



# Paragon Analytics, Inc.

## Radiochemistry Case Narrative

### Isotopic Thorium

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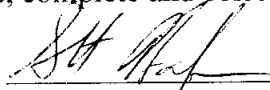
### **New Horizons**

CSMRI / 2112


PAI WO 0212096

1. This report consists of 3 filter samples received by Paragon on 12/19/02.
2. These samples were prepared according to QASS 253318 and Paragon Analytics, Inc. procedures PAI SOP773R7, PAI SOP776R7, and PAI SOP721R9.
3. The samples were analyzed for the presence of isotopic thorium according to Paragon Analytics, Inc. procedure PAI SOP714R7. The analyses were completed on 12/31/02.
4. The analysis results for these samples are reported on an "as received" basis in units of pCi/filter.
5. Due to tailing of the Th-229 tracer peak into the Th-230 region of interest, there is always a small amount of Th-230 observed in the blank. Since there is a similar tailing contribution in sample results, all Th-230 activities should be compared to the reported Th-230 activity in the blank. Per the client's request, data from this batch is submitted without further qualification (see NCR 004630).
6. Due to insufficient sample volume, a duplicate laboratory control sample (LCS) was prepared in lieu of a prep batch duplicate.
7. The samples were given an extended count time of 1000 minutes, at which time the requested MDC of 0.2 pCi/filter could not be achieved for Th-228. Data is submitted without further qualification (see NCR 004630).
8. No further anomalous situations were encountered during the preparation or analysis of these samples. All remaining quality control criteria were met.

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

  
\_\_\_\_\_  
Scott Hafeman  
Radiochemistry Instrumentation

1/6/03  
Date

  
\_\_\_\_\_  
Julie Ellingson  
Radiochemistry Final Data Review

1/7/03  
Date

# Isotopic Thorium By Alpha Spectroscopy

Method PAI SOP 714R7

## Method Blank Results

Page: 1 of 1

Reported on: Monday, January 06, 2003  
15:19:52

Client Name: New Horizons  
Client Project Name: CSMRI  
Client Project Number: 2112

Laboratory Name: Paragon Analytics, Inc.  
PAI Work Order: 0212096

Field ID:

Lab ID: AS06023BLK1

Sample Matrix: Filter  
Date Prepared: 20-Dec-02  
Prep SOP: PAI 777R6  
Prep Batch: AS06023

Date Collected: 20-Dec-02  
Date Analyzed: 31-Dec-02  
Analytical SOP: PAI 714R7

Final Aliquot: 0.2500  
Aliquot Units: filter  
Report Basis: As Received  
Count Time (min.): 1000

Target Nuclide	Result +/- 2s TPU	MDC	Reporting Units	Lab Qualifier
Th-228	0.15 +/- 0.18	0.30	pCi/filt	U
Th-230	0.247 +/- 0.095	0.061	pCi/filt	B
Th-232	0.040 +/- 0.042	0.061	pCi/filt	U

## Chemical Yield Summary

Tracer Nuclide	Tracer Known	Tracer Measured	Units	Tracer Yield	Control Limits	Flag
Th-229	9.3	7.21	pCi/filt	77.81	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 in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.
- B - Analyte concentration greater than MDC.

#### Abbreviations:

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

Data Package ID: TH0212096-1

Paragon Analytics Inc.

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# Isotopic Thorium By Alpha Spectroscopy

## Method PAI SOP 714R7

### LCS Results

Page: 1 of 2

Reported on: Monday, January 06, 2003  
15:19:52

Client Name: New Horizons

Client Project Name: CSMRI

Client Project Number: 2112

Laboratory Name: Paragon Analytics, Inc.

PAI Work Order: 0212096

Field ID:

Lab ID: AS06023LCS1

Sample Matrix: Filter

Date Prepared: 20-Dec-02

Prep SOP: PAI 777R6

Prep Batch: AS06023

Date Collected: 20-Dec-02

Date Analyzed: 31-Dec-02

Analytical SOP: PAI 714R7

Final Aliquot: 0.2500

Aliquot Units: filter

Report Basis: As Received

Count Time (min.): 1000

Target Nuclide	LCS Results +/- 2s TPU	MDC	Spike Added	Reporting Units	LCS Recovery	Control Limits	Lab Qualifier
Th-228	-0.05 +/- 0.19	0.35	N/A	pCi/filt	N/A	N/A	U
Th-230	19.8 +/- 2.7	0.10	18.0	pCi/filt	110%	85-121%	P
Th-232	0.170 +/- 0.091	0.10	N/A	pCi/filt	N/A	N/A	LT

### Chemical Yield Summary

Tracer Nuclide	Tracer Known	Tracer Measured	Units	Tracer Yield	Control Limits	Flag
Th-229	9.3	6.21	pCi/filt	67.06	30-110%	

#### Comments:

Data Package ID: TH0212096-1

#### 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.

\* - Duplicate DER not within control limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

#### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

Paragon Analytics Inc.

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# Isotopic Thorium By Alpha Spectroscopy

## Method PAI SOP 714R7

### LCS Results

Page: 2 of 2

Reported on: Monday, January 06, 2003  
15:19:52

Client Name: New Horizons

Client Project Name: CSMRI

Client Project Number: 2112

Laboratory Name: Paragon Analytics, Inc.

PAI Work Order: 0212096

Field ID:  
Lab ID: AS06023LCS1-D1

Sample Matrix: Filter  
Date Prepared: 20-Dec-02  
Prep SOP: PAI 777R6  
Prep Batch: AS06023

Date Collected: 20-Dec-02  
Date Analyzed: 31-Dec-02  
Analytical SOP: PAI 714R7

Final Aliquot: 0.2500  
Aliquot Units: filter  
Report Basis: As Received  
Count Time (min.): 1000

Target Nuclide	LCS Results +/- 2s TPU	MDC	Spike Added	Reporting Units	LCS Recovery	Control Limits	Lab Qualifier
Th-228	-0.09 +/- 0.19	0.35	N/A	pCi/filt	N/A	N/A	U
Th-230	19.0 +/- 2.6	0.061	18.0	pCi/filt	106%	85-121%	P
Th-232	0.088 +/- 0.058	0.061	N/A	pCi/filt	N/A	N/A	LT

### Chemical Yield Summary

Tracer Nuclide	Tracer Known	Tracer Measured	Units	Tracer Yield	Control Limits	Flag
Th-229	9.3	6.73	pCi/filt	72.63	30-110%	

#### Comments:

Data Package ID: TH0212096-1

#### 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.
- \* - Duplicate DER not within control limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.

#### Abbreviations:

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

Paragon Analytics Inc.

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# Isotopic Thorium By Alpha Spectroscopy

Method PAI SOP 714R7

## Duplicate Sample Results (DER)

Page: 1 of 1

Reported on: Monday, January 06, 2003  
15:19:52

Client Name: New Horizons

Client Project Name: CSMRI

Client Project Number: 2112

Laboratory Name: Paragon Analytics, Inc.

PAI Work Order: 0212096

Field ID:	Prep Date	Analysis Date	Prep Batch	Final Aliquot
Lab ID: AS06023LCS1	12/20/02	12/31/02	AS06023	0.2500
DUP ID: AS06023LCS1-D1	12/20/02	12/31/02	AS06023	0.2500

Sample Matrix: Filter  
Date Collected: 20-Dec-02  
Analytical SOP: PAI 714R7  
Prep SOP: PAI 777R6  
Aliquot Units: filter  
Report Basis: As Received

Analyte	Sample Result +/- 2s TPU	Duplicate Result +/- 2s TPU	Units	DER	Warning Limit	Lab Qualifiers
Th-228	-0.05 +/- 0.19	-0.09 +/- 0.19	pCi/filt	0.14	< 1.42	
Th-230	19.8 +/- 2.7	19.0 +/- 2.6	pCi/filt	0.2	< 1.42	
Th-232	0.170 +/- 0.091	0.088 +/- 0.058	pCi/filt	0.75	< 1.42	

## Chemical Yield Summary

Tracer Nuclide	Tracer Known	Tracer Measured	Units	Tracer Yield	Control Limits	Flag
Th-229	9.3	6.73	pCi/filt	72.63	30-110%	

### Comments:

#### Qualifiers/Flags:

W - DER is greater than Warning Limit of 1.42  
H - DER is Higher than Control Limit of 2.13

#### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)  
DER - Duplicate Error Ratio

Data Package ID: TH0212096-1

Paragon Analytics Inc.

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# Isotopic Thorium By Alpha Spectroscopy

## Method PAI SOP 714R7

### Sample Results

Page: 1 of 3

Reported on: Monday, January 06, 2003  
15:19:52

Client Name: New Horizons

Client Project Name: CSMRI

Client Project Number: 2112

Laboratory Name: Paragon Analytics, Inc.

PAI Work Order: 0212096

Field ID: 11072002-2

Lab ID: 0212096-1

Sample Matrix: Filter

Date Prepared: 20-Dec-02

Prep SOP: PAI 777R6

Prep Batch: AS06023

Date Collected: 07-Nov-02

Date Analyzed: 31-Dec-02

Analytical SOP: PAI 714R7

Final Aliquot: 0.2500 filter

Report Basis: As Received

Count Time (min.): 1000

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Th-228	-0.08 +/- 0.19	0.37	pCi/filt	U
Th-230	0.188 +/- 0.100	0.10	pCi/filt	LT
Th-232	0.031 +/- 0.050	0.080	pCi/filt	U

### Chemical Yield Summary

Tracer Nuclide	Tracer Known	Tracer Measured	Units	Tracer Yield	Control Limits	Flag
Th-229	9.3	5.79	pCi/filt	62.43	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)

Data Package ID: TH0212096-1

Paragon Analytics Inc.

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# Isotopic Thorium By Alpha Spectroscopy

## Method PAI SOP 714R7

### Sample Results

Page: 2 of 3

Reported on: Monday, January 06, 2003  
15:19:52

Client Name: New Horizons

Client Project Name: CSMRI

Client Project Number: 2112

Laboratory Name: Paragon Analytics, Inc.

PAI Work Order: 0212096

Field ID: 11062002-1

Lab ID: 0212096-2

Sample Matrix: Filter

Date Prepared: 20-Dec-02

Prep SOP: PAI 777R6

Prep Batch: AS06023

Date Collected: 06-Nov-02

Date Analyzed: 31-Dec-02

Analytical SOP: PAI 714R7

Final Aliquot: 0.2500 filter

Report Basis: As Received

Count Time (min.): 1000

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Th-228	0.05 +/- 0.21	0.37	pCi/filt	U
Th-230	0.21 +/- 0.10	0.11	pCi/filt	
Th-232	-0.010 +/- 0.047	0.11	pCi/filt	U

### Chemical Yield Summary

Tracer Nuclide	Tracer Known	Tracer Measured	Units	Tracer Yield	Control Limits	Flag
Th-229	9.3	6.43	pCi/filt	69.40	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)

Data Package ID: TH0212096-1

Paragon Analytics Inc.

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# Isotopic Thorium By Alpha Spectroscopy

## Method PAI SOP 714R7

### Sample Results

Page: 3 of 3

Reported on: Monday, January 06, 2003  
15:19:52

Client Name: New Horizons

Client Project Name: CSMRI

Client Project Number: 2112

Laboratory Name: Paragon Analytics, Inc.

PAI Work Order: 0212096

Field ID: 10312002-2

Lab ID: 0212096-3

Sample Matrix: Filter

Date Prepared: 20-Dec-02

Prep SOP: PAI 777R6

Prep Batch: AS06023

Date Collected: 31-Oct-02

Date Analyzed: 31-Dec-02

Analytical SOP: PAI 714R7

Final Aliquot: 0.2500 filter

Report Basis: As Received

Count Time (min.): 1000

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Th-228	0.04 +/- 0.11	0.21	pCi/filt	U
Th-230	0.33 +/- 0.13	0.094	pCi/filt	
Th-232	0.069 +/- 0.075	0.12	pCi/filt	U

### Chemical Yield Summary

Tracer Nuclide	Tracer Known	Tracer Measured	Units	Tracer Yield	Control Limits	Flag
Th-229	9.3	6.61	pCi/filt	71.35	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)

Data Package ID: TH0212096-1

Paragon Analytics Inc.

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Paragon Analytics, Inc.  
NON-CONFORMANCE REPORT

Initiated by WTK  
Date Initiated 1/2/03

Method/Procedure Th ISO  
Work Orders Affected 0212096  
4506023  
Clients New Horizons

SECTION I TYPE OF EVENT

- 1. Spike / Surrogate / IS / Tracer Criteria Not Met
- 2. Calibration Criteria Not Met (ICAL, ICV, CCV)
- 3. Lab Contamination
- 4. Method Requirements Not Met (HTV, MB, DER)
- 5. Equipment Failure
- 6. Deviation from QAP, SOP, Method DQO
- 7. Data resubmission (hc, edd, narrative, letter)
- 8. Client complaint
- 9. Other

SPECIFY: ① Method Blank + 506023BLK1 has Th-230 activity above the achieved MDC of 0.061 at 0.247 pCi/filter. Th samples in the batch have Th-230 activity at approximately the same level.  
② Following an extended count (1000 min), the requested MDC of 0.2 pCi/filter was not achieved for Th-228

Client Contacted? (Y) Name: Robert Krumberger <sup>(left message)</sup> Date: 1-2-03 Time: 1200

SECTION II CORRECTIVE ACTION

- 1. Submit for Re-Extraction
  - 2. Recalibrate
  - 3. Re-analyze
  - 4. Return to Vendor/Reject
  - 5. Resubmit data
  - 6. Retrain
  - 7. Document in Narrative 303
  - 8. Other:
- Approved by KDC

SECTION III REQUEST FOR RE-EXTRACTION

Initial date prepared, Page # \_\_\_\_\_  
Date for Rework, Page # \_\_\_\_\_  
Submitted by \_\_\_\_\_  
Received by \_\_\_\_\_  
Outcome of Re-analysis \_\_\_\_\_  
Approved by \_\_\_\_\_

SECTION IV DISPOSITION

Use as is	Reject	Repair
<u>Report and narrate</u>		

SIGNATURES:  
Approved by KD [Signature] Date 1-2-03 (Project Manager)  
Verification of Disposition [Signature] Date 1/2/03 (Department Manager)  
QA Department Approval [Signature] [Signature] Date 01-02-03 (QA Manager)

COPIES: Project Manager [Signature] Operations Manager [Signature] Dept. Manager [Signature] Reporting Group (as applicable)

QUALITY ASSURANCE SUMMARY SHEET

PAI W.O. # / BATCH 0212096 /  
TEST Th-ISO  
METHOD PREP  
SOP/REV (PREP) 777/R6  
SOP/REV (ANAL) \_\_\_\_\_

253318

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. JDB 12/24/02

JDB 12/24/02

Samples were muffled and digested in accordance with SOP 773/R7. After step 8.3.8 (SOP 773/R7), the samples were brought to a volume of 1 Liter with DI water. The samples were treated as waters, and for the actinides tests SOP 776/R7 was followed; SOP 783/R3 was followed for Ra226 (903.1).

Aliquot sizes were determined according to project specified detection limits. The aliquot sizes taken for the required tests are as follows:

Ra226 (903.1)	250 mL
TH-ISO	250 mL
U-ISO	250 mL

The samples are to be reported on a per filter basis. The filter equivalents were calculated using the following equation:

$$\text{filter equivalent (x)} = \frac{\text{aliquot volume (mL)}}{\text{sample volume (mL)}}$$

Hence the filter equivalents entered into the bench sheets as "Sample Size" are:

Ra226 (903.1)	.250
TH-ISO	.250
U-ISO	.250

LCS duplicates were created due to limited sample volume.

Because the digestate solution is a common one for multiple analyses, the samples were traced and spiked after the aliquots were taken from the 1.0 L common digestate. Tracing and spiking at this stage reduced the potential for interferences caused by the different matrices used in the tracing and spiking solutions.

JDB 12/24/02

JDB 12/24/02

TECHNICIAN/ANALYST Jerry Bell (JDB)

DATE 12/24/02

DEPARTMENT MANAGER R. Folan

DATE 12/24/02