.00	44.00	655.00	1.17	653.83	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	19.37	3.032	n/a	6.67 %
2	Th-232	4013.00	58.12	2.427	n/a	7.39 %
3	Ac-227	6038.21	19.37	0.107	n/a	37.68 %
4	Th-228	5430.00	19.37	2.102	n/a	8.06 %
Tracer	Th-229	4845.00	116.25	2.252	n/a	7.66 %

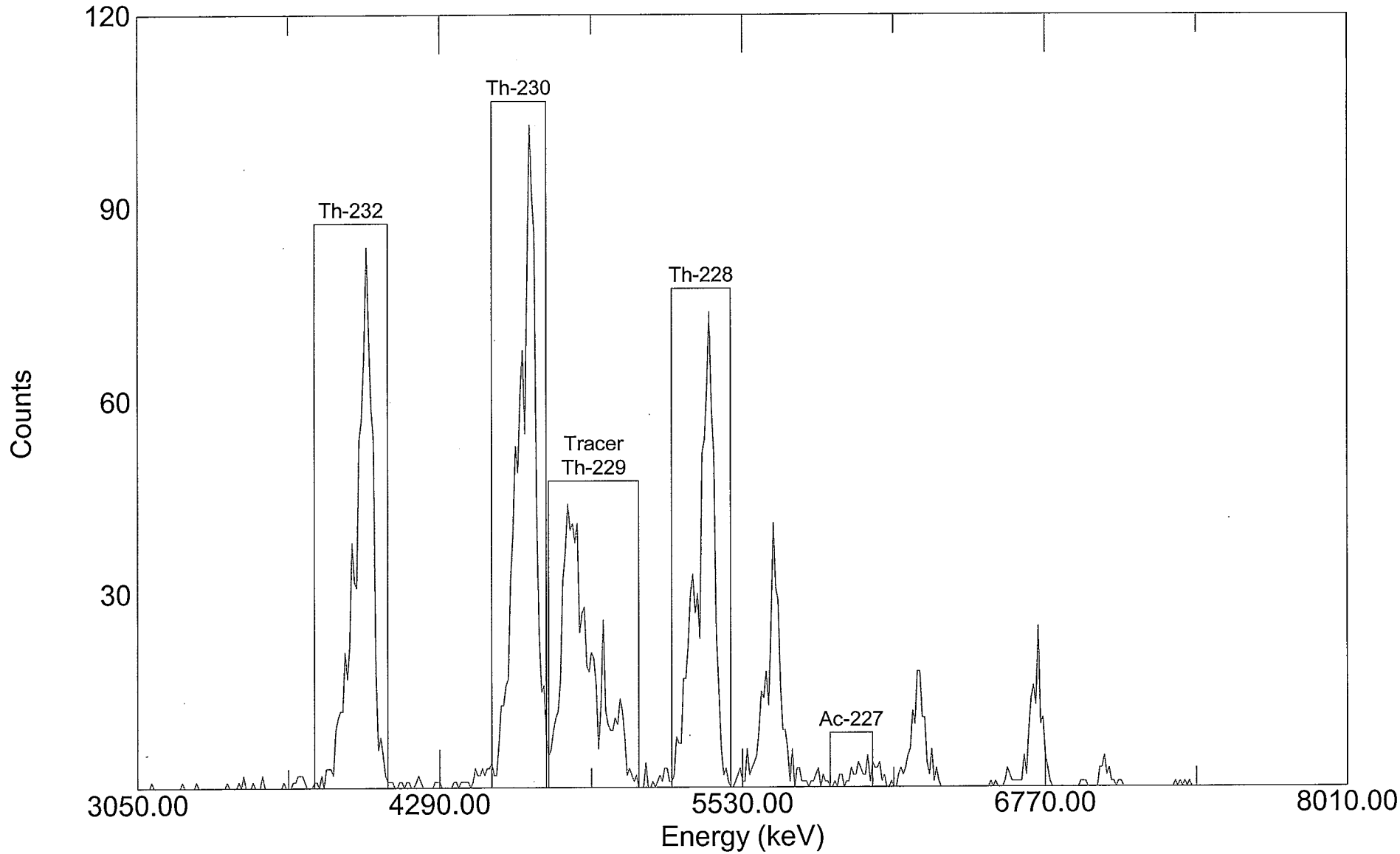
Totals

		% Total
Gross Count:	3,572.00	100.00
Net Area:	3,468.02	97.09
Background:	103.98	2.91
Composite Fit:	2,922.00	81.80
Residuals:	650.00	18.20

Analyzed By: Sm

Checked By: SD

TA50964D AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 07:03:02 on 11-Jun-2004
File: C:\User\Alpha\ALPHA\TA50964D.SPC
Sample: 0405096-4D TAS040607-2

Real Time: 18000.54 s. Live Time: 18000.00 s.
Detector: #12 MCB 2 Input 4
Type: Th/Ac

020000

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/16/04 1:35:22 PM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: AS040607-2MB TAS040607-2

Analysis Type: Th/Ac

Detector: MCB 2 Input 5

Date/Time of Count: 6/11/04 7:03:46 AM

Sample Volume: 2.000 Total, 2.000 Aliquot.

Live Time: **300.00 Minutes**

Chem. Yield: **62.19%**

Real Time: 300.01 Minutes

Total Eff.: 19.73 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminate

Acquisition: 512 Channels

Efficiency: 31.73%

Analysis: Relative Region-Of-Interest

Original: 3,042 + 9.8766 * Chn + -0.00035 * Chn **2.

Spectrum Calibration: 3,042 + 9.8538 * Chn + -0.00035 * Chn **2.

Cal File:

Spectrum File: **C:\User\Alpha\ALPHA\TA6072B.SPC**

Background File: **C:\User\Alpha\ALPHA\B4060813.SPC**

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

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	168.00	146	169	2.00	4.00	16.00	1.17	0.16	0.00
2	98.88	75	106	6.00	1.00	3.00	0.87	2.13	0.04
3	307.41	293	311	2.00	2.00	5.00	2.33	2.67	0.05
4	244.45	222	247	2.00	1.00	7.00	6.99	0.01	0.00
Tracer	184.17	170	209	6.00	50.00	596.00	4.08	591.92	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	19.47	0.001	n/a	5,064.59%
2	Th-232	4013.00	58.71	0.008	n/a	161.63 %
3	Ac-227	6038.21	19.28	0.010	n/a	167.37 %
4	Th-228	5430.00	19.37	0.000	n/a	55,628.8%
Tracer	Th-229	4845.00	58.35	2.252	n/a	8.03 %

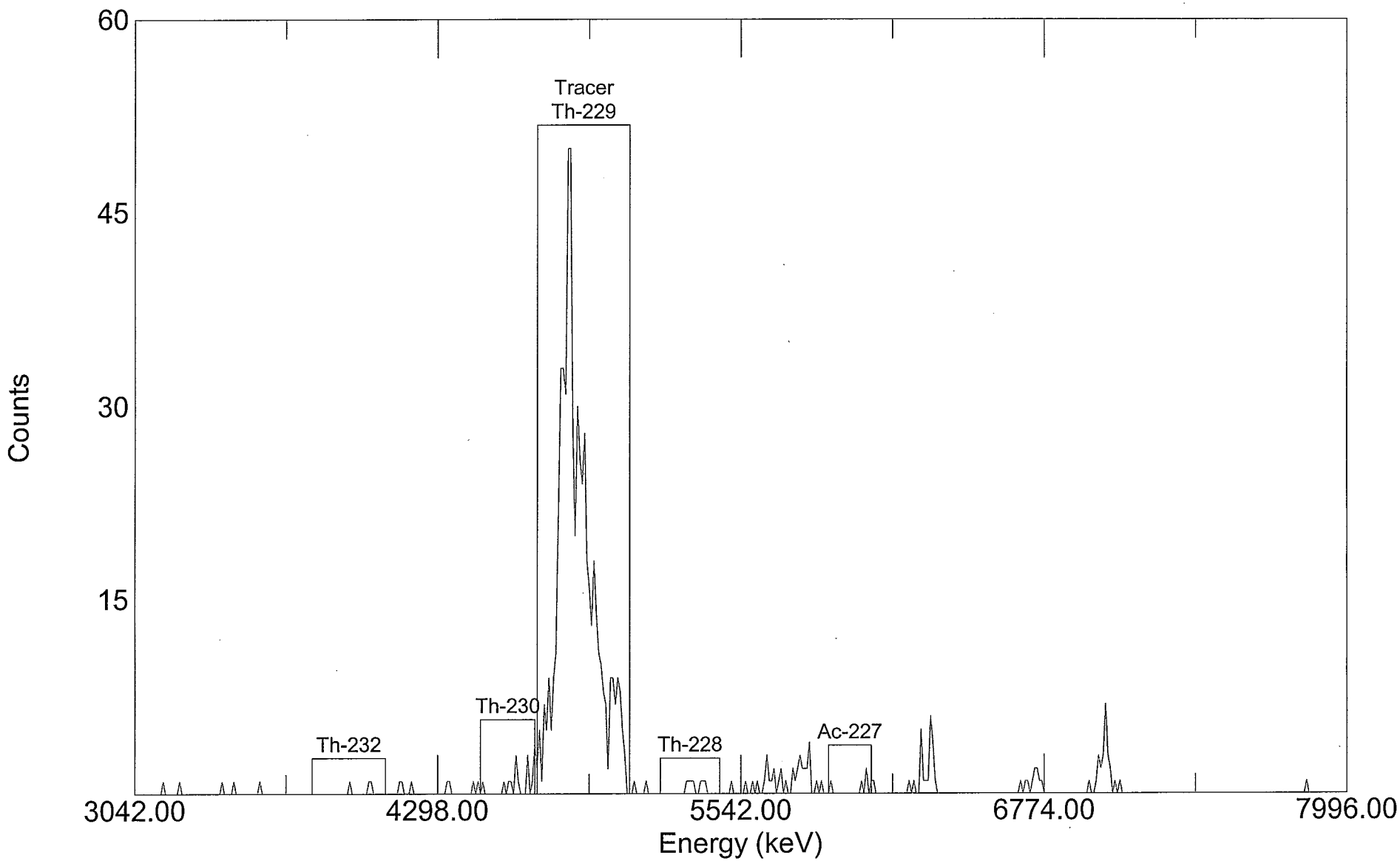
Totals

		% Total
Gross Count:	734.00	100.00
Net Area:	663.22	90.36
Background:	70.78	9.64
Composite Fit:	627.00	85.42
Residuals:	107.00	14.58

Analyzed By: Sm

Checked By: SM

TA6072B AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 07:03:46 on 11-Jun-2004 Real Time: 18000.54 s. Live Time: 18000.00 s.
File: C:\User\Alpha\ALPHA\TA6072B.SPC Detector: #13 MCB 2 Input 5
Sample: AS040607-2MB TAS040607-2 Type: Th/Ac

000033

Paragon Analytics
Alpha Spectroscopy Analysis

Report Printed:
6/16/04 1:33:53 PM
Para0327.rpt
rev 11/13/03 KVG

Sample Name: AS040607-2LCS TAS040607-2

Analysis Type: Th/Ac

Detector: MCB 2 Input 7

Date/Time of Count: 6/11/04 7:04:20 AM

Sample Volume: 2.000 Total, 2.000 Aliquot.

Live Time: **300.00 Minutes**

Chem. Yield: **77.94%**

Real Time: 300.01 Minutes

Total Eff.: 23.49 %

Dead Time: 0.0 %

Tracer Amount: 9.999 DPM, With Contaminate

Acquisition: 512 Channels

Efficiency: 30.14%

Analysis: Relative Region-Of-Interest

Original: 3,022 + 10.0160 * Chn + -0.00072 * Chn **2.

Spectrum Calibration: 3,022 + 10.0154 * Chn + -0.00072 * Chn **2.

Cal File:

Spectrum File: **C:\User\Alpha\ALPHA\TA6072L.SPC**

Background File: **C:\User\Alpha\ALPHA\B4060815.SPC**

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

Peaks

Peak	Channel	Start	End	FWHM	Height	Gross Cts	Bkg Cts	Net Area	DPM
1	168.40	148	172	4.00	114.00	769.00	1.17	750.36	10.65
2	99.71	76	107	2.00	1.00	4.00	1.46	2.54	0.04
3	308.04	294	312	6.00	3.00	8.00	7.28	0.72	0.01
4	244.79	223	248	2.00	5.00	25.00	18.35	6.65	0.09
Tracer	184.52	173	210	8.00	61.00	709.00	4.37	704.63	10.00

Analysis Results

Peak	Nuclide	Energy (keV)	Width (keV)	Aliquot pCi	MDA pCi	% Error
1	Th-230	4687.70	39.09	2.398	n/a	7.24 %
2	Th-232	4013.00	19.74	0.008	n/a	156.47 %
3	Ac-227	6038.21	57.43	0.002	n/a	800.86 %
4	Th-228	5430.00	19.32	0.021	n/a	151.88 %
Tracer	Th-229	4845.00	77.99	2.252	n/a	7.36 %

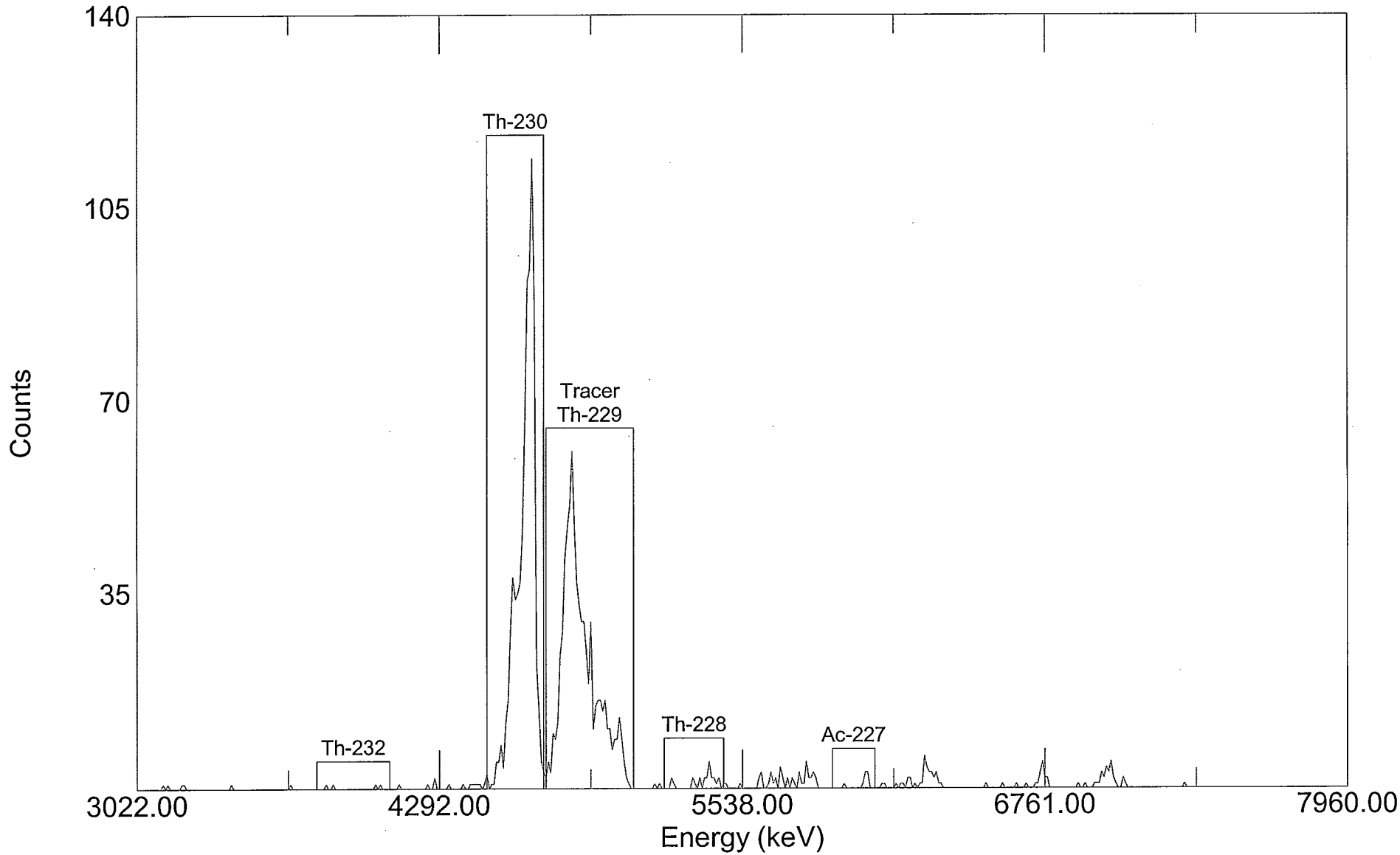
Totals

		% Total
Gross Count:	1,661.00	100.00
Net Area:	1,535.76	92.46
Background:	125.24	7.54
Composite Fit:	1,515.00	91.21
Residuals:	146.00	8.79

Analyzed By: Sm

Checked By: SD

TA6072L AlphaVision Relative Region-Of-Interest (Slope Recalibration)



Acquired: 07:04:20 on 11-Jun-2004
File: C:\User\Alpha\ALPHA\TA6072L.SPC
Sample: AS040607-2LCS TAS040607-2

Real Time: 18000.54 s. Live Time: 18000.00 s.
Detector: #15 MCB 2 Input 7
Type: Th/Ac

000036

Paragon Analytics

Alpha Spectrometer Instrument Run Log

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

Date: 6-11-04

277771

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial	File ID/Comm.
9	AS040603-2	0405096-30	U/S	300	Sm	UR509630
10	AS040601-6	0405135-3D	U/S	240	Sm	UR51353D
11	AS040607-2	0405096-4	Th/AC/S	310	Sm	TA 50964
12	↓	↓ -4D	↓	300	↓	↓ 4D
13	↓	AS040607-2MB	↓	*300	↓	TA 6072B
15	↓	↓ -2LCS	↓	300	↓	↓ L
64	AS040603-1	0405096-1	U/S	300	↓	U50961
16	↓	↓ -2	↓	↓	↓	↓ 2
17	↓	↓ -3	↓	↓	↓	↓ 3
18	↓	↓ -3D	↓	↓	↓	↓ 3D
19	↓	↓ -4	↓	↓	↓	↓ 4
21	↓	↓ -5	↓	↓	↓	↓ 5
22	↓	↓ -8	↓	↓	↓	↓ 8
23	↓	↓ -10	↓	↓	↓	↓ 10
24	↓	↓ -11	↓	↓	↓	↓ 11
42	↓	↓ -12	↓	↓	↓	↓ 12
43	↓	↓ -13	↓	↓	↓	↓ 13
44	↓	↓ -14	↓	↓	↓	↓ 14
45	↓	↓ -15	↓	↓	↓	↓ 15
46	↓	↓ -15D	↓	↓	↓	↓ 15D
47	↓	↓ -16	↓	↓	↓	↓ 16
48	↓	↓ -17	↓	↓	↓	↓ 17
57	↓	↓ -19	↓	↓	↓	↓ 19
58	↓	↓ -20	↓	↓	↓	↓ 20

Detector	Batch ID	Sample ID	Iso/Matrix	Duration	Initial	File ID/Comm.
59	AS040603-1	0405096-22	U/S	300	Sm	U509622
60	↓	↓ -25	↓	↓	↓	↓ 25
61	↓	↓ -26	↓	↓	↓	↓ 26
62	↓	↓ -31	↓	↓	↓	↓ 31
9	AS040607-2	0405096-4	Th/AC/S	360	Sm	TZ50964
10	AS040603-1	AS040603-1MB	Sm 6/11/04 U/W/S	300	Sm	U6031B
11	↓	↓ -1LCS	U/S	↓	↓	↓ L
12	276517	0418004-2	U/W	300	Sm	UR180042
13	↓	↓ -3	↓	↓	↓	↓ 3
15	↓	↓ -4	↓	↓	↓	↓ 4
16	AS040604-2	0404255-1	Th/S	300	Sm	T42551
17	↓	↓ -2	↓	↓	↓	↓ 2
18	↓	↓ -3	↓	↓	↓	↓ 3
19	↓	↓ -4	↓	↓	↓	↓ 4
21	↓	↓ -5	↓	↓	↓	↓ 5
22	↓	↓ -6	↓	↓	↓	↓ 6
23	↓	↓ -7	↓	↓	↓	↓ 7
24	↓	↓ -8	↓	↓	↓	↓ 8
42	↓	↓ -9	↓	↓	↓	↓ 9
43	↓	↓ -9D	↓	↓	↓	↓ 9D
44	↓	↓ -10	↓	↓	↓	↓ 10
45	↓	↓ -11	↓	↓	↓	↓ 11
46	↓	↓ -12	↓	↓	↓	↓ 12
47	↓	↓ -13	↓	↓	↓	↓ 13

Notes: * MB ran for 310 mins. Report did not print and new samples loaded. 310 min file lost. Sample 4 required recounting and will be recounted for 300 min. Sm 6-11-04.

Cont. on page 277772 Sm 6-11-04

Reviewed by: Sm

Date: 6-14-04

PARAGON ANALYTICS
Radiochemistry Data Package

Section 5

QUALITY ASSURANCE SUMMARY REPORTS

5

Paragon Analytics, Inc.

QUALITY ASSURANCE SUMMARY SHEET

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

268111

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.

AH 4/14/04

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

AH 4/14/04

AH 4/14/04

TECHNICIAN/ANALYST A. Lawson DATE 4/14/04
DEPARTMENT MANAGER Kevin Nye DATE 4/14/04

FORM 302r5.FRM (04/30/01)

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

LABORATORY BENCH SHEETS

6

Radiochemistry Instrument Worksheet

Paragon Analytics

Prep Batch: AS040607-2

Prep Procedure: Th/Ac

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	0405096-4	SMP	2.0118	2.0118	g	TA_50964	11	Sm	TZ_50964 *	9	JD	_50964			* Poor spectral quality Sm 6/11/04
1	0405096-4	DUP	2.0149	2.0149	g	_50964D	12		_50964D			_50964D			
1	AS040607-2	MB	2	2	g	_6072B	13		_6072B			_6072B			
1	AS040607-2	LCS	2	2	g	_6072L	15		_6072L			_6072L			

Sm 7/30/04

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	06/07/04	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	06/07/04	0.5	ml	AW004

000031

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS040607-2

Prep Procedure: Th/Ac

Reviewed By: CRW CW **Review Date:** 7/29/04

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: solid

Prep Analyst: Grace Campagnola
Prep Date: 6/7/04
Prep Dept: AP

Balance: 23
Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq g	Fin Alq g	Prep Basis	Decay Date/Time	Micro Init	Micro Date	Standards	Prep Notes
1	1	0405096-4	SMP		2.0118	2.0118	Dry Weight	06/08/04 19:00			T1	
2	1	0405096-4	DUP		2.0149	2.0149	Dry Weight	06/08/04 19:00			T1	
3	1	AS040607-2	MB		2	2	Dry Weight	06/08/04 19:00			T1	
4	1	AS040607-2	LCS		2	2	Dry Weight	06/08/04 19:00			S1,T1	

Spiked By: Tambrae Elhart **Date:** 6/7/04

Witnessed By: Carissa Moncavage **Date:** 6/7/04

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	06/07/04	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	06/07/04	0.5	ml	AW004

Comments

1.All samples were muffled at 600°C overnight.
2. All of the samples received PEG treatment.

Paragon Analytics

LIMS Version: 5.044A

Supersedes: _____

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS040607-2

Prep Procedure: Th/Ac

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: solid

Prep Analyst: Grace Campagnola GC
Prep Date: 6/7/04 6/9/04
Prep Dept: AP

Balance: 23
Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq g	Fin Alq g	Prep Basis	Decay Date/Time	Micro Init	Micro Date	Standards	Prep Notes
1	1	0405096-4	SMP		2	2	Dry Weight	1020	2.0118		T1	
2	1	0405096-4	DUP		2	2	Dry Weight	478	2.0149		T1	
3	1	AS040607-2	MB		2	2	Dry Weight	471	2.0000		T1	
4	1	AS040607-2	LCS		2	2	Dry Weight	305	2.0000		S1,T1	

Spiked By: JC **Date:** 6/7/04
Witnessed By: Cbm **Date:** 6/7/04

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	06/07/04	0.5	ml	AW004

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	06/07/04	0.5	ml	AW004

Exp 9/26/04

000033

Comments
Muffled, PEG

Supersedes: NA

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: AS040607-2

Prep Procedure: Th/Ac

Reviewed By: gxc 6/9/04 **Review Date:** 6/9/04

Non-Routine Pre-Treatment? (Y) / N **Batch:** See comments **Re-Prep?** Y / (N) **Batch:** NA **Prep QASS / NCR?** (Y) / N 268111

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

Prep Analyst: Grace Campagnola
Prep Date: 6/7/04
Prep Dept: AP

Balance: 23
Balance:

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq g	Fin Alq g	Prep Basis	Decay Date/Time	Micro Init	Micro Date	Standards	Prep Notes
1	1	0405096-4	SMP		2.0118	2.0118	Dry Weight	6/8/04 @ 1900	TC	6/9/04	T1	
2	1	0405096-4	DUP		2.0149	2.0149	Dry Weight				T1	
3	1	AS040607-2	MB		2	2	Dry Weight				T1	
4	1	AS040607-2	LCS		2	2	Dry Weight				S1,T1	

Spiked By: Tambrae Elhart **Date:** 6/7/04
Witnessed By: Carissa Moncavage **Date:** 6/7/04

Relinquished By: CM
Date: 6/9/04
Received By: Sm
Date: ~~06-09-04~~ 6/9/04
Sm 6/9/04

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	06/07/04	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	06/07/04	0.5	ml	AW004

000034

Comments
1. All samples were muffled at 600°C overnight.
2. All of the samples received PEG treatment.

Paragon Analytics

LIMS Version: 5.028A

Supersedes: 6/7/04 10:45

SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TC

ANALYSIS DATE: 6/7/04 METHOD:

WORK ORDER	SAMPLE ID	SAMPLE CONDITION		
		Dry/Wet	TEXTURE	Remarks
0405096	4	dry	ground	fine

TC 6/7/04

PROJECT KENT & SULLIVAN

Notebook No. 2770

Continued From Page

6/2/04 W.O. # 04-05-096 (Th$^{I\pm 50}$, U$^{I\pm 50}$, RA226(903.1))

in oven - 5/28 @ 1740
out oven - 6/1 @ 1430

S.O.P. - 721-R11
balance #15, oven #1
5 balls, shake 15 min.

Sample #	sample/can/balls (g)	can/balls (g)	ground sample (g)	TYPE sample
04-05-096 - 1	127.0	96.6	30.4	SOIL
- 2	128.1	97.4	30.7	
- 3	127.1	96.5	30.6	
- 4	127.7	97.4	30.3	
- 5	127.7	97.3	30.4	
- 7	127.5	97.0	30.5	
- 8	126.8	96.8	30.0	
- 9	127.3	97.0	30.3	
- 10	127.2	97.1	30.1	
- 11	127.6	97.3	30.3	
- 12	127.8	97.3	30.5	
- 13	127.8	97.4	30.4	
- 14	127.6	97.2	30.4	
- 15	128.0	97.8	30.2	
- 16	127.8	97.4	30.4	
- 17	127.7	97.2	30.5	

C.O. - 6/2/04

Continued on Page 51

Read and Understood By

Carson R. O'Dell 6/2/04 — Signed, Date

T Elhart 6/2/04 — Signed, Date

3

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 K2966590 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 = 1.01189 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

$$\frac{(1{,}647.2\ \text{dpm/g})(10.5927\ \text{g})(1.01189\ \text{g/ml})}{882.67\ \text{g}} = 20.00\ \text{dpm/ml}$$

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

CDS 6/26/03

SD 6/26/03

Continued on Page

Read and Understood By

Chumcavage 6/3/03 Signed Date

Signed 6/26/03 Date

Prepare a 1° dilution of Analytics 64286-307 by transferring contents of the ampule to a ~~50 ml~~ 08/15/02 LOA 1250 ml Nalgene bottle & diluting to approx 150 ml w/ .5 N HNO_3. (Lot # K2933831 0.43 g/cm³)

1) Transfer contents of ampule to 250 ml bottle

Mass of empty Nalgene bottle (½ full)	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

$$\left(\frac{4.258 \times 10^{7}\ \text{dps}}{5.0424\ \text{g}}\right)\left(\frac{4.7388\ \text{g}}{146.5773\ \text{g}}\right)(60.5\ \text{hr}) = 1647.2\ \text{dpm/g}$$

RE 9/16/02

Continued on Page _____

Read and Understood By

Signed 8/15/02 Date

Signed 9/16/02 Date

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: M. Rt 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.

Notebook No. _____
Continued From Page _____

OJECT Th-230 working dilution 581.2613.24

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

1) Determine the density of 0.1M HNO_3 Lot# K296659011133
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

Signed: Chonica Page — Date: 9/11/03
Signed: [signature] — Date: 10/7/03

NOTEBOOK NO. _____
Continued From Page _____

OJECT 581.1808.65 Th-230 Calibration Std.

0/01 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 1 L 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

ρ = .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 #12)
Net mass of std (calculated)	200.65 g

5) Final Activity Calculation:

$$\frac{(18,370\ Bq)(60\ dpm/Bq)(0.99916\ g/mL)(10.5456\ g)}{(49.884389\ g)(233.16\ g - 32.5073\ g)} = \cancel{1,000.03}\ dpm/mL$$

1162.06 dpm/mL

Stnd ID: 581.1808.65

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

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

Read on Page

Read and Understood By

R Fil 5/10/01 Signed Date

Signed 5/10/01 Date

000043

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

PAIID 00581
Rec'd 5-02-01

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

.dionuclide:	Th-230	Customer:	PARAGON ANALYTICS, INC.
ılf-life:	(7.54 ± 0.03)E+04 years	P.O. No.:	001295
ıtalog 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

ıysical 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 Dalsen — 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: 0405096
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
MSED-01	0405096-1		SOIL	06-May-04	13:00
MSED-02	0405096-2		SOIL	06-May-04	13:40
MSED-03	0405096-3		SOIL	06-May-04	14:00
MSED-04	0405096-4		SOIL	06-May-04	9:10
MSED-05	0405096-5		SOIL	06-May-04	9:20
MSED-06	0405096-6		SOIL	07-May-04	8:30
MSED-07	0405096-7		SOIL	07-May-04	9:00
MSED-08	0405096-8		SOIL	07-May-04	9:15
MSED-09	0405096-9		SOIL	07-May-04	9:20
MSED-10	0405096-10		SOIL	07-May-04	10:10
SSED-01	0405096-11		SOIL	05-May-04	16:15
SSED-02	0405096-12		SOIL	05-May-04	17:05
SSED-03	0405096-13		SOIL	04-May-04	18:10
SSED-04	0405096-14		SOIL	04-May-04	17:00
SSED-05	0405096-15		SOIL	04-May-04	15:59
SSED-06	0405096-16		SOIL	04-May-04	15:03
SSED-07	0405096-17		SOIL	04-May-04	14:00
SSED-08	0405096-18		SOIL	05-May-04	12:40
SSED-09	0405096-19		SOIL	05-May-04	15:20
SSED-10	0405096-20		SOIL	04-May-04	19:05
GEN-01	0405096-21		SOIL	07-May-04	12:40
GEN-02	0405096-22		SOIL	07-May-04	12:35
GEN-03	0405096-23		SOIL	07-May-04	12:50
GEN-04	0405096-24		SOIL	07-May-04	13:06
SOIL-01	0405096-25		SOIL	06-May-04	16:00
SOIL-02	0405096-26		SOIL	06-May-04	15:40
SOIL-04	0405096-27		SOIL	06-May-04	15:04
SOIL-05	0405096-28		SOIL	06-May-04	15:10
SOIL-07	0405096-29		SOIL	07-May-04	13:50
SOIL-08	0405096-30		SOIL	07-May-04	16:15
SOIL-09	0405096-31		SOIL	07-May-04	14:10
SOIL-10	0405096-32		SOIL	07-May-04	16:40

000049

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) 0405096

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 ~~by KPA~~ Isotopic	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	Pa 231 - Po 210
(X) FR-01	5-6-04	0800		W	2										(B)									X									
(X) FR-01	↓	0810		W	2										(B)									X									
MSED-01	5-6	1300	1	SED	2										(C)									-		X			X			X	
MSED-02	5-6	1510	2		3										(C)											X			X			X	
MSED-03	5-6	1400	3		2½										(C)											X			X			X	
MSED-04	5-6	0910	4		3										(C)											X			X			X	X
MSED-05	5-6	0930	5		3										(C)											X			X			X	
MSED-06	5-7	0930	6		[illegible]										(C)											X			X			X	
MSED-07	5-7	0900	7	↓	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 OSA-01, 700-01, and 900-01.
(X) on WO # 0405095 AW 5/12/04

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
Printed Name Amy Wolf
Date 5/11/04 Time 11:45
Company Paragon Analytics

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

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

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

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

000047

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) 0405096

Date _____ Page 3 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 pg 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	Total Uranium ~~by KPA-D5174-91~~ isotopic	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
MSED-08	5-7	0915	8	SED	3										(c)											X			X				X	
MSED-09	↓	0920	9	↓	3										(c)											X			X				X	
MSED-10	↓	1010	10	↓	3										(c)											X			X				X	
SSED-01	5-5	1615	11	SED	3										(c)											X			X				X	
SSED-02	5-5	1705	12	↓	3										(c)											X			X				X	
SSED-03	5-4	1810	13	↓	3										(c)											X			X				X	
SSED-04	↓	1700	14	↓	3										(c)											X			X				X	
SSED-05	↓	1559	15	↓	3										(c)											X			X				X	
SSED-06	↓	1503	16	↓	3										(c)											X			X				X	

Comments:
(c) Hold analyses pending metal results from samples 050-01, 700-01, and 900-01.

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

Relinquished By: (1)	Relinquished By: (2)
Signature Gerald Warnick	Signature
Printed Name Gerald Warnick	Printed Name
Date 5-10-04 Time 1030	Date Time
Company Kent & Sullivan	Company

Received By (1)	Received By: (2)
Signature	Signature
Printed Name Amy Wolf	Printed Name
Date 5/11/04 Time 1645	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.

000048

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) 0405096

Chain-of-Custody

Date _____ Page 4 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 pg 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) (RRO)	~~TOX~~ TOC	Gross Alpha / Beta SW9310 E900.0	Actinides by PAI SOP (circle): Pu / U / Am / Th / Cm	~~Total~~ Uranium ~~by KPA D5174-91~~ isotopic	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	
SSED-07	5-4	1400	17	SED	3										(c)											X			X			X	
SSED-08	5-5	1240	18	(	3										(c)											X			X			X	
SSED-09	5-5	1530	19		3										(c)											X			X			X	
SSED-10	5-4	1905	20	↓	3										(c)											X			X			X	
GEN-01	5-7	1240	21	SOIL	2																	X	X										
GEN-02	5-7	1235	22	(	5										(c)							X	X			X			X			X	
GEN-03	5-7	1250	23		2																	X	X										
GEN-04	5-7	1306	24	↓	2																	X	X										

Comments:

(c) Hold analyses pending metal results from samples OSA-01, 700-01, and 900-01.

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 Gerald Warrick	Company
Received By: (1)	**Received By: (2)**
Signature Amy Wolf	Signature
Printed Name Amy Wolf	Printed Name
Date 5/11/04 Time 1645	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.

000069

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) 0405096

Date _____ Page 5 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:

All pg 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	~~Total~~ Uranium by KPA D5174-91 isotopic	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	
SOIL-01	5-6	1600	25	SOIL	3										C											X			X				X	
SOIL-02	5-6	1540	26	SOIL	3										C											X			X				X	
SOIL-04	5-6	1504	27	SOIL	3										C											X			X				X	
SOIL-05	5-6	1510	28	SOIL	3										C											X			X				X	
SOIL-07	5-7	1350	29	SOIL	3										C											X			X				X	
SOIL-08	5-7	1615	30	SOIL	3										C											X			X				X	
SOIL-09	5-7	1410	31	SOIL	3										C											X			X				X	
SOIL-10	5-7	1640	32	SOIL	3										C											X			X				X	
(X) HR-01	5-6	1900		RK	1										C											X			X				X	

Comments:
(X) on WO # 0405097
AW 5/12/04

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	Signature
Printed Name Amy Wolf	Printed Name
Date 5/11/04 Time 1645	Date Time
Company Paragon Analytics	Company

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

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

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

000063

Paragon Analytics, Inc. -- Fort Collins, Colorado

CONDITION OF SAMPLE UPON RECEIPT FORM

CLIENT: Kent + Sullivan WORKORDER NO: 0405096

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 DW 5/12/04	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	924	898	897	749	868	22	
Temperature	10°	10°	9°	15°	12°	14°	°C

Project Manager Signature / Date: Debbie Fazio 5/14/04

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: 0405096

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

- [ ] **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.
- [x] **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).
- [ ] Other (describe below).

Describe discrepancy:

- All samples received between 9° - 15° C. Refer to page 1 for cooler temperatures and refer to DOT Survey pages for cooler contents. Insufficient ice packed with samples
- Sample #17, bottle 3: Container received with a small crack in lid, no loss of sample was apparent. Lid was replaced during sample check-in.

Was the client contacted? ___ No; ✓ Yes: Name Sue Kent Date/Time 5/14/04

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: 5/14/04

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan

Workorder No: 0405096 & 0405097

Project Manager: Debbie Fazio

Initials: AW

Date: 05/12/04

COOLER #: 924

External Micro R Meter Reading (μ R/hr): 190

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405096-1-1	MSED-01	< background
0405096-1-2	MSED-01	< background
0405096-2-1	MSED-02	< background
0405096-2-2	MSED-02	< background
0405096-2-3	MSED-02	< background
0405096-3-1	MSED-03	< background
0405096-3-2	MSED-03	< background
0405096-3-3	MSED-03	< background
0405096-7-1	MSED-07	< background
0405096-7-2	MSED-07	< background
0405096-7-3	MSED-07	35
0405096-8-1	MSED-08	75
0405096-8-2	MSED-08	< background
0405096-8-3	MSED-08	30
0405096-9-1	MSED-09	< background
0405096-9-2	MSED-09	< background
0405096-9-3	MSED-09	150
0405096-10-1	MSED-10	> background
0405096-10-2	MSED-10	30
0405096-10-3	MSED-10	40
0405096-16-1	SSED-06	< background
0405096-16-2	SSED-06	< background
0405096-16-3	SSED-06	< background
0405097-2-1	MR-01	70
0405097-2-2	MR-01	60
0405097-2-3	MR-01	80
0405097-3-1	MR-02	85
0405097-3-2	MR-02	85
0405097-3-3	MR-02	85
0405097-17-1	300-01	800

If applicable, was the client contacted? **YES** / **NO** / **NA** Client Rep. Name: Sue Kent Date/Time: 5/14/04

Project Manager Signature/ Date: 5/14/04

000053

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan Workorder No: 0405096 & 0405097

Project Manager: Debbie Fazio Initials: AW Date: 05/12/04

COOLER #: 898 External Micro R Meter Reading (μ R/hr): 140

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405096-4-1	MSED-04	< background
0405096-4-2	MSED-04	< background
0405096-4-3	MSED-04	< background
0405096-11-1	SSED-01	< background
0405096-11-2	SSED-01	< background
0405096-11-3	SSED-01	< background
0405096-26-1	SOIL-02	< background
0405096-26-2	SOIL-02	< background
0405096-26-3	SOIL-02	< background
0405096-27-1	SOIL-04	< background
0405096-27-2	SOIL-04	40
0405096-27-3	SOIL-04	< background
0405096-28-1	SOIL-05	30
0405096-28-2	SOIL-05	< background
0405096-28-3	SOIL-05	< background
0405097-4-1	GR-01	< background
0405097-6-1	GR-03	< background
0405097-13-1	GR-10	< background
0405097-14-1	QM-01	< background
0405097-16-1	QM-03	< background
0405097-18-1	300-02	45
0405097-19-1	700-01	1000
0405097-19-2	700-01	950
0405097-19-3	700-01	1100

If applicable, was the client contacted? **YES / NO / NA** Client Rep. Name: Sue Kent Date/Time: 5/14/04

Project Manager Signature/ Date: DJ 5/14/04

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan Workorder No: 0405096 & 0405097

Project Manager: Debbie Fazio Initials: AW Date: 05/12/04

COOLER #: 897 External Micro R Meter Reading (μ R/hr): 320

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405096-5-1	MSED-05	< background
0405096-5-2	MSED-05	< background
0405096-5-3	MSED-05	< background
0405096-21-1	GEN-01	28
0405096-21-2	GEN-01	28
0405096-22-1	GEN-02	30
0405096-22-2	GEN-02	29
0405096-22-3	GEN-02	< background
0405096-22-4	GEN-02	< background
0405096-22-5	GEN-02	< background
0405096-23-1	GEN-03	< background
0405096-23-2	GEN-03	< background
0405096-24-1	GEN-04	< background
0405096-24-2	GEN-04	< background
0405097-9-1	GR-06	30
0405097-11-1	GR-08	< background
0405097-15-1	QM-02	< background
0405097-20-1	700-02	250
0405097-24-1	900-02	1500
0405097-25-1	900-03	300
0405097-27-1	900-05	100

If applicable, was the client contacted? **YES / NO / NA** Client Rep. Name: Sue Kent Date/Time: 5/14/04

Project Manager Signature/ Date: 5/14/04

000055

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan Workorder No: 0405096 & 0405097

Project Manager: Debbie Fazio Initials: AW Date: 05/12/04

COOLER #: 749 External Micro R Meter Reading (μ R/hr): 300

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405096-6-1	MSED-06	40
0405096-12-1	SSED-02	40
0405096-12-2	SSED-02	< background
0405096-12-3	SSED-02	< background
0405096-18-1	SSED-08	< background
0405096-18-2	SSED-08	< background
0405096-18-3	SSED-08	30
0405096-19-1	SSED-09	< background
0405096-19-2	SSED-09	< background
0405096-19-3	SSED-09	< background
0405096-25-1	SOIL-01	< background
0405096-25-2	SOIL-01	< background
0405096-25-3	SOIL-01	< background
0405097-1-1	HR-01	140
0405097-5-1	GR-02	< background
0405097-7-1	GR-04	90
0405097-28-1	OSA-01	1200
0405097-28-2	OSA-01	1100
0405097-28-3	OSA-01	1200

If applicable, was the client contacted? **YES / NO / NA** Client Rep. Name: Sue Kent Date/Time: 5/14/04

Project Manager Signature/ Date: 5/14/04

000055

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan Workorder No: 0405096 & 0405097

Project Manager: Debbie Fazio Initials: AW Date: 05/12/04

COOLER #: 868 External Micro R Meter Reading (μ R/hr): 320

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405096-13-1	SSED-03	< background
0405096-13-2	SSED-03	< background
0405096-13-3	SSED-03	< background
0405096-14-1	SSED-04	< background
0405096-14-2	SSED-04	< background
0405096-14-3	SSED-04	< background
0405096-15-1	SSED-05	< background
0405096-15-2	SSED-05	< background
0405096-15-3	SSED-05	< background
0405096-17-1	SSED-07	< background
0405096-17-2	SSED-07	< background
0405096-17-3	SSED-07	< background
0405096-20-1	SSED-10	< background
0405096-20-2	SSED-10	< background
0405096-20-3	SSED-10	< background
0405097-8-1	GR-05	< background
0405097-10-1	GR-07	< background
0405097-12-1	GR-09	< background
0405097-21-1	700-03	800
0405097-21-2	700-03	950
0405097-21-3	700-03	850
0405097-26-1	900-04	95
0405097-29-1	OSA-02	180
0405097-29-2	OSA-02	150
0405097-29-3	OSA-02	160
0405097-30-1	OSA-03	200
0405097-30-2	OSA-03	250
0405097-30-3	OSA-03	150

If applicable, was the client contacted? **YES / NO / NA** Client Rep. Name: Sue Kent Date/Time: 5/14/04

Project Manager Signature/ Date: 5/14/04

SAMPLE LOGIN / DOT SURVEY

Client: Kent & Sullivan Workorder No: 0405096 & 0405097

Project Manager: Debbie Fazio Initials: AW Date: 05/12/04

COOLER #: 22 External Micro R Meter Reading (μ R/hr): 260

Paragon Sample ID:	Client Sample ID:	Micro R Meter Reading (μ R/hr):
0405096-29-1	SOIL-07	< background
0405096-29-2	SOIL-07	< background
0405096-29-3	SOIL-07	< background
0405096-30-1	SOIL-08	45
0405096-30-2	SOIL-08	40
0405096-30-3	SOIL-08	40
0405096-31-1	SOIL-09	< background
0405096-31-2	SOIL-09	< background
0405096-31-3	SOIL-09	< background
0405096-32-1	SOIL-10	55
0405096-32-2	SOIL-10	50
0405096-32-3	SOIL-10	65
0405097-22-1	700-04	450
0405097-23-1	900-01	110
0405097-23-2	900-01	110
0405097-23-3	900-01	140

If applicable, was the client contacted? **YES / NO / NA** Client Rep. Name: Sue Kent Date/Time: 5/14/04

Project Manager Signature/ Date: 5/14/04

0405096
0405097

Air Cargo
Alaska Airlines
1-800-2ALASKA

Airbill Number: 027 KTN 5436-6152 Box No. 0001

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

190
#924
2 seals
10°C

ARTIC 0-0410-3-1635

Air Cargo
Alaska Airlines
1-800-2ALASKA

10°C

Airbill Number: 027 KTN 5436-6152 Box No. 0015

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

140
#898
2 seals

ARTIC 0-0410-3-1635

Air Cargo
Alaska Airlines
1-800-2ALASKA

Airbill Number: 027 KTN 5436-6152 Box No. 0011

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

320
9°C
#897
2 seals

ARTIC 0-0410-3-1635

Air Cargo
Alaska Airlines
1-800-2ALASKA

Airbill Number: 027 KTN 5436-6152 Box No. 0002

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

300
15°C
#899
2 seals

ARTIC 0-0410-3-1635

0405096
0405097

AirCargo
Alaska Airlines
1-800-2ALASKA

Airbill Number: 027 KTN 5436-6152 Box No. 0006

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

320 12.0 2 seals

ARTIC 0-0410-3-1635

AirCargo
Alaska Airlines
1-800-2ALASKA

Airbill Number: 027 KTN 5436-6152 Box No. 0010

Destination: DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

260 14.0 2 seals

ARTIC 0-0410-3-1635

0405096
0405097

Air Cargo
Alaska Airlines
1-800-2ALASKA

Airbill Number
027 KTN 5436-6152 Box No. 0001

Destination
DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

190
#924
2 seals
10°C

ARTIC 0-0410-3-1635

Air Cargo
Alaska Airlines
1-800-2ALASKA

10°C

Airbill Number
027 KTN 5436-6152 Box No. 0015

Destination
DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

140
#898
2 seals

ARTIC 0-0410-3-1635

Air Cargo
Alaska Airlines
1-800-2ALASKA

Airbill Number
027 KTN 5436-6152 Box No. 0011

Destination
DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

320
9°C
#897
2 seals

ARTIC 0-0410-3-1635

Air Cargo
Alaska Airlines
1-800-2ALASKA

Airbill Number
027 KTN 5436-6152 Box No. 0002

Destination
DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

300
15°C
#899
2 seals

ARTIC 0-0410-3-1635

0405096
0405097

AirCargo
Alaska Airlines
1-800-2ALASKA

Airbill Number
027 KTN 5436-6152 Box No. 0006

Destination
DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

320 12°C 2 seals

#408

ARTIC 0-0410-3-1635

AirCargo
Alaska Airlines
1-800-2ALASKA

Airbill Number
027 KTN 5436-6152 Box No. 0010

Destination
DEN

Pieces	Total Weight	Date
17	865	10-MAY-04

14 RAIDOACTIVE COOLERS COOL
3 MT COOLERS

260 14°C 2 seals

#22

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: 0405096

Prep SOP: PAI 777
Analytical SOP: PAI 714

Reported on: Friday, July 30, 2004
7:28:49 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
0405096-4	SMP	AS040607-2	Th/Ac	9	C4060809	6/8/2004	28.82	Warning	28.42	28.93	30.91	31.42
TZ50964		AS040607-2A			B4060909	6/10/2004	0.1700	Pass	0.0000	0.0500	0.4000	0.5000
6/11/2004					C4060809	6/8/2004	5534.3	Pass	5477.6	5487.6	5567.6	5577.6
0405096-4	DUP	AS040607-2	Th/Ac	12	C4060812	6/8/2004	29.31	Pass	27.56	28.05	29.97	30.46
TA50964D		AS040607-2A			B4060812	6/9/2004	0.3466	Pass	0.0000	0.0500	0.4000	0.5000
6/11/2004					C4060812	6/8/2004	5537.9	Pass	5493.9	5503.9	5583.9	5593.9
AS040607-2	MB	AS040607-2	Th/Ac	13	C4060813	6/8/2004	31.73	Pass	29.90	30.43	32.51	33.04
TA6072B		AS040607-2A			B4060813	6/9/2004	0.2359	Pass	0.0000	0.0500	0.4000	0.5000
6/11/2004					C4060813	6/8/2004	5547.6	Pass	5504.0	5514.0	5594.0	5604.0
AS040607-2	LCS	AS040607-2	Th/Ac	15	C4060815	6/8/2004	30.14	Pass	28.43	28.94	30.83	31.43
TA6072L		AS040607-2A			B4060815	6/9/2004	0.4175	Warning	0.0000	0.0500	0.4000	0.5000
6/11/2004					C4060815	6/8/2004	5538.3	Pass	5535.0	5538.0	5550.0	5553.0

Data Package ID: *ThAc0405096-1*

Abbreviations:

Eff - Efficiency	Bkg - Background	LCL - Lower Control Limit	UWL - Upper Warning Limit	
Egy - Energy	CPM - Counts per Minute	LWL - Lower Warning Limit	UCL - Upper Control Limit	CI - The Analysis Date exceeds the Calibration Date by more than 7 days.

Alpha Spec Calibration Source Re-Certification

R:\INSTVALPHA\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 (Lablled #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	70580.76	2100	31.57%	4197.37	6387.72	10585.09
92MIX2203029	189	97-19-103-08	3/22/04	84881.65	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	7546.69	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]

PAI 187
recalibrated 4-15-03

CERTIFICATE OF CALIBRATION
MIXED ALPHA STANDARD SOURCE

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

Contained Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel James Van Dalsem
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

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α 2

PAI 183
Recalibrated 4-15-03

CERTIFICATE OF CALIBRATION
MIXED ALPHA STANDARD SOURCE

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

Contained Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel James Van Dalsem
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7

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α3

PAT I.D 184
recalibrated 4-15-03

CERTIFICATE OF CALIBRATION
MIXED ALPHA STANDARD SOURCE

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

Contained Radioactivity:

U-234:	3.227	nCi	(119.4 Bq)	Am-241:	2.866	nCi	(106.0 Bq)
U-235:	0.05205	nCi	(1.926 Bq)	Total Activity:	6.145	nCi	(227.3 Bq)

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel James Van Delaan
Quality Control

15-APR-03
Date Signed

IPL Ref. No.: 987-7

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α4

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

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOURCE

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

Contained Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel James Van Dalsem
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α5

PAI I-D 00186
recertification
received 3-28-03

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOURCE

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

Contained Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel Jamal Ann Dalson
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α 6

PAID, CC 187
recd for recalibration
3-28-03

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOURCE

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

Contained Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel James Van Dalsem
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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α 7

PA I.D. 188
rec'd for recalibration
3-28-03

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOURCE

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

Contained Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel Haines Van DeBoerm
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

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[α 8]

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

CERTIFICATE OF CALIBRATION
MIXED ALPHA STANDARD SOURCE

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

Contained Radioactivity:

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

Physical description:

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

Radioimpurities: Not determined

Method of Calibration:

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

Uncertainty of Measurement:

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

Notes:

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

Daniel James Van Dalen
Quality Control

15-Apr-03
Date Signed

IPL Ref. No.: 987-7