



Paragon Analytics

Radiochemistry Case Narrative

Gamma Spectroscopy

Cordilleran Compliance Services, Inc.

Rulison Area Well Monitoring


Paragon Work Order 0811110

1. This report consists of analytical results and supporting documentation for two water samples received by Paragon Analytics on 11/14/08.
2. These samples were prepared according to procedure PA SOP739R9. The samples were aliquoted from the aqueous phase.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to procedure PA SOP713R10. The analyses were completed on 11/29/08.
4. The analysis results for these samples are reported in units of pCi/L. The samples were filtered prior to analysis. Sample 0811110-2 was diluted prior to analysis.
5. Sample volumes were insufficient to allow preparation of a duplicate. A duplicate analysis of sample 0811110-1 was performed in lieu of a prepared duplicate.
6. Activity concentrations above the calculated MDC are reported in some instances where minimum nuclide identification criteria are not met. Such tentative identifications result when the software attempts to calculate net activity concentrations for analytes where either one or both of the following criteria are not satisfied: the 'diagnostic' peak for a nuclide must be identified above the critical level, or the minimum library peak abundance must be attained. Nuclides not meeting these requirements have been flagged with a "TI" qualifier.
7. Paragon Analytics has found there to be a significant low bias to ^{214}Pb and ^{214}Bi results when using a mixed nuclide gamma source for efficiency calibrations. The magnitude of this bias has been determined to be approximately 32% for ^{214}Bi , and 23% for ^{214}Pb . Therefore, any reported results for ^{214}Pb and ^{214}Bi are flagged with a "J" qualifier, indicating the activity values to be an estimated value. Results are reported without further qualification.
8. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.




9. There are cases where the magnitude of negative activity is greater than the 2σ TPU. Under typical conditions, where background data is normally distributed and analyzed by paired observations, this event is likely to occur at least 2.5% of the time. Review of the data does not indicate a problem with the instrument or reporting systems and results are reported without further qualification.
10. No further problems were encountered with either the client samples or the associated quality control 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 certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.


Linda Arend
Radiochemistry Primary Reviewer

12/09/08
Date


Radiochemistry Final Data Review

12-9-08
Date

Radiochemistry Data Package

Section 1

CHAIN OF CUSTODY

ALS Paragon

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0811110

Client Name: Cordilleran Compliance Services, Inc.

Client Project Name: Rulison Area Well monitoring

Client Project Number:

Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
A11-15D	0811110-1		WATER	13-Nov-08	8:40
A11-15B	0811110-2		WATER	13-Nov-08	8:30

CONDITION OF SAMPLE UPON RECEIPT FORM

Paragon Analytics

Client: CondillieranWorkorder No: 0811110Project Manager: LSInitials: oo Date: 11-14-08

1. Does this project require any special handling in addition to standard Paragon procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	NONE	<input checked="" type="radio"/> YES	NO
3. Are Custody seals on sample containers intact?	NONE	<input checked="" type="radio"/> YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible ?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly ? (excluding volatiles)	N/A	<input checked="" type="radio"/> YES	NO
9. Are all aqueous non-preserved samples pH 4-9 ?	N/A	<input checked="" type="radio"/> YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact ? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: <u>✓</u> < green pea <u> </u> > green pea	N/A	YES	<input checked="" type="radio"/> NO
15. Do perchlorate LCMS-MS samples have headspace ? (at least 1/3 of container required)	<input checked="" type="radio"/> N/A	YES	NO
16. Were samples checked for and free from the presence of residual chlorine ? (Applicable when PM has indicated samples are from a chlorinated water source; note if field preservation with sodium thiosulfate was not observed.)	<input checked="" type="radio"/> N/A	YES	NO
17. Were the samples shipped on ice ?		<input checked="" type="radio"/> YES	NO
18. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: <u>#2</u> <u>#4</u>		<input checked="" type="radio"/> YES	NO
Cooler #: <u>1</u>			
Temperature (°C): <u>3.4</u>			
No. of custody seals on cooler: <u>1</u>			
External µR/hr reading: <u>14</u>			
Background µR/hr reading: <u>13</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES <input type="radio"/> NO <input type="radio"/> NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

Headspace Bottle # (1) 1, 2, 3, 6, 7, 9
2 - 1, 2

Slime layer in -1-15 & -1-16 (Organic?)

If applicable, was the client contacted? ☒ YES / NO / NA Contact: J. Hix Date/Time: 11/12/08Project Manager Signature / Date: [Signature] 11/12/08

*IR Gun #2: Oakton. SN 29922500201-0066

*IR Gun #4: Oakton. SN 2372220101-0002

CONDITION OF SAMPLE UPON RECEIPT FORM

Paragon Analytics

Client: Condillivan

Workorder No: 0811110

Project Manager: LS

Initials: as Date: 11-14-08

Additional Information:

Was the laboratory directed to proceed with the analysis of any samples yielding the presence of residual chlorine? YES / NO / NA

NOTE:

No pH adjustments shall be made without prior consent of Project Manager. After pH adjustments, hold metals and radchem samples ≥ 24 hrs. before analysis.

Was the pH of any sample adjusted by the laboratory? YES (See Table below) / NO

pH Excursion:

Paragon Sample ID	Client Sample ID	Initial pH	Final pH	Reagent Used	Volume Added (mL)	Lot No. of Reagent	Requested Analysis	Initials / Date / Time
-1-12		7	1.6	conc HNO ₃	1mL			as 11/14/08 10:30
-1-15		↓	↓	↓	↓			↓
-1-16		↓	↓	↓	↓			↓
-1-17		↓	↓	↓	↓			↓
-2-12		↓	↓	↓	↓			↓
-2-15		↓	↓	↓	↓			↓
-2-16		↓	↓	↓	↓			↓
-2-17		↓	↓	↓	↓			↓

If applicable, was the client contacted? YES / NO / NA Contact: _____ Date/Time: _____

Project Manager Signature / Date: [Signature] 11/17/08

ORIGIN ID: GJTA (970) 270-2986
TIM DOBRANSKY
CORDILLERAN COMPLIANCE SERVICES, IN
826 21 1/2 ROAD

GRAND JUNCTION, CO 81505
UNITED STATES US

Ship Date: 13NOV08
ActWgt: 20.0 LB MAN
System#: 390082/CAFE2358
Account: S 235727234

TO

PARAGON ANALYTICS
225 COMMERCE DRIVE

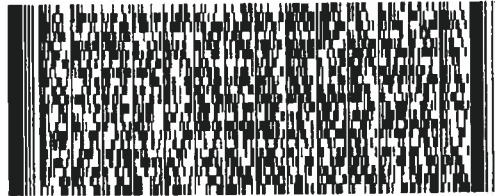
FORT COLLINS, CO 80524

(800) 443-1511

FedEx
Express



Ref: 8360



Delivery Address
Barcode

BILL SENDER

PRIORITY OVERNIGHT

TRK# 9660 0451 2332 Form 0201

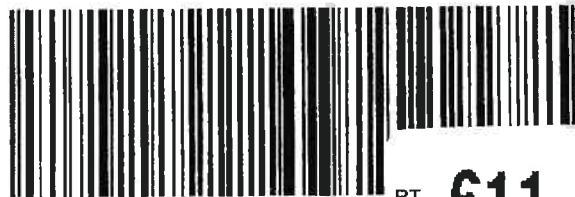
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14NOV08

DEN AA

80524 -CO-US

72 FTCA



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611 A

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2332
11.14

Radiochemistry Data Package

Section 2

SAMPLE RESULTS SUMMARY

Due to the nature of gamma spectroscopy data, a summary report is not provided.

Please refer to the individual sample results in Section 4.

Radiochemistry Data Package

Section 3

QC RESULTS SUMMARY

Gamma Spectroscopy Results

PAI 713 Rev 10

Method Blank Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Lab ID: GS081121-4AMB

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 21-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 29-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 510 minutes

Final Aliquot: 975 ml

Result Units: pCi/l

File Name: 082003d02A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14331-83-0	Ac-228	21 +/- 15	23		U
14391-76-5	Ag-110m	0.5 +/- 3.2	5.5		U
14682-66-7	Al-26	-3.2 +/- 5.5	10.0		U
14596-10-2	Am-241	-6 +/- 22	38		U
13966-02-4	Be-7	18 +/- 26	42		U
14913-49-6	Bi-212	-32 +/- 53	94		U
14733-03-0	Bi-214	0 +/- 15	25		U,J
13982-30-4	Ce-139	1.4 +/- 2.3	3.8		U
14762-78-8	Ce-144	19 +/- 15	24		U
14093-03-9	Co-56	-0.3 +/- 6.4	11.2		U
13981-50-5	Co-57	-0.1 +/- 1.9	3.3		U
13981-38-9	Co-58	2.1 +/- 3.6	6.0		U
10198-40-0	Co-60	-3.3 +/- 4.4	7.9		U
14392-02-0	Cr-51	13 +/- 25	41		U
13967-70-9	Cs-134	-2.1 +/- 3.9	6.8		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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Method Blank Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Lab ID: GS081121-4AMB

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 21-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 29-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 510 minutes

Final Aliquot: 975 ml

Result Units: pCi/l

File Name: 082003d02A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10045-97-3	Cs-137	0.2 +/- 3.7	6.3	10	U
14683-23-9	Eu-152	-9 +/- 21	37		U
15585-10-1	Eu-154	-1 +/- 20	35		U
14391-16-3	Eu-155	4.1 +/- 8.6	14.3		U
14596-12-4	Fe-59	10.9 +/- 7.6	11.8		U
10043-66-0	I-131	-0.4 +/- 3.0	5.1		U
13966-00-2	K-40	33 +/- 86	143		U
13966-31-9	Mn-54	-0.2 +/- 3.6	6.3		U
13966-32-0	Na-22	1.4 +/- 4.0	6.8		U
14681-63-1	Nb-94	-3.2 +/- 3.9	6.9		U
13967-76-5	Nb-95	1.4 +/- 3.3	5.5		U
15100-28-4	Pa-234m	-300 +/- 960	1660		U
15092-94-1	Pb-212	-0.3 +/- 8.0	13.3		U
15067-28-4	Pb-214	-3 +/- 12	21		U,J
13967-48-1	Ru-106	14 +/- 32	54		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: GSW0811110-1

Gamma Spectroscopy Results

PAI 713 Rev 10

Method Blank Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Lab ID: GS081121-4AMB

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 21-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 29-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 510 minutes

Final Aliquot: 975 ml

Result Units: pCi/l

File Name: 082003d02A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14683-10-4	Sb-124	0.3 +/- 3.8	6.5		U
14234-35-6	Sb-125	7.5 +/- 9.1	14.9		U
13967-63-0	Sc-46	-0.3 +/- 3.4	5.8		U
15623-47-9	Th-227	0 +/- 24	40		U
15065-10-8	Th-234	18 +/- 90	150		U
14913-50-9	Ti-208	-0.8 +/- 6.6	11.2		U
15117-96-1	U-235	16 +/- 15	24		U
13982-39-3	Zn-65	-2.7 +/- 8.2	14.4		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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Laboratory Control Sample(s)

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Lab ID: GS081121-4LCS

Library: ANALYTICAL

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 21-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 25-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 30 minutes

Final Aliquot: 1000 ml

Result Units: pCi/l

File Name: 081831d06

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14596-10-2	Am-241	102000 +/- 12000	2000	99200	103	85 - 115	P
10198-40-0	Co-60	45900 +/- 5400	100	46800	98.1	85 - 115	P
10045-97-3	Cs-137	37200 +/- 4400	300	37700	98.7	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 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)

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.

Data Package ID: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Duplicate Sample Results (DER)

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D

Lab ID: 0811110-1DUP

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 25-Nov-08

Prep Batch: GS081121-4

QC Batch ID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 210 minutes

Report Basis: Filtered

Final Aliquot: 1000 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 081210d10

CASNO	Analyte	Sample Result +/- 2s TPU	Duplicate Result +/- 2s TPU	DER	Control Limit	Lab Qualifiers
14331-83-0	Ac-228	24 +/- 25	22 +/- 24	0.06	2.13	U
14391-76-5	Ag-110m	-0.6 +/- 4.3	0.2 +/- 4.8	0.13	2.13	U
14682-66-7	Al-26	2.2 +/- 6.7	2.7 +/- 7.6	0.05	2.13	U
14596-10-2	Am-241	3 +/- 29	1 +/- 53	0.03	2.13	U
13966-02-4	Be-7	30 +/- 32	35 +/- 45	0.09	2.13	U
14913-49-6	Bi-212	19 +/- 67	16 +/- 79	0.03	2.13	U
14733-03-0	Bi-214	5 +/- 16	2 +/- 17	0.13	2.13	U,J
13982-30-4	Ce-139	-1.0 +/- 3.2	-0.2 +/- 4.0	0.15	2.13	U
14762-78-8	Ce-144	-3 +/- 19	-18 +/- 28	0.46	2.13	U
14093-03-9	Co-56	-0.9 +/- 8.5	8.9 +/- 10	0.73	2.13	U
13981-50-5	Co-57	0.9 +/- 2.6	-1.9 +/- 3.3	0.65	2.13	U
13981-38-9	Co-58	0.3 +/- 4.9	-5.4 +/- 5.5	0.77	2.13	U
10198-40-0	Co-60	-1.1 +/- 5.8	2.2 +/- 6.7	0.36	2.13	U
14392-02-0	Cr-51	21 +/- 42	-7 +/- 46	0.44	2.13	U
13967-70-9	Cs-134	0.5 +/- 4.9	-1.0 +/- 5.5	0.21	2.13	U
10045-97-3	Cs-137	-1.0 +/- 4.6	-2.7 +/- 5.0	0.25	2.13	U
14683-23-9	Eu-152	9 +/- 28	15 +/- 29	0.14	2.13	U

Comments: This sample was filtered prior to analysis.

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

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)

DER - Duplicate Error Ratio (see PAI SOP 715)

BDL - Below Detection Limit

NR - Not Reported

Data Package ID: GSW0811110-1

Gamma Spectroscopy Results

PAI 713 Rev 10

Duplicate Sample Results (DER)

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D

Lab ID: 0811110-1DUP

Library: FANP.LIB

Sample Matrix: WATER
Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 25-Nov-08

Prep Batch: GS081121-4
QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 210 minutes

Report Basis: Filtered

Final Aliquot: 1000 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 081210d10

CASNO	Analyte	Sample Result +/- 2s TPU	Duplicate Result +/- 2s TPU	DER	Control Limit	Lab Qualifiers
15585-10-1	Eu-154	1 +/- 25	-31 +/- 33	0.77	2.13	U
14391-16-3	Eu-155	3 +/- 11	-3 +/- 15	0.33	2.13	U
14596-12-4	Fe-59	3 +/- 11	2 +/- 12	0.09	2.13	U
10043-66-0	I-131	1.6 +/- 9.1	-5 +/- 13	0.44	2.13	U
13966-00-2	K-40	-22 +/- 84	77 +/- 99	0.77	2.13	U
13966-31-9	Mn-54	1.9 +/- 5.0	1.2 +/- 5.3	0.10	2.13	U
13966-32-0	Na-22	1.1 +/- 5.2	-4.7 +/- 6.5	0.70	2.13	U
14681-63-1	Nb-94	-1.5 +/- 5.0	3.4 +/- 5.7	0.65	2.13	U
13967-76-5	Nb-95	-0.2 +/- 4.7	2.4 +/- 5.7	0.35	2.13	U
15100-28-4	Pa-234m	300 +/- 780	-250 +/- 950	0.45	2.13	U
15092-94-1	Pb-212	1.4 +/- 9.3	5 +/- 11	0.21	2.13	U
15067-28-4	Pb-214	6 +/- 13	7 +/- 14	0.07	2.13	U,J
13967-48-1	Ru-106	-51 +/- 42	-45 +/- 49	0.09	2.13	U
14683-10-4	Sb-124	0.2 +/- 5.6	-1.1 +/- 6.6	0.15	2.13	U
14234-35-6	Sb-125	6 +/- 12	7 +/- 13	0.07	2.13	U
13967-63-0	Sc-46	2.6 +/- 5.2	3.7 +/- 5.6	0.15	2.13	U
15623-47-9	Th-227	-2 +/- 21	-17 +/- 39	0.35	2.13	U

Comments: This sample was filtered prior to analysis.

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

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)

DER - Duplicate Error Ratio (see PAI SOP 715)

BDL - Below Detection Limit

NR - Not Reported

Data Package ID: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Duplicate Sample Results (DER)

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D

Lab ID: 0811110-1DUP

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 25-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 210 minutes

Report Basis: Filtered

Final Aliquot: 1000 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 081210d10

CASNO	Analyte	Sample Result +/- 2s TPU	Duplicate Result +/- 2s TPU	DER	Control Limit	Lab Qualifiers
15065-10-8	Th-234	9 +/- 99	40 +/- 120	0.18	2.13	U
14913-50-9	Tl-208	5.2 +/- 5.3	10.1 +/- 5.8	0.62	2.13	TI
15117-96-1	U-235	-4 +/- 47	16 +/- 28	0.35	2.13	U
13982-39-3	Zn-65	-1 +/- 11	-6 +/- 11	0.31	2.13	U

Comments: This sample was filtered prior to analysis.

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 (see PAI SOP 715)

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: GSW0811110-1

Radiochemistry Data Package



Section 4

INDIVIDUAL SAMPLE RESULTS

Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D

Lab ID: 0811110-1

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 24-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 300 minutes

Report Basis: Filtered

Final Aliquot: 1000 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 081983d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14331-83-0	Ac-228	24 +/- 25	40		U
14391-76-5	Ag-110m	-0.6 +/- 4.3	7.5		U
14682-66-7	Al-26	2.2 +/- 6.7	11.5		U
14596-10-2	Am-241	3 +/- 29	50		U
13966-02-4	Be-7	30 +/- 32	51		U
14913-49-6	Bi-212	19 +/- 67	114		U
14733-03-0	Bi-214	5 +/- 16	26		U,J
13982-30-4	Ce-139	-1.0 +/- 3.2	5.6		U
14762-78-8	Ce-144	-3 +/- 19	32		U
14093-03-9	Co-56	-0.9 +/- 8.5	15.2		U
13981-50-5	Co-57	0.9 +/- 2.6	4.4		U
13981-38-9	Co-58	0.3 +/- 4.9	8.6		U
10198-40-0	Co-60	-1.1 +/- 5.8	10.3		U
14392-02-0	Cr-51	21 +/- 42	70		U
13967-70-9	Cs-134	0.5 +/- 4.9	8.6		U

Comments: This sample was filtered prior to analysis.

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.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D

Lab ID: 0811110-1

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 24-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 300 minutes

Report Basis: Filtered

Final Aliquot: 1000 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 081983d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10045-97-3	Cs-137	-1.0 +/- 4.6	8.1	10	U
14683-23-9	Eu-152	9 +/- 28	48		U
15585-10-1	Eu-154	1 +/- 25	43		U
14391-16-3	Eu-155	3 +/- 11	19		U
14596-12-4	Fe-59	3 +/- 11	20		U
10043-66-0	I-131	1.6 +/- 9.1	15.6		U
13966-00-2	K-40	-22 +/- 84	148		U
13966-31-9	Mn-54	1.9 +/- 5.0	8.4		U
13966-32-0	Na-22	1.1 +/- 5.2	9.0		U
14681-63-1	Nb-94	-1.5 +/- 5.0	8.8		U
13967-76-5	Nb-95	-0.2 +/- 4.7	8.2		U
15100-28-4	Pa-234m	300 +/- 780	1330		U
15092-94-1	Pb-212	1.4 +/- 9.3	15.7		U
15067-28-4	Pb-214	6 +/- 13	22		U,J
13967-48-1	Ru-106	-51 +/- 42	78		U

Comments: This sample was filtered prior to analysis.

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.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D

Lab ID: 0811110-1

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 24-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 300 minutes

Report Basis: Filtered

Final Aliquot: 1000 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 081983d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14683-10-4	Sb-124	0.2 +/- 5.6	9.5		U
14234-35-6	Sb-125	6 +/- 12	19		U
13967-63-0	Sc-46	2.6 +/- 5.2	8.7		U
15623-47-9	Th-227	-2 +/- 21	36		U
15065-10-8	Th-234	9 +/- 99	166		U
14913-50-9	Tl-208	5.2 +/- 5.3	8.6		U
15117-96-1	U-235	-4 +/- 47	79		U
13982-39-3	Zn-65	-1 +/- 11	20		U

Comments: This sample was filtered prior to analysis.

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.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Duplicate Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D

Lab ID: 0811110-1DUP

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 25-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 210 minutes

Report Basis: Filtered

Final Aliquot: 1000 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 081210d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14331-83-0	Ac-228	22 +/- 24	43		U
14391-76-5	Ag-110m	0.2 +/- 4.8	8.4		U
14682-66-7	Al-26	2.7 +/- 7.6	13.1		U
14596-10-2	Am-241	1 +/- 53	90		U
13966-02-4	Be-7	35 +/- 45	73		U
14913-49-6	Bi-212	16 +/- 79	136		U
14733-03-0	Bi-214	2 +/- 17	29		U,J
13982-30-4	Ce-139	-0.2 +/- 4.0	6.8		U
14762-78-8	Ce-144	-18 +/- 28	49		U
14093-03-9	Co-56	8.9 +/- 10	16.8		U
13981-50-5	Co-57	-1.9 +/- 3.3	5.8		U
13981-38-9	Co-58	-5.4 +/- 5.5	10.3		U
10198-40-0	Co-60	2.2 +/- 6.7	11.6		U

Comments: This sample was filtered prior to analysis.

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 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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Duplicate Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D

Lab ID: 0811110-1DUP

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 25-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 210 minutes

Report Basis: Filtered

Final Aliquot: 1000 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 081210d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14392-02-0	Cr-51	-7 +/- 46	80		U
13967-70-9	Cs-134	-1.0 +/- 5.5	9.6		U
10045-97-3	Cs-137	-2.7 +/- 5.0	9.2	10	U
14683-23-9	Eu-152	15 +/- 29	50		U
15585-10-1	Eu-154	-31 +/- 33	62		U
14391-16-3	Eu-155	-3 +/- 15	27		U
14596-12-4	Fe-59	2 +/- 12	21		U
10043-66-0	I-131	-5 +/- 13	23		U
13966-00-2	K-40	77 +/- 99	162		U
13966-31-9	Mn-54	1.2 +/- 5.3	9.1		U
13966-32-0	Na-22	-4.7 +/- 6.5	12.2		U
14681-63-1	Nb-94	3.4 +/- 5.7	9.5		U
13967-76-5	Nb-95	2.4 +/- 5.7	9.7		U

Comments: This sample was filtered prior to analysis.

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 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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Duplicate Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15D	Sample Matrix: WATER	Prep Batch: GS081121-4	Final Aliquot: 1000 ml
Lab ID: 0811110-1DUP	Prep SOP: PAI 739 Rev 9	QCBatchID: GS081121-4-1	Prep Basis: Filtered
Library: FANP.LIB	Date Collected: 13-Nov-08	Run ID: GS081121-4A	Moisture(%): NA
	Date Prepared: 21-Nov-08	Count Time: 210 minutes	Result Units: pCi/l
	Date Analyzed: 25-Nov-08	Report Basis: Filtered	File Name: 081210d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
15100-28-4	Pa-234m	-250 +/- 950	1710		U
15092-94-1	Pb-212	5 +/- 11	19		U
15067-28-4	Pb-214	7 +/- 14	23		U,J
13967-48-1	Ru-106	-45 +/- 49	90		U
14683-10-4	Sb-124	-1.1 +/- 6.6	11.5		U
14234-35-6	Sb-125	7 +/- 13	22		U
13967-63-0	Sc-46	3.7 +/- 5.6	9.2		U
15623-47-9	Th-227	-17 +/- 39	68		U
15065-10-8	Th-234	40 +/- 120	200		U
14913-50-9	Tl-208	10.1 +/- 5.8	8.7		TI
15117-96-1	U-235	16 +/- 28	46		U
13982-39-3	Zn-65	-6 +/- 11	21		U

Comments: This sample was filtered prior to analysis.

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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15B
Lab ID: 0811110-2

Library: FANP.LIB

Sample Matrix: WATER
Prep SOP: PAI 739 Rev 9
Date Collected: 13-Nov-08
Date Prepared: 21-Nov-08
Date Analyzed: 29-Nov-08

Prep Batch: GS081121-4
QCBatchID: GS081121-4-1
Run ID: GS081121-4A
Count Time: 510 minutes
Report Basis: Filtered

Final Aliquot: 850 ml
Prep Basis: Filtered
Moisture(%): NA
Result Units: pCi/l
File Name: 082002d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14331-83-0	Ac-228	27 +/- 30	49		U
14391-76-5	Ag-110m	1.7 +/- 3.7	6.3		U
14682-66-7	Al-26	-3.5 +/- 6.2	11.2		U
14596-10-2	Am-241	20 +/- 27	44		U
13966-02-4	Be-7	0 +/- 36	62		U
14913-49-6	Bi-212	13 +/- 61	103		U
14733-03-0	Bi-214	4 +/- 17	29		U,J
13982-30-4	Ce-139	1.6 +/- 3.0	5.0		U
14762-78-8	Ce-144	-1 +/- 17	29		U
14093-03-9	Co-56	3.1 +/- 8.5	14.4		U
13981-50-5	Co-57	0 +/- 2.3	3.9		U
13981-38-9	Co-58	-3.1 +/- 4.7	8.4		U
10198-40-0	Co-60	-1.0 +/- 5.1	8.9		U
14392-02-0	Cr-51	5 +/- 44	74		U
13967-70-9	Cs-134	2.8 +/- 2.9	6.0		U

Comments: This sample was filtered prior to analysis.

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.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15B

Lab ID: 0811110-2

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 29-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 510 minutes

Report Basis: Filtered

Final Aliquot: 850 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 082002d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10045-97-3	Cs-137	-3.8 +/- 3.9	7.1	10	U
14683-23-9	Eu-152	-9 +/- 23	42		U
15585-10-1	Eu-154	-24 +/- 25	45		U
14391-16-3	Eu-155	-1 +/- 11	18		U
14596-12-4	Fe-59	9 +/- 12	19		U
10043-66-0	I-131	1 +/- 14	24		U
13966-00-2	K-40	52 +/- 95	158		U
13966-31-9	Mn-54	1.3 +/- 4.6	7.8		U
13966-32-0	Na-22	-2.3 +/- 4.9	8.7		U
14681-63-1	Nb-94	5.7 +/- 4.6	7.3		U
13967-76-5	Nb-95	0.4 +/- 4.4	7.5		U
15100-28-4	Pa-234m	200 +/- 1100	1900		U
15092-94-1	Pb-212	4.6 +/- 9.7	16.0		U
15067-28-4	Pb-214	14 +/- 15	25		U,J
13967-48-1	Ru-106	-28 +/- 38	67		U

Comments: This sample was filtered prior to analysis.

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.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0811110

Client Name: Cordilleran Compliance Services, Inc.

ClientProject ID: Rulison Area Well monitoring

Field ID: A11-15B

Lab ID: 0811110-2

Library: FANP.LIB

Sample Matrix: WATER

Prep SOP: PAI 739 Rev 9

Date Collected: 13-Nov-08

Date Prepared: 21-Nov-08

Date Analyzed: 29-Nov-08

Prep Batch: GS081121-4

QCBatchID: GS081121-4-1

Run ID: GS081121-4A

Count Time: 510 minutes

Report Basis: Filtered

Final Aliquot: 850 ml

Prep Basis: Filtered

Moisture(%): NA

Result Units: pCi/l

File Name: 082002d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
14683-10-4	Sb-124	-1.5 +/- 5.3	9.1		U
14234-35-6	Sb-125	8.5 +/- 10	16.6		U
13967-63-0	Sc-46	-2.0 +/- 4.4	7.8		U
15623-47-9	Th-227	-3 +/- 27	45		U
15065-10-8	Th-234	0 +/- 100	170		U
14913-50-9	Tl-208	-0.4 +/- 8.0	13.5		U
15117-96-1	U-235	12 +/- 17	28		U
13982-39-3	Zn-65	-2.7 +/- 9.8	17.2		U

Comments: This sample was filtered prior to analysis.

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: GSW0811110-1

Date Printed: Tuesday, December 09, 2008

ALS Paragon

LIMS Version: 6.214A

Page 6 of 6

Radiochemistry Data Package

Section 5



RAW DATA

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0811110-1 GS081121-4

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Sampling Start:   11/13/2008 12:00:00 | Counting Start:   11/24/2008 15:35:54
Sampling Stop:    11/13/2008 12:00:00 | Decay Time. . . . . 2.68E+002 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 18000 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 18029 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081983D02.SPC
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```

Detector #: 2 (Detector 2)

Energy(keV) = -0.60 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 11/24/2008

FWHM(keV) = 0.69 + 0.003*En + 1.19E-03*En^2 + 0.00E+00*En^3 05/08/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

=====

PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.31	93.63	31	32	24	145	0.42	a
2	63.68	128.30	90	58	45	349	1.22	a
3	66.41	133.75	183	56	40	299	0.97	b
4	70.33	141.58	41	33	25	150	0.44	c
5	77.26	155.42	96	52	40	289	1.06	a
6	87.31	175.47	27	30	24	137	0.44	a
7	92.79	186.41	118	54	41	305	1.04	a
8	140.17	280.99	143	52	38	267	0.98	a
9	186.05	372.56	95	48	36	241	1.04	a
10	198.50	397.40	132	46	32	211	0.75	a
11	238.75	477.74	103	47	35	220	1.00	a
12	295.09	590.20	31	25	19	85	0.55	a
13	338.51	676.88	40	33	25	124	0.78	a
14	352.35	704.49	88	39	29	139	1.11	a
15	478.32	955.93	25	26	20	81	0.98	a
16	500.13	999.48	22	23	17	66	0.75	a
17	511.58	1022.33	449	67	42	240	2.30	a Wide Pk
18	514.13	1027.43	11	21	17	69	0.70	b NET< CL
19	558.95	1116.89	138	36	23	91	1.54	a
20	570.39	1139.72	32	34	27	118	1.67	a
21	583.58	1166.05	30	27	20	86	0.98	a
22	596.58	1191.99	62	38	29	135	1.70	a
23	609.59	1217.97	62	35	26	126	1.39	a
24	803.66	1605.33	38	23	16	50	1.26	a

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
25	912.34	1822.26	54	27	19	70	1.72	a
26	1461.95	2919.31	42	25	17	50	2.46	a

081983D02.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET021121.BKG (081121-2 WEEKLY BKG)

Bkg.File Detector #: 2

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BACKGROUND SUBTRACT RESULTS

=====

PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
1	46.31	31	32	24	6	54	44	NET<CL
2	63.68	90	58	45	48	67	54	NET<CL
3	66.41	183	56	40	133	69	53	
4	70.33	41	33	25	29	41	32	NET<CL
5	77.26	96	52	40	66	69	55	
6	87.31	27	30	24	13	52	42	NET<CL
7	92.79	118	54	41	7	74	61	NET<CL
8	140.17	143	52	38	80	66	52	
9	186.05	95	48	36	7	64	52	NET<CL
10	198.50	132	46	32	52	70	57	NET<CL
11	238.75	103	47	35	9	61	50	NET<CL
12	295.09	31	25	19	-11	50	41	NET<CL
13	338.51	40	33	25	30	43	34	NET<CL
14	352.35	88	39	29	24	57	46	NET<CL
17	511.58	449	67	42	-17	99	82	NET<CL
19	558.95	138	36	23	85	49	37	
21	583.58	30	27	20	2	40	32	NET<CL
23	609.59	62	35	26	16	54	44	NET<CL
24	803.66	38	23	16	-7	36	30	NET<CL
25	912.34	54	27	19	33	34	27	
26	1461.95	42	25	17	-9	35	29	NET<CL

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0811110-1 GS081121-4

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Sampling Start:    11/13/2008 12:00:00 | Counting Start:    11/24/2008 15:35:54
Sampling Stop:    11/13/2008 12:00:00 | Decay Time. . . . . 2.68e+002 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 18000 Sec
Sample Size . . . . . 1.00e+000 L | Real Time . . . . . 18029 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 081983D02.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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```

Detector #: 2 (Detector 2)

Efficiency File: (D02)(Sh01).EFF (Geo 1 Eff Cal)

Eff.=1/[4.29E-03*En^-3.71E+00 + 1.32E+02*En^7.89E-01] 05/11/2008

Library File: FANP.LIB (FANP (Fiss. Act. and Nat. Products))

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MEASURED or MDA CONCENTRATIONS

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Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
Th-234	92.50	N	9.21E+00 +- 9.90E+01	1.66E+02	8.13E+01	3.92E+13
Pb-212	238.63	N	1.42E+00 +- 9.32E+00	1.57E+01	7.63E+00	1.67E+04
Pb-214	351.99	N	5.70E+00 +- 1.34E+01	2.23E+01	1.09E+01	1.40E+07
Be-7	477.56		3.05E+01 +- 3.14E+01	5.09E+01	2.38E+01	1.28E+03
Cs-134	Average:x		5.02E-01 +- 4.90E+00			1.81E+04
	569.29		2.70E+01 +- 2.87E+01	4.69E+01	2.23E+01	1.81E+04
	604.66	N	2.93E-01 +- 4.97E+00	8.57E+00B	4.10E+00	1.81E+04
Bi-214	609.32	N	4.72E+00 +- 1.57E+01	2.63E+01	1.27E+01	1.40E+07
Ac-228	911.07		2.37E+01 +- 2.46E+01	4.00E+01	1.90E+01	5.04E+04
K-40	1460.75	N	2.25E+01 +- 8.43E+01	1.48E+02	7.05E+01	1.12E+13
Am-241	59.54	N	3.09E+00 +- 2.94E+01	4.99E+01B	2.40E+01	3.80E+06
Eu-155	105.31	N	3.35E+00 +- 1.14E+01	1.92E+01	9.23E+00	4.35E+04
Co-57	122.07	N	8.87E-01 +- 2.64E+00	4.45E+00	2.14E+00	6.48E+03
Ce-144	133.53	N	2.55E+00 +- 1.86E+01	3.21E+01	1.54E+01	6.82E+03
U-235	143.76	N	3.57E+00 +- 4.74E+01	7.94E+01b	3.91E+01	6.17E+12
Ce-139	165.85	N	9.76E-01 +- 3.22E+00	5.56E+00	2.69E+00	3.30E+03
Th-227	236.00	N	1.58E+00 +- 2.12E+01	3.65E+01B	1.75E+01	1.90E+05
Cr-51	320.07	N	2.09E+01 +- 4.16E+01	6.95E+01	3.33E+01	6.65E+02
I-131	364.48	N	1.63E+00 +- 9.14E+00	1.56E+01	7.43E+00	1.93E+02
Sb-125	427.95	N	5.79E+00 +- 1.16E+01	1.95E+01	9.28E+00	2.43E+04
Tl-208	583.14	N	5.20E+00 +- 5.27E+00	8.56E+00	4.07E+00	1.67E+04
Sb-124	602.71	N	1.54E-01 +- 5.55E+00	9.54E+00b	4.56E+00	1.44E+03
Ru-106	621.84	N	5.10E+01 +- 4.21E+01	7.85E+01	3.73E+01	8.84E+03
Ag-110M	657.75	N	6.30E-01 +- 4.27E+00	7.53E+00	3.55E+00	6.00E+03
Cs-137	661.62	N	9.57E-01 +- 4.60E+00	8.14E+00	3.84E+00	2.64E+05

MEASURED or MDA CONCENTRATIONS

Nuclide	ENERGY E (keV)	N		Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
		T					
Nb-94	702.50	N	-1.53E+00	+ - 4.99E+00	8.78E+00	4.18E+00	1.78E+08
Bi-212	727.17	N	1.89E+01	+ - 6.69E+01	1.14E+02	5.39E+01	1.67E+04
Nb-95	765.82	N	-1.81E-01	+ - 4.68E+00	8.21E+00	3.86E+00	1.54E+03
Co-58	810.75	N	3.20E-01	+ - 4.91E+00	8.55E+00	4.02E+00	1.70E+03
Mn-54	834.81	N	1.92E+00	+ - 4.95E+00	8.40E+00	3.96E+00	7.49E+03
Sc-46	889.26	N	2.61E+00	+ - 5.17E+00	8.70E+00	4.08E+00	2.01E+03
Pa-234m	1001.03	N	3.02E+02	+ - 7.80E+02	1.33E+03	6.20E+02	3.92E+13
Eu-154	1004.80	N	1.11E+00	+ - 2.45E+01	4.32E+01	2.01E+01	7.45E+04
Fe-59	1099.22	N	3.25E+00	+ - 1.15E+01	1.96E+01	9.21E+00	1.08E+03
Zn-65	1115.52	N	-1.28E+00	+ - 1.10E+01	1.95E+01	9.17E+00	5.85E+03
Co-56	1238.28	N	-8.95E-01	+ - 8.54E+00	1.52E+01	7.09E+00	1.86E+03
Na-22	1274.54	N	1.13E+00	+ - 5.21E+00	9.04E+00	4.19E+00	2.28E+04
Co-60	1332.51	N	-1.06E+00	+ - 5.76E+00	1.03E+01	4.81E+00	4.62E+04
Eu-152	1408.08	N	9.28E+00	+ - 2.77E+01	4.76E+01	2.21E+01	1.17E+05
Al-26	1808.65	N	2.22E+00	+ - 6.71E+00	1.15E+01	5.34E+00	6.31E+09

MEASURED TOTAL: 4.60E+02 + - 1.25E+03 pCi/L

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.31	93.63	6	54	44	145	0.42	Deleted
2	63.68	128.29	48	67	54	349	1.22	Deleted
3	66.41	133.75	133	69	53	299	0.97	Unknown
4	70.33	141.58	29	41	32	150	0.44	Deleted
5	77.26	155.42	66	69	55	289	1.06	Unknown
6	87.31	175.47	13	52	42	137	0.44	Deleted
8	140.17	280.99	80	66	52	267	0.98	Unknown
9	186.05	372.56	7	64	52	241	1.04	Deleted
10	198.50	397.40	52	70	57	211	0.75	Deleted
12	295.09	590.20	-11	50	41	85	0.55	Deleted
13	338.51	676.88	30	43	34	124	0.78	Deleted
16	500.13	999.48	22	23	17	66	0.75	Unknown
17	511.58	1022.33	-17	99	82	240	2.30	Deleted
18	514.13	1027.43	11	21	17	69	0.70	Deleted
19	558.95	1116.89	85	49	37	91	1.54	Unknown
21	583.58	1166.05	2	40	32	86	0.98	Deleted
22	596.58	1191.99	62	38	29	135	1.70	Unknown
24	803.66	1605.33	-7	36	30	50	1.26	Deleted

c:\SEEKER\BIN\081983d02.res Analysis Results Saved.

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0811110-1D GS081121-4

 Sampling Start: 11/13/2008 12:00:00 | Counting Start: 11/25/2008 09:52:29
 Sampling Stop: 11/13/2008 12:00:00 | Decay Time. 2.86E+002 Hrs
 Buildup Time. 0.00E+000 Hrs | Live Time 12600 Sec
 Sample Size 1.00E+000 L | Real Time 12671 Sec
 Collection Efficiency 1.0000 | Spc. File 081210D10.SPC

Detector #: 10 (Detector 10)

Energy(keV) = -0.81 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 11/25/2008

FWHM(keV) = 0.90 + 0.003*En + 1.07E-03*En^2 + 0.00E+00*En^3 09/02/2008

Where En = Sqrt(Energy in keV)

 Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	66.28	134.10	86	55	43	309	1.16	a
2	73.98	149.48	60	52	41	264	1.27	a
3	76.93	155.39	67	43	33	198	0.97	b
4	92.47	186.44	109	54	41	271	1.23	a
5	139.73	280.89	78	40	30	176	0.87	a
6	185.95	373.26	88	43	31	182	0.91	a
7	198.25	397.84	115	42	30	162	0.96	a
8	238.58	478.45	114	47	34	214	1.29	a
9	295.48	592.17	60	34	25	134	1.02	a
10	338.16	677.47	34	42	33	179	1.56	a
11	352.11	705.34	82	35	24	116	1.14	a
12	511.25	1023.41	362	61	39	207	2.80	a Wide Pk
13	558.59	1118.03	80	31	21	88	1.46	a
14	582.88	1166.56	35	44	35	167	2.80	a Wide Pk
15	596.06	1192.90	26	21	16	60	0.87	a
16	609.57	1219.90	57	33	24	114	1.42	a
17	911.34	1823.02	46	23	15	47	1.49	a
18	969.74	1939.73	37	37	29	107	3.78	a Wide Pk
19	1461.11	2921.79	75	24	14	33	2.23	a

081210D10.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET101121.BKG (081121-10 WEEKLY BKG)

Bkg.File Detector #: 10

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
1	66.28	86	55	43	24	71	58	NET<CL
2	73.98	60	52	41	1	64	52	NET<CL
3	76.93	67	43	33	17	59	48	NET<CL
4	92.47	109	54	41	20	66	54	NET<CL
5	139.73	78	40	30	42	54	43	NET<CL
6	185.95	88	43	31	22	55	44	NET<CL
7	198.25	115	42	30	57	61	48	
8	238.58	114	47	34	24	60	49	NET<CL
9	295.48	60	34	25	31	43	35	NET<CL
10	338.16	34	42	33	20	47	38	NET<CL
11	352.11	82	35	24	25	47	38	NET<CL
12	511.25	362	61	39	11	82	67	NET<CL
13	558.59	80	31	21	30	39	30	NET<CL
14	582.88	35	44	35	6	54	44	NET<CL
15	596.06	26	21	16	14	31	25	NET<CL
16	609.57	57	33	24	5	48	39	NET<CL
17	911.34	46	23	15	16	29	23	NET<CL
19	1461.11	75	24	14	25	31	25	

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0811110-1D GS081121-4

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Sampling Start:    11/13/2008 12:00:00 | Counting Start:    11/25/2008 09:52:29
Sampling Stop:    11/13/2008 12:00:00 | Decay Time. . . . . 2.86e+002 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 12600 Sec
Sample Size . . . . . 1.00e+000 L | Real Time . . . . . 12671 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 081210D10.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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Detector #: 10 (Detector 10)

Efficiency File: (D10)(Sh01).EFF (Geo 1 Eff Cal)

Eff=10^{-2.99E+01 +2.65E+01*L +-6.17E+00*L² +0.00E+00*L³} 09/11/2008
 Eff.=10^{-4.86E+00 +4.51E+00*L +-1.79E+00*L² +2.00E-01*L³} Above 180.00 keV

Library File: FANP.LIB (FANP (Fiss. Act. and Nat. Products))

MEASURED or MDA CONCENTRATIONS

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=====
              N
      ENERGY E   Concentration      Critical   Halflife
Nuclide   (keV) T (pCi/L)           MDA       Level   (hrs)
-----
Th-234    92.50 N 3.71E+01 +- 1.22E+02  2.04E+02  9.97E+01  3.92E+13
Pb-212    238.63 N 4.53E+00 +- 1.14E+01  1.91E+01  9.28E+00  1.67E+04
Pb-214    351.99 N 7.11E+00 +- 1.35E+01  2.26E+01  1.09E+01  1.40E+07
Bi-214    609.32 N 1.67E+00 +- 1.70E+01  2.88E+01  1.39E+01  1.40E+07
Ac-228    Average:x 2.18E+01 +- 2.36E+01  . . . . . 5.04E+04
           911.07 N 1.45E+01 +- 2.59E+01  4.34E+01  2.05E+01  5.04E+04
           968.90  5.77E+01 +- 5.78E+01  9.41E+01  4.50E+01  5.04E+04
K-40      1460.75  7.71E+01 +- 9.83E+01  1.62E+02  7.67E+01  1.12E+13
Am-241     59.54 N 1.26E+00 +- 5.26E+01  8.99E+01  4.32E+01  3.80E+06
Eu-155     105.31 N-3.03E+00 +- 1.53E+01  2.65E+01  1.27E+01  4.35E+04
Co-57      122.07 N-1.88E+00 +- 3.33E+00  5.84E+00  2.81E+00  6.48E+03
Ce-144     133.53 N-1.81E+01 +- 2.82E+01  4.92E+01  2.38E+01  6.82E+03
U-235      143.76 N 1.57E+01 +- 2.76E+01  4.59E+01b 2.22E+01  6.17E+12
Ce-139     165.85 N-2.15E-01 +- 3.95E+00  6.77E+00  3.26E+00  3.30E+03
Th-227     236.00 N-1.72E+01 +- 3.90E+01  6.78E+01R 3.30E+01  1.90E+05
Cr-51      320.07 N-6.72E+00 +- 4.62E+01  8.03E+01  3.83E+01  6.65E+02
I-131      364.48 N-5.27E+00 +- 1.28E+01  2.26E+01  1.08E+01  1.93E+02
Sb-125     427.95 N 6.96E+00 +- 1.32E+01  2.21E+01  1.05E+01  2.43E+04
Be-7       477.56 N 3.54E+01 +- 4.46E+01  7.34E+01  3.47E+01  1.28E+03
Tl-208     583.14 N 1.01E+01 +- 5.69E+00  8.70E+00  4.09E+00  1.67E+04
Sb-124     602.71 N-1.14E+00 +- 6.59E+00  1.15E+01B 5.47E+00  1.44E+03
Cs-134     604.66 N-1.01E+00 +- 5.52E+00  9.63E+00B 4.59E+00  1.81E+04
Ru-106     621.84 N-4.53E+01 +- 4.88E+01  9.01E+01  4.27E+01  8.84E+03
Ag-110M    657.75 N 1.94E-01 +- 4.78E+00  8.36E+00  3.92E+00  6.00E+03
  
```

MEASURED or MDA CONCENTRATIONS

Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
Cs-137	661.62	N-2.69E+00	+ - 5.02E+00	9.17E+00	4.30E+00	2.64E+05
Nb-94	702.50	N 3.38E+00	+ - 5.71E+00	9.53E+00	4.51E+00	1.78E+08
Bi-212	727.17	N 1.58E+01	+ - 7.88E+01	1.36E+02	6.38E+01	1.67E+04
Nb-95	765.82	N 2.40E+00	+ - 5.70E+00	9.68E+00	4.53E+00	1.54E+03
Co-58	810.75	N-5.35E+00	+ - 5.42E+00	1.03E+01	4.83E+00	1.70E+03
Mn-54	834.81	N 1.21E+00	+ - 5.25E+00	9.06E+00	4.23E+00	7.49E+03
Sc-46	889.26	N 3.74E+00	+ - 5.53E+00	9.20E+00	4.26E+00	2.01E+03
Pa-234m	1001.03	N-2.47E+02	+ - 9.47E+02	1.71E+03	7.97E+02	3.92E+13
Eu-154	1004.80	N-3.06E+01	+ - 3.28E+01	6.19E+01	2.91E+01	7.45E+04
Fe-59	1099.22	N 1.68E+00	+ - 1.23E+01	2.15E+01	9.96E+00	1.08E+03
Zn-65	1115.52	N-6.21E+00	+ - 1.12E+01	2.09E+01	9.69E+00	5.85E+03
Co-56	1238.28	N 8.88E+00	+ - 1.03E+01	1.68E+01	7.74E+00	1.86E+03
Na-22	1274.54	N-4.70E+00	+ - 6.46E+00	1.22E+01	5.67E+00	2.28E+04
Co-60	1332.51	N 2.16E+00	+ - 6.74E+00	1.16E+01	5.37E+00	4.62E+04
Eu-152	1408.08	N 1.47E+01	+ - 2.94E+01	4.99E+01	2.28E+01	1.17E+05
Al-26	1808.65	N 2.67E+00	+ - 7.60E+00	1.31E+01	6.01E+00	6.31E+09

MEASURED TOTAL: 2.76E+02 +- 6.02E+02 pCi/L

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	66.28	134.10	24	71	58	309	1.16	Deleted
2	73.98	149.48	1	64	52	264	1.27	Deleted
3	76.93	155.39	17	59	48	198	0.97	Deleted
5	139.73	280.89	42	54	43	176	0.87	Deleted
6	185.95	373.26	22	55	44	182	0.91	Deleted
7	198.25	397.84	57	61	48	162	0.96	Unknown
9	295.48	592.17	31	43	35	134	1.02	Deleted
10	338.16	677.47	20	47	38	179	1.56	Deleted
12	511.25	1023.41	11	82	67	207	2.80	Deleted
13	558.59	1118.03	30	39	30	88	1.46	Deleted
14	582.88	1166.56	6	54	44	167	2.80	Deleted
15	596.06	1192.90	14	31	25	60	0.87	Deleted

c:\SEEKER\BIN\081210d10.res Analysis Results Saved.

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0811110-2 GS081121-4

 Sampling Start: 11/13/2008 12:00:00 | Counting Start: 11/29/2008 13:05:25
 Sampling Stop: 11/13/2008 12:00:00 | Decay Time. 3.85E+002 Hrs
 Buildup Time. 0.00E+000 Hrs | Live Time 30600 Sec
 Sample Size 8.50E-001 L | Real Time 30656 Sec
 Collection Efficiency 1.0000 | Spc. File 082002D02.SPC

Detector #: 2 (Detector 2)

Energy(keV) = -0.62 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 11/29/2008

FWHM(keV) = 0.69 + 0.003*En + 1.19E-03*En^2 + 0.00E+00*En^3 05/08/2008

Where En = Sqrt(Energy in keV)

 Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.47	94.06	81	55	43	364	0.79	a
2	63.79	128.65	22	130	106	1253	2.36	a NET< CL Wide Pk
3	66.30	133.67	329	75	54	537	1.01	b
4	74.57	150.18	52	59	47	448	0.90	a
5	77.26	155.57	42	75	61	627	1.12	b NET< CL
6	80.48	162.00	7	31	25	179	0.41	c NET< CL
7	84.28	169.58	15	58	47	448	0.82	d NET< CL
8	92.70	186.40	208	68	51	473	0.98	a
9	129.17	259.24	33	39	30	226	0.44	a
10	139.85	280.58	220	59	42	360	0.89	a
11	185.73	372.22	176	58	43	370	0.85	a
12	198.37	397.47	207	52	36	280	0.58	a
13	238.57	477.75	167	59	43	345	0.97	a
14	242.17	484.96	49	73	59	518	1.46	b NET< CL
15	295.15	590.77	91	47	35	252	0.77	a
16	326.10	652.59	43	48	38	263	0.93	a
17	338.44	677.24	39	55	44	335	1.12	a NET< CL
18	351.86	704.04	194	59	43	293	1.23	a
19	511.15	1022.21	820	89	56	403	2.51	a Wide Pk
20	558.43	1116.65	195	47	31	181	1.37	a
21	570.44	1140.63	53	34	25	131	0.95	a
22	583.74	1167.19	66	48	37	216	1.80	a
23	596.19	1192.05	145	50	36	221	1.46	a

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
24	609.32	1218.29	95	50	38	255	1.41	a
25	651.19	1301.93	34	36	28	160	1.36	a
26	795.16	1589.48	33	28	21	93	1.07	a
27	803.41	1605.96	48	36	27	137	1.59	a
28	911.17	1821.20	91	40	29	142	2.21	a
29	1461.13	2919.68	123	36	23	81	2.82	a
30	1765.68	3527.97	22	18	13	34	1.52	a

082002D02.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET021128.BKG (081128-2 WEEKLY BKG)

Bkg.File Detector #: 2

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
1	46.47	81	55	43	21	85	70	NET<CL
2	63.79	22	130	106	-65	155	128	NET<CL
3	66.30	329	75	54	245	106	83	
4	74.57	52	59	47	-11	81	67	NET<CL
5	77.26	42	75	61	-31	94	78	NET<CL
8	92.70	208	68	51	-2	112	92	NET<CL
9	129.17	33	39	30	10	83	68	NET<CL
10	139.85	220	59	42	153	78	61	
11	185.73	176	58	43	-11	112	93	NET<CL
12	198.37	207	52	36	80	99	80	NET<CL
13	238.57	167	59	43	44	91	74	NET<CL
15	295.15	91	47	35	37	81	66	NET<CL
18	351.86	194	59	43	89	92	74	
19	511.15	820	89	56	17	157	129	NET<CL
20	558.43	195	47	31	85	78	62	
21	570.44	53	34	25	16	70	57	NET<CL
22	583.74	66	48	37	-3	74	61	NET<CL
23	596.19	145	50	36	109	79	62	
24	609.32	95	50	38	18	86	70	NET<CL
27	803.41	48	36	27	-31	65	55	NET<CL
28	911.17	91	40	29	55	60	48	
29	1461.13	123	36	23	31	57	46	NET<CL
30	1765.68	22	18	13	-1	40	33	NET<CL

 SEEKER FINAL ACTIVITY REPORT Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0811110-2 GS081121-4

 Sampling Start: 11/13/2008 12:00:00 Counting Start: 11/29/2008 13:05:25
 Sampling Stop: 11/13/2008 12:00:00 Decay Time: 3.85e+002 Hrs
 Buildup Time: 0.00e+000 Hrs Live Time: 30600 Sec
 Sample Size: 8.50e-001 L Real Time: 30656 Sec
 Collection Efficiency: 1.0000 Spectrum File: 082002D02.SPC
 Cr. Level Confidence Interval: 95 % Det. Limit Confidence Interval: 95 %

Detector #: 2 (Detector 2)

Efficiency File: (D02) (Sh01).EFF (Geo 1 Eff Cal)

Eff.=1/[4.29E-03*En^{-3.71E+00} + 1.32E+02*En^{7.89E-01}] 05/11/2008

Library File: FANP.LIB (FANP (Fiss. Act. and Nat. Products))

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MEASURED or MDA CONCENTRATIONS

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Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
Th-234	92.50	N-2.23E+00	+ 1.03E+02	1.73E+02	8.52E+01	3.92E+13
Pb-212	238.63	N 4.64E+00	+ 9.64E+00	1.60E+01	7.85E+00	1.67E+04
Pb-214	351.99	1.44E+01	+ 1.50E+01	2.45E+01	1.20E+01	1.40E+07
Tl-208	583.14	N-3.64E-01	+ 8.00E+00	1.35E+01	6.59E+00	1.67E+04
Bi-214	609.32	N 3.72E+00	+ 1.73E+01	2.88E+01	1.42E+01	1.40E+07
Cs-134	Average:x	2.78E+00	+ 2.88E+00			1.81E+04
	795.76	4.42E+00	+ 3.74E+00	5.98E+00	2.81E+00	1.81E+04
	604.66	N 4.31E-01	+ 4.49E+00	7.61E+00B	3.68E+00	1.81E+04
Ac-228	911.07	2.74E+01	+ 2.96E+01	4.86E+01	2.36E+01	5.04E+04
K-40	1460.75	N 5.17E+01	+ 9.52E+01	1.58E+02	7.68E+01	1.12E+13
Am-241	59.54	N 2.03E+01	+ 2.64E+01	4.35E+01	2.11E+01	3.80E+06
Eu-155	105.31	N-7.30E-01	+ 1.05E+01	1.79E+01	8.66E+00	4.35E+04
Co-57	122.07	N 4.49E-02	+ 2.29E+00	3.89E+00	1.89E+00	6.48E+03
Ce-144	133.53	N-1.12E+00	+ 1.71E+01	2.92E+01	1.41E+01	6.82E+03
U-235	143.76	N 1.19E+01	+ 1.72E+01	2.84E+01	1.38E+01	6.17E+12
Ce-139	165.85	N 1.63E+00	+ 3.01E+00	5.00E+00	2.43E+00	3.30E+03
Th-227	236.00	N-3.28E+00	+ 2.67E+01	4.51E+01R	2.21E+01	1.90E+05
Cr-51	320.07	N 4.90E+00	+ 4.37E+01	7.39E+01	3.58E+01	6.65E+02
I-131	364.48	N 6.52E-01	+ 1.39E+01	2.37E+01	1.14E+01	1.93E+02
Sb-125	427.95	N 8.52E+00	+ 1.01E+01	1.66E+01	7.99E+00	2.43E+04
Be-7	477.56	N 0.00E+00	+ 3.64E+01	6.24E+01	3.00E+01	1.28E+03
Sb-124	602.71	N-1.48E+00	+ 5.26E+00	9.05E+00	4.37E+00	1.44E+03
Ru-106	621.84	N-2.80E+01	+ 3.75E+01	6.68E+01	3.21E+01	8.84E+03
Ag-110M	657.75	N 1.75E+00	+ 3.74E+00	6.28E+00	2.99E+00	6.00E+03
Cs-137	661.62	N-3.79E+00	+ 3.91E+00	7.10E+00	3.39E+00	2.64E+05

MEASURED or MDA CONCENTRATIONS

Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
Nb-94	702.50	N	5.72E+00 +- 4.55E+00	7.32E+00	3.52E+00	1.78E+08
Bi-212	727.17	N	1.32E+01 +- 6.05E+01	1.03E+02	4.92E+01	1.67E+04
Nb-95	765.82	N	3.97E-01 +- 4.39E+00	7.54E+00	3.59E+00	1.54E+03
Co-58	810.75	N	3.11E+00 +- 4.69E+00	8.38E+00	4.00E+00	1.70E+03
Mn-54	834.81	N	1.27E+00 +- 4.61E+00	7.80E+00	3.73E+00	7.49E+03
Sc-46	889.26	N	2.01E+00 +- 4.40E+00	7.83E+00	3.72E+00	2.01E+03
Pa-234m	1001.03	N	1.85E+02 +- 1.13E+03	1.92E+03	9.26E+02	3.92E+13
Eu-154	1004.80	N	2.38E+01 +- 2.47E+01	4.50E+01	2.15E+01	7.45E+04
Fe-59	1099.22	N	9.41E+00 +- 1.15E+01	1.90E+01	9.04E+00	1.08E+03
Zn-65	1115.52	N	2.65E+00 +- 9.79E+00	1.72E+01	8.19E+00	5.85E+03
Co-56	1238.28	N	3.14E+00 +- 8.48E+00	1.44E+01	6.81E+00	1.86E+03
Na-22	1274.54	N	2.32E+00 +- 4.88E+00	8.74E+00	4.14E+00	2.28E+04
Co-60	1332.51	N	9.51E-01 +- 5.06E+00	8.89E+00	4.21E+00	4.62E+04
Eu-152	1408.08	N	8.99E+00 +- 2.34E+01	4.19E+01	1.98E+01	1.17E+05
Al-26	1808.65	N	3.51E+00 +- 6.22E+00	1.12E+01	5.32E+00	6.31E+09

MEASURED TOTAL: 3.72E+02 +- 1.52E+03 pCi/L

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.47	94.06	21	85	70	364	0.79	Deleted
2	63.79	128.65	-65	155	128	1253	2.36	Deleted
3	66.30	133.67	245	106	83	537	1.01	Unknown
4	74.57	150.18	-11	81	67	448	0.90	Deleted
5	77.26	155.57	-31	94	78	627	1.12	Deleted
6	80.48	162.00	7	31	25	179	0.41	Deleted
7	84.28	169.58	15	58	47	448	0.82	Deleted
9	129.17	259.24	10	83	68	226	0.44	Deleted
10	139.85	280.58	153	78	61	360	0.89	Unknown
11	185.73	372.22	-11	112	93	370	0.85	Deleted
12	198.37	397.47	80	99	80	280	0.58	Deleted
14	242.17	484.96	49	73	59	518	1.46	Deleted
15	295.15	590.77	37	81	66	252	0.77	Deleted
16	326.10	652.59	43	48	38	263	0.93	Unknown
17	338.44	677.24	39	55	44	335	1.12	Deleted
19	511.15	1022.21	17	157	129	403	2.51	Deleted
20	558.43	1116.65	85	78	62	181	1.37	Unknown
21	570.44	1140.63	16	70	57	131	0.95	Deleted
23	596.19	1192.05	109	79	62	221	1.46	Unknown
25	651.19	1301.93	34	36	28	160	1.36	Unknown
27	803.41	1605.96	-31	65	55	137	1.59	Deleted
30	1765.68	3527.97	-1	40	33	34	1.52	Deleted

c:\SEEKER\BIN\082002d02.res Analysis Results Saved.

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: GS081121-4AMB GS081121-4

 Sampling Start: 11/29/2008 21:00:00 | Counting Start: 11/29/2008 21:55:16
 Sampling Stop: 11/29/2008 21:00:00 | Decay Time. 9.21E-001 Hrs
 Buildup Time. 0.00E+000 Hrs | Live Time 30600 Sec
 Sample Size 9.75E-001 L | Real Time 30654 Sec
 Collection Efficiency 1.0000 | Spc. File 082003D02.SPC

Detector #: 2 (Detector 2)

Energy(keV) = -0.62 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 11/29/2008

FWHM(keV) = 0.69 + 0.003*En + 1.19E-03*En^2 + 0.00E+00*En^3 05/08/2008

Where En = Sqrt(Energy in keV)

 Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	66.44	133.94	258	69	50	501	0.84	a
2	77.03	155.10	30	32	25	176	0.40	a
3	92.68	186.35	233	67	49	448	1.04	a
4	123.04	247.00	9	37	30	227	0.43	a NET< CL
5	129.29	259.48	41	38	30	218	0.44	a
6	134.18	269.25	36	47	37	311	0.63	a NET< CL
7	139.88	280.64	227	61	44	382	0.82	a
8	175.16	351.11	41	54	43	381	0.80	a NET< CL
9	185.84	372.44	172	61	45	376	1.01	a
10	198.37	397.46	287	64	45	370	0.98	a
11	238.60	477.81	120	53	40	316	0.77	a
12	295.42	591.30	43	38	30	194	0.72	a
13	352.08	704.48	84	51	39	261	1.15	a
14	500.25	1000.44	25	35	27	158	0.95	a NET< CL
15	511.16	1022.22	807	94	62	451	2.84	a Wide Pk
16	558.64	1117.07	230	49	32	179	1.46	a
17	569.89	1139.53	28	25	19	89	0.72	a
18	583.55	1166.82	61	44	34	196	1.44	a
19	596.36	1192.40	154	55	40	266	1.69	a
20	609.23	1218.10	74	49	37	243	1.44	a
21	669.94	1339.38	34	34	26	142	1.32	a
22	803.18	1605.50	71	40	30	158	1.84	a
23	868.03	1735.03	37	26	19	82	1.23	a
24	911.93	1822.72	35	26	19	82	1.16	a

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PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
25	962.41	1923.55	47	43	34	183	2.67	a
26	1461.53	2920.47	115	39	26	104	2.93	a

082003D02.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET021128.BKG (081128-2 WEEKLY BKG)

Bkg.File Detector #: 2

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
1	66.44	258	69	50	173	102	81	
2	77.03	30	32	25	-44	65	55	NET<CL
3	92.68	233	67	49	23	111	91	NET<CL
5	129.29	41	38	30	17	83	68	NET<CL
7	139.88	227	61	44	159	79	62	
9	185.84	172	61	45	-15	114	94	NET<CL
10	198.37	287	64	45	160	106	85	
11	238.60	120	53	40	-3	88	72	NET<CL
12	295.42	43	38	30	-11	77	63	NET<CL
13	352.08	84	51	39	-21	87	72	NET<CL
15	511.16	807	94	62	3	160	131	NET<CL
16	558.64	230	49	32	121	79	63	
17	569.89	28	25	19	-9	66	55	NET<CL
18	583.55	61	44	34	-8	72	59	NET<CL
19	596.36	154	55	40	118	82	65	
20	609.23	74	49	37	-2	85	70	NET<CL
22	803.18	71	40	30	-8	68	56	NET<CL
24	911.93	35	26	19	-1	51	42	NET<CL
25	962.41	47	43	34	0	60	50	NET<CL
26	1461.53	115	39	26	22	59	48	NET<CL

 SEEKER FINAL ACTIVITY REPORT Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: GS081121-4AMB GS081121-4

 Sampling Start: 11/29/2008 21:00:00 | Counting Start: 11/29/2008 21:55:16
 Sampling Stop: 11/29/2008 21:00:00 | Decay Time: 9.21e-001 Hrs
 Buildup Time: 0.00e+000 Hrs | Live Time 30600 Sec
 Sample Size 9.75e-001 L | Real Time 30654 Sec
 Collection Efficiency 1.0000 | Spectrum File 082003D02.SPC
 Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %

Detector #: 2 (Detector 2)

Efficiency File: (D02) (Sh01).EFF (Geo 1 Eff Cal)

Eff.=1/[4.29E-03*En^-3.71E+00 + 1.32E+02*En^7.89E-01] 05/11/2008

Library File: FANP.LIB (FANP (Fiss. Act. and Nat. Products))
 =====

MEASURED or MDA CONCENTRATIONS

Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
Th-234	92.50	N	1.83E+01 +- 8.99E+01	1.49E+02	7.36E+01	3.92E+13
Pb-212	238.63	N	2.92E-01 +- 7.95E+00	1.33E+01	6.55E+00	1.67E+04
Pb-214	351.99	N	3.04E+00 +- 1.23E+01	2.08E+01	1.02E+01	1.40E+07
Tl-208	583.14	N	7.58E-01 +- 6.61E+00	1.12E+01	5.46E+00	1.67E+04
Bi-214	609.32	N	3.40E-01 +- 1.49E+01	2.50E+01	1.22E+01	1.40E+07
K-40	1460.75	N	3.28E+01 +- 8.58E+01	1.43E+02	6.96E+01	1.12E+13
Am-241	59.54	N	6.41E+00 +- 2.24E+01	3.83E+01	1.86E+01	3.80E+06
Eu-155	105.31	N	4.05E+00 +- 8.55E+00	1.43E+01	6.90E+00	4.35E+04
Co-57	122.07	N	1.25E-01 +- 1.94E+00	3.29E+00	1.60E+00	6.48E+03
Ce-144	133.53	N	1.86E+01 +- 1.50E+01	2.42E+01	1.17E+01	6.82E+03
U-235	143.76	N	1.62E+01 +- 1.46E+01	2.37E+01	1.15E+01	6.17E+12
Ce-139	165.85	N	1.35E+00 +- 2.31E+00	3.83E+00	1.86E+00	3.30E+03
Th-227	236.00	N	3.17E-01 +- 2.38E+01	4.01E+01R	1.96E+01	1.90E+05
Cr-51	320.07	N	1.33E+01 +- 2.47E+01	4.11E+01	1.99E+01	6.65E+02
I-131	364.48	N	3.95E-01 +- 2.95E+00	5.07E+00	2.44E+00	1.93E+02
Sb-125	427.95	N	7.55E+00 +- 9.06E+00	1.49E+01	7.17E+00	2.43E+04
Be-7	477.56	N	1.84E+01 +- 2.56E+01	4.23E+01	2.03E+01	1.28E+03
Sb-124	602.71	N	2.66E-01 +- 3.84E+00	6.52E+00	3.15E+00	1.44E+03
Cs-134	604.66	N	2.06E+00 +- 3.92E+00	6.81E+00B	3.29E+00	1.81E+04
Ru-106	621.84	N	1.39E+01 +- 3.22E+01	5.40E+01	2.58E+01	8.84E+03
Ag-110M	657.75	N	5.35E-01 +- 3.25E+00	5.54E+00	2.65E+00	6.00E+03
Cs-137	661.62	N	2.03E-01 +- 3.66E+00	6.28E+00	3.00E+00	2.64E+05
Nb-94	702.50	N	3.23E+00 +- 3.89E+00	6.89E+00	3.32E+00	1.78E+08
Bi-212	727.17	N	3.25E+01 +- 5.29E+01	9.36E+01	4.49E+01	1.67E+04
Nb-95	765.82	N	1.36E+00 +- 3.26E+00	5.49E+00	2.61E+00	1.54E+03

MEASURED or MDA CONCENTRATIONS

Nuclide	N		Concentration		MDA	Critical Level	Half-life (hrs)
	ENERGY (keV)	E T	(pCi/L))			
Co-58	810.75	N	2.07E+00 +- 3.61E+00		6.02E+00b	2.87E+00	1.70E+03
Mn-54	834.81	N	2.49E-01 +- 3.63E+00		6.28E+00	3.00E+00	7.49E+03
Sc-46	889.26	N	2.91E-01 +- 3.35E+00		5.84E+00	2.77E+00	2.01E+03
Ac-228	911.07	N	2.06E+01 +- 1.44E+01		2.27E+01	1.08E+01	5.04E+04
Pa-234m	1001.03	N	3.05E+02 +- 9.64E+02		1.66E+03	8.04E+02	3.92E+13
Eu-154	1004.80	N	1.33E+00 +- 2.02E+01		3.52E+01	1.67E+01	7.45E+04
Fe-59	1099.22	N	1.09E+01 +- 7.49E+00		1.18E+01	5.59E+00	1.08E+03
Zn-65	1115.52	N	2.75E+00 +- 8.16E+00		1.44E+01	6.85E+00	5.85E+03
Co-56	1238.28	N	3.49E-01 +- 6.44E+00		1.12E+01	5.31E+00	1.86E+03
Na-22	1274.54	N	1.45E+00 +- 4.01E+00		6.81E+00	3.21E+00	2.28E+04
Co-60	1332.51	N	3.26E+00 +- 4.36E+00		7.94E+00	3.77E+00	4.62E+04
Eu-152	1408.08	N	8.57E+00 +- 2.09E+01		3.74E+01	1.77E+01	1.17E+05
Al-26	1808.65	N	3.25E+00 +- 5.51E+00		9.95E+00	4.72E+00	6.31E+09

MEASURED TOTAL: 1.82E+02 +- 3.51E+02 pCi/L

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	66.44	133.94	173	102	81	501	0.84	Unknown
2	77.03	155.10	-44	65	55	176	0.40	Deleted
4	123.04	247.00	9	37	30	227	0.43	Deleted
5	129.29	259.48	17	83	68	218	0.44	Deleted
6	134.18	269.25	36	47	37	311	0.63	Deleted
7	139.88	280.64	159	79	62	382	0.82	Unknown
8	175.16	351.11	41	54	43	381	0.80	Deleted
9	185.84	372.44	-15	114	94	376	1.01	Deleted
10	198.37	397.46	160	106	85	370	0.98	Unknown
12	295.42	591.30	-11	77	63	194	0.72	Deleted
14	500.25	1000.44	25	35	27	158	0.95	Deleted
15	511.16	1022.22	3	160	131	451	2.84	Deleted
16	558.64	1117.07	121	79	63	179	1.46	Unknown
17	569.89	1139.53	-9	66	55	89	0.72	Deleted
19	596.36	1192.40	118	82	65	266	1.69	Unknown
21	669.94	1339.38	34	34	26	142	1.32	Unknown
22	803.18	1605.50	-8	68	56	158	1.84	Deleted
23	868.03	1735.03	37	26	19	82	1.23	Unknown
24	911.93	1822.72	-1	51	42	82	1.16	Deleted
25	962.41	1923.55	0	60	50	183	2.67	Deleted

c:\SEEKER\BIN\082003d02A.res Analysis Results Saved.

081831D06.SPC Analyzed by

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Geo 1 / Water

Sample ID: GS081121-4LCS GS081121-4

Sampling Start: 11/25/2008 15:00:00 | Counting Start: 11/25/2008 15:05:34
Sampling Stop: 11/25/2008 15:00:00 | Decay Time. 9.28E-002 Hrs
Buildup Time. 0.00E+000 Hrs | Live Time 1800 Sec
Sample Size 1.00E+000 L | Real Time 1825 Sec
Collection Efficiency 1.0000 | Spc. File 081831D06.SPC

Detector #: 6 (Detector 6)

Energy(keV)= -0.51 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 11/25/2008

FWHM(keV) = 0.73 + 0.012*En + 6.10E-04*En^2 + 0.00E+00*En^3 07/25/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.54	120.11	8750	224	102	2080	0.87	a
2	88.02	177.06	13522	260	96	1861	0.87	a
3	122.09	245.21	4370	178	98	1764	0.91	a
4	126.66	254.35	82	75	60	882	0.47	b
5	136.44	273.91	488	113	85	1463	0.81	a
6	165.92	332.85	683	123	92	1557	1.00	a
7	181.15	363.33	59	99	81	1316	0.79	a NET< CL
8	246.88	494.77	90	124	101	1744	1.09	a NET< CL
9	391.73	784.49	235	105	83	1262	1.28	a
10	428.92	858.86	41	82	67	943	1.01	a NET< CL
11	661.67	1324.35	19077	287	65	741	1.42	a
12	898.29	1797.59	139	66	51	597	1.02	a
13	1173.29	2347.58	16827	266	47	424	1.82	a HiResid
14	1332.55	2666.08	15193	248	23	94	1.94	a
15	1835.94	3672.86	104	24	11	21	2.35	a

081831D06.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET061121.BKG (081121-6 WEEKLY BKG)

Bkg.File Detector #: 6

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
12	898.29	139	66	51	138	66	51	

 SEEKER FINAL ACTIVITY REPORT Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: GS081121-4LCS GS081121-4

 Sampling Start: 11/25/2008 15:00:00 | Counting Start: 11/25/2008 15:05:34
 Sampling Stop: 11/25/2008 15:00:00 | Decay Time: 9.28e-002 Hrs
 Buildup Time: 0.00e+000 Hrs | Live Time 1800 Sec
 Sample Size 1.00e+000 L | Real Time 1825 Sec
 Collection Efficiency 1.0000 | Spectrum File 081831D06.SPC
 Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %

Detector #: 6 (Detector 6)

Efficiency File: (D06) (Sh01).EFF (Geo 1 Eff Cal)

Eff=10^[-2.91E+01 +2.55E+01*L +-5.92E+00*L² +0.00E+00*L³] 08/06/2008
 Eff.=10^[-3.99E+00 +3.72E+00*L +-1.60E+00*L² +1.86E-01*L³] Above 180.00 keV

Library File:ANALYTICAL.LIB (Analytical)

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MEASURED or MDA CONCENTRATIONS

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Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
Am-241	59.54	1.03E+05 +- 2.63E+03	2.41E+03	1.19E+03	3.79E+06	
Cd-109	88.02	4.01E+05 +- 7.72E+03	5.78E+03	2.85E+03	1.11E+04	
Co-57	122.07	3.19E+03 +- 1.30E+02	1.44E+02	7.12E+01	6.50E+03	
Ce-139	165.85	5.27E+02 +- 9.51E+01	1.44E+02	7.08E+01	3.30E+03	
Sn-113	391.68	3.87E+02 +- 1.73E+02	2.76E+02	1.36E+02	2.76E+03	
Cs-137	661.62	3.73E+04 +- 5.61E+02	2.60E+02	1.27E+02	2.64E+05	
Y-88	Average:x	3.84E+02 +- 8.14E+01	. . . . .	. . . . .	2.56E+03
	898.02	3.20E+02 +- 1.54E+02	2.43E+02	1.18E+02	2.56E+03	
	1836.01	4.09E+02 +- 9.60E+01	9.82E+01	4.37E+01	2.56E+03	
Co-60	Average:x	4.59E+04 +- 5.21E+02	. . . . .	. . . . .	4.62E+04
	1173.21	4.58E+04 +- 7.23E+02	2.62E+02	1.28E+02	4.62E+04	
	1332.48	4.60E+04 +- 7.51E+02	1.45E+02	6.83E+01	4.62E+04	
Hg-203	279.18	MDA	1.87E+02	9.21E+01	1.12E+03	

MEASURED TOTAL: 5.91E+05 +- 1.19E+04 pCi/L

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UNKNOWN, SUM or ESCAPE PEAKS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
4	126.66	254.35	82	75	60	882	0.47	Unknown
5	136.44	273.91	488	113	85	1463	0.81	Unknown

081831D06.SPC Analyzed by

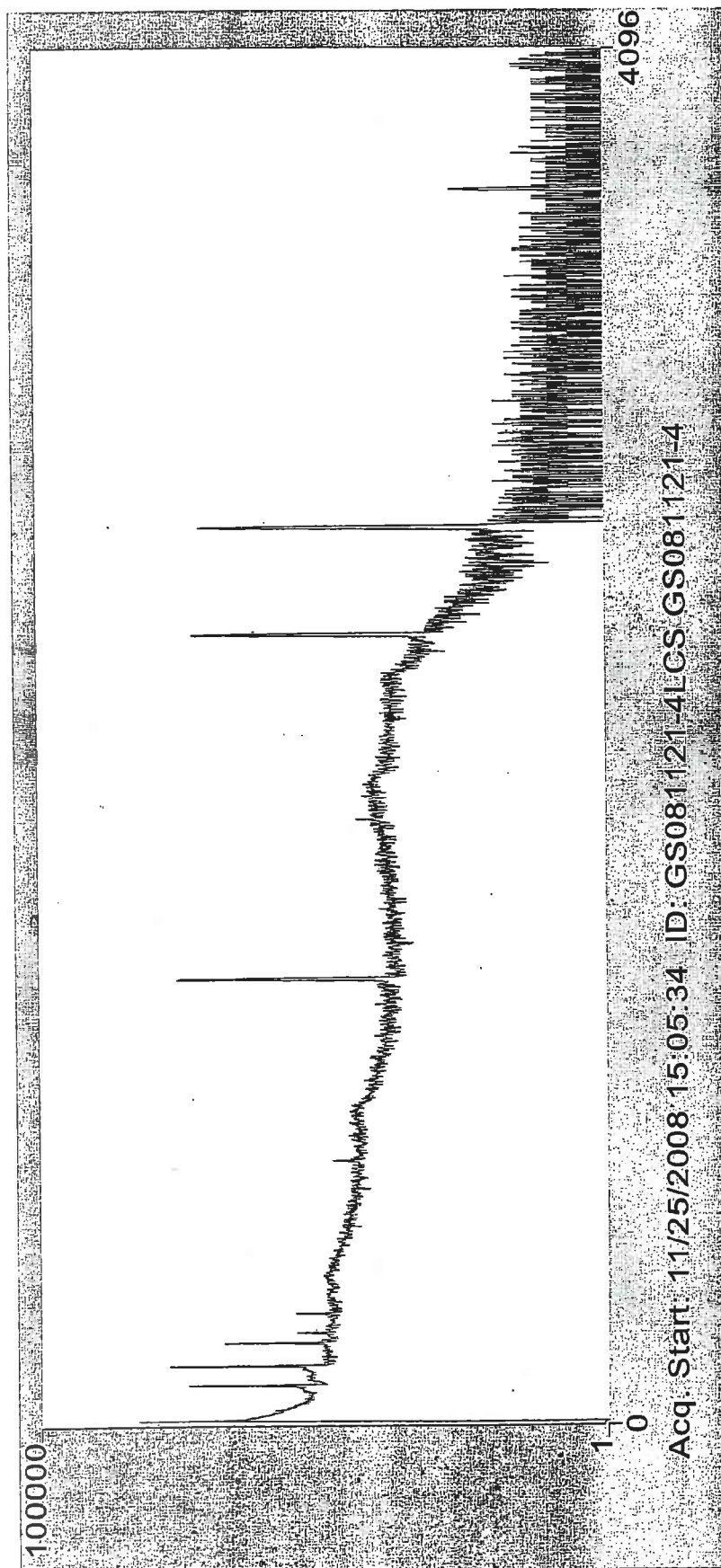
=====

UNKNOWN, SUM or ESCAPE PEAKS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
7	181.15	363.33	59	99	81	1316	0.79	Deleted
8	246.88	494.77	90	124	101	1744	1.09	Deleted
10	428.92	858.86	41	82	67	943	1.01	Deleted

c:\SEEKER\BIN\081831d06.res Analysis Results Saved.



Gamma Spectrometer Run Log

Date: 11-24-08
WAC 11-24-08Reviewed By/Date: WAC 11-25-08

Sample ID	Ver ¹	Det. No.	Geo ²	Count Dur. (min.) ³	Start Time	Analyst	File ID/Comments	Saved?
0811117-1	WAC	2	11	120	12:41	WAC	081981002.87C	WAC
↓ -2	↓	3	↓	↓	↓	↓	081391003.87C	↓
08081121-7	↓	4	↓	↓	↓	↓	082103004.87C	↓
0811133-7	WAC	8	11	60	12:44	WAC	082120008.87C	WAC
0810010-1	↓	6	1	1000	14:13	↓	081828006.87C	↓
↓ -2	↓	7	↓	↓	↓	↓	081681007.87C	↓
↓ -2B	↓	8	↓	↓	↓	↓	082127008.87C	↓
↓ -3	↓	10	↓	↓	14:14	↓	081208010.87C	↓
0811117-1A	WAC	4	11	30	14:51	WAC	082106004.87C	WAC
08081121-7LCS	↓	2	↓	30	14:52	↓	081982002.87C	↓
0810010-4	WAC	3	1	1000	14:54	WAC	081392003.87C	WAC
↓ -5	↓	4	↓	↓	15:29	↓	082107004.87C	↓
0811110-1	↓	2	1	300 WAC 11-25-08	15:35	WAC	081983002.87C	↓
WAC 11-25-08								

¹ Analyst will verify the position, detector, and geometry when the sample is removed from the detector.² Calibration geometry.³ Count duration.**KEY:**

* sample was counted on a puck

↑ sample was counted with air flow arrow pointing up

↓ sample was counted with air flow arrow pointing down

369977 B

Gamma Spectrometer Run Log

Date: 11-25-08

Reviewed By/Date: WJV 11-26-08

Sample ID	Ver ¹	Det. No.	Geo ²	Count Dur. (min.) ³	Start Time	Analyst	File ID/Comments	Saved?
0811181-1	WJV	8	11	30	9:46	WJV	082129808.8PC	WJV
0811110-1D	↓	10	1	210	9:52	↓	081210110.8PC	↓
0811119-12	WJV	6	↓	300	9:53	↓	081830106.8PC	WJV
0811133-7D	WJV	9	11	30	9:55	WJV	081938809.8PC	WJV
G5081122-1LCS	↓	7	1	30	9:59	↓	081683307.8PC	↓
0811181-1D	WJV	3	11	60	10:02	WJV	081394103.8PC	WJV
0811189-1	↓	4	↓	↓	↓	↓	082109104.8PC	↓
0811110-2	WJV	2	1	270	10:05	WJV	081988102.8PC	WJV
G5081124-1MB	WJV	8	11	60	10:20	↓	082130108.8PC	WJV
0811147-1	WJV	9	↓	30	10:36	WJV	081939109.8PC	WJV
0811133-12	↓	7	1	300	10:38	↓	081684107.8PC	↓
G5081124-1LCS	WJV	3	11	30	11:07	WJV	081395103.8PC	WJV
0811147-2	↓	4	↓	↓	11:08	↓	082110104.8PC	↓
↓ -2D	↓	9	11	30	11:10	WJV	081940109.8PC	WJV
G5081121-8MB	WJV	8	↓	60	11:27	↓	082131108.8PC	↓
0811173-3	WJV	3	11	30	11:42	WJV	081396103.8PC	WJV
G5081125-5MB	↓	4	↓	↓	11:47	↓	082111104.8PC	↓
↓ -5LCS	↓	9	↓	↓	↓	↓	081941109.8PC	↓
0811173-3D	WJV	4	11	30	12:24	WJV	082112104.8PC	WJV
G5081124-3MB	↓	3	↓	↓	↓	↓	081397103.8PC	↓
G5081121-8LCS	WJV	8	11	30	13:39 12:30	WJV	082133108.8PC	WJV
G5081124-3LCS	WJV	3	↓	↓	13:06	↓	081398103.8PC	WJV
G5081122-1MB	↓	3	1	1000	13:42	WJV	081399103.8PC	↓
0811155-1	↓	10	↓	300	13:44	↓	081211110.8PC	↓

¹ Analyst will verify the position, detector, and geometry when the sample is removed from the detector.

² Calibration geometry.

³ Count duration.

KEY:

* sample was counted on a puck

↑ sample was counted with air flow arrow pointing up

↓ sample was counted with air flow arrow pointing down

359978 B

Reviewed By/Date: WFO 11-26-08

- 1 Analyst will verify the position, detector, and geometry when the sample is removed from the detector.
- 2 Calibration geometry.
- 3 Count duration.

- * sample was counted on a puck
- ↑ sample was counted with air flow arrow pointing up
- ↓ sample was counted with air flow arrow pointing down



Technical Comments Regarding Analysis using the FANP Gamma Spectroscopy Library

Analysis using the FANP (Fission, Activation, and Natural Products) library is limited to the list of gamma emitting radionuclides specified by Paragon Analytics. Paragon Analytics specifies all values assigned to the nuclides in this library. In cases where multiple gamma emissions are used to quantify activity, the most abundant emission is used for quantification in the absence of any supporting gamma emissions. It should be noted that the current software program used for gamma spectroscopic analysis is limited to a ± 2.0 keV photo-peak resolution tolerance. Thus, any gamma emissions occurring within the same ± 2.0 keV range will suffer interference, consequently preventing accurate quantification. Nuclide specific information regarding analysis using the FANP library is as follows:

Nuclide: ^{228}Ac Energy: various Photon Abundance: various

All activity values for ^{228}Ac are calculated using the half-life, $t_{1/2}=5.75$ years, of the long-lived ^{228}Ra parent. It is assumed that secular equilibrium is achieved between the ^{228}Ra parent and the ^{228}Ac progeny.

Nuclide: ^{212}Bi , ^{212}Pb , ^{208}Tl Energy: various Photon Abundance: various

All activity values for ^{212}Bi , ^{212}Pb , and ^{208}Tl are calculated using the half-life, $t_{1/2}=1.91$ years, of the long-lived ^{228}Th parent. It is assumed that secular equilibrium is achieved between the ^{228}Th parent and the ^{212}Bi , ^{212}Pb , ^{208}Tl progeny.

Nuclide: ^{214}Bi , ^{214}Pb Energy: various Photon Abundance: various

All activity values for ^{214}Bi and ^{214}Pb are calculated using the half-life, $t_{1/2}=1600$ years, of the long-lived ^{226}Ra parent. It is assumed that secular equilibrium is achieved between the ^{226}Ra parent and the ^{214}Bi and ^{214}Pb progeny.

Nuclide: ^{56}Co Energy: 1175.13 keV Photon Abundance: 0.0228

This emission for this nuclide suffers from possible resolution interference due to the ^{60}Co gamma emission occurring at 1173.23 keV (0.9997, abundance). Therefore, this emission will be used as an identifier only and not in the activity calculations for this nuclide.

Nuclides: ^{57}Co Energy: 122.07 Photon Abundance: 0.8560

The most abundant gamma emission specified for quantification of this nuclide suffers from possible resolution interference due to the ^{152}Eu gamma emission occurring at 121.78 keV (0.2050, abundance). Therefore, a possibility of a high bias to the ^{57}Co results may occur in the presence of elevated ^{152}Eu activity.



Nuclide: ^{134}Cs Energy: 604.66 Photon Abundance: 0.9762

Cesium-134 suffers from coincidence summing, due to the multiple simultaneous photon emissions during each decay event. This results in a potentially low bias in the final analytical results. The magnitude of this low bias is highly dependent on the Cs-134 activity levels and the specific counting geometry. Any Cs-134 activity reported above the associated Minimum Detectable Concentration should be considered to have a potential low bias.

The most abundant gamma emission specified for quantification of this nuclide suffers from possible resolution interference due to the ^{124}Sb gamma emission occurring at 602.71 keV (0.9826, abundance). Therefore, a possibility of a high bias to the ^{134}Cs results may occur in the presence of elevated ^{124}Sb activity.

Other gamma emissions used for quantification of this nuclide suffer from possible resolution interference due to multiple gamma emissions of ^{228}Ac . Therefore, a possible high bias to the ^{134}Cs activity results may occur in the presence of elevated ^{228}Ac activity.

Nuclide: ^{137}Cs Energy: 661.62 keV Photon Abundance: 0.8512

Cesium-137 does not emit any gamma photons useful for quantification. However, it can be assumed to be in secular equilibrium with the short-lived $^{137\text{m}}\text{Ba}$ daughter product. Therefore, the activity for ^{137}Cs is determined from the 661.62 keV gamma emission of the $^{137\text{m}}\text{Ba}$ daughter product. The calculated gamma photon abundance used in the library is the product of the 0.8998 abundance of the 661.62 keV $^{137\text{m}}\text{Ba}$ photon and the 0.946 branching ratio between ^{137}Ba and $^{137\text{m}}\text{Ba}$.

Nuclide: ^{155}Eu Energy: 105.31 Photon Abundance: 0.2120

The only gamma emission useful for quantification of this nuclide suffers from possible resolution interference due to the ^{235}U gamma emission occurring at 105 keV (0.0210, abundance). Therefore, a possibility of a high bias to the ^{155}Eu results may occur in the presence of elevated ^{235}U activity.

Nuclide: ^{40}K Energy: 1460.75 Photon Abundance: 0.1100

The only gamma emission useful for quantification of this nuclide suffers from possible resolution interference due to the ^{228}Ac gamma emission occurring at 1459.2 keV (0.0104, abundance). Therefore, a possibility of a high bias to the ^{40}K results may occur in the presence of elevated ^{228}Ac activity.

Nuclide: ^{54}Mn Energy: 834.81 Photon Abundance: 0.9997

The only gamma emission useful for quantification of this nuclide suffers from possible resolution interference due to the ^{228}Ac gamma emission occurring at 835.6 keV (0.0182, abundance). Therefore, a possibility of a high bias to the ^{54}Mn results may occur in the presence of elevated ^{228}Ac activity.



Nuclide: ^{95}Nb Energy: 765.82 Photon Abundance: 0.9999

All activity values for ^{95}Nb are calculated using the half-life, $t_{1/2}=64.02$ days, of the ^{95}Zr parent. It is assumed that a transient equilibrium is achieved between the ^{95}Zr parent and the ^{95}Nb progeny.

The only gamma emission useful for quantification of this nuclide suffers from possible resolution interference due to the $^{234\text{m}}\text{Pa}$ gamma emission occurring at 766.6 keV (0.0020, abundance). Therefore, a possibility of a high bias to the ^{95}Nb results may occur in the presence of elevated $^{234\text{m}}\text{Pa}$ activity.

Nuclide: $^{234\text{m}}\text{Pa}$ Energy: 1001.03 Photon Abundance: 0.0059

All activity values for $^{234\text{m}}\text{Pa}$ are calculated using the half-life, $t_{1/2}=4.468\text{E}+09$ yrs, of the long-lived ^{238}U parent. It is assumed that secular equilibrium is achieved between the ^{238}U parent and the $^{234\text{m}}\text{Pa}$ progeny.

Nuclide: ^{106}Ru Energy: various Photon Abundance: various

Ru-106 does not emit any gamma photons. Therefore, all activity values for ^{106}Ru are calculated using the gamma emissions of the short-lived ^{106}Rh daughter. The half-life, $t_{1/2}=368.2$ days, of the ^{106}Ru parent is used in the activity calculations. It is assumed that a secular equilibrium is achieved between the ^{106}Ru parent and the ^{106}Rh progeny.

Nuclide: ^{124}Sb Energy: 602.71 Photon Abundance: 0.9826

The most abundant gamma emission specified for quantification of this nuclide suffers from possible resolution interference due to the ^{134}Cs gamma emission occurring at 604.66 keV (0.9762, abundance). Therefore, a possibility of a high bias to the ^{124}Sb results may occur in the presence of elevated ^{134}Cs activity.

Nuclide: ^{125}Sb Energy: 600.77 Photon Abundance: 0.1786

The gamma emission specified for quantification of this nuclide that occurs at 600.77 keV suffers from possible resolution interference due to the ^{124}Sb gamma emission occurring at 602.71 keV (0.9826, abundance). Therefore, this photo-peak will be used as an identifier only and not in the activity calculations for this nuclide.

Nuclide: ^{227}Th Energy: 236.00 Photon Abundance: 0.1230

All activity values for ^{227}Th are calculated using the half-life, $t_{1/2}=21.7$ yrs, of the long-lived ^{227}Ac parent. It is assumed that secular equilibrium is achieved between the ^{227}Ac parent and the ^{227}Th progeny.



Nuclide: ^{234}Th

Energy: 92.50

Photon Abundance: 0.0553

The 92.50 keV photo-peak used in this library for Th-234 quantification is actually two separate photo-peaks, occurring at 92.4 keV and 92.8 keV. The current software used for gamma spectroscopic analysis cannot resolve two photo-peaks that occur within the 2-keV resolution tolerance. Therefore, these two photopeaks are observed as a single photo-peak. Therefore, the average of the two photo-peak energies is used in this library. Also, the sum of the two photo-peak abundances, 0.0553, is used in the activity calculations for this observed 'single' photo-peak.

All activity values for ^{234}Th are calculated using the half-life, $t_{1/2}=4.468\text{E}+09$ yrs, of the long-lived ^{238}U parent. It is assumed that secular equilibrium is achieved between the ^{238}U parent and the ^{234}Th progeny.

Nuclide: ^{235}U

Energy: 185.70

Photon Abundance: 0.5720

Quantifying ^{235}U activity using the 185.70 keV photo-peak is vulnerable to a significant high bias due to interference from gamma emissions from ^{226}Ra occurring at 186.21 keV (0.0328, abundance). Therefore, this emission will be used as an identifier only and not in the activity calculations for this nuclide.



Gamma Spectroscopist

11/20/07

Date

Radiochemistry Instrumentation Laboratory



Radiochemistry Manager

11/20/07

Date

Library File: FANP.lib

File I.D.: FANP (Fiss. Act. and Nat. Products)

Pk. #	Energy (keV)	Isotope Name	2ndary Pk #	Type	Gamma Fraction	Half-life
24	338.40	Ac-228	61	QUANT	0.1127	5.7500E+00 yrs
61	911.07	Ac-228	63	NET	0.2580	5.7500E+00 yrs
63	968.90	Ac-228	24	QUANT	0.1580	5.7500E+00 yrs
41	657.75	Ag-110M	43	NET	0.9314	2.4990E+02 dys
43	677.71	Ag-110M	46	QUANT	0.1054	2.4990E+02 dys
46	706.67	Ag-110M	49	QUANT	0.1646	2.4990E+02 dys
49	763.93	Ag-110M	59	QUANT	0.2198	2.4990E+02 dys
59	884.67	Ag-110M	62	QUANT	0.7163	2.4990E+02 dys
62	937.48	Ag-110M	84	QUANT	0.3375	2.4990E+02 dys
84	1384.27	Ag-110M	87	QUANT	0.2394	2.4990E+02 dys
87	1505.00	Ag-110M	41	QUANT	0.1289	2.4990E+02 dys
90	1808.65	Al-26	0	NET	0.9973	7.2000E+05 yrs
1	59.54	Am-241	0	NET	0.3590	4.3310E+02 yrs
30	477.56	Be-7	0	NET	0.1052	5.3440E+01 dys
48	727.17	Bi-212	0	NET	0.0658	1.9100E+00 yrs
38	609.32	Bi-214	73	NET	0.4609	1.6000E+03 yrs
73	1120.28	Bi-214	38	QUANT	0.1510	1.6000E+03 yrs
11	165.85	Ce-139	0	NET	0.8035	1.3766E+02 dys
7	133.53	Ce-144	44	NET	0.1109	2.8414E+02 dys
44	696.49	Ce-144	7	QUANT	0.0130	2.8414E+02 dys
56	846.81	Co-56	67	QUANT	0.9999	7.7300E+01 dys
67	1037.83	Co-56	76	QUANT	0.1400	7.7300E+01 dys
76	1175.13	Co-56	77	ID	0.0228	7.7300E+01 dys
77	1238.28	Co-56	81	NET	0.6760	7.7300E+01 dys
81	1360.22	Co-56	89	QUANT	0.0429	7.7300E+01 dys
89	1771.49	Co-56	56	QUANT	0.1570	7.7300E+01 dys
6	122.07	Co-57	8	NET	0.8560	2.7000E+02 dys
8	136.43	Co-57	6	QUANT	0.1068	2.7000E+02 dys
54	810.75	Co-58	0	NET	0.9945	7.0780E+01 dys
75	1173.23	Co-60	80	QUANT	0.9997	5.2721E+00 yrs
80	1332.51	Co-60	75	NET	0.9998	5.2721E+00 yrs
23	320.07	Cr-51	0	NET	0.1000	2.7700E+01 dys
31	563.26	Cs-134	32	QUANT	0.0835	2.0623E+00 yrs
32	569.29	Cs-134	37	QUANT	0.1538	2.0623E+00 yrs
37	604.66	Cs-134	52	NET	0.9762	2.0623E+00 yrs
52	795.76	Cs-134	53	QUANT	0.8553	2.0623E+00 yrs
53	801.84	Cs-134	74	QUANT	0.0869	2.0623E+00 yrs
74	1167.86	Cs-134	82	QUANT	0.0180	2.0623E+00 yrs
82	1365.13	Cs-134	31	QUANT	0.0304	2.0623E+00 yrs
42	661.62	Cs-137	0	NET	0.8512	3.0104E+01 yrs
25	344.30	Eu-152	51	QUANT	0.2650	1.3330E+01 yrs
51	778.90	Eu-152	69	QUANT	0.1294	1.3330E+01 yrs
69	1085.80	Eu-152	71	QUANT	0.1021	1.3330E+01 yrs
71	1112.07	Eu-152	85	QUANT	0.1364	1.3330E+01 yrs
85	1408.08	Eu-152	25	NET	0.2100	1.3330E+01 yrs
18	248.04	Eu-154	34	QUANT	0.0660	8.5019E+00 yrs
34	591.70	Eu-154	58	QUANT	0.0460	8.5019E+00 yrs
58	873.20	Eu-154	64	QUANT	0.1227	8.5019E+00 yrs
64	996.30	Eu-154	66	QUANT	0.1030	8.5019E+00 yrs
66	1004.80	Eu-154	18	NET	0.1801	8.5019E+00 yrs
4	105.31	Eu-155	0	NET	0.2120	4.9600E+00 yrs

Pk. #	Energy (keV)	Isotope Name	2ndary Pk #	Type	Gamma Fraction	Halflife
14	192.34	Fe-59	70	QUANT	0.0308	4.5100E+01 dys
70	1099.22	Fe-59	79	NET	0.5650	4.5100E+01 dys
79	1291.56	Fe-59	14	QUANT	0.4320	4.5100E+01 dys
20	284.29	I-131	27	QUANT	0.0614	8.0405E+00 dys
27	364.48	I-131	20	NET	0.8170	8.0405E+00 dys
86	1460.75	K-40	0	NET	0.1100	1.2800E+09 yrs
55	834.81	Mn-54	0	NET	0.9997	3.1220E+02 dys
78	1274.54	Na-22	0	NET	0.9994	2.6000E+00 yrs
45	702.50	Nb-94	0	NET	0.9790	2.0300E+04 yrs
50	765.82	Nb-95	0	NET	0.9999	6.4020E+01 dys
65	1001.03	Pa-234m	0	NET	0.0059	4.4680E+09 yrs
5	115.18	Pb-212	17	QUANT	0.0059	1.9100E+00 yrs
17	238.63	Pb-212	22	NET	0.4330	1.9100E+00 yrs
22	300.09	Pb-212	5	QUANT	0.0327	1.9100E+00 yrs
21	295.22	Pb-214	26	QUANT	0.1920	1.6000E+03 yrs
26	351.99	Pb-214	21	NET	0.3710	1.6000E+03 yrs
39	621.84	Ru-106	68	NET	0.0981	3.6820E+02 dys
68	1050.47	Ru-106	39	QUANT	0.0173	3.6820E+02 dys
36	602.71	Sb-124	40	NET	0.9826	6.0200E+01 dys
40	645.84	Sb-124	47	QUANT	0.0745	6.0200E+01 dys
47	713.82	Sb-124	83	QUANT	0.0238	6.0200E+01 dys
83	1368.21	Sb-124	88	QUANT	0.0251	6.0200E+01 dys
88	1691.04	Sb-124	36	QUANT	0.4779	6.0200E+01 dys
12	176.29	Sb-125	28	QUANT	0.0682	2.7702E+00 yrs
28	427.95	Sb-125	29	NET	0.3000	2.7702E+00 yrs
29	463.51	Sb-125	35	QUANT	0.1049	2.7702E+00 yrs
35	600.77	Sb-125	12	ID	0.1786	2.7702E+00 yrs
60	889.26	Sc-46	0	NET	0.9998	8.3850E+01 dys
16	236.00	Th-227	0	NET	0.1230	2.1700E+01 yrs
2	63.29	Th-234	3	QUANT	0.0390	4.4680E+09 yrs
3	92.50	Th-234	2	NET	0.0553	4.4680E+09 yrs
19	277.36	Tl-208	33	QUANT	0.0631	1.9100E+00 yrs
33	583.14	Tl-208	57	NET	0.8450	1.9100E+00 yrs
57	860.47	Tl-208	19	QUANT	0.1242	1.9100E+00 yrs
9	143.76	U-235	10	NET	0.1096	7.0379E+08 yrs
10	163.35	U-235	13	QUANT	0.0508	7.0379E+08 yrs
13	185.72	U-235	15	ID	0.5720	7.0379E+08 yrs
15	205.31	U-235	9	QUANT	0.0501	7.0379E+08 yrs
72	1115.52	Zn-65	0	NET	0.5060	2.4380E+02 dys

Radiochemistry Data Package

Section 6

**QUALITY ASSURANCE
SUMMARY REPORTS**



No *NON-CONFORMANCE REPORTS* or
QUALITY ASSURANCE SUMMARY SHEETS
are included in this data package.

Radiochemistry Data Package

Section 7

LABORATORY BENCH SHEETS



Radiochemistry Instrument Worksheet

Prep Batch: 6808112124

Paragon Analytics

Prep Procedure: GAMMASCAN

Analytical QASS / NCR? Y / N A914

Prep Num	Lab ID	QC Type	Init Aliq	Fin Aliq	Units	Geo.	Report	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Count Date	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Count Date	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Count Date	Notes
12-8	1	0811110-1	SMP	1000	1000	ml	pCII	300	2	11-24-08							Count dup.
12-9	1	0811110-1	DUP	1000	1000	ml	pCII	210	10	11-25-08							
12-10	1	0811110-2	SMP	850	850	ml	pCII	270	2	11-26-08	330	9	11-26-08	510	2	11-29-08	
12-11	1	0811111-12	SMP	1000	1000	ml	pCII	300	6								Count dup.
12-12	1	0811111-12	DUP	1000	1000	ml	pCII		7	11-25-08							
12-13	1	0811113-12	SMP	1000	1000	ml	pCII	300	7	11-25-08							
12-14	1	0811155-1	SMP	1000	1000	ml	pCII		10								Count dup.
12-15	1	0811155-3	SMP	1000	1000	ml	pCII	330	9								
12-16	1	GS081121-4A	MB	975	975	ml	pCII		2	11-29-08							FANP. Lib
12-17	1	GS081121-4B	MB	975	975	ml	pCII										FANP. Lib
12-18	1	GS081121-4C	MB	975	975	ml	pCII										BSC-COCK. Lib
12-19	1	GS081121-4	LCS	1000	1000	ml	pCII	30	6	11-29-08							

119,135,155
print spectra!

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	824	220.287	DPM/ml	11/21/08	1000	ml	N/A
S1	Co-60	824	104.025	DPM/ml	11/21/08	1000	ml	N/A
S1	Cs-137	824	83.784	DPM/ml	11/21/08	1000	ml	N/A

* Recount, Peak fit error! wto 11-26-08

Δ Recount MDC not met JP 11/28/08

X RECOUNT FOR LONGEST SAMPLE COUNT TIME.
MC 11/29/08

Radiochemistry Instrument Worksheet



















Prep Batch: GS0811214

Paragon Analytics

Reporting Units

LabID:	TstGrpName:	RptUnits:
0811155-1	GAMMA_Cs137_Co60_K40 only	pCi/l
0811110-1	GAMMA_FANP	pCi/l
0811110-2	GAMMA_FANP	pCi/l
0811155-3	GAMMA_Cs137_Co60_K40 only	pCi/l
0811133-12	GAMMA_Cs137_Co60_K40_U235	pCi/l
0811119-12	GAMMA_Cs137_Co60_K40_U235	pCi/l

Sample Barcodes

0811110-1 GS081121-4PS1			0811110-1DUP GS081121-4PS2	
0811110-2 GS081121-4PS3			0811119-12 GS081121-4PS4	
0811119-12DUP GS081121-4PS5			0811133-12 GS081121-4PS6	
0811155-1 GS081121-4PS7			0811155-3 GS081121-4PS8	
GS081121-4AMB GS081121-4PS9			GS081121-4BMB GS081121-4PS10	
GS081121-4CMB GS081121-4PS11			GS081121-4LCS GS081121-4PS12	

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Procedure: GAMMASCAN

Reviewed By: *CMS*

Review Date: 11/24/2008

Non-Routine Pre-Treatment? Y / ☒ N ☐ Batch: *11/21* Re-Prep? Y / ☒ N ☐ Prep QASS / NCR? Y / ☒ N ☐ *11/21/08*

Prep SOP: PAI 739 Rev: 9

Prep Analyst: Christine Schmidt

Balance:

Prep Date: 11/21/2008

Balance:

Matrix Class: liquid

Prep Dept: GM

Samp Num	LabID	QC Type	Dish No.	Init Aliq ml	Fin Aliq ml	Prep Beads	Geometry	Standards	Prep Notes
1	0811110-1	SMP		1000	1000	Filtered	01		
2	0811110-1	DUP		1000	1000	Filtered	01		Count duplicate; insufficient volume
3	0811110-2	SMP		850	850	Filtered	01		850mL sample, diluted to 1000mL with DI water
4	0811118-12	SMP		1000	1000	Unfiltered	01		
5	0811119-12	DUP		1000	1000	Unfiltered	01		Count duplicate; insufficient volume
6	0811133-12	SMP		1000	1000	Unfiltered	01		
7	0811155-1	SMP		1000	1000	Unfiltered	01		
8	0811155-3	SMP		1000	1000	Unfiltered	01		
9	GS08121-4A	MB		975	975	Unfiltered	01		
10	GS08121-4B	MB		975	975	Unfiltered	01		
11	GS08121-4C	MB		975	975	Unfiltered	01		
12	GS08121-4	LCS		1000	1000	Unfiltered	01		

Comments

Spiked By: N/A

Date: N/A

Witnessed By: N/A

Date: N/A

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	824	220.287	DPW/ml	11/21/08	1000	ml	N/A
S1	Co-60	824	104.025	DPW/ml	11/21/08	1000	ml	N/A
S1	Cs-137	824	83.784	DPW/ml	11/21/08	1000	ml	N/A

Radiochemistry Prep Worksheet

Paragon Analytics

Prep Batch: 0808112121

Prep Procedure: GAMMASCAN

Prep Batch Not Validated!!!

Reviewed By: Review Date:

Non-Routine Pre-Treatment? Y / N Batch: _____

Prep QASS / NCR? Y / N _____

Prep SOP: PAI 739 Rev: 9

Prep Analyst: Christine Schmidt CMS

Balance:

Prep Date: 11/21/2008

Balance:

Matrix Class: liquid

Prep Dept: GM

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq ml	Fin Aliq ml	Prep Basels	Geometry	Standards	Prep Notes
1	1	0811110-1	SMP		1000	1000	Unfiltered	01		Filtered
2	1	0811110-1	DUP		1000	1000	Unfiltered	01		
3	1	0811110-2	SMP		1000	1000	Unfiltered	01		Count Dup
4	1	0811110-2	SMP		1000	1000	Unfiltered	01		850 mL sample
5	1	0811119-12	DUP		1000	1000	Unfiltered	01		Count Dup
6	1	0811133-12	SMP		1000	1000	Unfiltered	01		
7	1	0811155-1	SMP		1000	1000	Unfiltered	01		
8	1	0811165-3	SMP		1000	1000	Unfiltered	01		
9	1	GS081121-4A	MB		1000	1000	Unfiltered	01		
10	1	GS081121-4B	MB		1000	1000	Unfiltered	01		
11	1	GS081121-4C	MB		1000	1000	Unfiltered	01		
12	1	GS081121-4	LCS		1000	1000	Unfiltered	01	S1	

Comments

Spiked By: N/A Date: N/A

Witnessed By: N/A Date: N/A

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	824	220.267	DPM/ml	11/21/08	1000	ml	N/A
S1	Co-60	824	104.025	DPM/ml	11/21/08	1000	ml	N/A
S1	Cs-137	824	83.784	DPM/ml	11/21/08	1000	ml	N/A

SAMPLE CONDITION FORM (LIQUID)

ANALYST: CMS

ANALYSIS DATE: 11/21/08

METHOD: Pre P

[illegible]

Radiochemistry Data Package

Section 8

STANDARDS TRACEABILITY DOCUMENTS



CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

73487-307

RSO# 824 Rec'd 8/29/06
JUS

1.0 Solid in 138G GA-MA Beaker

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytix maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776.
Density of solid matrix 1.15 g/cc.

Calibration date: July 1, 2006 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1323	3.0
Cd-109	88	462.6 d	1872	3.3
Co-57	122	271.79 d	984.9	3.0
Ce-139	166	137.6 d	1391	2.8
Hg-203	279	46.61 d	3088	2.7
Sn-113	392	115.1 d	1971	2.6
Cs-137	662	30.07 y	1256	3.0
Y-88	898	106.6 d	4857	2.6
Co-60	1173	5.2714 y	2377	2.7
Co-60	1332	5.2714 y	2374	2.6
Y-88	1836	106.6 d	5084	2.6

P O NUMBER 71239, Rel. 7/31/06, Item 1

SOURCE PREPARED BY: M. Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: UM [Signature] 8-24-06

This standard will expire one year after the calibration date.

SOURCE RE-VERIFIED 07-29-08 Reverified Exp 7/26/08 MC
NEW EXPIRATION DATE = 07-29-09 10 5/12/08 09-10-08

Radiochemistry Data Package

Section 9

ADDITIONAL SUPPORTING DOCUMENTATION



Gamma Spectroscopy

Initial Calibration
Standards Traceability



Eckert & Ziegler

Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analytiscinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

RSO# 855

76484A-307

Sand in 16 Ounce PP MRP Jar

Customer: Paragon Analytics / Fort Collins, CO

P.O. No.: 72905 REL 12-13-07, Item 3

Calibration Date: 01-Jan-2008 12:00 EST **Grams of Master Source:** 0.011313

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST."

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					Type	u _A	u _B	U
Am-241	59.5	157860	—	1.322E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.671E+05	1.890E+03	0.9	1.7	3.8	HPGe
Co-57	122.1	271.79	8.639E+04	9.773E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.219E+05	1.379E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	46.61	2.884E+05	3.263E+03	0.5	1.1	2.4	HPGe
Sn-113	391.7	115.1	1.718E+05	1.944E+03	0.6	1.1	2.5	HPGe
Cs-137	661.7	10983	1.095E+05	1.239E+03	0.2	1.2	2.4	HPGe
Y-88	898.0	106.6	4.140E+05	4.684E+03	0.7	1.1	2.6	HPGe
Co-60	1173.2	1925.4	2.071E+05	2.343E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.072E+05	2.344E+03	0.9	1.1	2.8	HPGe
Y-88	1836.1	106.6	4.376E+05	4.951E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

500 grams / 290 mL of customer supplied sand.

This standard will expire one year after the calibration date.

Source Prepared by:

M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved:

D. M. Montgomery
D. M. Montgomery, QA Manager

Date:

1-23-08

End of Certificate

Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

080821D02.SPC Analyzed by *for*

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Geo 13 / Solid

Sample ID: 0813514-2 FWHM CAL (855)

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Sampling Start:   01/01/2008 10:00:00 | Counting Start:   05/08/2008 10:01:31
Sampling Stop:    01/01/2008 10:00:00 | Decay Time. . . . . 3.07E+003 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 2700 Sec
Sample Size . . . . . 5.00E+002 g | Real Time . . . . . 2813 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 080821D02.SPC
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Detector #: 2 (Detector 2)

Energy(keV) = -0.63 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 05/08/2008

FWHM(keV) = 0.69 + 0.005*En + 9.43E-04*En^2 + 0.00E+00*En^3 05/07/2007

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.55	120.19	15662	365	219	9662	0.77	a
2	70.80	142.65	432	209	168	6977	0.54	a
3	72.98	147.01	905	298	240	11628	0.76	b
4	88.01	177.03	71668	611	243	11890	0.83	a
5	122.12	245.14	46797	508	219	9654	0.86	a
6	136.55	273.97	6218	325	233	10056	0.91	a
7	165.89	332.56	49762	518	217	8715	0.93	a
8	250.38	501.31	87	134	109	2930	0.50	a NET< CL
9	255.16	510.86	1487	229	177	5791	0.97	a
10	279.24	558.95	25239	388	184	5753	1.09	a
11	310.41	621.20	127	184	150	4171	0.91	a NET< CL
12	391.78	783.72	36384	423	151	3865	1.23	a
13	476.39	952.69	81	128	104	2476	0.76	a NET< CL
14	510.91	1021.64	936	264	211	5994	2.34	a Wide Pk
15	512.12	1024.05	68	242	199	5566	2.07	b NET< CL
16	661.78	1322.95	33318	407	148	3796	1.52	a HiResid
17	725.81	1450.83	178	192	156	3608	2.03	a
18	766.49	1532.08	90	95	76	1439	0.84	a
19	813.76	1626.49	543	147	114	2540	1.47	a
20	898.18	1795.09	42041	441	133	3133	1.88	a HiResid
21	1173.35	2344.66	37868	409	104	1901	2.12	a HiResid
22	1325.13	2647.79	894	139	103	1565	2.91	a HiResid
23	1332.57	2662.65	35119	390	89	1304	2.43	b HiResid
24	1836.01	3668.11	25476	325	50	377	3.00	a HiResid

Page 001

080821D02.SPC Analyzed by

SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813514-2 FWHM CAL (855)

Stds. Match Tolerance: 2.00 keV

Detector Number: 02 Calibration Date. . . 05/08/2008 10:01:31

FWHM(keV) = $0.69 + 0.003 \cdot E_n + 1.19e-03 \cdot E_n^2 + 0.00e+00 \cdot E_n^3$
(Where E_n = SQR(Energy in keV))

Pk. #	Energy (keV)	Measured FWHM(keV)	% Diff.	Calculated FWHM(keV)	% Diff.	Prev.Calc. FWHM(keV)
1	59.50	0.770	1.78	0.784	-0.50	0.780
2	88.04	0.833	-1.19	0.823	-0.98	0.815
3	122.06	0.864	0.44	0.868	-1.58	0.855
4	165.85	0.925	0.04	0.926	-2.33	0.905
5	279.00	1.089	-1.65	1.071	-4.12	1.029
6	391.68	1.226	-0.93	1.215	-5.64	1.150
7	661.64	1.517	2.31	1.553	-8.47	1.432
8	898.02	1.882	-1.91	1.847	-10.30	1.675
9	1173.21	2.120	3.06	2.187	-11.93	1.954
10	1332.48	2.432	-2.03	2.383	-12.70	2.115
11	1836.01	3.000	0.05	3.001	-14.60	2.619

Calibration Results Saved.

OK
MC
5/9/08



Eckert & Ziegler

Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analytiscinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

R50# 855

76484A-307

Sand in 16 Ounce PP MRP Jar

Customer: Paragon Analytics / Fort Collins, CO

P.O. No.: 72905 REL 12-13-07, Item 3

Calibration Date: 01-Jan-2008 12:00 EST Grams of Master Source: 0.011313

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST."

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					u _A	u _B	U	
Am-241	59.5	157860	—	1.322E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.671E+05	1.890E+03	0.9	1.7	3.8	HPGe
Co-57	122.1	271.79	8.639E+04	9.773E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.219E+05	1.379E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	46.61	2.884E+05	3.263E+03	0.5	1.1	2.4	HPGe
Sn-113	391.7	115.1	1.718E+05	1.944E+03	0.6	1.1	2.5	HPGe
Cs-137	661.7	10983	1.095E+05	1.239E+03	0.2	1.2	2.4	HPGe
Y-88	898.0	106.6	4.140E+05	4.684E+03	0.7	1.1	2.6	HPGe
Co-60	1173.2	1925.4	2.071E+05	2.343E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.072E+05	2.344E+03	0.9	1.1	2.8	HPGe
Y-88	1836.1	106.6	4.376E+05	4.951E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. Uncertainty: U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

800 grams / 290 mL of customer supplied sand.

This standard will expire one year after the calibration date.

Source Prepared by:

M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved:

D. M. Montgomery
D. M. Montgomery, QA Manager

Date: 1-23-08

End of Certificate

Corporate Office

24937 Avenue Tibblitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Geo 13 / Solid

Sample ID: 0813514-6 FWHM CAL (855)

Sampling Start:	01/01/2008 10:00:00	Counting Start:	07/25/2008 10:15:36
Sampling Stop:	01/01/2008 10:00:00	Decay Time:	4.94E+003 Hrs
Buildup Time:	0.00E+000 Hrs	Live Time:	5400 Sec
Sample Size:	5.00E+002 g	Real Time:	5558 Sec
Collection Efficiency:	1.0000	Spc. File:	081285D06.SPC

Detector #: 6 (Detector 6)

Energy(keV) = -0.55 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 07/25/2008

FWHM(keV) = 0.79 + 0.009*En + 6.42E-04*En^2 + 0.00E+00*En^3 07/24/2007

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.45	119.97	15413	378	235	11114	0.87	a
2	87.96	176.96	88852	694	292	17192	0.89	a
3	122.01	245.05	61225	601	280	14514	0.94	a HiResid
4	136.40	273.82	8064	366	262	12678	0.98	a
5	165.79	332.58	54940	556	245	11125	1.00	a
6	186.32	373.63	287	281	230	9733	0.99	a
7	255.11	511.16	1553	262	205	7794	1.01	a
8	257.84	516.61	118	154	126	3897	0.55	b NET< CL
9	279.13	559.19	13473	351	216	7987	1.09	a
10	391.64	784.13	38452	444	171	5753	1.22	a
11	511.13	1023.04	992	296	237	7940	2.15	a Wide Pk
12	598.60	1197.93	114	134	109	2694	0.85	a
13	661.52	1323.72	55767	515	170	5004	1.45	a
14	813.80	1628.18	794	178	139	3772	1.46	a
15	897.90	1796.34	42335	455	160	4754	1.63	a HiResid
16	1115.65	2231.69	81	113	92	1957	0.92	a NET< CL
17	1173.01	2346.38	61907	515	108	2243	1.87	a HiResid
18	1324.52	2649.30	896	141	105	1687	2.70	a HiResid
19	1332.25	2664.76	56788	486	80	1191	2.01	b HiResid
20	1835.61	3671.15	25911	327	45	336	2.37	a HiResid

081285D06.SPC Analyzed by

SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813514-6 FWHM CAL (855)

Stds. Match Tolerance: 2.00 keV

Detector Number: 06 Calibration Date. . . 07/25/2008 10:15:36

FWHM(keV) = $0.73 + 0.012 \cdot E_n + 6.10e-04 \cdot E_n^2 + 0.00e+00 \cdot E_n^3$
(Where E_n = SQR(Energy in keV))

Pk. #	Energy (keV)	Measured FWHM(keV)	% Diff.	Calculated FWHM(keV)	% Diff.	Prev.Calc. FWHM(keV)
1	59.50	0.865	-0.75	0.859	4.77	0.902
2	88.04	0.891	0.63	0.897	4.08	0.935
3	122.06	0.935	0.35	0.938	3.43	0.972
4	165.85	0.999	-1.12	0.988	2.79	1.016
5	279.00	1.088	1.55	1.105	1.66	1.123
6	391.68	1.220	-0.63	1.212	0.94	1.223
7	661.64	1.453	-0.16	1.451	-0.04	1.450
8	898.02	1.635	0.79	1.648	-0.48	1.640
9	1173.21	1.873	-0.19	1.869	-0.75	1.855
10	1332.48	2.011	-0.85	1.994	-0.85	1.978
11	1836.01	2.372	0.36	2.381	-0.97	2.358

Calibration Results Saved.

OK
MC
7/25/08

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

RSO# 855

76484A-307

Sand in 16 Ounce PP MRP Jar

Customer: Paragon Analytics / Fort Collins, CO

P.O. No.: 72905 REL 12-13-07, Item 3

Calibration Date: 01-Jan-2008 12:00 EST **Grams of Master Source:** 0.011313

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST."

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					u _A	u _B	U	
Am-241	59.5	157860	—	1.322E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.671E+05	1.890E+03	0.9	1.7	3.8	HPGe
Co-57	122.1	271.79	8.639E+04	9.773E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.219E+05	1.379E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	46.61	2.884E+05	3.263E+03	0.5	1.1	2.4	HPGe
Sn-113	391.7	115.1	1.718E+05	1.944E+03	0.6	1.1	2.5	HPGe
Cs-137	661.7	10983	1.095E+05	1.239E+03	0.2	1.2	2.4	HPGe
Y-88	898.0	106.6	4.140E+05	4.684E+03	0.7	1.1	2.6	HPGe
Co-60	1173.2	1925.4	2.071E+05	2.343E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.072E+05	2.344E+03	0.9	1.1	2.8	HPGe
Y-88	1836.1	106.6	4.376E+05	4.951E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

500 grams / 290 mL of customer supplied sand.

This standard will expire one year after the calibration date.

Source Prepared by:

M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved:

D. M. Montgomery
D. M. Montgomery, QA Manager

Date:

1-23-08

End of Certificate

Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

 SEEKER G A M M A A N A L Y S I S R E S U L T S P S Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 13 / Solid

Sample ID: 0813514-10 FWHM CAL (855)

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Sampling Start:   01/01/2008 10:00:00 | Counting Start:   09/02/2008 10:31:57
Sampling Stop:    01/01/2008 10:00:00 | Decay Time. . . . . 5.88E+003 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 2700 Sec
Sample Size . . . . . 5.00E+002 g | Real Time . . . . . 2925 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 080925D10.SPC
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Detector #: 10 (Detector 10)

Energy(keV) = -0.67 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 09/02/2008

FWHM(keV) = 1.19 + 0.003*En + 1.06E-03*En^2 + 0.00E+00*En^3 06/02/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.34	119.91	9665	297	183	7109	0.98 a	HiResid
2	85.78	172.73	1736	489	397	22141	2.11 a	Wide Pk
3	87.91	176.98	48745	504	200	8405	1.04 b	
4	121.89	244.87	29295	406	179	6791	1.00 a	HiResid
5	136.32	273.71	3918	257	185	6747	1.13 a	
6	165.74	332.48	24131	376	174	5980	1.11 a	
7	255.06	510.94	606	178	141	4292	1.17 a	
8	279.13	559.04	4031	217	145	4330	1.25 a	
9	391.72	783.98	16419	304	134	3509	1.44 a	
10	511.00	1022.29	626	239	192	5061	2.84 a	
11	661.82	1323.62	30448	376	115	2660	1.67 a	HiResid
12	813.59	1626.85	208	138	111	2377	1.82 a	
13	898.14	1795.77	17911	307	124	2840	1.94 a	HiResid
14	1173.25	2345.42	33568	381	86	1317	2.21 a	HiResid
15	1332.40	2663.39	30571	362	78	1006	2.38 a	HiResid
16	1835.31	3668.18	11247	216	34	176	3.01 a	HiResid

080925D10.SPC Analyzed by

SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813514-10 FWHM CAL (855)

Stds. Match Tolerance: 2.00 keV

Detector Number: 10

Calibration Date. . . 09/02/2008 10:31:57

FWHM(keV) = 0.90 + 0.003*En + 1.07e-03*En^2 + 0.00e+00*En^3
(Where En = SQR(Energy in keV))

Pk. #	Energy (keV)	Measured FWHM(keV)	% Diff.	Calculated FWHM(keV)	% Diff.	Prev.Calc. FWHM(keV)
1	59.50 X	0.982	-0.08	0.981	22.87	1.272
2	88.04	1.036	-1.93	1.016	22.27	1.307
3	122.06	1.001	5.33	1.057	21.60	1.348
4	165.85	1.106	0.24	1.109	20.80	1.400
5	279.00	1.247	-0.61	1.240	19.01	1.531
6	391.68	1.435	-4.88	1.368	17.52	1.659
7	661.64	1.672	0.03	1.673	14.75	1.962
8	898.02	1.936	0.02	1.937	12.95	2.225
9	1173.21	2.209	1.49	2.242	11.33	2.529
10	1332.48	2.379	1.63	2.418	10.56	2.704
11	1836.01	3.012	-1.27	2.974	8.67	3.256

Calibration Results Saved.

X 10,000 COUNTS NOT ACHIEVED.
ASSOCIATED COUNTING UNCERTAINTY = $\boxed{2.03\%}$ = $\left[Z \times \left(\frac{1}{\sqrt{9665}} \right) \right] \times 10$
(2σ)

RESULT IS ACCEPTABLE PER
SUPERVISORY APPROVAL

APPROVAL: Bence Helleys 9/4/08

RSO# 848
rec 7-23-07

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analytiscinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

75354-307

1.0 Liter Solid in 138G GA-MA Beaker

Customer: Paragon Analytics

P.O. No.: 72905, Item 1

Calibration Date: 01-Jul-2007 12:00 EST **Grams of Master Source:** 0.011424

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					Type	u_A	u_B	U
Am-241	59.5	157860	—	1.378E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.657E+05	1.893E+03	0.9	1.7	3.8	HPGe
Co-57	122.1	271.79	8.714E+04	9.955E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.237E+05	1.413E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	46.61	2.588E+05	2.957E+03	0.5	1.1	2.4	HPGe
Sn-113	391.7	115.1	1.737E+05	1.984E+03	0.6	1.1	2.5	HPGe
Cs-137	661.7	10983	1.109E+05	1.267E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	106.6	4.154E+05	4.746E+03	0.7	1.1	2.6	HPGe
Co-60	1173.2	1925.4	2.050E+05	2.342E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.054E+05	2.346E+03	0.9	1.1	2.8	HPGe
Y-88	1836.1	106.6	4.398E+05	5.024E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

This standard will expire one year after the calibration date.

Source Prepared by: N. E. Kiesman
N. E. Kiesman, Radiochemist

QA Approved: D. M. Montgomery
D. M. Montgomery, QA Manager

Date: 7-11-07

End of Certificate



Eckert & Ziegler

Analytics

RSO # 867

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

77649A-307

1.0 Liter Solid in 138G GA-MA Beaker

Customer: Paragon Analytics

P.O. No.: 73625, 5/19/08 Rel., Item 1

Calibration Date: 01-Jul-2008 12:00 EST **Grams of Master Source:** 0.011238

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					Type	u _A	u _B	
Am-241	59.5	157860	—	1.353E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.681E+05	1.889E+03	0.5	1.7	3.5	HPGe
Co-57	122.1	271.79	8.748E+04	9.831E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.218E+05	1.369E+03	0.6	1.1	2.5	HPGe
Hg-203	279.2	46.61	2.761E+05	3.103E+03	0.6	1.1	2.5	HPGe
Sn-113	391.7	115.1	1.725E+05	1.939E+03	0.7	1.1	2.6	HPGe
Cs-137	661.7	10983	1.078E+05	1.211E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	106.6	4.154E+05	4.668E+03	0.8	1.1	2.7	HPGe
Co-60	1173.2	1925.4	2.017E+05	2.267E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.020E+05	2.270E+03	0.6	1.1	2.5	HPGe
Y-88	1836.1	106.6	4.398E+05	4.942E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

This standard will expire one year after the calibration date.

Source Prepared by: N. E. Tibbitts
N. E. Tibbitts, Radiochemist

QA Approved: D. M. Montgomery
D. M. Montgomery, QA Manager

Date: 7-22-08

End of Certificate

Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

86

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-2 GEO 1 EFF CAL (848)

 Sampling Start: 07/01/2007 10:00:00 | Counting Start: 05/11/2008 14:33:18
 Sampling Stop: 07/01/2007 10:00:00 | Decay Time. 7.56E+003 Hrs
 Buildup Time. 0.00E+000 Hrs | Live Time 7200 Sec
 Sample Size 1.00E+000 L | Real Time 7424 Sec
 Collection Efficiency 1.0000 | Spc. File 080829D02.SPC

Detector #: 2 (Detector 2)

Energy(keV)= -0.72 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 05/11/2008

FWHM(keV) = -0.69 + 0.003*En + -1.19E-03*En^2 + 0.00E+00*En^3 05/08/2008

Where En = Sqrt(Energy in keV)

 Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	57.89	117.07	5479	730	588	42602	2.01 a	Wide Pk
2	59.54	120.37	57970	602	297	17751	0.77 b	
3	87.99	177.21	163201	893	313	19713	0.80 a	
4	122.10	245.34	87066	665	252	12763	0.81 a	HiResid
5	136.55	274.21	11365	350	228	10489	0.86 a	
6	165.89	332.82	59494	576	252	11690	0.92 a	
7	255.24	511.32	1426	310	247	10441	1.09 a	
8	257.80	516.42	87	165	135	4475	0.54 b	NET< CL
9	279.29	559.36	3390	249	181	6578	0.85 a	HiResid
10	309.97	620.64	308	349	285	11273	1.56 a	
11	391.81	784.12	34865	435	184	6669	1.18 a	
12	511.12	1022.46	1043	337	272	9921	2.25 a	Wide Pk
13	531.53	1063.24	117	185	151	4497	1.09 a	NET< CL
14	661.82	1323.51	96660	654	167	5450	1.52 a	HiResid
15	691.85	1383.49	323	311	254	9200	2.56 a	Wide Pk
16	814.17	1627.85	798	254	203	6652	2.11 a	
17	821.56	1642.62	437	251	203	6652	2.20 b	
18	898.25	1795.82	35803	440	184	6540	1.83 a	
19	1173.46	2345.58	99839	654	138	3370	2.12 a	HiResid
20	1332.66	2663.60	89241	609	99	1664	2.30 a	HiResid
21	1836.18	3669.46	21488	299	49	354	2.94 a	HiResid

 SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813503-2 GEO 1 EFF CAL (848)

Stds. Match Tolerance: 2.00 keV

Detector Number: 02 Calibration Date: . . 05/11/2008 14:33:18

Geometry File (D02)(Sh01).EFF ID. Geo 1 Eff Cal

Amount of Std. in Calib. Source: 1.000000 gm

$$\text{Eff} = 1 / [4.29\text{e-}03 * \text{En}^{-3.71\text{e}+00} + 1.32\text{e}+02 * \text{En}^{7.89\text{e-}01}]$$

(Where En = Energy in MeV) (Exponential)

Pk. #	Energy (keV)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.50	5.85e-03	3.88	6.09e-03	-12.59	5.41e-03
2	88.04	1.92e-02	-4.56	1.84e-02	0.19	1.84e-02
3	122.06	2.71e-02	3.67	2.82e-02	3.39	2.92e-02
4	165.85	2.86e-02	-0.82	2.84e-02	-0.39	2.82e-02
5	391.68	1.63e-02	-2.63	1.59e-02	3.54	1.64e-02
6	661.64	1.08e-02	-2.84	1.05e-02	2.06	1.07e-02
7	898.02	8.13e-03	1.61	8.26e-03	0.39	8.29e-03
8	1173.21	6.63e-03	0.82	6.69e-03	-0.89	6.63e-03
9	1332.48	5.92e-03	2.15	6.05e-03	-1.28	5.97e-03
10	1836.01	4.61e-03	1.84	4.70e-03	-1.19	4.64e-03

Calibration Results Saved.

X 279 KeV PHOTOPEAK MANUALLY DELETED
 FOR FROM EFFICIENCY CALIBRATION DUE
 TO MORE THAN 5 HALF-LIVES
 EXPIRED, MC 5/21/08

Standards File. Gsstd01.std
Assay Date 07/01/2007 10:00
ID.: Geo 1 Std#848 1 L Mari. Mixed Gamma

Pk #	Nuclide	Energy	Halflife	Br.Ratio	dps/gm
1	Am-241	59.50	4.322E+02 yrs	0.35900	3838.40
2	Cd-109	88.04	4.626E+02 dys	0.03610	52437.70
3	Co-57	122.06	2.718E+02 dys	0.85510	1164.20
4	Ce-139	165.85	1.376E+02 dys	0.80350	1758.60
5	Hg-203	279.00	4.660E+01 dys	0.77300	3825.40
6	Sn-113	391.68	1.151E+02 dys	0.64900	3057.00
7	Cs-137	661.64	3.017E+01 yrs	0.85120	1488.50
8	Y-88	898.02	1.066E+02 dys	0.93400	5081.40
9	Co-60	1173.21	5.271E+00 yrs	0.99980	2342.00
10	Co-60	1332.48	5.271E+00 yrs	0.99990	2346.00
11	Y-88	1836.01	1.066E+02 dys	0.99380	5055.30

RSO# 848
rec 7-23-07

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

75354-307

1.0 Liter Solid in 138G GA-MA Beaker

Customer: Paragon Analytics

P.O. No.: 72905, Item 1

Calibration Date: 01-Jul-2007 **12:00 EST** **Grams of Master Source:** 0.011424

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					u _A	u _B	U	
Am-241	59.5	157860	—	1.378E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.657E+05	1.893E+03	0.9	1.7	3.8	HPGe
Co-57	122.1	271.79	8.714E+04	9.955E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.237E+05	1.413E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	46.61	2.588E+05	2.957E+03	0.5	1.1	2.4	HPGe
Sn-113	391.7	115.1	1.737E+05	1.984E+03	0.6	1.1	2.5	HPGe
Cs-137	661.7	10983	1.109E+05	1.267E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	106.6	4.154E+05	4.746E+03	0.7	1.1	2.6	HPGe
Co-60	1173.2	1925.4	2.050E+05	2.342E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.054E+05	2.346E+03	0.9	1.1	2.8	HPGe
Y-88	1836.1	106.6	4.398E+05	5.024E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

This standard will expire one year after the calibration date.

Source Prepared by: N. E. Kiesman
N. E. Kiesman, Radiochemist

QA Approved: D. M. Montgomery
D. M. Montgomery, QA Manager

Date: 7-11-07

End of Certificate

[illegible]

OK
80/12/5
M

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-2 GEO 1 LCS VER (824)

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Sampling Start:   07/01/2006 10:00:00 | Counting Start:   05/12/2008 15:43:07
Sampling Stop:    07/01/2006 10:00:00 | Decay Time. . . . . 1.63E+004 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 1833 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 080831D02.SPC
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Detector #: 2 (Detector 2)

Energy(keV) = -0.71 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 05/12/2008

FWHM(keV) = 0.69 + 0.003*En + 1.19E-03*En^2 + 0.00E+00*En^3 05/08/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	49.39	100.08	125	165	134	3626	0.81 a	NET< CL
2	59.49	120.25	14372	284	125	3157	0.80 a	
3	87.93	177.06	23528	336	113	2572	0.81 a	
4	98.56	198.29	46	83	67	1119	0.56 a	NET< CL
5	122.05	245.21	8747	220	96	1843	0.85 a	
6	136.42	273.91	1061	126	89	1599	0.78 a	
7	144.32	289.70	68	94	76	1291	0.69 a	NET< CL
8	165.80	332.59	2159	142	89	1584	0.84 a	
9	255.76	512.30	57	71	57	809	0.52 a	
10	391.71	783.86	918	116	82	1318	1.08 a	
11	405.75	811.89	66	109	89	1466	1.28 a	NET< CL
12	510.57	1021.28	85	78	62	819	0.98 a	
13	639.99	1279.79	50	72	58	727	1.11 a	NET< CL
14	661.72	1323.20	23438	317	69	928	1.51 a	
15	814.90	1629.18	61	59	47	541	0.88 a	
16	898.06	1795.29	892	113	79	1248	1.59 a	
17	902.85	1804.87	115	84	67	998	1.36 b	
18	1173.34	2345.16	22696	311	62	689	2.15 a	
19	1332.53	2663.15	20197	287	32	172	2.33 a	
20	1836.15	3669.12	499	50	18	44	3.06 a	

080831D02.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET020509.BKG (080509-2 WEEKLY BKG)

Bkg.File Detector #: 2

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
3	87.93	23528	336	113	23528	336	113	
7	144.32	68	94	76	65	94	76	NET<CL
8	165.80	2159	142	89	2159	142	89	
12	510.57	85	78	62	40	78	64	NET<CL
16	898.06	892	113	79	890	113	79	

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-2 GEO 1 LCS VER (824)

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Sampling Start: 07/01/2006 10:00:00 | Counting Start: 05/12/2008 15:43:07
Sampling Stop: 07/01/2006 10:00:00 | Decay Time . . . . . 1.63e+004 Hrs
Buildup Time . . . . . 0.00e+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00e+000 L | Real Time . . . . . 1833 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 080831D02.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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Detector #: 2 (Detector 2)

Efficiency File: (D02) (Sh01).EFF (Geo 1 Eff Cal)

Eff.=1/[4.29E-03*En^-3.71E+00 + 1.32E+02*En^7.89E-01] 05/11/2008

Library File:ANALYTICAL.LIB (Analytical)

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MEASURED or MDA CONCENTRATIONS

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Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
Am-241	59.54	9.88E+04	+/- 1.95E+03	1.74E+03	8.61E+02	3.79E+06
Cd-109	88.02	1.47E+06	+/- 2.11E+04	1.43E+04	7.08E+03	1.11E+04
Co-57	122.07	3.11E+04	+/- 7.84E+02	6.90E+02	3.40E+02	6.50E+03
Ce-139	165.85	4.39E+04	+/- 2.89E+03	3.66E+03	1.80E+03	3.30E+03
Sn-113	391.68	8.09E+04	+/- 1.03E+04	1.47E+04	7.21E+03	2.76E+03
Cs-137	661.62	4.10E+04	+/- 5.56E+02	2.46E+02	1.21E+02	2.64E+05
Y-88	Average:x	1.38E+05	+/- 1.08E+04	. . . . .	. . . . .	2.56E+03
	898.02	1.45E+05	+/- 1.84E+04	2.61E+04	1.28E+04	2.56E+03
	1836.01	1.35E+05	+/- 1.34E+04	1.02E+04	4.75E+03	2.56E+03
Co-60	Average:x	6.46E+04	+/- 6.37E+02	. . . . .	. . . . .	4.62E+04
	1173.21	6.51E+04	+/- 8.92E+02	3.65E+02	1.79E+02	4.62E+04
	1332.48	6.41E+04	+/- 9.10E+02	2.10E+02	1.01E+02	4.62E+04
Hg-203	279.18	MDA	4.54E+06	2.24E+06	1.12E+03

MEASURED TOTAL: 1.97E+06 +/- 4.90E+04 pCi/L

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UNKNOWN, SUM or ESCAPE PEAKS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	49.39	100.08	125	165	134	3626	0.81	Deleted
4	98.56	198.29	46	83	67	1119	0.56	Deleted
6	136.42	273.91	1061	126	89	1599	0.78	Unknown

080831D02.SPC Analyzed by

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
7	144.32	289.70	65	94	76	1291	0.69	Deleted
9	255.76	512.30	57	71	57	809	0.53	Unknown
11	405.75	811.89	66	109	89	1466	1.28	Deleted
12	510.57	1021.28	40	78	64	819	0.98	Deleted
13	639.99	1279.79	50	72	58	727	1.11	Deleted
15	814.90	1629.18	61	59	47	541	0.88	1836DEsc
17	902.85	1804.87	115	84	67	998	1.36	Unknown

c:\SEEKER\BIN\080831d02.res Analysis Results Saved.

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

73487-307

RSO# 824 Rec'd 8/29/06
GUS

1.0 Solid in 138G GA-MA Beaker

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytix maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776.
Density of solid matrix 1.15 g/cc.

Calibration date: July 1, 2006 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1323	3.0
Cd-109	88	462.6	d	1872	3.3
Co-57	122	271.79	d	984.9	3.0
Ce-139	166	137.6	d	1391	2.8
Hg-203	279	46.61	d	3088	2.7
Sn-113	392	115.1	d	1971	2.6
Cs-137	662	30.07	y	1256	3.0
Y-88	898	106.6	d	4857	2.6
Co-60	1173	5.2714	y	2377	2.7
Co-60	1332	5.2714	y	2374	2.6
Y-88	1836	106.6	d	5084	2.6

P O NUMBER 71239, Rel. 7/31/06, Item 1

SOURCE PREPARED BY: M. Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: UM [Signature] 8-24-06

This standard will expire one year after the calibration date.

Reverified. Exp 7/26/08
W 5/12/08

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-6 GEO 1 EFF CAL (867)

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Sampling Start:   07/01/2008 10:00:00 | Counting Start:   08/06/2008 09:04:19
Sampling Stop:    07/01/2008 10:00:00 | Decay Time. . . . . 8.63E+002 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 3600 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 3814 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081369D06.SPC
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Detector #: 6 (Detector 6)

Energy(keV) = -0.51 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 08/06/2008

FWHM(keV) = 0.73 + 0.012*En + 6.10E-04*En^2 + 0.00E+00*En^3 07/25/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.56	120.13	17131	438	289	16808	0.89	a
2	70.83	142.66	2957	538	434	29792	1.25	a
3	72.88	146.75	4560	393	304	18620	0.78	b
4	82.43	165.84	1244	403	326	21448	0.80	a
5	88.03	177.05	94105	723	314	19919	0.89	a HiResid
6	122.12	245.21	74218	680	335	20708	0.98	a
7	136.54	274.06	9702	447	330	20123	0.98	a
8	165.90	332.76	101297	734	301	16700	1.02	a HiResid
9	255.21	511.34	3705	345	265	11995	1.17	a
10	279.25	559.40	120686	755	244	10127	1.12	a HiResid
11	362.71	726.29	166	265	217	8189	1.44	a NET< CL
12	391.78	784.42	78855	607	190	6650	1.23	a
13	482.07	964.95	120	150	122	3373	0.90	a NET< CL
14	510.64	1022.09	1362	319	255	8759	2.33	a Wide Pk
15	511.71	1024.24	825	316	255	8759	2.35	b
16	514.65	1030.10	183	183	149	4379	1.13	c
17	661.69	1324.12	39735	461	190	6280	1.43	a
18	814.04	1628.75	1554	190	142	3737	1.67	a
19	850.91	1702.49	37	108	88	1918	0.81	a NET< CL
20	898.11	1796.86	90512	628	148	4054	1.63	a HiResid
21	1173.25	2347.03	44730	444	111	2382	1.83	a
22	1325.03	2650.53	1854	187	136	2751	2.98	a HiResid
23	1332.50	2665.46	40216	419	100	1834	1.93	b HiResid
24	1835.92	3672.09	53877	469	54	494	2.29	a HiResid

Page 001

081369D06.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Version 1.8.2

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET060802.BKG (080802-6 WEEKLY BACKGROUND)

Bkg.File Detector #: 6

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
2	70.83	2957	538	434	2956	538	434	
3	72.88	4560	393	304	4558	393	304	
5	88.03	94105	723	314	94102	723	314	
14	510.64	1362	319	255	1282	319	256	
20	898.11	90512	628	148	90508	628	148	

081369D06.SPC Analyzed by

SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813503-6 GEO 1 EFF CAL (867)

Stds. Match Tolerance: 2.00 keV

Detector Number: 06 Calibration Date. . . 08/06/2008 09:04:19

Geometry File (D06)(Sh01).EFF ID. Geo 1 Eff Cal

Amount of Std. in Calib. Source: 1.000000 gm

Crossover: 180.00 keV

Below Crossover Efficiency Fit:

$\text{Eff} = 10^{[-2.91e+01 + 2.55e+01 \cdot \text{En} + -5.92e+00 \cdot \text{En}^2 + 0.00e+00 \cdot \text{En}^3]}$

(Where En = LOG(Energy in keV)) (Polynomial)

Above Knee Efficiency Fit:

$\text{Eff} = 10^{[-3.99e+00 + 3.72e+00 \cdot \text{En} + -1.60e+00 \cdot \text{En}^2 + 1.86e-01 \cdot \text{En}^3]}$

(Where En = LOG(Energy in keV)) (Polynomial)

Pk. #	Energy (keV)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.50	3.52e-03	1.13	3.56e-03	4.72	3.73e-03
2	88.04	1.46e-02	-4.14	1.40e-02	1.81	1.43e-02
3	122.06	2.30e-02	4.47	2.41e-02	0.25	2.41e-02
4	165.85	2.46e-02	-1.67	2.42e-02	-0.46	2.41e-02
5	279.00	1.84e-02	-0.07	1.84e-02	-0.53	1.83e-02
6	391.68	1.40e-02	0.31	1.41e-02	-1.00	1.39e-02
7	661.64	9.14e-03	-1.24	9.02e-03	-0.20	9.00e-03
8	898.02	6.80e-03	1.84	6.93e-03	0.48	6.96e-03
9	1173.21	5.55e-03	-0.61	5.52e-03	0.87	5.57e-03
10	1332.48	4.99e-03	-0.47	4.96e-03	0.91	5.01e-03
11	1836.01	3.83e-03	0.21	3.83e-03	0.40	3.85e-03

Calibration Results Saved.

OK
MC
09/10/08

Standards File. Gsstd01.std
 Assay Date 07/01/2008 10:00
 ID.: Geo 1 Std#867 1 L Mari. Mixed Gamma

Pk #	Nuclide	Energy	Halflife	Br.Ratio	dps/gm
1	Am-241	59.50	4.322E+02 yrs	0.35900	3768.80
2	Cd-109	88.04	4.626E+02 dys	0.03610	52326.87
3	Co-57	122.06	2.718E+02 dys	0.85510	1149.69
4	Ce-139	165.85	1.376E+02 dys	0.80350	1703.80
5	Hg-203	279.00	4.660E+01 dys	0.77300	4014.23
6	Sn-113	391.68	1.151E+02 dys	0.64900	2987.67
7	Cs-137	661.64	3.017E+01 yrs	0.85120	1422.70
8	Y-88	898.02	1.066E+02 dys	0.93400	4997.86
9	Co-60	1173.21	5.271E+00 yrs	0.99980	2267.45
10	Co-60	1332.48	5.271E+00 yrs	0.99990	2270.23
11	Y-88	1836.01	1.066E+02 dys	0.99380	4972.83

RSO # 867

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

77649A-307

1.0 Liter Solid in 138G GA-MA Beaker

Customer: Paragon Analytics

P.O. No.: 73625, 5/19/08 Rel., Item 1

Calibration Date: 01-Jul-2008 12:00 EST **Grams of Master Source:** 0.011238

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					Type	u_A	u_B	U
Am-241	59.5	157860	—	1.353E+03	0.3	1.5	3.1	4 π LS
Cd-109	88.0	462.60	1.681E+05	1.889E+03	0.5	1.7	3.5	HPGe
Co-57	122.1	271.79	8.748E+04	9.831E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.218E+05	1.369E+03	0.6	1.1	2.5	HPGe
Hg-203	279.2	46.61	2.761E+05	3.103E+03	0.6	1.1	2.5	HPGe
Sn-113	391.7	115.1	1.725E+05	1.939E+03	0.7	1.1	2.6	HPGe
Cs-137	661.7	10983	1.078E+05	1.211E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	106.6	4.154E+05	4.668E+03	0.8	1.1	2.7	HPGe
Co-60	1173.2	1925.4	2.017E+05	2.267E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.020E+05	2.270E+03	0.6	1.1	2.5	HPGe
Y-88	1836.1	106.6	4.398E+05	4.942E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4 π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

This standard will expire one year after the calibration date.

Source Prepared by: N. E. Tibbitts
N. E. Tibbitts, Radiochemist

QA Approved: D. M. Montgomery
D. M. Montgomery, QA Manager

Date: 7-22-08

End of Certificate

101

Geometry 1 Calibration Verification: Gamma Mixed Nuclide Source											
CAL STD	867	Detector	6								
CAL VER		824		REF DATE :	7/11/2006						
FROM CALIBRATION CERTIFICATE				FROM ANALYTICS.LIB				count date			
				EXPECTED ACTIVITY				8/12/2008			
Isotope	KeV	Half Life(y)	Gammas/Sec.	Gamma Fraction:	Mass of Standard	DPS	pCi/L	Activity	Recovery	Pass/Fail	# of half-lives expired
Am-241	59.9	432.0000	1323	0.3590	1	3685.2	99601.0	99300	100%	Pass	0.00
Cd-109	88	1.2666	1872	0.0361		51856.0	1401512.3	1450000	103%	Pass	1.67
Co-57	122	0.7441	984.9	0.8551		1151.8	31129.6	28900	93%	Pass	2.84
Ce-139	166	0.3768	1391	0.8035		1731.2	46788.5	NA	>5 h-lives	>5 h-lives	5.62
Hg-203	279	0.1276	3088	0.7730		3994.8	107968.3	NA	>5 h-lives	>5 h-lives	16.59
Sn-113	392	0.3151	1971	0.6490		3037.0	82080.5	NA	>5 h-lives	>5 h-lives	6.72
Cs-137	662	30.0000	1256	0.8512		1475.6	39880.1	40000	100%	Pass	0.07
Y-88	898	0.2919	4857	0.9340		5200.2	140546.3	NA	>5 h-lives	>5 h-lives	7.25
Co-60	1173	5.2714	2377	1.0000		2377.0	64243.2	63700	99%	Pass	0.40
Co-60	1332	5.2714	2374	1.0000		2374.0	64162.2	64000	100%	Pass	0.40
Y-88	1836	0.2919	5084	0.9938		5115.7	138262.6	M	>5 h-lives	>5 h-lives	7.25

OK
MC
09-10-08

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-6 GEO 1 LCS VER (824)

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Sampling Start:   07/01/2006 10:00:00 | Counting Start:   08/12/2008 08:18:54
Sampling Stop:    07/01/2006 10:00:00 | Decay Time. . . . . 1.86E+004 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 1826 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081408D06.SPC
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Detector #: 6 (Detector 6)

Energy(keV) = -0.48 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 08/12/2008

FWHM(keV) = 0.73 + 0.012*En + 6.10E-04*En^2 + 0.00E+00*En^3 07/25/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.53	119.99	8443	230	113	2594	0.87	a
2	88.00	176.92	15439	282	110	2421	0.90	a
3	122.06	245.04	5493	194	103	1967	0.93	a
4	136.46	273.81	647	130	99	1799	1.01	a
5	145.58	292.06	78	118	96	1715	0.90	a NET< CL
6	165.83	332.55	1349	148	105	1896	1.12	a
7	225.18	451.23	42	76	62	935	0.53	a NET< CL
8	391.84	784.47	530	113	85	1324	1.24	a
9	510.22	1021.20	73	73	58	716	0.96	a
10	661.66	1324.02	19496	291	67	782	1.42	a
11	898.03	1796.66	355	87	64	852	1.34	a
12	1173.24	2346.97	17718	272	46	411	1.81	a
13	1332.51	2665.43	16004	255	25	118	1.93	a HiResid
14	1835.92	3672.05	244	35	14	33	2.22	a

081408D06.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET060808.BKG (080808-6 WEEKLY BACKGROUND)

Bkg.File Detector #: 6

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
9	510.22	73	73	58	34	73	59	NET<CL
11	898.03	355	87	64	354	87	64	

 SEEKER FINAL ACTIVITY REPORT Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-6 GEO 1 LCS VER (824)

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Sampling Start: 07/01/2006 10:00:00 | Counting Start: 08/12/2008 08:18:54
Sampling Stop: 07/01/2006 10:00:00 | Decay Time. . . . . 1.86e+004 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00e+000 L | Real Time . . . . . 1826 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 081408D06.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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Detector #: 6 (Detector 6)

Efficiency File: (D06)(Sh01).EFF (Geo 1 Eff Cal)

Eff=10[^][-2.91E+01 +2.55E+01*L + -5.92E+00*L[^]2 +0.00E+00*L[^]3] 08/06/2008

Eff.=10[^][-3.99E+00 +3.72E+00*L + -1.60E+00*L[^]2 +1.86E-01*L[^]3] Above 180.00 keV

Library File:ANALYTICAL.LIB (Analytical)

MEASURED or MDA CONCENTRATIONS

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              N
      ENERGY E      Concentration      Critical  Halflife
Nuclide  (keV) T (pCi/L )      MDA      Level      (hrs)
-----
Am-241    59.54    9.93E+04 +- 2.70E+03  2.70E+03  1.33E+03  3.79E+06
Cd-109    88.02    1.45E+06 +- 2.65E+04  2.09E+04  1.03E+04  1.11E+04
Co-57    122.07    2.89E+04 +- 1.02E+03  1.10E+03  5.43E+02  6.50E+03
Ce-139    165.85    5.10E+04 +- 5.58E+03  8.06E+03  3.98E+03  3.30E+03
Sn-113    391.68    9.15E+04 +- 1.95E+04  2.97E+04  1.46E+04  2.76E+03
Cs-137    661.62    4.00E+04 +- 5.96E+02  2.80E+02  1.37E+02  2.64E+05
Y-88      Average:x 1.39E+05 +- 1.75E+04  . . . . . 2.56E+03
           898.02    1.25E+05 +- 3.07E+04  4.65E+04  2.28E+04  2.56E+03
           1836.01   1.46E+05 +- 2.13E+04  1.82E+04  8.30E+03  2.56E+03
Co-60     Average:x 6.38E+04 +- 7.06E+02  . . . . . 4.62E+04
           1173.21   6.37E+04 +- 9.78E+02  3.42E+02  1.66E+02  4.62E+04
           1332.48   6.40E+04 +- 1.02E+03  2.13E+02  1.01E+02  4.62E+04
Hg-203    279.18      MDA      . . . . . 1.87E+07  9.22E+06  1.12E+03
  
```

MEASURED TOTAL: 1.97E+06 +- 7.41E+04 pCi/L

UNKNOWN, SUM or ESCAPE PEAKS

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PK.  ENERGY  ADDRESS  NET    UN-    C.L.    BKG    FWHM
#    (keV)    CHANNEL  COUNTS CERTAINTY  COUNTS  COUNTS  (keV)  FLAG
-----
 4   136.46   273.81    647    130     99     1799   1.01  Unknown
 5   145.58   292.06     78    118     96     1715   0.90  Deleted
  
```

081408D06.SPC Analyzed by

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
7	225.18	451.23	42	76	62	935	0.53	Deleted
9	510.22	1021.20	34	73	59	716	0.96	Deleted

c:\SEEKER\BIN\081408d06.res Analysis Results Saved.

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

73487-307

RSO# 824 Rec'd 8/29/06
JUS

1.0 Solid in 138G GA-MA Beaker

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776.
Density of solid matrix 1.15 g/cc.

Calibration date: July 1, 2006 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1323	3.0
Cd-109	88	462.6 d	1872	3.3
Co-57	122	271.79 d	984.9	3.0
Ce-139	166	137.6 d	1391	2.8
Hg-203	279	46.61 d	3088	2.7
Sn-113	392	115.1 d	1971	2.6
Cs-137	662	30.07 y	1256	3.0
Y-88	898	106.6 d	4857	2.6
Co-60	1173	5.2714 y	2377	2.7
Co-60	1332	5.2714 y	2374	2.6
Y-88	1836	106.6 d	5084	2.6

P O NUMBER 71239, Rel. 7/31/06, Item 1

SOURCE PREPARED BY: M. Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: UM [Signature] 8-24-06

This standard will expire one year after the calibration date.

SOURCE REVERIFIED. Reverified Exp 7/26/08 MC
EXPIRES 07/29/09. 5-11-08 09/10/08
MC 9/10/08

Corporate Office

Laboratory

1380 Seaboard Industrial Blvd. Atlanta Georgia 30318

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-10 GEO 1 EFF CAL (867)

 Sampling Start: 07/01/2008 10:00:00 Counting Start: 09/11/2008 10:28:57
 Sampling Stop: 07/01/2008 10:00:00 Decay Time. 1.73E+003 Hrs
 Buildup Time. 0.00E+000 Hrs Live Time 1800 Sec
 Sample Size 1.00E+000 L Real Time 2112 Sec
 Collection Efficiency 1.0000 Spc. File 080961D10.SPC

Detector #: 10 (Detector 10)

Energy(keV) = -0.71 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 09/11/2008

FWHM(keV) = 0.90 + 0.003*En + 1.07E-03*En^2 + 0.00E+00*En^3 09/02/2008

Where En = Sqrt(Energy in keV)

 Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.35	120.03	11313	360	239	10550	0.96	a
2	66.70	134.70	752	339	275	12896	1.14	a Wide Pk
3	70.26	141.84	2810	736	599	33162	2.98	b
4	72.77	146.85	1860	310	245	11054	0.94	c
5	82.42	166.12	2768	596	482	25807	2.31	a Wide Pk
6	85.62	172.52	5380	709	570	31337	2.81	b
7	87.92	177.11	60186	574	245	11060	1.02	c
8	102.32	205.89	311	255	208	8709	0.83	a
9	121.92	245.05	42429	501	234	10156	0.94	a HiResid
10	136.38	273.95	6041	341	249	10598	1.15	a
11	140.44	282.07	221	237	194	7570	0.85	b
12	165.78	332.70	53739	527	207	7892	1.03	a HiResid
13	255.13	511.25	2007	230	174	5995	1.22	a
14	279.23	559.41	45234	468	160	5019	1.14	a HiResid
15	391.83	784.43	42113	444	139	3578	1.34	a
16	511.52	1023.60	814	202	159	4248	1.98	a
17	662.00	1324.32	26680	369	141	3661	1.59	a
18	783.24	1566.60	80	104	84	1544	1.13	a NET< CL
19	814.36	1628.77	609	128	97	2000	1.51	a
20	898.38	1796.66	48451	462	116	2601	1.85	a HiResid
21	1173.56	2346.58	29891	364	92	1517	2.13	a HiResid
22	1325.27	2649.73	1066	159	119	1807	3.82	a HiResid
								Wide Pk
23	1332.71	2664.60	27234	343	76	1022	2.18	b HiResid

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PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
24	1835.75	3669.85	28597	343	45	320	2.70	a HiResid

080961D10.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Version 1.8.2

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET100906.BKG (080906-10 WEEKLY BACKGROUND)

Bkg.File Detector #: 10

=====

BACKGROUND SUBTRACT RESULTS

=====

PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
2	66.70	752	339	275	747	339	275	
11	140.44	221	237	194	216	238	194	
16	511.52	814	202	159	767	202	160	

 SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813503-10 GEO 1 EFF CAL (867)

Stds. Match Tolerance: 2.00 keV

Detector Number: 10 Calibration Date: . . 09/11/2008 10:28:57

Geometry File (D10) (Sh01).EFF ID. Geo 1 Eff Cal

Amount of Std. in Calib. Source: 1.000000 gm

Crossover: 180.00 keV

Below Crossover Efficiency Fit:

Eff = $10^{-2} [-2.99e+01 + 2.65e+01 \cdot \text{En} + -6.17e+00 \cdot \text{En}^2 + 0.00e+00 \cdot \text{En}^3]$

(Where En = LOG(Energy in keV)) (Polynomial)

Above Knee Efficiency Fit:

Eff = $10^{-2} [-4.86e+00 + 4.51e+00 \cdot \text{En} + -1.79e+00 \cdot \text{En}^2 + 2.00e-01 \cdot \text{En}^3]$

(Where En = LOG(Energy in keV)) (Polynomial)

Pk. #	Energy (keV)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev. Calc. Efficiency
1	59.50	4.65e-03	1.39	4.71e-03	-0.15	4.71e-03
2	88.04	1.97e-02	-5.11 ⁰	1.88e-02	-3.14	1.82e-02
3	122.06	2.99e-02 X	5.46 ⁰	3.16e-02	-2.66	3.08e-02
4	165.85	3.13e-02	-2.05	3.07e-02	0.21	3.08e-02
5	279.00	2.36e-02	0.19	2.37e-02	-0.00	2.37e-02
6	391.68	1.86e-02	-0.30	1.86e-02	-0.00	1.86e-02
7	661.64	1.23e-02	-0.85	1.22e-02	-0.00	1.22e-02
8	898.02	9.21e-03	2.21	9.42e-03	-0.00	9.42e-03
9	1173.21	7.52e-03	-0.26	7.50e-03	-0.00	7.50e-03
10	1332.48	6.84e-03	-1.60	6.73e-03	-0.00	6.73e-03
11	1836.01	5.13e-03	0.57	5.16e-03	-0.00	5.16e-03

Calibration Results Saved.

X MANUALLY ADJUSTED EFFICIENCY FROM
 ORIGINAL VALUE OF 2.88×10^{-2} . % DIFFERENCE
 FROM NEWLY CALIBRATED VALUE:

$$\left| \left(\frac{3.16 \times 10^{-2}}{2.88 \times 10^{-2}} \right) - 1 \right| \times 100 = 9.72\%$$

CHANGES OK PER PA S.O.P. 713R10
 AND DPM APPROVAL.

0 GREATER THAN 5% DIFFERENCE. OK
 PER DPM APPROVAL. MARGINAL
 EXCELLENCE.

MC 09-16-08

DPM APPROVAL

RG 10/2/08



Eckert & Ziegler
Analytics

R50 # 867

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION Standard Radionuclide Source

77649A-307

1.0 Liter Solid in 138G GA-MA Beaker

Customer: Paragon Analytics

P.O. No.: 73625, 5/19/08 Rel., Item 1

Calibration Date: 01-Jul-2008 **12:00 EST** **Grams of Master Source:** 0.011238

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* cps/gram	This Source cps	Uncertainty, %			Calibration Method
					u _k	u _p	U	
Am-241	59.5	157860	—	1.353E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.681E+05	1.889E+03	0.5	1.7	3.5	HPGe
Co-57	122.1	271.79	8.748E+04	9.831E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.218E+05	1.369E+03	0.6	1.1	2.8	HPGe
Hg-203	279.2	46.61	2.761E+05	3.103E+03	0.6	1.1	2.8	HPGe
Sn-113	391.7	115.1	1.725E+05	1.939E+03	0.7	1.1	2.6	HPGe
Cs-137	661.7	10983	1.078E+05	1.211E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	106.6	4.154E+05	4.668E+03	0.8	1.1	2.7	HPGe
Co-60	1173.2	1925.4	2.017E+05	2.267E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.020E+05	2.270E+03	0.6	1.1	2.5	HPGe
Y-88	1836.1	106.6	4.398E+05	4.942E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

This standard will expire one year after the calibration date.

Source Prepared by:

N. E. Tibbitts
N. E. Tibbitts, Radiochemist

QA Approved:

D. M. Montgomery
D. M. Montgomery, QA Manager

Date:

7-22-08

End of Certificate

Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Standards File. Gsstd01.std
Assay Date 07/01/2008 10:00
ID.: Geo 1 Std#867 1 L Mari. Mixed Gamma

Pk #	Nuclide	Energy	Halflife	Br.Ratio	dps/gm
1	Am-241	59.50	4.322E+02 yrs	0.35900	3768.80
2	Cd-109	88.04	4.626E+02 dys	0.03610	52326.87
3	Co-57	122.06	2.718E+02 dys	0.85510	1149.69
4	Ce-139	165.85	1.376E+02 dys	0.80350	1703.80
5	Hg-203	279.00	4.660E+01 dys	0.77300	4014.23
6	Sn-113	391.68	1.151E+02 dys	0.64900	2987.67
7	Cs-137	661.64	3.017E+01 yrs	0.85120	1422.70
8	Y-88	898.02	1.066E+02 dys	0.93400	4997.86
9	Co-60	1173.21	5.271E+00 yrs	0.99980	2267.45
10	Co-60	1332.48	5.271E+00 yrs	0.99990	2270.23
11	Y-88	1836.01	1.066E+02 dys	0.99380	4972.83

Geometry 1 Calibration Verification: Gamma Mixed Nuclide Source
 CAL STD 867 Detector 10

CAL VER 824				REF DATE : 7/1/2006		count date 9/11/2008	
FROM CALIBRATION CERTIFICATE				FROM ANALYTICS.LIB		EXPECTED ACTIVITY	
Isotope	KeV	Half Life(y)	Gammars/Sec.	Mass of		pCi/L	# of half-lives expired
				Gamma Fraction:	Standard		
Am-241	59.9	432.0000	1323	0.3590	1 L	3685.2	102000
Cd-109	88	1.2666	1872	0.0361	Cd-109	51856.0	1440000
Co-57	122	0.7441	984.9	0.8551	Co-57	1151.8	29500
Ce-139	166	0.3768	1391	0.8035	Ce-139	1731.2	na
Hg-203	279	0.1276	3088	0.7730	Hg-203	3994.8	na
Sn-113	392	0.3151	1971	0.6490	Sn-113	3037.0	na
Cs-137	662	30.0000	1256	0.8512	Cs-137	1475.6	38900
Y-88	898	0.2919	4857	0.9340	Y-88	5200.2	na
Co-60	1173	5.2714	2377	1.0000	Co-60	2377.0	62800
Co-60	1332	5.2714	2374	1.0000	Co-60	2374.0	64200
Y-88	1836	0.2919	5084	0.9938	Y-88	5115.7	na

OK
Pg 10/2/08

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-10 GEO 1 LCS VER(824)

 Sampling Start: 07/01/2006 10:00:00 Counting Start: 09/11/2008 11:46:59
 Sampling Stop: 07/01/2006 10:00:00 Decay Time. 1.93E+004 Hrs
 Buildup Time. 0.00E+000 Hrs Live Time 1800 Sec
 Sample Size 1.00E+000 L Real Time 1899 Sec
 Collection Efficiency 1.0000 Spc. File 080962D10.SPC

Detector #: 10 (Detector 10)

Energy(keV) = -0.71 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 09/11/2008

FWHM(keV) = 0.90 + 0.003*En + 1.07E-03*En^2 + 0.00E+00*En^3 09/02/2008

Where En = Sqrt(Energy in keV)

 Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.37	120.06	11471	275	142	3748	1.01 a	
2	67.82	136.95	237	268	219	5928	1.94 a	Wide Pk
3	87.92	177.11	19614	323	133	3266	1.01 a	
4	121.91	245.05	6824	211	108	2143	1.03 a	
5	128.43	258.07	96	111	90	1632	0.86 a	
6	136.39	273.97	810	137	103	1944	0.99 a	
7	165.79	332.73	1263	143	102	1922	0.98 a	
8	215.11	431.28	99	132	108	2145	1.01 a	NET< CL
9	391.79	784.34	478	120	92	1570	1.23 a	
10	661.91	1324.14	25559	333	76	1079	1.57 a	HiResid
11	821.16	1642.37	118	98	78	1182	1.75 a	
12	898.36	1796.63	320	97	74	1165	1.45 a	
13	1173.40	2346.25	23497	317	65	785	1.97 a	HiResid
14	1332.54	2664.27	21570	297	33	190	2.23 a	HiResid
15	1835.60	3669.53	236	36	16	40	2.62 a	

080962D10.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET100906.BKG (080906-10 WEEKLY BACKGROUND)

Bkg.File Detector #: 10

=====

BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
2	67.82	237	268	219	232	269	219	

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-10 GEO 1 LCS VER(824)

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Sampling Start:      07/01/2006 10:00:00 | Counting Start:      09/11/2008 11:46:59
Sampling Stop:       07/01/2006 10:00:00 | Decay Time. . . . . 1.93e+004 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00e+000 L | Real Time . . . . . 1899 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 080962D10.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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```

Detector #: 10 (Detector 10)

Efficiency File: (D10)(Sh01).eff (Geo 1 Eff Cal)

*Eff=10^{[-2.99E+01 +2.65E+01*L +-6.17E+00*L² +0.00E+00*L³] 09/11/2008}Eff.=10^{[-4.86E+00 +4.51E+00*L +-1.79E+00*L² +2.00E-01*L³] Above 180.00 keV}

Library File:ANALYTICAL.LIB (Analytical)

MEASURED or MDA CONCENTRATIONS

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=====
              N
      ENERGY E      Concentration      Critical  Halflife
Nuclide  (keV) T  (pCi/L )      MDA      Level  (hrs)
-----
Am-241    59.54   1.02E+05 +- 2.45E+03   2.55E+03   1.26E+03   3.79E+06
Cd-109    88.02   1.44E+06 +- 2.38E+04   1.98E+04   9.79E+03   1.11E+04
Co-57    122.07   2.95E+04 +- 9.12E+02   9.43E+02   4.66E+02   6.50E+03
Ce-139    165.85   4.38E+04 +- 4.96E+03   7.17E+03   3.54E+03   3.30E+03
Sn-113    391.68   7.50E+04 +- 1.89E+04   2.94E+04   1.45E+04   2.76E+03
Cs-137    661.62   3.89E+04 +- 5.06E+02   2.36E+02   1.16E+02   2.64E+05
Y-88      Average:x 1.20E+05 +- 1.65E+04   . . . .   . . . .   2.56E+03
           898.02   1.01E+05 +- 3.07E+04   4.78E+04   2.35E+04   2.56E+03
           1836.01  1.28E+05 +- 1.96E+04   1.87E+04   8.60E+03   2.56E+03
Co-60     Average:x 6.35E+04 +- 6.11E+02   . . . .   . . . .   4.62E+04
           1173.21  6.28E+04 +- 8.47E+02   3.56E+02   1.74E+02   4.62E+04
           1332.48  6.42E+04 +- 8.83E+02   2.07E+02   9.94E+01   4.62E+04
Hg-203    279.18      MDA   . . . .   2.53E+07   1.25E+07   1.12E+03
  
```

MEASURED TOTAL: 1.92E+06 +- 6.86E+04 pCi/L

UNKNOWN, SUM or ESCAPE PEAKS

```

=====
PK.  ENERGY  ADDRESS  NET    UN-    C.L.    BKG    FWHM
#    (keV)    CHANNEL  COUNTS CERTAINTY  COUNTS  COUNTS  (keV)  FLAG
-----
  2    67.82   136.95    232     269     219     5928    1.94  Unknown
  5   128.43   258.07     96     111     90     1632    0.86  Unknown
  
```

080962D10.SPC Analyzed by

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UNKNOWN, SUM or ESCAPE PEAKS

=====

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
6	136.39	273.97	810	137	103	1944	0.99	Unknown
8	215.11	431.28	99	133	108	2145	1.01	Deleted
11	821.16	1642.37	118	98	78	1182	1.75	1333SEsc

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

73487-307

RSO# 824 Rec'd 8/29/06
QUB

1.0 Solid in 138G GA-MA Beaker

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytix maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776.
Density of solid matrix 1.15 g/cc.

Calibration date: July 1, 2006 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1323	3.0
Cd-109	88	462.6 d	1872	3.3
Co-57	122	271.79 d	984.9	3.0
Ce-139	166	137.6 d	1391	2.8
Hg-203	279	46.61 d	3088	2.7
Sn-113	392	115.1 d	1971	2.6
Cs-137	662	30.07 y	1256	3.0
Y-88	898	106.6 d	4857	2.6
Co-60	1173	5.2714 y	2377	2.7
Co-60	1332	5.2714 y	2374	2.6
Y-88	1836	106.6 d	5084	2.6

P O NUMBER 71239, Rel. 7/31/06, Item 1

SOURCE PREPARED BY: M. Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: UM [Signature] 8-24-06

This standard will expire one year after the calibration date.

~~SOURCE~~
~~RE-VERIFIED 07-29-08~~ ~~Reverified~~ ~~Exp 7/26/09~~ ~~MC~~
~~NEW EXPIRATION DATE = 07-29-09~~ ~~10 5/12/08~~ ~~09-10-08~~

Corporate Office

Laboratory

1380 Seaboard Industrial Blvd Atlanta Georgia 30318

Gamma Spectroscopy

Quality Control Data

Weekly Background Calibrations

Paragon Analytics

Gamma Spectrometer Calibration Log

Date: 11-21-08

Reviewed By/Date: MC 11/23/08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	MCU	/	/	/	/					
2.		MCU	MC	MCU	MCU					
3.		|	|	|	|					
4.		|	|	|	|					
5.		|	|	|	|					
6.		|	|	|	|	662 keV Centroid	MCU			
7.		|	|	|	|	MCU				
8.		|	|	|	|	1332 keV Centroid	MCU		Gain Adj.	
9.		|	|	|	|	60 keV FWHM	↓		Pole zero adj. Gain Adj.	
10.		✓	✓	✓	MCU					

** Corrective Action:

369974

369974

369974

A

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Weekly Background Check

Sample ID: 081121-2 WEEKLY BKG

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Sampling Start:   11/21/2008 15:00:00 | Counting Start:   11/21/2008 15:23:48
Sampling Stop:    11/21/2008 15:00:00 | Decay Time. . . . . 3.97E-001 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 60095 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081975D02.SPC
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```

Detector #: 2 (Detector 2)

Energy(keV) = $-0.59 + 0.501 \cdot \text{Ch} + 0.00\text{E}+00 \cdot \text{Ch}^2 + 0.00\text{E}+00 \cdot \text{Ch}^3$ 11/21/2008FWHM(keV) = $0.69 + 0.003 \cdot \text{En} + 1.19\text{E}-03 \cdot \text{En}^2 + 0.00\text{E}+00 \cdot \text{En}^3$ 05/08/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.59	94.18	83	73	58	673	0.81	a
2	63.31	127.56	140	56	42	430	0.44	a HiResid
3	66.50	133.94	167	67	51	573	0.73	b HiResid
4	69.34	139.60	41	41	32	287	0.40	c HiResid
5	74.89	150.68	97	66	52	591	0.72	a
6	77.14	155.17	101	76	61	739	0.77	b
7	86.99	174.84	46	70	56	640	0.78	a NET< CL
8	92.66	186.16	370	84	62	701	1.01	a
9	140.03	280.73	209	67	50	499	0.90	a HiResid Wide Pk
10	144.61	289.88	29	153	126	1597	2.69	b NET< CL HiResid
11	185.87	372.25	294	69	50	497	0.88	a
12	198.43	397.33	269	89	68	736	1.35	a
13	238.86	478.03	311	66	46	432	0.83	a
14	241.62	483.55	135	99	79	863	1.71	b
15	245.97	492.24	40	50	39	345	0.62	c
16	295.41	590.93	139	72	56	527	1.14	a
17	338.67	677.30	32	46	37	298	0.57	a NET< CL
18	352.12	704.14	214	69	51	447	1.15	a
19	511.43	1022.20	1555	122	76	718	2.61	a Wide Pk
20	537.69	1074.62	34	48	39	275	1.36	a NET< CL
21	558.94	1117.05	176	54	39	282	1.39	a
22	583.69	1166.47	94	48	36	261	1.07	a

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
23	609.94	1218.87	153	68	52	469	1.41	a
24	664.06	1326.92	35	32	24	143	0.84	a
25	803.69	1605.69	150	48	34	208	1.68	a
26	912.01	1821.93	70	35	26	146	1.38	a
27	962.46	1922.65	39	34	26	148	1.44	a
28	1461.99	2919.93	170	41	26	116	2.20	a

081975D02.SPC Analyzed by

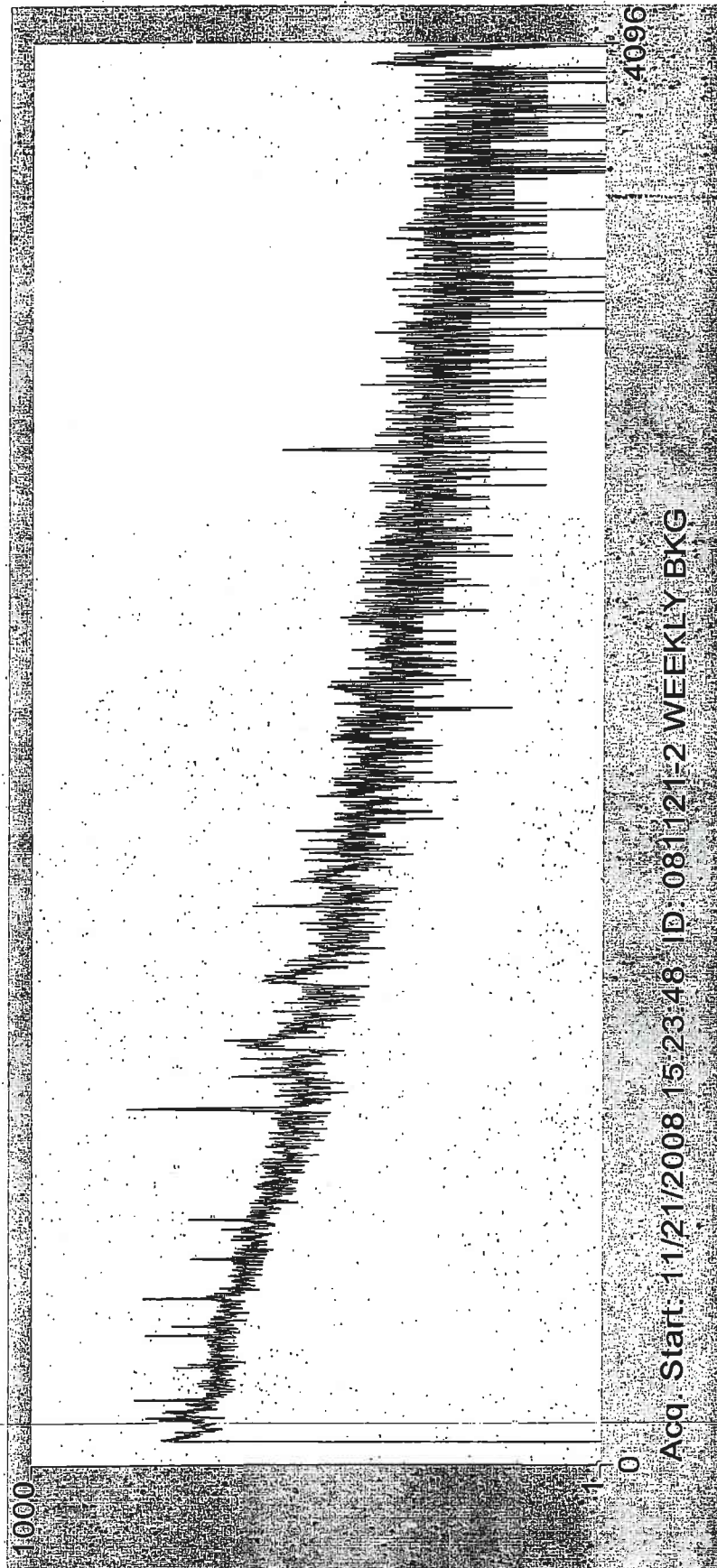
SEEKER BACKGROUND Q.C. ANALYSIS Version 2.2.2

ID: 081121-2 WEEKLY BKG

Detector # 2 Background Q.C. Analysis for 11/21/2008 15:23:48

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
10	50-> 150 keV Bkg	24.572	N.A.	Pass	N.A.
11	150-> 250 keV Bkg	20.473	N.A.	Pass	N.A.
12	250-> 500 keV Bkg	29.909	N.A.	Pass	N.A.
13	500->1000 keV Bkg	31.297	N.A.	Pass	N.A.
14	1000->2000 keV Bkg	18.201	N.A.	Pass	N.A.
15	40-> 50 keV Bkg	2.863	N.A.	Pass	N.A.

Q.C. Results Saved.



 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Weekly Background Check

Sample ID: 081121-6 WEEKLY BKG

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Sampling Start:   11/21/2008 15:00:00 | Counting Start:   11/21/2008 15:24:02
Sampling Stop:    11/21/2008 15:00:00 | Decay Time. . . . . 4.01E-001 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 63118 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . .081822D06.SPC
-----
  
```

Detector #: 6 (Detector 6)

Energy(keV) = -0.45 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 11/21/2008

FWHM(keV) = 0.73 + 0.012*En + 6.10E-04*En^2 + 0.00E+00*En^3 07/25/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

PEAK SEARCH RESULTS

```

=====
PK.   ENERGY  ADDRESS  NET/MDA  UN-   C.L.   BKG   FWHM
#     (keV)    CHANNEL  COUNTS  CERTAINTY  COUNTS  COUNTS  (keV)  FLAG
-----
 1    44.88     90.55      63      57      45      494    0.42  a
 2    66.42    133.58     122      88      70      911    0.96  a
 3    69.87    140.47      31      53      43      456    0.46  b NET< CL
 4    75.15    151.00      19      54      44      468    0.44  a NET< CL
 5    92.77    186.21     151      86      68      785    1.17  a
 6    99.17    199.00      16      46      37      342    0.46  a NET< CL
 7   140.05    280.66      80      59      46      466    0.63  a
 8   169.93    340.35      66      84      68      783    1.09  a NET< CL
 9   185.73    371.90     150      76      59      646    0.91  a
10   198.54    397.50     257      93      72      823    1.32  a
11   238.84    477.99     124      65      50      504    0.77  a
12   295.43    591.03      91      58      45      415    0.78  a
13   352.10    704.25     171      58      42      376    0.95  a
14   382.58    765.12      53      51      40      344    0.92  a
15   511.29   1022.23    1265     117      76      750    2.44  a Wide Pk
16   558.77   1117.08     116      48      35      262    0.90  a
17   569.94   1139.40      65      50      39      300    1.10  a
18   583.60   1166.67      71      46      35      246    1.09  a
19   609.69   1218.78     142      62      47      405    1.27  a
20   670.10   1339.46      47      56      44      324    1.57  a
21   754.62   1508.30      46      54      43      294    2.12  a
22   803.42   1605.77     107      44      32      204    1.29  a
23   898.92   1796.55      41      46      36      231    1.88  a
24   911.57   1821.81      65      37      27      153    1.35  a
  
```

=====

PEAK SEARCH RESULTS

=====

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
25	962.89	1924.34	41	40	31	179	1.59	a
26	1120.86	2239.88	53	39	30	150	2.01	a
27	1238.78	2475.44	22	22	17	68	1.06	a
28	1461.58	2920.51	328	46	24	107	1.81	a
29	1765.08	3526.77	55	28	19	64	2.23	a

=====

081822D06.SPC Analyzed by

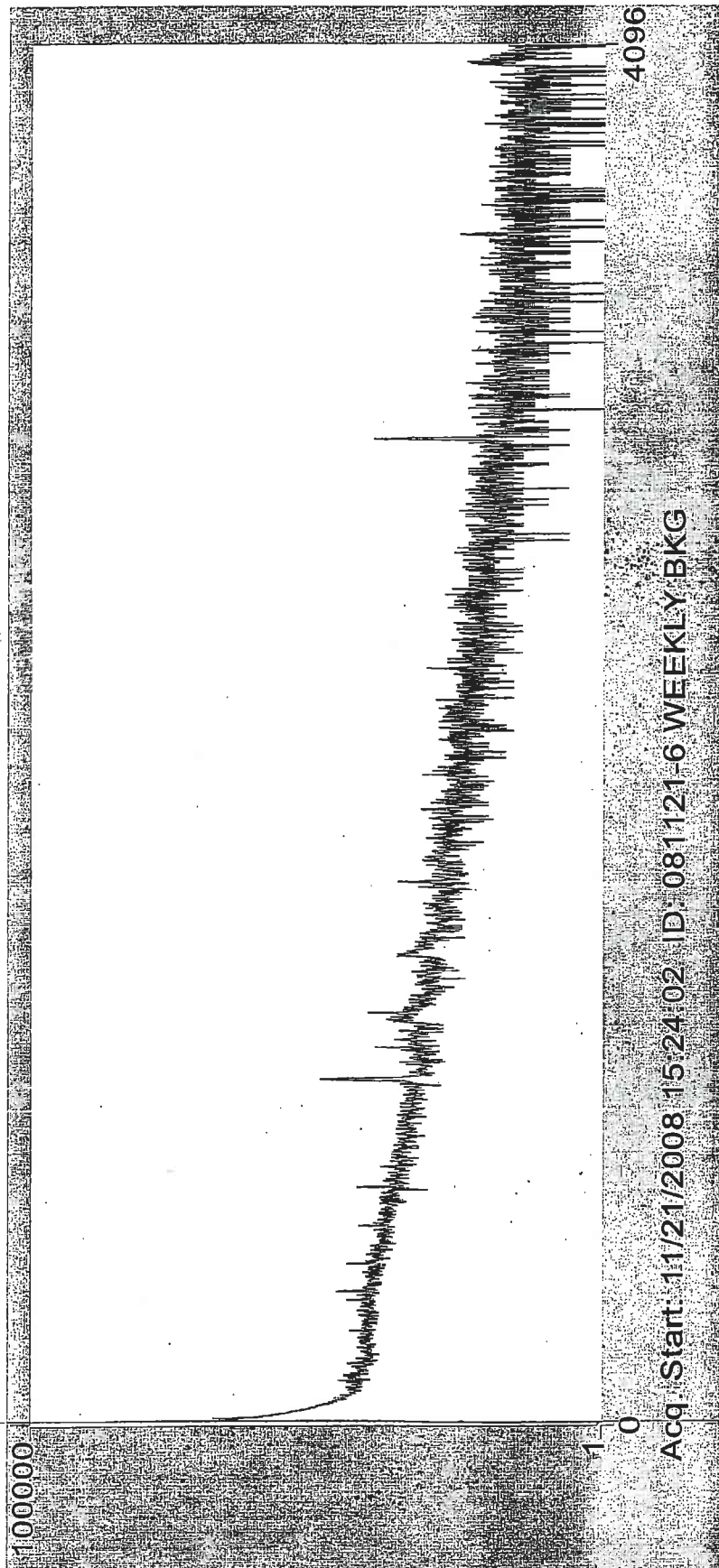
SEEKER B A C K G R O U N D Q . C . A N A L Y S I S Version 2.2.2

ID: 081121-6 WEEKLY BKG

Detector # 6 Background Q.C. Analysis for 11/21/2008 15:24:02

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
10	50-> 150 keV Bkg	25.670	N.A.	Pass	N.A.
11	150-> 250 keV Bkg	22.027	N.A.	Pass	N.A.
12	250-> 500 keV Bkg	32.459	N.A.	Pass	N.A.
13	500->1000 keV Bkg	31.599	N.A.	Pass	N.A.
14	1000->2000 keV Bkg	17.262	N.A.	Pass	N.A.
15	40-> 50 keV Bkg	3.608	N.A.	Pass	N.A.

Q.C. Results Saved.



 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Weekly Background Check

Sample ID: 081121-10 WEEKLY BKG

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-----
Sampling Start:   11/21/2008 15:00:00 | Counting Start:   11/21/2008 15:24:17
Sampling Stop:   11/21/2008 15:00:00 | Decay Time. . . . . 4.05E-001 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 60198 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081204D10.SPC
-----

```

Detector #: 10 (Detector 10)

Energy(keV) = -0.71 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 11/21/2008

FWHM(keV) = 0.90 + 0.003*En + 1.07E-03*En^2 + 0.00E+00*En^3 09/02/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

=====

PEAK SEARCH RESULTS

=====

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.38	94.10	90	97	78	1035	1.23	a
2	53.49	108.31	54	72	58	682	0.78	a NET< CL
3	63.26	127.83	137	75	59	693	0.77	a Wide Pk
4	66.32	133.95	296	107	84	1109	1.29	b
5	69.14	139.56	53	52	41	416	0.51	c
6	70.47	142.24	233	135	108	1525	1.84	d
7	74.95	151.19	282	88	67	832	1.04	e
8	77.12	155.51	235	97	75	971	1.07	f
9	87.55	176.37	46	51	41	409	0.51	a
10	92.70	186.65	425	91	66	817	1.05	b
11	128.66	258.51	29	84	69	803	1.07	a NET< CL
12	139.68	280.52	173	87	68	797	1.11	a
13	171.83	344.76	39	92	75	885	1.26	a NET< CL
14	185.83	372.73	317	81	60	667	0.96	a
15	198.44	397.93	278	105	82	987	1.45	a
16	238.89	478.75	428	89	65	785	1.37	a
17	241.88	484.72	87	67	53	589	1.01	b
18	264.78	530.49	79	69	55	586	1.15	a
19	270.52	541.95	79	102	82	1005	1.98	b NET< CL
20	295.46	591.78	141	64	49	497	0.92	a
21	338.61	678.00	65	53	42	393	0.89	a
22	352.33	705.41	271	76	57	590	1.37	a
23	511.59	1023.63	1671	130	83	935	2.73	a Wide Pk
24	537.03	1074.47	23	53	43	355	1.39	a NET< CL

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
25	558.98	1118.33	239	53	36	276	1.16	a
26	570.01	1140.37	69	45	35	278	0.91	a
27	583.75	1167.83	137	73	57	515	2.07	a
28	597.09	1194.48	59	53	42	386	1.21	a
29	610.05	1220.38	250	82	62	672	1.79	a
30	651.90	1303.99	41	36	27	184	0.84	a
31	803.67	1607.25	131	49	36	253	1.50	a
32	911.87	1823.45	144	43	29	177	1.54	a
33	962.59	1924.79	38	33	25	146	1.17	a
34	1461.54	2921.75	242	48	30	152	2.23	a
35	1592.32	3183.06	31	27	21	83	1.74	a
36	1765.60	3529.30	33	50	40	182	4.37	a NET< CL

081204D10.SPC Analyzed by

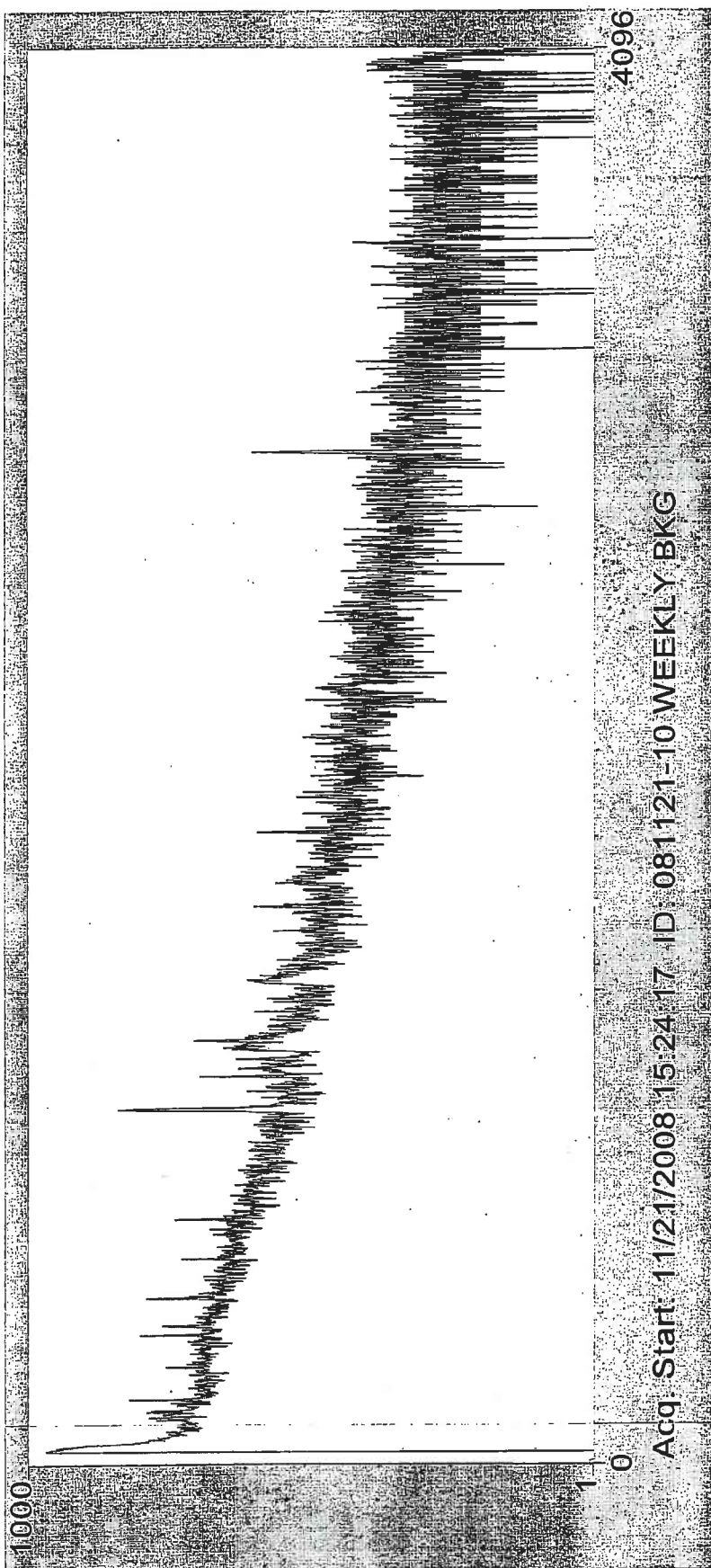
SEEKER B A C K G R O U N D Q . C . A N A L Y S I S Version 2.2.2

ID: 081121-10 WEEKLY BKG

Detector # 10 Background Q.C. Analysis for 11/21/2008 15:24:17

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
10	50-> 150 keV Bkg	27.097	N.A.	Pass	N.A.
11	150-> 250 keV Bkg	22.693	N.A.	Pass	N.A.
12	250-> 500 keV Bkg	34.465	N.A.	Pass	N.A.
13	500->1000 keV Bkg	35.767	N.A.	Pass	N.A.
14	1000->2000 keV Bkg	20.632	N.A.	Pass	N.A.
15	40-> 50 keV Bkg	3.328	N.A.	Pass	N.A.

Q.C. Results Saved.



Paragon Analytics

Gamma Spectrometer Calibration Log

Date: 11/28/08

Reviewed By/Date: MC 11/30/08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	JP	/	/	/	/					
2.		JP	MC	JP	JP					
3.		JP	|	JP	JP					
4.		JP	✓	JP	JP					
5.		JP	X	JP	JP					
6.		JP	MC	JP	JP					
7.		JP	|	JP	JP					
8.		JP	✓	JP	/	1332 FWHM	JP			
9.		JP	0	JP	JP					
10.		JP	00	JP	JP					

** Corrective Action:

X BIAS SHUTDOWN DURING
COUNT. MC 11/29/08

0 PEAK FIT ERROR.
MC 11/29/08

00 GAIN SHIFT.
MC 11/29/08

369983 A

Form 754r13a.doc (7/20/07)

 SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Weekly Background Check

Sample ID: 081128-2 WEEKLY BKG

 Sampling Start: 11/28/2008 12:00:00 | Counting Start: 11/28/2008 12:51:06
 Sampling Stop: 11/28/2008 12:00:00 | Decay Time. 8.52E-001 Hrs
 Buildup Time. 0.00E+000 Hrs | Live Time 60000 Sec
 Sample Size 1.00E+000 L | Real Time 60107 Sec
 Collection Efficiency 1.0000 | Spc. File 082000D02.SPC

Detector #: 2 (Detector 2)

Energy(keV) = -0.64 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 11/28/2008

FWHM(keV) = 0.69 + 0.003*En + 1.19E-03*En^2 + 0.00E+00*En^3 05/08/2008

Where En = Sqrt(Energy in keV)

 Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.39	93.93	118	64	49	541	0.73	a
2	47.81	96.76	20	50	41	406	0.42	b NET< CL DELETED
3	53.22	107.58	61	81	65	790	1.06	a NET< CL
4	63.23	127.58	171	83	65	776	0.91	a
5	66.39	133.88	166	74	57	647	0.85	b
6	74.72	150.51	124	55	41	423	0.55	a
7	77.14	155.35	144	56	41	423	0.49	b
8	92.63	186.30	412	87	63	736	0.91	a
9	129.13	259.19	46	72	58	631	0.93	a NET< CL
10	139.84	280.59	132	49	36	317	0.45	a
11	185.68	372.16	367	94	71	792	1.31	a
12	198.11	397.00	250	83	63	676	1.10	a
13	238.58	477.82	241	68	50	508	0.76	a
14	258.56	517.73	48	72	58	581	1.08	a NET< CL
15	295.16	590.84	106	65	51	479	0.94	a
16	351.87	704.11	206	69	52	456	1.15	a
17	456.74	913.60	38	55	44	362	1.27	a NET< CL
18	511.07	1022.11	1575	126	81	804	2.54	a Wide Pk
19	537.05	1074.02	46	38	29	191	0.85	a
20	558.47	1116.79	215	61	44	333	1.48	a
21	569.64	1139.12	73	60	47	390	1.43	a
22	583.32	1166.43	136	56	42	319	1.33	a
23	596.87	1193.50	71	60	47	413	1.25	a

Page 001

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
24	609.15	1218.03	150	68	52	478	1.41	a
25	692.69	1384.90	27	46	37	291	1.07	a NET< CL
26	802.96	1605.17	155	54	39	257	1.91	a
27	898.69	1796.38	51	43	34	216	1.80	a
28	911.35	1821.68	70	44	33	211	1.78	a
29	962.48	1923.80	92	41	30	171	1.82	a
30	968.97	1936.76	48	30	22	109	1.19	b
31	1001.86	2002.46	28	36	28	159	1.56	a NET< CL
32	1120.58	2239.60	50	29	21	99	1.20	a
33	1460.99	2919.56	181	43	28	123	2.54	a
34	1764.05	3524.92	44	35	27	105	3.11	a

082000D02.SPC Analyzed by

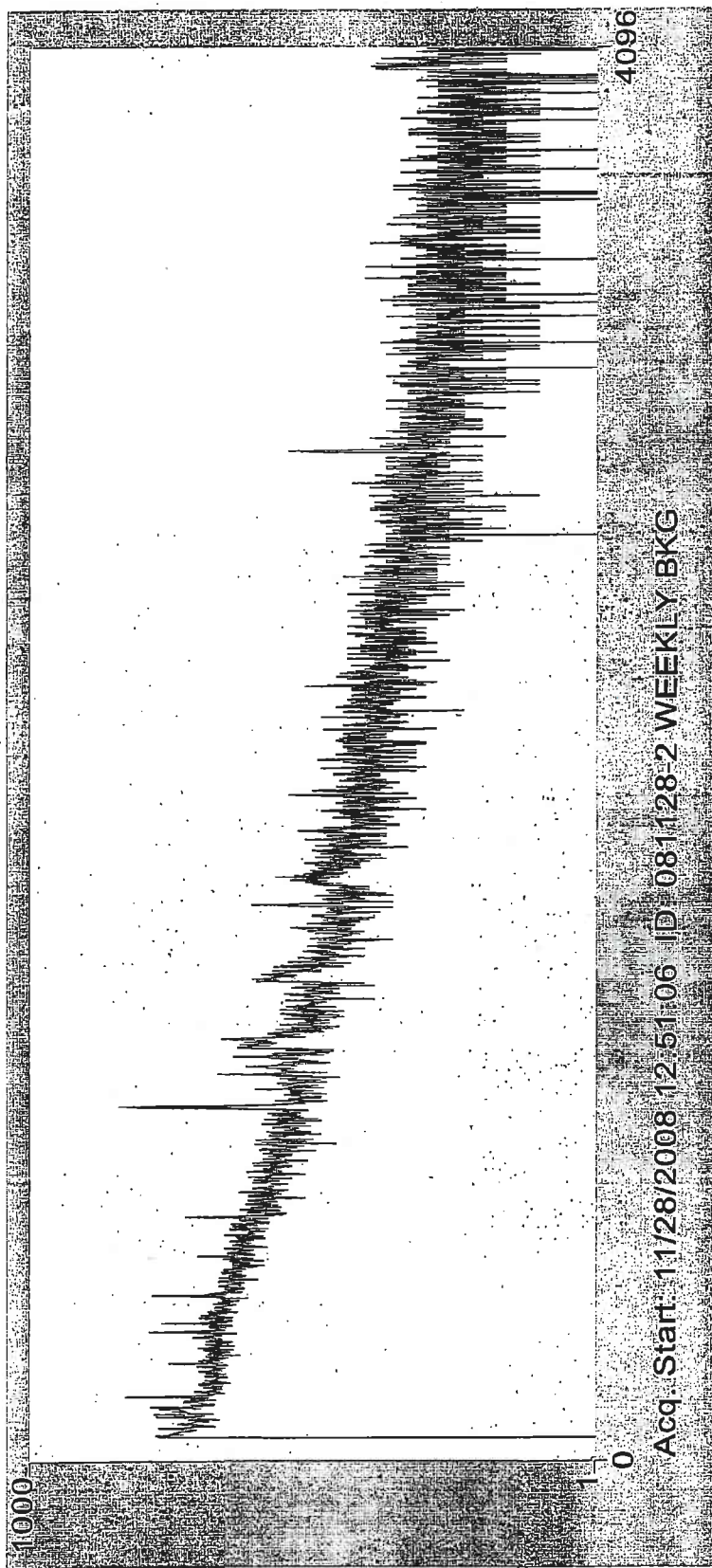
SEEKER BACKGROUND Q.C. ANALYSIS Version 2.2.2

ID: 081128-2 WEEKLY BKG

Detector # 2 Background Q.C. Analysis for 11/28/2008 12:51:06

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
10	50-> 150 keV Bkg	24.671	N.A.	Pass	N.A.
11	150-> 250 keV Bkg	20.615	N.A.	Pass	N.A.
12	250-> 500 keV Bkg	30.865	N.A.	Pass	N.A.
13	500->1000 keV Bkg	32.073	N.A.	Pass	N.A.
14	1000->2000 keV Bkg	18.099	N.A.	Pass	N.A.
15	40-> 50 keV Bkg	3.125	N.A.	Pass	N.A.

Q.C. Results Saved.



Gamma Spectroscopy

Quality Control Data

Daily Instrument Performance Checks



CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

PAI 0720

66354A-307

215 Grams of Sand in Metal Can

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytix maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

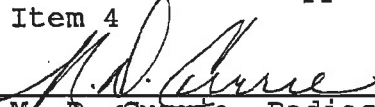
Calibration date: July 1, 2003 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1316	3.0
Cd-109	88	462.6 d	1879	3.3
Co-57	122	271.79 d	1042	2.8
Ce-139	166	137.6 d	1432	2.8
Hg-203	279	46.61 d	3223	2.7
Sn-113	392	115.1 d	1978	2.6
Cs-137	662	30.07 y	1272	3.0
Y-88	898	106.6 d	5106	2.6
Co-60	1173	5.2714 y	2424	2.7
Co-60	1332	5.2714 y	2449	2.6
Y-88	1836	106.6 d	5335	2.6

Approximately 126.5 mL of customer supplied sand.

P O NUMBER EW060303, Item 4

SOURCE PREPARED BY:


M. D. Currie, Radiochemist

Q A APPROVED:

 8-1-03

This standard will expire one year after the calibration date.

RSO # 767
Rec'd 8/12/04
JJB



CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

68681-307

215 Grams of Sand in Metal Can

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: July 1, 2004 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1355	3.0
Cd-109	88	462.6 d	1900	3.3
Co-57	122	271.79 d	995.1	3.0
Ce-139	166	137.6 d	1411	2.8
Hg-203	279	46.61 d	3241	2.7
Sn-113	392	115.1 d	1939	2.6
Cs-137	662	30.07 y	1247	3.0
Y-88	898	106.6 d	4853	2.6
Co-60	1173	5.2714 y	2457	2.7
Co-60	1332	5.2714 y	2474	2.6
Y-88	1836	106.6 d	5064	2.6

140 mL of customer supplied sand.

P O NUMBER 70564, Item 4

SOURCE PREPARED BY:

M. D. Currie for
M. D. Currie, Radiochemist

Q A APPROVED:

M. D. Currie 8-9-04

This standard will expire one year after the calibration date.

$\approx 203 \mu\text{Ci}$



PAT ID 0636
rec'd 8-02-02

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

64122-307

215 Grams of Sand in Metal Can

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytical maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: July 1, 2002 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1301	5.0
Cd-109	88	462.6 d	1882	5.0
Co-57	122	271.79 d	994.2	4.7
Ce-139	166	137.6 d	1420	4.3
Hg-203	279	46.61 d	3085	4.1
Sn-113	392	115.1 d	2094	4.1
Cs-137	662	30.07 y	1320	4.8
Y-88	898	106.6 d	4847	4.2
Co-60	1173	5.2714 y	2354	4.1
Co-60	1332	5.2714 y	2382	4.2
Y-88	1836	106.6 d	5068	4.0

Approximately 140 mL customer supplied sand.

P O NUMBER EW060602, Item 4

SOURCE PREPARED BY:

M. Taskaeva
M. Taskaeva Radiochemist

Q A APPROVED:

Rec'd 7/31/02

This standard will expire one year after the calibration date.

RSO # 720 was opened and split into multiple LSC vials, as shown

720.3020.47	-1	35.8071 g	(Bal 12)
	-2	36.1586	
	-3	36.1325	
	-4	36.0040	
	-5	36.4197	
	-6	34.5663	

These will be used as δ daily check sources

[Signature]
10/30/06

Continued on Page

Read and Understood By

[Signature]

10/30/06

Signed

Date

Signed

Date

143

RSO #967 was opened and split into multiple LSC vials, to be used as 8 check sources, as shown

767.3020.48-7	36.6640g	(Bal 12)
8	36.1856g	
9	36.3376g	
10	35.9937g	
11	36.7952g	
12	33.1100g	

[Signature]
10/30/06

Continued on Page _____

Read and Understood By

[Signature]

Signed

10/30/06

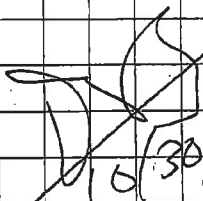
Date

Signed

RSO # 636 was opened and split into multiple LSC vials, to be used as daily check sources, as shown

636.3020.49 - 13	34.2237 g	(Bal 12)
↓ 14	33.7917 g	↓
15	34.6628	
16	34.1622	
17	34.2401	
18	34.6838	

The remaining 9.1386g was transferred to a 200 ml plastic beaker and marked for disposal.


10/30/06

Continued on Page

Read and Understood By



Signed

10/30/06

Date

Signed

Date

145

Paragon Analytics

Gamma Spectrometer Calibration Log

Date: ¹¹10-24-08
11-24-08

Reviewed By/Date: MAU 11-24-08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	MAU			/	/					
2.				MAU	MAU					
3.				↓	↓					
4.										
5.					↓					
6.					/	662 KeV Cendroid	MAU			
7.					MAU					
8.					↓					
9.					/	60/132 KeV FWHM	/	662 KeV FWHM	Pole zero gain Adj.	MAU
10.				↓	/	60 KeV Efficiency	MAU			

** Corrective Action:

369977

A

081978D02.SPC Analyzed by *MS*

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 2 Detector Q.C. Analysis for 11/24/2008 09:37:03

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	119.896	N.A.	Pass	N.A.
2	60 keV FWHM	7.753E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.117E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1321.976	N.A.	Pass	N.A.
5	662 keV FWHM	1.639	N.A.	Pass	N.A.
6	662 keV Efficiency	1.735E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2660.817	N.A.	Pass	N.A.
8	1332 keV FWHM	2.526	N.A.	Pass	N.A.
9	1332 keV Efficiency	7.443E-03	N.A.	Pass	N.A.

Q.C. Results Saved.

Paragon Analytics

Gamma Spectrometer Calibration Log

Date: 11-25-08

Reviewed By/Date: MTU 11-25-08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	MTU			/	/					
2.				MTU	/	60 Kev Efficiency	MTU	1332 Kev Efficiency		
3.					MTU					
4.										
5.										
6.										
7.										
8.										
9.										
10.				✓	✓					

** Corrective Action:

369978 A

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 2 Detector Q.C. Analysis for 11/25/2008 09:26:37

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.067	N.A.	Pass	N.A.
2	60 keV FWHM	7.040E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.065E-02	N.A.	<FAIL>	N.A.
4	662 keV Centroid	1322.907	N.A.	Pass	N.A.
5	662 keV FWHM	1.729	N.A.	Pass	N.A.
6	662 keV Efficiency	1.701E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2662.830	N.A.	Pass	N.A.
8	1332 keV FWHM	2.658	N.A.	Pass	N.A.
9	1332 keV Efficiency	7.683E-03	N.A.	Pass	N.A.

Q.C. Results Saved.

081985D02.SPC Analyzed by *MS*

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 2 Detector Q.C. Analysis for 11/25/2008 09:38:15

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.073	N.A.	Pass	N.A.
2	60 keV FWHM	7.067E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.090E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1322.876	N.A.	Pass	N.A.
5	662 keV FWHM	1.707	N.A.	Pass	N.A.
6	662 keV Efficiency	1.688E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2662.698	N.A.	Pass	N.A.
8	1332 keV FWHM	2.574	N.A.	Pass	N.A.
9	1332 keV Efficiency	7.113E-03	N.A.	<FAIL>	N.A.

Q.C. Results Saved.

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 2 Detector Q.C. Analysis for 11/25/2008 09:51:55

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.066	N.A.	Pass	N.A.
2	60 keV FWHM	7.591E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.121E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1322.896	N.A.	Pass	N.A.
5	662 keV FWHM	1.703	N.A.	Pass	N.A.
6	662 keV Efficiency	1.677E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2663.014	N.A.	Pass	N.A.
8	1332 keV FWHM	2.606	N.A.	Pass	N.A.
9	1332 keV Efficiency	8.254E-03	N.A.	Pass	N.A.

Q.C. Results Saved.

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 6 Detector Q.C. Analysis for 11/25/2008 09:27:06

Standards File #: 98 (Daily Performance Check)

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.085	N.A.	Pass	N.A.
2	60 keV FWHM	9.207E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	9.575E-03	N.A.	Pass	N.A.
4	662 keV Centroid	1324.279	N.A.	Pass	N.A.
5	662 keV FWHM	1.430	N.A.	Pass	N.A.
6	662 keV Efficiency	2.656E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2665.996	N.A.	Pass	N.A.
8	1332 keV FWHM	1.991	N.A.	Pass	N.A.
9	1332 keV Efficiency	3.593E-02	N.A.	Pass	N.A.

Q.C. Results Saved.

081209D10.SPC Analyzed by *lv*

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 10 Detector Q.C. Analysis for 11/25/2008 09:27:43

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.318	N.A.	Pass	N.A.
2	60 keV FWHM	9.764E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	7.619E-03	N.A.	Pass	N.A.
4	662 keV Centroid	1324.402	N.A.	Pass	N.A.
5	662 keV FWHM	1.784	N.A.	Pass	N.A.
6	662 keV Efficiency	1.689E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2664.509	N.A.	Pass	N.A.
8	1332 keV FWHM	2.375	N.A.	Pass	N.A.
9	1332 keV Efficiency	9.205E-03	N.A.	Pass	N.A.

Q.C. Results Saved.

Paragon Analytics

Gamma Spectrometer Calibration Log

Date: 11-26-08

Reviewed By/Date: WAV 11-26-08

Del. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	WAV			/	/					
2.				WAV	WAV					
3.				WAV	WAV					
4.				|	/	1332 keV FWHM	WAV			
5.				|	WAV					
6.				|	|					
7.				|	|					
8.				↓	↓					
9.				WAV	WAV					
10.				WAV	WAV					

** Corrective Action:

369980 A

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 6 Detector Q.C. Analysis for 11/26/2008 09:20:50

Standards File #: 98 (Daily Performance Check)

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.123	N.A.	Pass	N.A.
2	60 keV FWHM	8.537E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.015E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1324.224	N.A.	Pass	N.A.
5	662 keV FWHM	1.389	N.A.	Pass	N.A.
6	662 keV Efficiency	2.935E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2666.023	N.A.	Pass	N.A.
8	1332 keV FWHM	1.947	N.A.	Pass	N.A.
9	1332 keV Efficiency	3.518E-02	N.A.	Pass	N.A.

Q.C. Results Saved.

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 10 Detector Q.C. Analysis for 11/26/2008 09:21:14

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.389	N.A.	Pass	N.A.
2	60 keV FWHM	9.630E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	8.084E-03	N.A.	Pass	N.A.
4	662 keV Centroid	1324.364	N.A.	Pass	N.A.
5	662 keV FWHM	1.774	N.A.	Pass	N.A.
6	662 keV Efficiency	1.729E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2664.518	N.A.	Pass	N.A.
8	1332 keV FWHM	2.318	N.A.	Pass	N.A.
9	1332 keV Efficiency	9.680E-03	N.A.	Pass	N.A.

Q.C. Results Saved.

Paragon Analytics

Gamma Spectrometer Calibration Log

Date: 11/29/08

Reviewed By/Date: MC 11/30/08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	MC			/	/					
2.				MC	MC					
3.				|	|					
4.				|	|					
5.	MC			/	/					
6.				MC	MC					
7.				|	|					
8.				|	|					
9.		MC	MC	|	|					
10.		|	|	|	|				GAIN ADJUST.	

** Corrective Action:

369984 A

082001D02.SPC Analyzed by *MC*

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CK

Detector # 2 Detector Q.C. Analysis for 11/29/2008 12:22:24

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.056	N.A.	Pass	N.A.
2	60 keV FWHM	8.104E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.156E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1322.854	N.A.	Pass	N.A.
5	662 keV FWHM	1.622	N.A.	Pass	N.A.
6	662 keV Efficiency	1.722E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2662.684	N.A.	Pass	N.A.
8	1332 keV FWHM	2.674	N.A.	Pass	N.A.
9	1332 keV Efficiency	8.234E-03	N.A.	Pass	N.A.

Paragon Analytics

Gamma Spectrometer Calibration Log

Date: 11/30/08

Reviewed By/Date: MC 11/30/08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	MC			/	/					
2.				MC	MC					
3.				|	|					
4.				|	|					
5.	MC			/	/					
6.				MC	MC					
7.				|	|					
8.				|	|					
9.				|	|					
10.				|	|					

** Corrective Action:

1/1

1/1

369985 A

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CK

Detector # 2 Detector Q.C. Analysis for 11/30/2008 08:48:41

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.085	N.A.	Pass	N.A.
2	60 keV FWHM	6.917E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.077E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1322.995	N.A.	Pass	N.A.
5	662 keV FWHM	1.715	N.A.	Pass	N.A.
6	662 keV Efficiency	1.842E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2662.898	N.A.	Pass	N.A.
8	1332 keV FWHM	2.662	N.A.	Pass	N.A.
9	1332 keV Efficiency	8.278E-03	N.A.	Pass	N.A.