



Paragon Analytics

Radiochemistry Case Narrative Gamma Spectroscopy

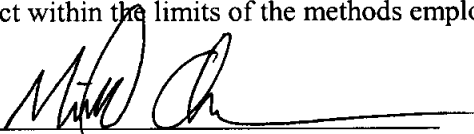
New Horizons

CSMRI / 2135


Paragon Work Order 0404241

1. The following report consists of analysis results for five soil samples received by Paragon on 4/23/04.
2. The results for these samples are reported on a 'dry weight' basis in units of pCi/gram.
3. These samples were prepared according to Paragon Analytics procedure PA SOP739R8. The samples were sealed in steel cans on 4/28/04 and stored for at least 21 days to allow Rn-222 to approach equilibrium with its progeny. The degree of ingrowth achieved prior to analysis on 5/21/04 is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
4. The samples were analyzed for the presence of gamma emitting radionuclides according to Paragon Analytics procedure PA SOP713R8. The analyses were completed on 5/21/04.
5. PA has observed a reproducible low bias in Ra-226 results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable Ra-226 source in the same geometry and configuration as the samples.
6. The library used for calibration and analysis employs multiple peaks for the Ra-226 progeny, Pb-214 (352 and 295 keV) and Bi-214 (609 and 1120 keV). Using these peaks avoids the use of the problematic Ra-226 photopeak at 186 keV, which suffers from poorly resolvable interference from U-235 at the same energy. Final activity results for Ra-226 are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.
7. Due to elevated activity and subsequent elevated background from the Compton Continuum in several samples in this workorder, the requested MDC of 0.5 pCi/gram for Ra-226 was not met. As there is significant activity in these samples, results are reported without further qualification.
8. No problems were encountered with either the client samples or the associated quality control 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.


Radiochemistry Instrument Technician

6-7-04
Date


Radiochemistry Final Data Review

6-7-04
Date

Gamma Spectroscopy Results

PAI 713 Rev 8
Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: BI17 Lab ID: 0404241-3	Sample Matrix: SOIL Prep SOP: PAI 739 Rev 8 Date Collected: 19-Apr-04 Date Prepared: 28-Apr-04 Date Analyzed: 21-May-04	Prep Batch: GS040428-2 QC Batch ID: GS040428-2-1 Run ID: gs040428-2a Count Time: 30 minutes Report Basis: Dry Weight	Final Aliquot: 182 g Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 040788D02A
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Library: Ra-226

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13982-63-3	Ra-226	5.27 +/- 0.74	0.51	M3,G

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU
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.

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 half-lives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:

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

Data Package ID: GSS0404241-2

Gamma Spectroscopy Results

PAI 713 Rev 8
Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: BI37
Lab ID: 0404241-5

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 8
Date Collected: 19-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 21-May-04

Prep Batch: GS040428-2
QCBatchID: GS040428-2-1
Run ID: gs040428-2a
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 173 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 040764D03A

Library: Ra-226

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13982-63-3	Ra-226	17.0 +/- 2.1	0.8	M3,G

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU
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.

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 half-lives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:

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

Data Package ID: GSS0404241-2

Gamma Spectroscopy Results

PAI 713 Rev 8

Sample Duplicate Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: BI37
Lab ID: 0404241-5DUP

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 8
Date Collected: 19-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 21-May-04

Prep Batch: GS040428-2
QCBatchID: GS040428-2-1
Run ID: gs040428-2a
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 168 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 040708D07A

Library: Ra-226

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13982-63-3	Ra-226	19.6 +/- 2.4	0.8	M3,G

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
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

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halfives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:

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

Data Package ID: GSS0404241-2

Gamma Spectroscopy Results

PAI 713 Rev 8
Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: BI42
Lab ID: 0404241-7

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 8
Date Collected: 19-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 21-May-04

Prep Batch: GS040428-2
QC Batch ID: GS040428-2-1
Run ID: gs040428-2a
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 151 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 040772D08A

Library: Ra-226

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13982-63-3	Ra-226	1.76 +/- 0.39	0.47	G

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU
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.

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 half-lives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:

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

Data Package ID: GSS0404241-2

Gamma Spectroscopy Results

PAI 713 Rev 8
Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: H07
Lab ID: 0404241-9

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 8
Date Collected: 22-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 21-May-04

Prep Batch: GS040428-2
QC Batch ID: GS040428-2-1
Run ID: gs040428-2a
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 147 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 040789D02A

Library: Ra-226

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13982-63-3	Ra-226	17.4 +/- 2.2	0.8	M3,G

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU
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.

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 half-lives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:

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

Data Package ID: GSS0404241-2

Gamma Spectroscopy Results

PAI 713 Rev 8
Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: H07S	Sample Matrix: SOIL	Prep Batch: GS040428-2	Final Aliquot: 142 g
Lab ID: 0404241-11	Prep SOP: PAI 739 Rev 8	QC Batch ID: GS040428-2-1	Prep Basis: Dry Weight
	Date Collected: 22-Apr-04	Run ID: gs040428-2a	Moisture(%): NA
	Date Prepared: 28-Apr-04	Count Time: 30 minutes	Result Units: pCi/g
Library: Ra-226	Date Analyzed: 21-May-04	Report Basis: Dry Weight	File Name: 040765D03A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13982-63-3	Ra-226	25.8 +/- 3.2	1.0	M3,G

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU
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.

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 half-lives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:

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

Data Package ID: GSS0404241-2

Gamma Spectroscopy Results

PAI 713 Rev 8

Method Blank Results

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Lab ID: GS040428-2MB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 8

Prep Batch: GS040428-2
QC Batch ID: GS040428-2-1

Final Aliquot: 215 g
Result Units: pCi/g
File Name: 040709D07A

Date Collected: 28-Apr-04

Run ID: gs040428-2a

Date Prepared: 28-Apr-04

Count Time: 30 minutes

Date Analyzed: 21-May-04

Library: Ra-226

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
13982-63-3	Ra-226	0.12 +/- 0.19	0.31	U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU
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.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 half-lives.
M - Requested MDC not met.
B - Analyte concentration greater than MDC.
B3 - Analyte concentration greater than MDC but less than Requested MDC.

Abbreviations:

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

Data Package ID: GSS0404241-2

Gamma Spectroscopy Results

PAI 713 Rev 8

Laboratory Control Sample(s)

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Lab ID: GS040428-2LCS

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 8

Prep Batch: GS040428-2
QCBatchID: GS040428-2-1

Final Aliquot: 215 g
Result Units: pCi/g
File Name: 040773D08A

Date Collected: 28-Apr-04

Run ID: gs040428-2a

Date Prepared: 28-Apr-04

Count Time: 30 minutes

Date Analyzed: 21-May-04

Library: Ra-226

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	468 +/- 55	2	471	99.3	85 - 115	P,M3

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU
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)

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Data Package ID: GSS0404241-2

Gamma Spectroscopy Results

PAI 713 Rev 8

Duplicate Sample Results (DER)

Lab Name: Paragon Analytics

Work Order Number: 0404241

Client Name: New Horizons

ClientProject ID: CSMRI 2135

Field ID: BI37
Lab ID: 0404241-5DUP

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 8
Date Collected: 19-Apr-04
Date Prepared: 28-Apr-04
Date Analyzed: 21-May-04

Prep Batch: GS040428-2
QCBatchID: GS040428-2-1
Run ID: gs040428-2a
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 168 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/g
File Name: 040708D07A

Library: Ra-226

CASNO	Analyte	Sample Result +/- 2 s TPU	Duplicate Result +/- 2 s TPU	DER	Control Limit	Lab Qualifiers
13982-63-3	Ra-226	17.0 +/- 2.1	19.6 +/- 2.4	0.81	2.13	M3,G

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

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS0404241-2

Date Printed: Monday, June 07, 2004

Paragon Analytics
LIMS Version: 5.027A

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