



# Paragon Analytics

## Radiochemistry Case Narrative

### Isotopic Uranium

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#### **New Horizons**

CSMRI / 2135

PA WO 0405063

1. This report consists of the analytical results for six soil samples received by Paragon on 05/06/04.
2. These samples were prepared according to Paragon Analytics procedures PA SOP721R10, PA SOP773R8, and PA SOP778R9.
3. The samples were analyzed for the presence of isotopic uranium according to Paragon Analytics procedure PA SOP714R8. The analyses were completed on 06/02/04.

The isotopic analysis results for these samples are reported on a dry weight basis in units of pCi/gram.

4. This analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to emission energies between those of U-234 and U-238. A potential limitation of this method is that measurable amounts of U-234 in the sample may cause a small amount of characteristic activity in the U-235 region of interest due to poorly resolved alpha activity at the boundary between the two regions. To minimize the potential for a high bias in the U-235 analytical results, the U-235 region of interest has been narrowed and limited to a lower energy region. An 85.1% abundance correction has been made to the final U-235 results.
5. Paragon Analytics follows the convention outlined in ANSI N42.23 for reporting significant digits in the TPU and MDC results. ANSI N42.23 states that the TPU result should be rounded to two significant digits and that the MDC result should be rounded to the same decimal place as the TPU result. In practice, this could result in an MDC result with a reported value of 0 for samples with significant activity, including the batch laboratory control sample.
6. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.

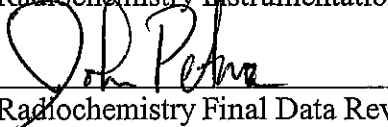
The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, Paragon Analytics certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.



Skye Dobberstein  
Radiochemistry Instrumentation

6/11/04

Date



John Palma  
Radiochemistry Final Data Review

6/11/04

Date

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Method Blank Results

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Lab ID: AS040518-4MB

Sample Matrix: SOIL

Prep Batch: AS040518-4

Final Aliquot: 2.00 g

Prep SOP: PAI 778 Rev 9

QCBatchID: AS040518-4-1

Result Units: pCi/g

Date Collected: 18-May-04

Run ID: AS040518-4A

File Name: U5184B

Date Prepared: 18-May-04

Count Time: 300 minutes

Date Analyzed: 02-Jun-04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13966-29-5	U-234	0.012 +/- 0.015	0.023	U
15117-96-1	U-235	0 +/- 0.015	0.011	U
7440-61-1	U-238	0.010 +/- 0.013	0.019	U

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	4.272	3.30	pCi/g	77.1	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

#### 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: U0405063-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Laboratory Control Sample(s)

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Lab ID: AS040518-4LCS	Sample Matrix: SOIL	Prep Batch: AS040518-4	Final Aliquot: 2.00 g
	Prep SOP: PAI 778 Rev 9	QCBatchID: AS040518-4-1	Result Units: pCi/g
	Date Collected: 18-May-04	Run ID: AS040518-4A	File Name: U5184L
	Date Prepared: 18-May-04	Count Time: 300 minutes	
	Date Analyzed: 02-Jun-04		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13966-29-5	U-234	4.47 +/- 0.74	0.03	4.34	103	82 - 122	P
7440-61-1	U-238	4.50 +/- 0.75	0.02	4.50	100	82 - 122	P

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	4.272	3.21	pCi/g	75.2	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

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

#### Abbreviations:

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

Data Package ID: U0405063-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Duplicate Sample Results (DER)

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: GSMRI 2135

Field ID: IC1014  
Lab ID: 0405063-5DUP

Sample Matrix: SOIL  
Prep SOP: PAI 778 Rev 9  
Date Collected: 04-May-04  
Date Prepared: 18-May-04  
Date Analyzed: 02-Jun-04

Prep Batch: AS040518-4  
QCBatchID: AS040518-4-1  
Run ID: AS040518-4A  
Count Time: 300 minutes  
Report Basis: Dry Weight

Final Aliquot: 2.04 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: U50635D

CASNO	Analyte	Sample Result +/- 2s TPU	Duplicate Result +/- 2s TPU	DER	Control Limit	Lab Qualifiers
13966-29-5	U-234	0.75 +/- 0.15	0.74 +/- 0.15	0.05	2.13	
15117-96-1	U-235	0.027 +/- 0.021	0.032 +/- 0.023	0.15	2.13	LT
7440-61-1	U-238	0.87 +/- 0.17	0.79 +/- 0.16	0.34	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: U0405063-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: H107-117

Lab ID: 0405063-2

Sample Matrix: SOIL

Prep SOP: PAI 778 Rev 9

Date Collected: 28-Apr-04

Date Prepared: 18-May-04

Date Analyzed: 02-Jun-04

Prep Batch: AS040518-4

QCBatchID: AS040518-4-1

Run ID: AS040518-4A

Count Time: 300 minutes

Report Basis: Dry Weight

Final Aliquot: 2.05 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: U50632

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13966-29-5	U-234	2.59 +/- 0.44	0.03	
15117-96-1	U-235	0.156 +/- 0.053	0.019	
7440-61-1	U-238	2.53 +/- 0.43	0.03	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	4.173	3.20	pCi/g	76.6	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: U0405063-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: HSDA  
Lab ID: 0405063-3

Sample Matrix: SOIL  
Prep SOP: PAI 778 Rev 9  
Date Collected: 30-Apr-04  
Date Prepared: 18-May-04  
Date Analyzed: 02-Jun-04

Prep Batch: AS040518-4  
QCBatchID: AS040518-4-1  
Run ID: AS040518-4A  
Count Time: 300 minutes  
Report Basis: Dry Weight

Final Aliquot: 1.00 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: U50633

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13966-29-5	U-234	2.36 +/- 0.44	0.06	
15117-96-1	U-235	0.126 +/- 0.068	0.064	
7440-61-1	U-238	2.30 +/- 0.43	0.03	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	8.530	6.7	pCi/g	78.5	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: U0405063-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: IC1014  
Lab ID: 0405063-5

Sample Matrix: SOIL  
Prep SOP: PAI 778 Rev 9  
Date Collected: 04-May-04  
Date Prepared: 18-May-04  
Date Analyzed: 02-Jun-04

Prep Batch: AS040518-4  
QCBatchID: AS040518-4-1  
Run ID: AS040518-4A  
Count Time: 300 minutes  
Report Basis: Dry Weight

Final Aliquot: 2.05 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: U50635

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13966-29-5	U-234	0.75 +/- 0.15	0.02	
15117-96-1	U-235	0.027 +/- 0.021	0.011	LT
7440-61-1	U-238	0.87 +/- 0.17	0.03	

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	4.164	3.18	pCi/g	76.3	30 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: U0405063-1



# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Sample Duplicate Results

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID:	IC1014
Lab ID:	0405063-5DUP

Sample Matrix: SOIL  
Prep SOP: PAI 778 Rev 9  
Date Collected: 04-May-04  
Date Prepared: 18-May-04  
Date Analyzed: 02-Jun-04

Prep Batch: AS040518-4  
QCBatchID: AS040518-4-1  
Run ID: AS040518-4A  
Count Time: 300 minutes  
Report Basis: Dry Weight

Final Aliquot: 2.04 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: U50635D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13966-29-5	U-234	0.74 +/- 0.15	0.03	
15117-96-1	U-235	0.032 +/- 0.023	0.025	LT
7440-61-1	U-238	0.79 +/- 0.16	0.03	

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	4.187	3.36	pCi/g	80.2	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.
- 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: U0405063-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID:	IC1017
Lab ID:	0405063-7

Sample Matrix: SOIL  
Prep SOP: PAI 778 Rev 9  
Date Collected: 04-May-04  
Date Prepared: 18-May-04  
Date Analyzed: 02-Jun-04

Prep Batch: AS040518-4  
QCBatchID: AS040518-4-1  
Run ID: AS040518-4A  
Count Time: 300 minutes  
Report Basis: Dry Weight

Final Aliquot: 2.03 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: U50637

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13966-29-5	U-234	3.39 +/- 0.57	0.02	
15117-96-1	U-235	0.238 +/- 0.071	0.030	
7440-61-1	U-238	3.36 +/- 0.56	0.03	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	4.202	3.30	pCi/g	78.5	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: U0405063-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: H256  
Lab ID: 0405063-9

Sample Matrix: SOIL  
Prep SOP: PAI 778 Rev 9  
Date Collected: 05-May-04  
Date Prepared: 18-May-04  
Date Analyzed: 02-Jun-04

Prep Batch: AS040518-4  
QCBatchID: AS040518-4-1  
Run ID: AS040518-4A  
Count Time: 300 minutes  
Report Basis: Dry Weight

Final Aliquot: 2.02 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: U50639

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13966-29-5	U-234	25.8 +/- 4.2	0	
15117-96-1	U-235	1.16 +/- 0.24	0.01	
7440-61-1	U-238	26.2 +/- 4.2	0	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	4.240	2.56	pCi/g	60.3	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

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

#### Abbreviations:

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

Data Package ID: U0405063-1

# Isotopic Uranium By Alpha Spectroscopy

PAI 714 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405063

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: H256S
Lab ID: 0405063-11

Sample Matrix: SOIL  
Prep SOP: PAI 778 Rev 9  
Date Collected: 04-May-04  
Date Prepared: 18-May-04  
Date Analyzed: 02-Jun-04

Prep Batch: AS040518-4  
QCBatchID: AS040518-4-1  
Run ID: AS040518-4A  
Count Time: 300 minutes  
Report Basis: Dry Weight

Final Aliquot: 1.03 g  
Prep Basis: Dry Weight  
Moisture(%): NA  
Result Units: pCi/g  
File Name: U506311

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13966-29-5	U-234	24.8 +/- 4.0	0.1	
15117-96-1	U-235	1.28 +/- 0.28	0.04	
7440-61-1	U-238	25.1 +/- 4.0	0	

### Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
U-232	8.273	6.27	pCi/g	75.8	30 - 110 %	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: U0405063-1