



Paragon Analytics

Radiochemistry Case Narrative

Isotopic Polonium

New Horizons

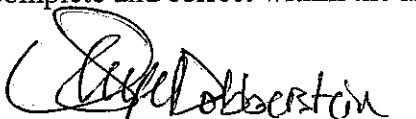
CSMRI / 2135

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 SOP773R8 and PA SOP711R1.
3. The samples were analyzed for the presence of Polonium-210 according to Paragon Analytics procedure PA SOP714R8. The analyses were completed on 06/07/04.
4. The isotopic analysis results for these samples are reported on a dry weight basis in units of pCi/gram.
5. Due to the poor availability of a 'NIST traceable' Polonium-209 tracer solution, the concentration of a dilution of isotopically pure Po-209 received from Oak Ridge National Laboratory was determined by cross calibration against two distinct NIST traceable sources (Po-210 and Pb/Po-210). While the calibration is not formally 'NIST traceable', the Po-209 concentration was calibrated against and is thus referenced to NIST traceable standards.
6. Results of this analysis are decay-corrected to the sampling date, based on the 138.4-day half-life of Po-210. This decay correction makes no assumptions as to the equilibrium state of Po-210 with the Pb-210 parent nuclide, which has a half-life of 22.3 years.
7. 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.

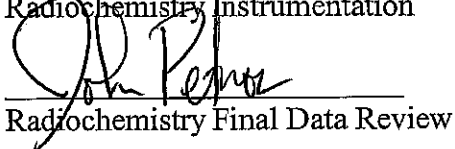
8. Sample IC1017 (PA ID 0405063-7) did not meet the requested MDC of 0.1 pCi/g, however the reported activity in this sample exceeds the achieved MDC value. This sample is identified with an "M3" flag on the final reports.
9. No anomalous situations were encountered during the preparation or analysis 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



Radiochemistry Final Data Review

6/11/04
Date

Polonium-210 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: PL040601-1MB

Sample Matrix: SOIL

Prep Batch: PL040601-1

Final Aliquot: 0.500 g

Prep SOP: PAI 711 Rev 5

QCBatchID: PL040601-1-1

Result Units: pCi/g

Date Collected: 01-Jun-04

Run ID: PL040601-1A

File Name: O40601B

Date Prepared: 01-Jun-04

Count Time: 300 minutes

Date Analyzed: 06-Jun-04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13981-52-7	Po-210	0.013 +/- 0.047	0.035	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.404	7.3	pCi/g	87.0	20 - 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: PL0405063-1

Polonium-210 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: PL040601-1LCS

Sample Matrix: SOIL
Prep SOP: PAI 711 Rev 5
Date Collected: 01-Jun-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: PL040601-1
QC Batch ID: PL040601-1-1
Run ID: PL040601-1A
Count Time: 300 minutes

Final Aliquot: 0.500 g
Result Units: pCi/g
File Name: O40601L

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13981-52-7	Po-210	15.6 +/- 2.6	0	14.2	109	83 - 117	P

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.404	7.2	pCi/g	85.7	20 - 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: *PL0405063-1*

Polonium-210 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: CSMRI 2135

Field ID: H107-117	Sample Matrix: SOIL	Prep Batch: PL040601-1	Final Aliquot: 0.508 g
Lab ID: 0405063-2DUP	Prep SOP: PAI 711 Rev 5	QCBatchID: PL040601-1-1	Prep Basis: Dry Weight
	Date Collected: 28-Apr-04	Run ID: PL040601-1A	Moisture(%): NA
	Date Prepared: 01-Jun-04	Count Time: 300 minutes	Result Units: pCi/g
	Date Analyzed: 06-Jun-04	Report Basis: Dry Weight	File Name: O50632D

CASNO	Analyte	Sample Result +/- 2s TPU	Duplicate Result +/- 2s TPU	DER	Control Limit	Lab Qualifiers
13981-52-7	Po-210	3.51 +/- 0.71	3.15 +/- 0.63	0.37	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
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Data Package ID: *PL0405063-1*

Polonium-210 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 711 Rev 5
Date Collected: 28-Apr-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: PL040601-1
QCBatchID: PL040601-1-1
Run ID: PL040601-1A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 0.504 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: O50631

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13981-52-7	Po-210	3.51 +/- 0.71	0.08	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.344	7.8	pCi/g	93.2	20 - 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: *PL0405063-1*

Polonium-210 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: H107-117
Lab ID: 0405063-2DUP

Sample Matrix: SOIL
Prep SOP: PAI 711 Rev 5
Date Collected: 28-Apr-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: PL040601-1
QCBatchID: PL040601-1-1
Run ID: PL040601-1A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 0.508 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: O50632D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13981-52-7	Po-210	3.15 +/- 0.63	0.08	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.275	7.4	pCi/g	89.9	20 - 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: PL0405063-1

Polonium-210 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 711 Rev 5
Date Collected: 30-Apr-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: PL040601-1
QCBatchID: PL040601-1-1
Run ID: PL040601-1A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 0.505 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: O50633

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13981-52-7	Po-210	1.15 +/- 0.34	0.09	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.313	5.16	pCi/g	62.1	20 - 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: PL0405063-1

Polonium-210 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 711 Rev 5
Date Collected: 04-May-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: PL040601-1
QCBatchID: PL040601-1-1
Run ID: PL040601-1A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 0.503 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: O50635

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13981-52-7	Po-210	0.68 +/- 0.21	0.08	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.356	7.7	pCi/g	91.7	20 - 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: *PL0405063-1*

Polonium-210 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 711 Rev 5
Date Collected: 04-May-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: PL040601-1
QCBatchID: PL040601-1-1
Run ID: PL040601-1A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 0.501 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: O50637

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13981-52-7	Po-210	9.0 +/- 1.6	0.1	M3

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.392	5.70	pCi/g	67.9	20 - 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: *PL0405063-1*

Polonium-210 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 711 Rev 5
Date Collected: 05-May-04
Date Prepared: 01-Jun-04
Date Analyzed: 06-Jun-04

Prep Batch: PL040601-1
QCBatchID: PL040601-1-1
Run ID: PL040601-1A
Count Time: 300 minutes
Report Basis: Dry Weight

Final Aliquot: 0.500 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: O50639

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13981-52-7	Po-210	6.1 +/- 1.1	0.1	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.399	7.4	pCi/g	88.2	20 - 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: *PL0405063-1*

Polonium-210 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 711 Rev 5

Date Collected: 04-May-04

Date Prepared: 01-Jun-04

Date Analyzed: 07-Jun-04

Prep Batch: PL040601-1

QCBatchID: PL040601-1-1

Run ID: PL040601-1A

Count Time: 300 minutes

Report Basis: Dry Weight

Final Aliquot: 0.502 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: OR506311

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13981-52-7	Po-210	5.06 +/- 0.95	0.09	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Po-209	8.372	7.1	pCi/g	85.0	20 - 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: PL0405063-1