Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

**LOS ALAMOS**
**NATIONAL LABORATORY**

ATTN: Lance Steere
Paragon Analytics, Inc.
225 Commerce
Fort Collins, CO 80524

These Samples are on:
LANL Request Number:08-939
Per Agreement Number:1-800-443-1511
Project Cost Code: WEPR13110300

Please analyse the enclosed samples according to the schedule indicated:

**SHIP DATE: 4/8/2008**
**TURNAROUND/REPORT DUE: 5/8/2008**
**TURNAROUND REQ'D: 30 Days**

**RAD SCREENING: Not Required**
**LAB REQUEST COMMENTS:**

LANL ER SMO CONTACT:
Signature:

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:ISOPU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:ISOU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:PO-210 | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |

Tuesday, April 08, 2008

P

REQUEST N

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE CO |
|---|---|---|---|---|---|---|
| | HASL-300:PO-210 | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample Rock at NM ove bathroom |

**Final Page of REQUEST NUMBER 08-939**

Tuesday, April 08, 2008

# LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 08-939C

REQUEST NUMBER: 08-939

## LOS ALAMOS
**NATIONAL LABORATORY**

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 5/8/2008

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS:

| SAMPLE ID | CTNR | CTNR DESC | ORDER | PRESERV | MATRIX |
|---|---|---|---|---|---|
| SFB08-08-11838 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |
| SFB08-08-11839 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |

| Relinquished By: | | Date | Time | Received By: | | Date | Time |
|---|---|---|---|---|---|---|---|
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |

| Received for DISPOSAL By: | | Date | Time | Remarks: |
|---|---|---|---|---|
| Printed Name | Signature | | | |

Los Alamos National Laboratory



# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

**EVENT ID:** 379

**EVENT NAME:** Dust from WR offices March08

**SAMPLE ID:** **SFB08-08-11838**

| | AS PLANNED | AS COLLECTED | | AS PLANNED | AS COLLECTED |
|---|---|---|---|---|---|
| DATE COLLECTED/MM/DD/YYYY: | | / / | | | |

Los Alamos National Laboratory



# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

**EVENT ID:** 379 **EVENT NAME:** Dust from WR offices March08

**SAMPLE ID:** SFB08-08-11839

| | AS PLANNED | AS COLLECTED | | AS PLANNED | AS COLLECTED |
|---|---|---|---|---|---|
| DATE COLLECTED(MM/DD/YYYY): | | 02/08/2008 | MEDIA: | NA | |
| TIME COLLECTED (HH:MM) | | (1400) 2:00pm | SUB-MEDIA: | OTHER | |
| PRS ID: | SFB | | SAMPLE TECH CODE: | M | |
| LOCATION ID: | UNK | | FIELD QC TYPE: | NA | |
| LOCATION TYPE: | GENERIC | | FIELD PREP: | NA | |
| TOP DEPTH: | 0 | | SAMPLE USAGE: | INV | |
| BOTTOM DEPTH: | 0 | | SCREEN/PORT DESC: | | |
| FIELD MATRIX: | S Dust | | EXCAVATED: YES / NO (NA) | | |

COMPOSITE TYPE: NA COMPOSITE TIME INTERVAL: NA WATER FLOWING: YES / NO / (NA)

BOREHOLE: YES / NO / (NA) BOREHOLE DECLINATION: NA BOREHOLE DIRECTION: NA

| # | PRIORITY | ORDER | CNTNR | PRESERVATIVE | COLLECTED Y/N | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|
| 2 1 | | AM-241+ISOPU+ISOU+SR90 | ~~1L POLY~~ 3/31/08 500 ML POLY- | None - | yes | sent to Paragon |
| 2 1 | | ISO_Po | ~~250 ML POLY~~ 3/31/08 | Ice | yes | sent to Paragon |

**SAMPLE DESC:**
Dust collection, NMED office White Rock.
One container 500 ml poly.

**SAMPLE COMMENTS:** #2 dust sample, White Rock at NM oversight bathroom

**LOCATION DESC:**

**FIELD SCREENING/MEASUREMENT RESULTS:**

**COLLECTED BY (PRINT)** Louis Naranjo Jr **REVIEWED BY (PRINT)** L Naranjo

| RELINQUISHED BY | Date/Time | RECEIVED BY | Date/Time |
|---|---|---|---|
| (Printed Name) L Naranjo (Signature) | 3/31/2008 11:00 | (Printed Name) (Signature) | 3/31/08 11:00 |
| RELINQUISHED BY (Printed Name) (Signature) | Date/Time | RECEIVED BY (Printed Name) (Signature) | Date/Time |

# DATA VALIDATION COVER SHEET

**5119-1**

**Data Validation Cover Sheet**

Records Use only

Los Alamos NATIONAL LABORATORY

**Section I.**

REQUEST NUMBER: 08-939 VALIDATION DATE: 7/11/08 LAB CODE: PARA

CONTRACT LABORATORY NAME: Paragon Analytics

VALIDATOR: Charissa Lewis ORGANIZATION: Analytical Quality Associates, Inc.

ANALYTICAL SUITE (CHECK ALL THAT APPLY):

- ☐ TPH-GRO
- ☐ TPH-DRO
- ☐ GENERAL CHEMISTRY
- ☐ HIGH EXPLOSIVES
- ☐ METALS
- ☒ RADIOCHEMISTRY
- ☐ DIOXIN FURANS
- ☐ PCB CONGENERS
- ☐ LCMSMS HIGH EXPLOSIVES
- ☐ LCMSMS PERCHLORATES
- ☐ ORGANOCHLORINE PESTICIDES/POLYCHLORINATED BIPHENYLS
- ☐ OTHER (DESCRIBE):

**Section II. Completeness Check**

| YES | NO | N/A | (CHECK ONE) | YES | NO | N/A | (CHECK ONE) |
|---|---|---|---|---|---|---|---|
| ☒ | ☐ | ☐ | 1. CHAIN-OF-CUSTODY FORM(S) | ☒ | ☐ | ☐ | 6. RAW/BSS DATA |
| ☒ | ☐ | ☐ | 2. CASE NARRATIVE | ☒ | ☐ | ☐ | 7. QUALITY CONTROL FORMS |
| ☒ | ☐ | ☐ | 3. SAMPLE RESULT FORMS | ☐ | ☐ | ☒ | 8. QUANTITATION REPORTS |
| ☐ | ☐ | ☒ | 4. SAMPLE CHROMATOGRAMS | ☐ | ☐ | ☒ | 9. TICS FORMS |
| ☐ | ☐ | ☒ | 5. STANDARD CHROMATOGRAMS | ☐ | ☐ | ☒ | 10. TICS MASS SPECTRA |

Comments/problems noted (include information about requests for further information submitted to the contract laboratory and agreed-upon date of resolution and contract laboratory point of contact):

# DATA VALIDATION COVER SHEET

**5119-1**

Records Use only

Los Alamos NATIONAL LABORATORY

## Data Validation Cover Sheet

**Reviewed By:** KAS **Level:** I **Date:** 7/14/08

VALIDATOR'S SIGNATURE: Chandra Lewis DATE: 7/11/08

Form 5119-1, Revision 0.0

LOS ALAMOS
Environmental Restoration Project

# RAD ANALYTICAL DATA VALIDATION CHECKLIST

**5119-2**

**Rad Analytical Data Validation Checklist**

Records Use only

Los Alamos NATIONAL LABORATORY EST. 1943

| Yes | No | N/A | | Assign Qualifier Listed Below If Criterion = Yes | |
|---|---|---|---|---|---|
| (Check One) | | | | Non-detected Analyte | Detected Analyte |
| ☐ | ☒ | ☐ | 1. The holding time was >1 and ≤2 times the applicable holding time requirement. | UJ, R9 | J-, R9 |
| ☐ | ☒ | ☐ | 2. The holding time was >2 times the applicable holding time requirement. | R, R9a | J-, R9a |
| ☒ | ☐ | ☐ | 3. The results for the affected analytes are considered not detected (U) because the associated sample concentration was less than or equal to the MDC. | U, R5 | N/A |
| ☐ | ☐ | ☒ | 4. The analyte should be regarded as rejected because spectral interferences prevent positive identification of the analytes. | R, R5a | R, R5a |
| ☐ | ☒ | ☐ | 5. The MDC and/or TPU documentation is missing. Data may not be acceptable for use. Contact the SMO or external laboratory for information. | R, R5b | J-, R5b |
| ☒ | ☐ | ☐ | 6. The results for the affected analytes should be regarded as not detected (U) because the associated sample concentration was less than 3X the 1 sigma TPU. | U, R11 | N/A |
| ☒ | ☐ | ☐ | 7. The sample result is ≤5X the concentration of the related analyte in the method blank. | U, R4 | N/A |
| ☐ | ☒ | ☐ | 8. The affected analytes are considered estimated and biased high because this analyte was identified in the method blank but was >5X. | N/A | J, R4a |
| ☐ | ☐ | ☒ | 9. The sample result is ≤5X the concentration of the related analyte in the trip blank, rinsate blank, or equipment blank. | U, R4d | N/A |
| ☐ | ☒ | ☐ | 10. Required method blank information is missing. Data may not be acceptable for use. Contact the SMO or external laboratory for information. | R, R4e | R, R4e |
| ☐ | ☒ | ☐ | 11. The tracer is <10%R. Follow the external laboratory limits located within the associated data package. Tracer%R is not applicable for Gamma Spectroscopy. | R, R3 | R, R3 |

# RAD ANALYTICAL DATA VALIDATION CHECKLIST

| 5119-2<br>Rad Analytical Data Validation Checklist | Records Use only<br>Los Alamos NATIONAL LABORATORY EST. 1947 |
|---|---|

| Yes | No | N/A | | Assign Qualifier Listed Below If Criterion = Yes | |
|---|---|---|---|---|---|
| (Check One) | | | | Non-detected Analyte | Detected Analyte |
| ☐ | ☒ | ☐ | 12. The tracer is < the Lower Acceptance Level (LAL) but ≥10%R. Follow the external laboratory limits located within the associated data package. Tracer%R is not applicable for Gamma Spectroscopy. | UJ, R3a | J-, R3a |
| ☐ | ☒ | ☐ | 13. The Tracer%R value is > the Upper Acceptance Limit (UAL). Follow the external laboratory limits located within the associated data package. Tracer%R is not applicable for Gamma Spectroscopy. | N/A | J+, R3b |
| ☐ | ☒ | ☐ | 14. Required tracer information is missing. Data may not be acceptable for use. Contact the SMO or external laboratory for information. Tracer%R is not applicable for Gamma Spectroscopy. | R, R3d | R, R3d |
| ☐ | ☒ | ☐ | 15. The LCS percent recovery was <10%. Follow the external laboratory limits located within the associated data package. | R, R12 | R, R12 |
| ☐ | ☒ | ☐ | 16. The LCS percent recovery was < the LAL but >10%. Follow the external laboratory limits located within the associated data package. | UJ, R12a | J-, R12a |
| ☐ | ☒ | ☐ | 17. The LCS percent recovery was > the UAL. Follow the external laboratory limits located within the associated data package. | N/A | J+, R12b |
| ☐ | ☒ | ☐ | 18. The LCS documentation is missing. Data may not be acceptable for use. Contact the SMO or external laboratory for information. | R, R12c | R, R12c |
| ☐ | ☒ | ☐ | 19. Associated duplicate sample has DER or RER > the analytical laboratory's acceptance limits. | R, R10 | J, J10 |
| ☐ | ☒ | ☐ | 20. The duplicate sample was not prepared and/or analyzed with the samples for unspecified reasons. The duplicate information is missing. Data may not be acceptable for use. Contact the SMO or external laboratory for information. | R, R6 | R, R6 |

| RAD ANALYTICAL DATA VALIDATION CHECKLIST | |
|---|---|
| 5119-2<br>Rad Analytical Data Validation Checklist | Records Use only<br>Los Alamos NATIONAL LABORATORY EST. 1943 |

| Yes | No | N/A | | Assign Qualifier Listed Below If Criterion = Yes | |
|---|---|---|---|---|---|
| (Check One) | | | | Non-detected Analyte | Detected Analyte |
| ☐ | ☐ | ☒ | 21. The associated matrix spike recovery was <10%. Follow the external laboratory limits. MS/MSD is not applicable to Gamma Spectroscopy. | R, R6 | R, R6 |
| ☐ | ☐ | ☒ | 22. The associated matrix spike recovery was <10%. Follow the external laboratory limits. MS/MSD is not applicable to Gamma Spectroscopy. | UJ, R6a | J-, R6a |
| ☐ | ☐ | ☒ | 23. The associated matrix spike recovery was above the UAL. Follow the external laboratory limits. MS/MSD is not applicable to Gamma Spectroscopy. | UJ, R6b | J+, R6b |
| ☐ | ☐ | ☒ | 24. Required matrix spike information is missing. Data may not be acceptable for use. Contact the SMO or external laboratory for information. If LCS information is present, do not Reject. Qualify data based on LCS information. MS/MSD is not applicable to Gamma Spectroscopy. | R, R6c | R, R6c |
| ☐ | ☒ | ☐ | 25. Duplicate, dilution, or reanalysis. | UJ, R88 | J, R88 |
| ☐ | ☒ | ☐ | 26. The LANL project chemist identified quality deficiencies in the reported data that require further qualification. This code can ONLY be used and/or under advisement by the LANL project chemist. | UJ, R, R19 | J, R, R19 |
| ☒ | ☐ | ☐ | 27. Quantification of data via data validation did not occur based on Quality Control requirements in this procedure. Adhere to the external laboratory qualifiers found within the Form I analytical data summary sheets generated by the external laboratory. | U, U_LAB | J, J_LAB<br>NQ, NQ |

# Isotopic Americium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11838
**Lab ID:** 0804083-1

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2A
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.454 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|---|
| 14596-10-2 | Am-241 | -0.005 +/- 0.013 | U,R5 | 0.050 | 0.02 | U,M |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Am-243 | 4.911 | 3.13 | pCi/g | 63.8 | 30 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaulti imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *AM0804083-1*



CLL
7/11/08

17

# Isotopic Americium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2A
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.595 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 14596-10-2 | Am-241 | 0.034 +/- 0.012 U,R11 | 0.011 | 0.02 | |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Am-243 | 3.748 | 2.17 | pCi/g | 57.8 | 30 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaulti imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *AM0804083-1*



CLL
7/11/08

18

# Isotopic Plutonium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11838
**Lab ID:** 0804083-1

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2B
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.454 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13981-16-3 | Pu-238 | 0.021 +/- 0.017 U,R11 | 0.019 | 0.02 | |
| 10-12-8 | Pu-239/240 | 0.028 +/- 0.017 U,R11 | 0.019 | 0.02 | |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Pu-242 | 4.912 | 2.16 | pCi/g | 44.0 | 30 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaultl imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *PU0804083-1*



CLL
7/11/08

18

# Isotopic Plutonium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2B
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.595 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|---|
| 13981-16-3 | Pu-238 | 0 +/- 0.014 | U,R5 | 0.058 | 0.02 | U,M |
| 10-12-8 | Pu-239/240 | 0.024 +/- 0.015 | U,R5 | 0.045 | 0.02 | U,M |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Pu-242 | 3.748 | 1.84 | pCi/g | 49.2 | 30 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaultl imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *PU0804083-1*



CLL
7/11/08

19

# Isotopic Uranium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11838
**Lab ID:** 0804083-1

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2C
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.454 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13966-29-5 | U-234 | 1.01 +/- 0.10 | 0.06 | 0.01 | M3 |
| 15117-96-1 | U-235 | 0.040 +/- 0.019 U,R5 | 0.053 | 0.01 | U,M |
| 7440-61-1 | U-238 | 0.811 +/- 0.089 | 0.070 | 0.01 | M3 |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| U-232 | 4.852 | 3.51 | pCi/g | 72.3 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaultl imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *UR0804083-1*



CLL
7/11/08

18

# Isotopic Uranium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2C
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.595 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|---|
| 13966-29-5 | U-234 | 0.643 +/- 0.071 | | 0.049 | 0.01 | M3 |
| 15117-96-1 | U-235 | 0.016 +/- 0.014 | U,R5 | 0.049 | 0.01 | U,M |
| 7440-61-1 | U-238 | 0.619 +/- 0.068 | | 0.042 | 0.01 | M3 |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| U-232 | 3.703 | 2.83 | pCi/g | 76.3 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaultl imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *UR0804083-1*



CLL
7/11/08

# Polonium-210 by Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11838
**Lab ID:** 0804083-1

**Analysis ReqCode:** ASP-A-019

**Sample Matrix:** SOLID
**Prep SOP:** PAI711 Rev 7
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 15-May-08

**Prep Batch:** PL080513-1
**QCBatchID:** PL080513-1-1
**Run ID:** PL080513-1A
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.227 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13981-52-7 | Po-210 | 343 +/- 25 | 0 | 0.25 | |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Po-209 | 15.89 | 14.0 | pCi/g | 87.9 | 20 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaultl imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *PL0804083-1*



CLL
7/11/08

# Polonium-210 by Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** ASP-A-019

**Sample Matrix:** SOLID
**Prep SOP:** PAI711 Rev 7
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 15-May-08

**Prep Batch:** PL080513-1
**QCBatchID:** PL080513-1-1
**Run ID:** PL080513-1A
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.297 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13981-52-7 | Po-210 | 25.4 +/- 1.9 | 0.1 | 0.25 | |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Po-209 | 12.13 | 11.84 | pCi/g | 97.7 | 20 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaultl imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *PL0804083-1*



CLL
7/11/08

# Strontium-90 Analysis by GFPC

## PAI 724 Rev 10

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11838
**Lab ID:** 0804083-1

**Analysis ReqCode:** GPC-A-012

**Sample Matrix:** SOLID
**Prep SOP:** PAI707 Rev 10
**Date Collected:** 08-Feb-08
**Date Prepared:** 14-May-08
**Date Analyzed:** 10-Jun-08

**Prep Batch:** SR080514-2
**QCBatchID:** SR080514-2-1
**Run ID:** SR080514-2B
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.452 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** SRA0610

| CASNO | Target Nuclide | Result +/- 1 s TPU | | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|---|
| 10098-97-2 | Sr-90 | 0.144 +/- 0.090 | U,R5 | 0.289 | 0.06 | U,M |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| STRONTIUM | 1014 | 913.6 | ug | 90.1 | 40 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaultl imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *SR0804083-1*



CLL
7/11/08

17

# Strontium-90 Analysis by GFPC

## PAI 724 Rev 10

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** GPC-A-012

**Sample Matrix:** SOLID
**Prep SOP:** PAI707 Rev 10
**Date Collected:** 08-Feb-08
**Date Prepared:** 14-May-08
**Date Analyzed:** 09-Jun-08

**Prep Batch:** SR080514-2
**QCBatchID:** SR080514-2-1
**Run ID:** SR080514-2B
**Count Time:** 1000 minutes
**Report Basis:** As Received

**FinalA liquot:** 0.592 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** SRB0609

| CASNO | Target Nuclide | Result +/- 1 s TPU | | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|---|
| 10098-97-2 | Sr-90 | 0.117 +/- 0.060 | U,R5 | 0.192 | 0.06 | U,M |

## ChemicalY ield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| STRONTIUM | 1078 | 987.2 | ug | 91.5 | 40 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

U - Resulti s less than the sample specific MDC.

Y1 - Chemical Yield is in control at10 0-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside defaulti imits.

LT - Resulti s less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was notm et, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAIS OP 743)

MDC - Minimum Detectable Concentration (see PAIS OP 709)

BDL - Below Detection Limit

**Data Package ID:** *SR0804083-1*



CLL
7/11/08

18

0804083



Tuesday, April 08, 2008

**LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 08-939C**

**REQUEST NUMBER: 08-939**

## LOS ALAMOS

**NATIONAL LABORATORY**

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 5/8/2008

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS:

| | SAMPLE ID | CTNR | CTNR DESC | ORDER | PRESERV | MATRIX |
|---|---|---|---|---|---|---|
| 1 | SFB08-08-11838 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |
| 2 | SFB08-08-11839 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |

| Relinquished By: | | Date | Time | Received By: | | Date | Time |
|---|---|---|---|---|---|---|---|
| [illegible] | | 4/8/08 | 1400 | Cheryl Trimble | Cheryl Trimble | 4-9-08 | 0930 |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |

**Received for DISPOSAL By:** **Date** **Time** **Remarks:**

Printed Name Signature

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

**LOS ALAMOS**
**NATIONAL LABORATORY**

ATTN: Lance Steere
Paragon Analytics, Inc.
225 Commerce
Fort Collins, CO 80524

These Samples are on:
LANL Request Number:08-939
Per Agreement Number:1-800-443-1511
Project Cost Code: WEPR13110300

Please analyse the enclosed samples according to the schedule indicated:

**SHIP DATE: 4/8/2008**
**TURNAROUND/REPORT DUE: 5/8/2008**
**TURNAROUND REQ'D: 30 Days**

**RAD SCREENING: Not Required**
**LAB REQUEST COMMENTS:**

LANL ER SMO CONTACT:
Signature:

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:ISOPU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:ISOU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:PO-210 | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:PO-210 | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |

**Final Page of REQUEST NUMBER 08-939**

PARAGON ANALYTICS
A Division of DataChem Laboratories, Inc.

225 Commerce Drive, Fort Collins, Colorado 80524
TF: (800) 443-1511 ◆ PH: (970) 490-1511 ◆ FX: (970) 490-1522
www.paragonlabs.com

June 16, 2008

Ms. Joylene Valdez
Los Alamos National Laboratory SMO
SMO TA-00, Bldg. 1237, Drop Point 03U
Los Alamos, NM 87545

RE: Paragon Workorder: 08-04-083
Client Project Name: None Submitted
Client Project Number: 08-939

Dear Ms. Valdez:

Two solid samples were received from Los Alamos National Laboratory SMO on April 9, 2008. The samples were scheduled for the following analyses:

| | | | |
|---|---|---|---|
| Strontium-90 | pages 1-192 | Isotopic Plutonium | pages 1-77 |
| Isotopic Uranium | pages 1-71 | Isotopic Americium | pages 1-68 |
| Isotopic Polonium | pages 1-69 | | |

The results for these analyses are contained in the enclosed reports.

Thank you for your confidence in Paragon Analytics, Inc. Should you have any questions, please call.

Sincerely,

Paragon Analytics, Inc.
Lance Steere
Senior Project Manager

LRS/jb
Enclosure: Report & CD

# Paragon Analytics

## Sample Number(s) Cross-Reference Table

**Paragon OrderNum:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939
**Client PO Number:** 33204-001-06 F3

| Client Sample Number | Lab Sample Number | COC Number | Matrix | Date Collected | Time Collected |
|---|---|---|---|---|---|
| SFB08-08-11838 | 0804083-1 | | SOLID | 08-Feb-08 | |
| SFB08-08-11839 | 0804083-2 | | SOLID | 08-Feb-08 | |

0804083



Tuesday, April 08, 2008

# LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 08-939C

**REQUEST NUMBER: 08-939**

## LOS ALAMOS

**NATIONAL LABORATORY**

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 5/8/2008

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS:

| | SAMPLE ID | CTNR | CTNR DESC | ORDER | PRESERV | MATRIX |
|---|---|---|---|---|---|---|
| 1 | SFB08-08-11838 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |
| 2 | SFB08-08-11839 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |

| Relinquished By: | | Date | Time | Received By: | | Date | Time |
|---|---|---|---|---|---|---|---|
| [illegible] | | 4/8/08 | 1400 | Cheryl Trimble | Cheryl Trimble | 4-9-08 | 0930 |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |

**Received for DISPOSAL By:** **Date** **Time** **Remarks:**

Printed Name Signature

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

# LOS ALAMOS
## NATIONAL LABORATORY

ATTN: Lance Steere
Paragon Analytics, Inc.
225 Commerce
Fort Collins, CO 80524

These Samples are on:
LANL Request Number:08-939
Per Agreement Number:1-800-443-1511
Project Cost Code: WEPR13110300

Please analyse the enclosed samples according to the schedule indicated:

**SHIP DATE: 4/8/2008**
**TURNAROUND/REPORT DUE: 5/8/2008**
**TURNAROUND REQ'D: 30 Days**

**RAD SCREENING: Not Required**
**LAB REQUEST COMMENTS:**

LANL ER SMO CONTACT:
Signature:

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:ISOPU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:ISOU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:PO-210 | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:PO-210 | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |

**Final Page of REQUEST NUMBER 08-939**

CONDITION OF SAMPLE UPON RECEIPT FORM

***Paragon Analytics***

Client: LANL

Workorder No: 0804083

Project Manager: LS

Initials: CT

Date: 4-9-08

| | | | |
|---|---|---|---|
| 1. Does this project require any **special handling** in addition to standard Paragon procedures? | | YES | (NO) |
| 2. Are custody **seals** on **shipping containers** intact? | NONE | (YES) | NO |
| 3. Are Custody seals on **sample containers** intact? | **NONE** | (YES) | NO |
| 4. Is there a **COC (Chain-of-Custody) present** or other representative documents? | | (YES) | NO |
| 5. Are the **COC and bottle labels complete and legible**? | | (YES) | NO |
| 6. Is the **COC in agreement** with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.) | | (YES) | NO |
| 7. Were **airbills / shipping documents** present and/or removable? | DROP OFF | (YES) | NO |
| 8. Are all aqueous **samples requiring preservation preserved correctly**? (excluding volatiles) | (N/A) | **YES** | NO |
| 9. Are all aqueous **non-preserved samples pH 4-9**? | (N/A) | **YES** | NO |
| 10. Is there **sufficient sample** for the requested analyses? | | (YES) | NO |
| 11. Were all samples placed in the **proper containers** for the requested analyses? | | (YES) | NO |
| 12. Are all samples within **holding times** for the requested analyses? | | (YES) | NO |
| 13. Were all sample containers received **intact**? (not broken or leaking, etc.) | | (YES) | NO |
| 14. Are all samples requiring no headspace (VOC, GRO, Rx, CN/S, radon) headspace free? | | | |

ORIGIN ID: SAFA (505) 665-9968
JOYLENE VALDEZ
LOS ALAMOS NATL LAB.
TA00 BLDG 1237 DPU 03

LOS ALAMOS, NM 87545
UNITED STATES US

Ship Date: 08APR08
ActWgt: 31.0 LB MAN
System#: 0014176/CAFE2355
Account: S *********

0804083

LANCE STEERE
PARAGON
225 COMMERCE

FORT COLLINS, CO 80524

f: 6b010amr1a01401hcc

16

2

(800) 443-1511
FedEx
Express

E

505187/22/23

# Paragon Analytics

## Radiochemistry Case Narrative
## Strontium-90

---

## Los Alamos National Laboratory SMO

08-939

Paragon WO 0804083

1. This report consists of the analytical results and supporting documentation for two solid samples received by Paragon on 04/09/08.
2. These samples were prepared according to procedure SOP707R10, with procedure modifications outlined in QASS 328377 and 323388.
3. These samples were analyzed for the presence of Strontium-90 according to procedure SOP724R10. The analyses were completed on 06/10/08.
4. Total radio-strontium is reported as Strontium-90. The presence of other radioisotopes of strontium may cause positive bias in the measured strontium concentration.
5. The analysis results for these samples are reported on an 'as received' basis in units of pCi/gram.
6. Sample volume was insufficient to allow preparation of a duplicate. A laboratory control sample duplicate (LCSD) was prepared in lieu of a client sample duplicate. Please refer to QASS 328377.
7. The requested MDC of 0.06 pCi/gram was not met for samples 0804083-1 and -2. These samples were counted for a maximum count time of 1000 minutes and results are reported without further qualification. These samples are identified with an "M" qualifier on the final reports.
8. The associated method blank has activity greater than the requested MDC OF 0.06 pCi/gram at 0.294 pCi/gram. A re-analysis of the batch confirmed comparable activity. In addition, the associated method blank was also prepared at a reduced aliquot to facilitate accurate comparison with the samples. Consequently, the requested MDC of 0.06 pCi/gram was not achieved following a maximum count time of 1000 minutes. This sample has been flagged with an "M" and "B" qualifier on the final reports. Please refer to NCR #10679 in section 6 of this report.
9. No further problems were encountered during the preparation and analysis of these samples. All remaining quality control criteria were met.

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

Linda Arend — 06/13/08
Linda Arend
Radiochemistry Primary Reviewer
Date

Radiochemistry Final Reviewer — FOR JASON HANER — 6/13/08
Date

Paragon Analytics

*A Division of DataChem Laboratories, Inc.*

1

PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

# CHAIN OF CUSTODY

# Paragon Analytics

## Sample Number(s) Cross-Reference Table

**Paragon OrderNum:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939
**Client PO Number:** 33204-001-06 F3

| Client Sample Number | Lab Sample Number | COC Number | Matrix | Date Collected | Time Collected |
|---|---|---|---|---|---|
| SFB08-08-11838 | 0804083-1 | | SOLID | 08-Feb-08 | |
| SFB08-08-11839 | 0804083-2 | | SOLID | 08-Feb-08 | |

0804083



Tuesday, April 08, 2008

**LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 08-939C**

**REQUEST NUMBER: 08-939**

## LOS ALAMOS
**NATIONAL LABORATORY**

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 5/8/2008

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS:

| | SAMPLE ID | CTNR | CTNR DESC | ORDER | PRESERV | MATRIX |
|---|---|---|---|---|---|---|
| 1 | SFB08-08-11838 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |
| 2 | SFB08-08-11839 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |

| Relinquished By: | | Date | Time | Received By: | | Date | Time |
|---|---|---|---|---|---|---|---|
| [illegible] | | 4/8/08 | 1400 | Cheryl Trimble | Cheryl Trimble | 4-9-08 | 0930 |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |

**Received for DISPOSAL By:** **Date** **Time** **Remarks:**

Printed Name Signature

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

**LOS ALAMOS**
**NATIONAL LABORATORY**

ATTN: Lance Steere
Paragon Analytics, Inc.
225 Commerce
Fort Collins, CO 80524

These Samples are on:
LANL Request Number:08-939
Per Agreement Number:1-800-443-1511
Project Cost Code: WEPR13110300

Please analyse the enclosed samples according to the schedule indicated:

**SHIP DATE: 4/8/2008**
**TURNAROUND/REPORT DUE: 5/8/2008**
**TURNAROUND REQ'D: 30 Days**

**RAD SCREENING: Not Required**
**LAB REQUEST COMMENTS:**

LANL ER SMO CONTACT:
Signature:

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:ISOPU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:ISOU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:PO-210 | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |

5

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:PO-210 | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |

**Final Page of REQUEST NUMBER 08-939**

CONDITION OF SAMPLE UPON RECEIPT FORM **Paragon Analytics**

Client: LANL Workorder No: 0804083

Project Manager: LS Initials: CT Date: 4-9-08

| | | | | |
|---|---|---|---|---|
| 1. Does this project require any **special handling** in addition to standard Paragon procedures? | | | YES | (NO) |
| 2. Are custody **seals** on **shipping containers** intact? | NONE | | (YES) | NO |
| 3. Are Custody seals on **sample containers** intact? | **NONE** | | (YES) | NO |
| 4. Is there a **COC (Chain-of-Custody) present** or other representative documents? | | | (YES) | NO |
| 5. Are the **COC and bottle labels complete and legible**? | | | (YES) | NO |
| 6. Is the **COC in agreement** with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.) | | | (YES) | NO |
| 7. Were **airbills / shipping documents** present and/or removable? | DROP OFF | | (YES) | NO |
| 8. Are all aqueous **samples requiring preservation preserved correctly**? (excluding volatiles) | (N/A) | | YES | NO |
| 9. Are all aqueous **non-preserved samples pH 4-9**? | (N/A) | | YES | NO |
| 10. Is there **sufficient sample** for the requested analyses? | | | (YES) | NO |
| 11. Were all samples placed in the **proper containers** for the requested analyses? | | | (YES) | NO |
| 12. Are all samples within **holding times** for the requested analyses? | | | (YES) | NO |
| 13. Were all sample containers received **intact**? (not broken or leaking, etc.) | | | (YES) | NO |
| 14. Are all samples requiring no headspace (VOC, GRO, Rx CN/S, radon), headspace free? **Size of bubble**: ____ < green pea ____ > green pea | (N/A) | | YES | NO |
| 15. 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.) | (N/A) | | YES | NO |
| 16. Were the samples **shipped on ice**? | | | (YES) | NO |
| 17. Were cooler temperatures measured at 0.1-6.0°C? **IR gun used*:** #2 (#4) | RAD ONLY | | (YES) | NO |
| Cooler #: 1 | | | | |

ORIGIN ID: SAFA (505) 665-9966
JOYLENE VALDEZ
LOS ALAMOS NATL LAB
TA00 BLDG 1237 DPU 03

LOS ALAMOS, NM 87545
UNITED STATES US

Ship Date: 08APR08
ActWgt: 31.0 LB MAN
System#: 0014176/CAFE2355
Account: S *********

0804083

LANCE STEERE
PARAGON
225 COMMERCE

16

(800) 443-1511
FedEx
Express

FORT COLLINS, CO 80524

2

f: 6b010amr1a01401hco

CLS8501 07/22/23

6

Delivery Address
Barcode

BILL SENDER

PRIORITY OVERNIGHT

WED
Deliver By:
09APR08

:# 7209 7844 0486 Form 0201

DEN AA

0524 -CO-US XH FTCA

2

PARAGON ANALYTICS
Radiochemistry Data Package

Section 2

# SAMPLE RESULTS SUMMARY

# Strontium-90 Analysis by GFPC Sample Results Summary

**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Page:** 1 of 1
**Reported on:** Thursday, June 12, 2008 4:19:41 PM

| Lab Sample ID | Client Sample ID | Sample Type | Nuclide | Result +/- 1 s TPU | MDC | Units | Matrix | Prep Batch | Date Analyzed | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SFB08-08-11838 | Sample | Sr-90 | 0.144 +/- 0.090 | 0.289 | pCi/g | SOLID | SR080514-2 | 6/10/2008 | U,M |
| 0804083-2 | SFB08-08-11839 | Sample | Sr-90 | 0.117 +/- 0.060 | 0.192 | pCi/g | SOLID | SR080514-2 | 6/9/2008 | U,M |

**Comments:**

**Data Package ID:** *SR0804083-1*

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
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)

BDL - Below Detection Limit

3

PARAGON ANALYTICS
Radiochemistry Data Package

Section 3

# QC RESULTS SUMMARY

# Strontium-90 Analysis by GFPC

## PAI 724 Rev 10

## Method Blank Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** SR080514-2MB

**Sample Matrix:** SOLID
**Prep SOP:** PAI 707 Rev 10
**Date Collected:** 14-May-08
**Date Prepared:** 14-May-08
**Date Analyzed:** 10-Jun-08

**Prep Batch:** SR080514-2
**QCBatchID:** SR080514-2-1
**Run ID:** SR080514-2B
**Count Time:** 1000 minutes

**Final Aliquot:** 0.522 g
**Result Units:** pCi/g
**File Name:** SRA0610

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 10098-97-2 | Sr-90 | 0.294 +/- 0.079 | 0.230 | 0.06 | B,M |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| STRONTIUM | 1033 | 969.8 | ug | 93.9 | 40 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Data Package ID:** *SR0804083-1*

# Strontium-90 Analysis by GFPC

## PAI 724 Rev 10

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** SR080514-2LCS

**Sample Matrix:** SOLID
**Prep SOP:** PAI 707 Rev 10
**Date Collected:** 14-May-08
**Date Prepared:** 14-May-08
**Date Analyzed:** 27-May-08

**Prep Batch:** SR080514-2
**QCBatchID:** SR080514-2-1
**Run ID:** SR080514-2B
**Count Time:** 60 minutes

**Final Aliquot:** 0.522 g
**Result Units:** pCi/g
**File Name:** SRB0527

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 10098-97-2 | Sr-90 | 20.7 +/- 2.5 | 0.9 | 21.0 | 98.4 | 75 - 125 | P,M3 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| STRONTIUM | 1025 | 958.5 | ug | 93.5 | 40 - 110 % | |

### Comments:

**Qualifiers/Flags:**

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

Abbreviations:

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

**Data Package ID:** *SR0804083-1*

# Strontium-90 Analysis by GFPC

## PAI 724 Rev 10

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** SR080514-2LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 707 Rev 10
**Date Collected:** 14-May-08
**Date Prepared:** 14-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** SR080514-2
**QCBatchID:** SR080514-2-1
**Run ID:** SR080514-2B
**Count Time:** 60 minutes

**Final Aliquot:** 0.522 g
**Result Units:** pCi/g
**File Name:** SRB0529

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 10098-97-2 | Sr-90 | 19.6 +/- 2.4 | 0.9 | 21.0 | 93.5 | 75 - 125 | P,M3 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| STRONTIUM | 1035 | 962.5 | ug | 93.0 | 40 - 110 % | |

### Comments:

**Qualifiers/Flags:**

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

Abbreviations:

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

**Data Package ID:** *SR0804083-1*

# Strontium-90 Analysis by GFPC

## PAI 724 Rev 10

## Duplicate Sample Results (DER)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:**
**Lab ID:** SR080514-2LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 707 Rev 10
**Date Collected:** 14-May-08
**Date Prepared:** 14-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** SR080514-2
**QCBatchID:** SR080514-2-1
**Run ID:** SR080514-2B
**Count Time:** 60 minutes

**Final Aliquot:** 0.522 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** SRB0529

| CASNO | Analyte | Sample Result +/- 1s TPU | Duplicate Result +/- 1s TPU | DER | Control Limit | Lab Qualifiers |
|---|---|---|---|---|---|---|
| 10098-97-2 | Sr-90 | 20.7 +/- 2.5 | 19.6 +/- 2.4 | 0.15 | 2.13 | P,M3 |

### Comments:

**Duplicate Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13
LT - Result is less than Request MDC, greater than sample specific MDC
M - Requested MDC not met.
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
L - LCS Recovery below lower control limit.
H - LCS Recovery above upper control limit.
P - LCS, Matrix Spike Recovery within control limits.
N - Matrix Spike Recovery outside control limits

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
DER - Duplicate Error Ratio (see PAI SOP 715)
BDL - Below Detection Limit
NR - Not Reported

**Data Package ID:** *SR0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

4

Section 4

# INDIVIDUAL SAMPLE RESULTS

# Strontium-90 Analysis by GFPC

## PAI 724 Rev 10

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11838
**Lab ID:** 0804083-1

**Analysis ReqCode:** GPC-A-012

**Sample Matrix:** SOLID
**Prep SOP:** PAI 707 Rev 10
**Date Collected:** 08-Feb-08
**Date Prepared:** 14-May-08
**Date Analyzed:** 10-Jun-08

**Prep Batch:** SR080514-2
**QCBatchID:** SR080514-2-1
**Run ID:** SR080514-2B
**Count Time:** 1000 minutes
**Report Basis:** As Received

**Final Aliquot:** 0.452 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** SRA0610

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 10098-97-2 | Sr-90 | 0.144 +/- 0.090 | 0.289 | 0.06 | U,M |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| STRONTIUM | 1014 | 913.6 | ug | 90.1 | 40 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

**Data Package ID:** *SR0804083-1*

# Strontium-90 Analysis by GFPC

## PAI 724 Rev 10

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** GPC-A-012

**Sample Matrix:** SOLID
**Prep SOP:** PAI 707 Rev 10
**Date Collected:** 08-Feb-08
**Date Prepared:** 14-May-08
**Date Analyzed:** 09-Jun-08

**Prep Batch:** SR080514-2
**QCBatchID:** SR080514-2-1
**Run ID:** SR080514-2B
**Count Time:** 1000 minutes
**Report Basis:** As Received

**Final Aliquot:** 0.592 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** SRB0609

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 10098-97-2 | Sr-90 | 0.117 +/- 0.060 | 0.192 | 0.06 | U,M |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| STRONTIUM | 1078 | 987.2 | ug | 91.5 | 40 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

**Data Package ID:** *SR0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

5

Section 5

# RAW DATA

# Strontium-90 Analysis by GFPC Raw Data Report

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Prep SOP:** PAI 707
**Analytical SOP:** PAI 724

**Reported on:** Wednesday, June 11, 2008
9:56:12 AM

| Sample ID<br>QC Type | Nuclide<br>Type | Sample<br>Date/Time | Prep Batch<br>QCBatchID | Ingrowth Date<br>/Time | Decay<br>Date/Time | Matrix<br>%Moist. | Samp Alq<br>Analy Alq | Inst ID<br>Det ID | AnRunID<br>File Name | Count<br>Date/Time | GrossCPM<br>BkgCPM | BaseEff<br>ProgEff | CntDur(min)<br>Yield | Activity +/-<br>1 s TPU | MDC<br>DecLev | ReportUnits<br>ReportBasis | DER<br>RPD | %Spk. Recov<br>Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | Sr-90 | 2/8/2008 | SR080514-2 | 5/20/2008 | NA | SOLID | 0.458 g | LB4100-A | SR080514-2B | 6/10/2008 | 2.106 | 40.75% | 1000 | 0.144 | 0.289 | pCi/g | NA | |
| SMP | Trg. Analyte | | SR080514-2-1 | 9:00:00 AM | NA | NA | 0.452 g | A1 | SRA0610 | 4:14 PM | 2.001 | NA | 90.1% | 0.090 | NA | As Received | NA | U,M |
| 0804083-2 | Sr-90 | 2/8/2008 | SR080514-2 | 5/20/2008 | NA | SOLID | 0.601 g | LB4100-B | SR080514-2B | 6/9/2008 | 1.902 | 43.63% | 1000 | 0.117 | 0.192 | pCi/g | NA | |
| SMP | Trg. Analyte | | SR080514-2-1 | 9:00:00 AM | NA | NA | 0.592 g | D2 | SRB0609 | 3:12 PM | 1.781 | NA | 91.5% | 0.060 | NA | As Received | NA | U,M |
| SR080514-2 | Sr-90 | 5/14/2008 | SR080514-2 | 5/20/2008 | NA | SOLID | 0.53 g | LB4100-A | SR080514-2B | 6/10/2008 | 2.105 | 40.60% | 1000 | 0.294 | 0.230 | pCi/g | NA | |
| MB | Trg. Analyte | 8:16:07 AM | SR080514-2-1 | 9:00:00 AM | NA | NA | 0.522 g | A2 | SRA0610 | 4:14 PM | 1.846 | NA | 93.9% | 0.079 | NA | As Received | NA | B,M |
| SR080514-2 | Sr-90 | 5/14/2008 | SR080514-2 | 5/20/2008 | NA | SOLID | 0.53 g | LB4100-B | SR080514-2B | 5/27/2008 | 19.883 | 44.38% | 60 | 20.7 | 0.9 | pCi/g | NA | 98.4 |
| LCS | Trg. Analyte | 8:16:07 AM | SR080514-2-1 | 9:00:00 AM | NA | NA | 0.522 g | B4 | SRB0527 | 12:13 PM | 1.587 | NA | 93.5% | 2.5 | NA | As Received | NA | P,M3 |
| SR080514-2 | Sr-90 | 5/14/2008 | SR080514-2 | 5/20/2008 | NA | SOLID | 0.53 g | LB4100-B | SR080514-2B | 5/29/2008 | 19.450 | 44.38% | 60 | 19.6 | 0.9 | pCi/g | 0.15 | 93.5 |
| LCSD | Trg. Analyte | 8:16:07 AM | SR080514-2-1 | 9:00:00 AM | NA | NA | 0.522 g | B4 | SRB0529 | 10:15 AM | 1.587 | NA | 93.0% | 2.4 | NA | As Received | NA | P,M3 |

**Comments:**

## Data Package ID: *SR0804083-1*

### 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

+ - Duplicate RPD not within limits.

LT - Result is less than Request MDC, greater than sample specific MDC

* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.

\# - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

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

NC - Not Calculated for duplicate results less than 5 times MDC

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

### Notes:

1) The Tracer results are not yield corrected (i.e. activity measured not activity added).

2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

### Abbreviations:

TR- Tracer TA - Target Analyte

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

# PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
Counting Unit ID: Orange
High Voltage Mode: Simultaneous
Application Version: C
Application Version: PA
Rev.12/29/03 JE

Data file name: SRA0510
Batch ID: SR080514-2
Count Preset (m): 1000
Batch Ended: 6/11/08 8:54

Background logfile: BKGAB
Date of Bkg. Cal: 6/7/08
Alpha efficiency logfile: Am241-09/07
Alpha attenuation calibration: Am0907
Beta efficiency logfile: Sr90F-09/07
Beta attenuation calibration: Sr0907

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration y = b*m^(a^(mass-x0)) | | Beta Attenuation Calibration y = b*m^(a^(mass-x0)) | |
|---|---|---|---|
| Alpha b= | 1.30129 | Beta b= | 1.0792 |
| m= | 0.99290 | m= | 0.9995 |
| a= | 1.0000 | a= | 1.0000 |
| x0= | 0.0000 | x0= | 0.0000 |
| **Alpha to Beta X-talk y = b*m^-x** | | **Beta to Alpha X-talk y = b*mass + m** | |
| a ->b xtalk b= | 0.1671 | b ->a xtalk b= | -2.000E-05 |
| a ->b xtalk m= | 0.9983 | b ->a xtalk m= | 0.0021 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Bkg. CPM | Alpha b>a xtlk CPM | Alpha Base Eff | Alpha Base Cor.Fact. | Alpha Progeny Eff | Alpha Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Bkg. CPM | Beta a>b xtlk CPM | Beta Base Eff | Beta Base Cor.Fact. | Beta Progeny Eff | Beta Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0804083-1 | 6/11/08 8:54 | 1000.00 | 0.0 | 0.175 | 0.051 | 0.000 | 0.2171 | 1.101 | n/a | n/a | 2.108 | 2.001 | 0.0232 | 0.4075 | 1.079 | n/a | n/a |
| A2 | SR080514-2MB | 6/11/08 8:54 | 1000.00 | 0.0 | 0.239 | 0.064 | 0.001 | 0.2414 | 1.101 | n/a | n/a | 2.105 | 1.946 | 0.0327 | 0.4060 | 1.079 | n/a | n/a |

JA
6/11/08

Date 6/10/08

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100A**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | JH | P | | | JH | P | | | P |
| 2 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 3 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 4 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 5 | OL | OL | | | OL | OL | | | OL |
| 6 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 7 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 8 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 9 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 10 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 11 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 12 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 13 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 14 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 15 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 16 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKA0606W | | | |
| Dr B | OL | | | |
| Dr C | ↓ | | | |
| Dr D | ↓ | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 450 | Dr A | 0.15 |
| | ↓ | Dr B | ↓ |
| Tank 2 | 1160 | Dr C | OL |
| | ↓ | Dr D | ↓ |

Comments:

Page No.: 364469 A

Form 780r8.doc (6/23/06)

Reviewed By / Date 6/11/08

Date 6/6/08

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100A**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-4 | Daily Eff | — | — | 30 | 814 | JH | EFA0610 | JH |
| 1-4 | Daily BKG | — | — | 60 | 826 | JH | BKA0610 | JH |
| 1 | 08060051-6 | AB080606-2 | LB | 10 | 935 | JH | ABA0610 | JH |
| 2 | -8 | | | | | | | |
| 3 | -11 | | | | | | | |
| 4 | -13 | | | | | | | |
| 1 | 08060521-15 | AB080606-2 | LB | 10 | 950 | JH | ABA0610A | JH |
| 2 | JH 6/6/08 -17 | | | | | | | |
| 3 | -21 | -3 | | | 950 | | ABA0610B | JH |
| 4 | -23 | | | | | | | |
| 1 | 08051180-1 | RA080529-1 | Ra228 | 250 | 1007 | JH | RAA0610 | JH |
| 2 | -10 | | | | | | | |
| 3 | 08051197-8 | | | | | | | |
| 4 | -9 | | | | | | | |
| 1 | 08051234-33 | AB080605-4 | LB | 90 | 1423 | JH | ABA0610C | JH |
| 2 | -34 | | | | | | | |
| 3 | -35 | | | | | | | |
| 4 | -36 | | | | | | | |
| 1 | 08090083-1 | SR080514-2 | Sr90 | 1000 | 1610 | JH | SRA0610 | JH |
| 2 | SR080514-2MS | | | | | | | |
| 3 | 08051247-12 | AB080606-1 | LB | 1000 | 1611 | JH | ABA0610D | JH |
| 4 | AB080606-1MS | | | | | | | |

JH 6/6/08

Comments:

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision:
Application Version: Standard
Rev.12/25/03 JE

Data file name: SR80527
Batch ID: SR080514-2
Count Preset (m): 60
2 Batch Ended: 5/27/08 13:09

Background logfile: BKGABW
Date of Bkg. Cal: 5/24/08
Alpha efficiency logfile: AmWipe-11/07
Alpha attenuation calibration: AAM1107
Beta efficiency logfile: Sr90F-11/07
Beta attenuation calibration: ASR1107

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration y = b*m^(a*(mass-x0)) | | Beta Attenuation Calibration y = b*m^(a*(mass-x0)) | |
|---|---|---|---|
| Alpha b= | 1.00000 | Beta b= | 1.0968 |
| m= | 0.99330 | m= | 0.9995 |
| a= | 0.0630 | a= | 1.0000 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk y = b *m^-mass | | Beta to Alpha X-talk y = b*mass + m | |
| a ->b xtalk b= | 0.2560 | b ->a xtalk b= | -2.00E-06 |
| a ->b xtalk m= | 0.9550 | b ->a xtalk m= | 0.0011 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Bkg. CPM | b>a xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. | Beta Activity Gross CPM | Bkg. CPM | a>b xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B4 | SR080514-2LCS | 5/27/08 13:09 | 60.00 | 0.0 | 0.433 | 0.059 | 0.020 | 0.2750 | 1.000 | n/a | n/a | 19.883 | 1.587 | 0.0955 | 0.4438 | 1.096 | n/a | n/a |

JH
5/27/08

Date 5/27/08

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | JH | P | | | JH | P | | | P |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | OLSW |
| 5 | | | | | | | | | |
| 6 | | LB | JH | LB | | | | | OLBD |
| 7 | | | | | | | | | |
| 8 | | P | | | | | | | P |
| 9 | | LB | JH | LB | | | | | OLBD |
| 10 | | | | P | | | | | P |

Date 5/27/08

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily Eff | — | — | 30 | 816 | JH | EF30527 | JH |
| 5,7,9-11 | ↓ | — | — | ↓ | 829 | ↓ | EF30527R | JH |
| 1-16 | Daily BKG | — | — | 60 | 840 | JH | BK30527 | JH |
| 1 | 080527BK-1 | A30080523-2 | αβ | 10 | 957 | JH | A30527 | JH |
| 2 | ↓ -6 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 3 | ↓ -14 | | | | | | | |
| 8 | A30080523-2ms | | | | ↓ | | ↓ | ↓ |
| 14 | ↓ -3ms | ↓ -3 | ↓ | ↓ | 958 | ↓ | A30527A | JH |
| 1 | [illegible] | [illegible] | [illegible] | 90 | 1017 | JH | A30527B | JH |

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision:
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB0529
Batch ID: SR080514-2
Count Preset (m): 60
2 Batch Ended: 5/29/08 11:17

Background logfile: BKGABW
Date of Bkg. Cal: 5/24/08
Alpha efficiency logfile: AmWpe-11/07
Alpha attenuation calibration: AAM1107
Beta efficiency logfile: Sr90F-11/07
Beta attenuation calibration: ASR1107

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(a*(mass-x0)) | | y = b*m^(a*(mass-x0)) | |
| Alpha b= | 1.00000 | Beta b= | 1.0000 |
| m= | 0.99330 | m= | 0.9995 |
| a= | 0.8830 | a= | 1.0000 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b *m^-mass | | y = b*mass + m | |
| a -> b xtalk b= | 0.2550 | b -> a xtalk b= | -2.00E-06 |
| a -> b xtalk m= | 0.9890 | b -> a xtalk m= | 0.6011 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity | | | | | | | Beta Activity | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Gross CPM | Bkg. CPM | b>a xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. | Gross CPM | Bkg. CPM | a>b xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. |
| B4 | SR080514-2LCSD | 5/29/08 11:17 | 60.00 | 0.0 | 0.350 | 0.059 | 0.020 | 0.2750 | 1.000 | n/a | n/a | 19.450 | 1.587 | 0.0742 | 0.4438 | 1.096 | n/a | n/a |

JH
5/29/08

Date 5/29/08

SOP 724r 10

# Paragon Analytics

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | JH | P | | | JH | P | | | P |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | αβW |
| 5 | | | | | | | | | |
| 6 | | LB | JH | LB | | | | | αβB |
| 7 | | | | | | | | | |
| 8 | | P | | | | | | | P |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | LB | JH | P | | Hα | JH | P | |
| 14 | | P | | | | P | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | HB | JH | HB | αβB |

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKB0523W + 24W | | | |
| Dr B | | | | |
| Dr C | | | | |
| Dr D | | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 550 | Dr A | 0.15 |
| | | Dr B | |
| Tank 2 | 1100 | Dr C | |
| | | Dr D | |

Comments:

Page No.: 364558 A

Form 780r8.doc (6/23/06)

Reviewed By / Date JH 5/30/08

Date 5/29/08

SOP 724r 1.0

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily Eff | — | — | 30 | 813 | JH | EFB0529 | JH |
| 4,7,13 | ↓ | — | — | ↓ | 821 | ↓ | EFB0529R | JH |
| 1-16 | Daily BKG | — | — | 60 | 835 | JH | BKB0529 | JH |
| 13,16 | ↓ | — | — | ↓ | 944 | JH | BKB0529R | JH |
| 2 | 0805186-5 | AB080523-2 | LB | 10 | 945 | JH | ABB0529 | JH |
| 3 | ↓ -23 | AB080523-3 | ↓ | ↓ | 946 | ↓ | ABB0529A | JH |
| 8 | ↓ -24 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 14 | AB080527-3ALCS | AB080527-3 | LB | 30 | 948 | JH | ABB0529B | JH |
| 15 | ↓ -3ALCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | AB080527-3MB | AB080527-3 | LB | 90 | 1008 | JH | ABB0529C | JH |
| 2 | ↓ -2MB | ↓ -2 | ↓ | ↓ | 1009 | ↓ | ABB0529D | ↓ |
| 3 | ↓ -4MB | ↓ -4 | ↓ | ↓ | 1010 | ↓ | ABB0529E | ↓ |
| 8 | SR080514-2LCS0 | SR080514-2 | SR90 | 60 | 1017 | JH | SRB0529 | JH |
| 14 | AB080527-2ALCS | AB080527-2 | LB | 30 | 1057 | JH | ABB0529F | JH |
| 15 | ↓ -2ALCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 14 | AB080527-4ALCS | AB080527-4 | LB | 30 | 1142 | JH | ABB0529G | JH |
| 15 | ↓ -4ALCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 0804900-6 | AB080512-6 | LB | 60 | 1148 | JH | ABB0529H | JH |
| 2 | ↓ -6 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 3 | ↓ -7 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 8 | ↓ -7MS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 14 | AB080527-1ALCS | AB080527-1 | LB | 30 | 1259 | JH | ABB0529I | JH |
| 15 | ↓ -1ALCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 0805115-16 | RA080521-1 | RA228 | 250 | 1306 | JH | RAB0529 | JH |
| 2 | RA080521-1MB | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 3 | ↓ -1LCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 8 | 0804900-8 | AB080512-6 | LB | 60 | 1436 | JH | ABB0529J | JH |
| 13 | ↓ -9 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 14 | ↓ -9D | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 15 | ↓ -10 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 8 | 0805142-1 | AB080522-1 | LB | 1000 | 1544 | JH | ABB0529K | JH |
| 13 | ↓ -10 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 14 | ↓ -2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 15 | ↓ -3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | SR080424-1CMB | SR080424-1 | SR90 | 120 | 1724 | JH | SRB0529A | JH |
| 2 | 0816017-4 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 3 | ↓ -2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |

JH 5/30/08

Comments:

Page No.: 364558 B

(cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By / Date: JH 5/30/08

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision: 2
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB0609
Batch ID: SR080514-2
Count Preset (m): 1000
Batch Ended: 6/10/08 8:00

Background logfile: BKGABW
Date of Bkg. Cal: 6/7/08
Alpha efficiency logfile: Am241-11/07
Alpha attenuation calibration: AAM1107
Beta efficiency logfile: Sr90P-11/07
Beta attenuation calibration: ABR1107

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^[a*(mass-x0)] | | y= b*m^[a*(mass-x0)] | |
| Alpha b= | 1.00000 | Beta b= | 1.0960 |
| m= | 0.98330 | m= | 0.9695 |
| a= | 0.6830 | a= | 1.0000 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b *m^-mass | | y= b*mass + m | |
| a ->b xtalk b= | 0.2560 | b ->a xtalk b= | -2.80E-06 |
| a ->b xtalk m= | 0.9990 | b ->a xtalk m= | 0.0031 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Bkg. CPM | Alpha b>a xtlk CPM | Alpha Base Eff | Alpha Base Cor.Fact. | Alpha Progeny Eff | Alpha Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Bkg. CPM | Beta a>b xtlk CPM | Beta Base Eff | Beta Base Cor.Fact. | Beta Progeny Eff | Beta Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D1 | 0804083-1 | 6/10/08 8:00 | 1000.00 | 0.0 | 0.259 | 0.113 | 0.000 | 0.2269 | 1.000 | n/a | n/a | 1.852 | 1.583 | 0.0398 | 0.4328 | 1.096 | n/a | n/a |
| D2 | 0804083-2 | 6/10/08 8:00 | 1000.00 | 0.0 | 0.270 | 0.067 | 0.000 | 0.2556 | 1.000 | n/a | n/a | 1.902 | 1.781 | 0.0548 | 0.4363 | 1.096 | n/a | n/a |
| D3 | SR080544-2MB | 6/10/08 8:00 | 1000.00 | 0.0 | 0.304 | 0.055 | 0.000 | 0.2536 | 1.000 | n/a | n/a | 1.912 | 1.734 | 0.0635 | 0.4286 | 1.096 | n/a | n/a |

- Recount due to daily checks not passing SB 6/12/08

JH 6/10/08

Date 6/9/08

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check | | | | Background Check | | Det. |
|---|---|---|---|---|---|---|---|
| | Start 1 | Status | Start 2 | Status | | | |

Date 6/9/08

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 6 | AB080603-3CMB | AB080603-3 | L-LO | 60 | 1403 | JH | AB30609H | JH |
| 8 | 06180004-3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | ↓ -4 | | | | | | | |
| 10 | AB080603-3BMB | | | | | | | |
| 11 | -3FB/MB | | | | | | | |
| 12 | -3FB2MB | | | | | | | |
| 13 | ↓ -3FB3MB | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |

**Paragon Analytics**

# Radiochemistry ICP Worksheet

**Prep Batch: SR080514-2**

Prep Procedure: **SR90**

Reviewed By: DBC DBC

Review Date: **5/20/2008**

## STRONTIUM Recovery Results

### Reference Carrier

| LabID | QC Type | Carr Vol | Ref Carr Dil Vol | Ref Carr ICP Alq | Ref Carr ICP Dil Vol | Ref Carr ICP Run | Ref Carr ICP Conc |
|---|---|---|---|---|---|---|---|
| SR080514-2 | CAR | 0.5 | 50 | 1 | 10 | IR080520-1A1 | 2.014985 |

### Samples

| Prep Num | LabID | QC Type | Init Samp Alq (g) | Car Vol (ml) | Samp Dil Vol (ml) | Init ICP Alq (ml) | Init ICP Dil Vol (ml) | Pre-Con Vol (ml) | Post Con Vol (ml) | Pre-Sep Vol (ml) | Post Sep Vol (ml) | Fin ICP Alq (ml) | Fin ICP Dil Vol (ml) | Initial ICP Run | Final ICP Run | Init ICP Conc (ug/ml) | Fin ICP Conc (ug/ml) | Init Samp Mass (ug) | Ref Mass (ug) | Flag | Fin Samp Mass (ug) | % Yield | Final Sample Alq |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0804083-1 | SMP | 0.4585 | 0.5 | 100 | 1 | 10 | 99 | 99 | 99 | 20 | 0.1 | 10 | IR080520-1A1 | IR080520-1A1 | 1.02431 | 0.456793 | 1014.066 | 997.4177 | | 913.5857 | 90.09% | 0.4516 |
| 1 | 0804083-2 | SMP | 0.6008 | 0.5 | 100 | 1 | 10 | 99 | 99 | 99 | 20 | 0.1 | 10 | IR080520-1A1 | IR080520-1A1 | 1.08923 | 0.493592 | 1078.337 | 997.4177 | | 987.1847 | 91.65% | 0.5918 |
| 1 | SR080514-2 | MB | 0.52965 | 0.5 | 100 | 1 | 10 | 99 | 99 | 99 | 20 | 0.1 | 10 | IR080520-1A1 | IR080520-1A1 | 1.04356 | 0.484898 | 1033.122 | 997.4177 | | 969.7961 | 93.87% | 0.5217 |
| 1 | SR080514-2 | LCS | 0.52965 | 0.5 | 100 | 1 | 10 | 99 | 99 | 99 | 20 | 0.1 | 10 | IR080520-1A1 | IR080520-1A1 | 1.03581 | 0.479232 | 1025.451 | 997.4177 | | 958.4647 | 93.47% | 0.5217 |
| 1 | SR080514-2 | LCSD | 0.52965 | 0.5 | 100 | 1 | 10 | 99 | 99 | 99 | 20 | 0.1 | 10 | IR080520-1A1 | IR080520-1A1 | 1.04589 | 0.481234 | 1035.426 | 997.4177 | | 962.4688 | 92.95% | 0.5217 |



FLAG - LB: low bias (<= 15%) 15%: low bias (>15%)

Z: Negative init. conc. treated as zer

Supersedes: N/A

1R080520-1A1



| ple Id1 | Pb | Ba | Sr | Al | Fe | K | Mg | Na | Ca | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0.4887 | 0.4926 | 0.4961 | 49.7073 | 20.3616 | 19.4703 | 50.6653 | 19.8954 | 50.4436 | 9.9450 |
| | -0.0003 | -0.0001 | -0.0001 | -0.0639 | -0.0041 | 0.0114 | -0.0047 | -0.0273 | -0.0124 | -0.0012 |
| 804083-1 | 0.0155 | 0.0795 | 1.0243 | 9.3019 | 2.8302 | 2.6237 | 2.9258 | 3.8568 | 12.8951 | 0.0005 |
| 804083-1 | -0.0018 | 0.0032 | 0.4568 | -0.0501 | -0.0072 | 0.0266 | -0.0158 | -0.0354 | -0.0056 | -0.0036 |
| 804083-2 | 0.0233 | 0.1336 | 1.0892 | 11.2875 | 3.9981 | 4.0632 | 2.1606 | 4.3250 | 15.0168 | 0.0010 |
| 804083-2 | -0.0029 | 0.0036 | 0.4936 | -0.0451 | -0.0092 | 0.0188 | -0.0153 | -0.0366 | -0.0041 | -0.0035 |
| R080514-2MB | -0.0036 | -0.0001 | 1.0436 | -0.0419 | -0.0194 | 0.0544 | -0.0108 | -0.0336 | 0.0256 | -0.0038 |
| R080514-2MB | -0.0037 | 0.0001 | 0.4849 | -0.0461 | -0.0105 | 0.0319 | -0.0160 | -0.0389 | -0.0034 | -0.0038 |
| R080514-2LCS | -0.0040 | 0.0000 | 1.0358 | -0.0484 | -0.0115 | 0.0283 | -0.0162 | -0.0340 | 0.0263 | -0.0039 |
| R080514-2LCS | -0.0030 | 0.0002 | 0.4792 | -0.0415 | -0.0183 | 0.0193 | -0.0174 | -0.0387 | 0.0139 | -0.0040 |
| R080514-2LCSD | -0.0043 | 0.0000 | 1.0459 | -0.0484 | -0.0102 | 0.0485 | -0.0139 | -0.0350 | 0.0263 | -0.0039 |
| R080514-2LCSD | -0.0026 | 0.0003 | 0.4812 | 0.0273 | -0.0123 | 0.0143 | -0.0094 | -0.0360 | 0.1655 | -0.0040 |
| | 0.4797 | 0.4879 | 0.4871 | 49.4675 | 19.9597 | 19.5381 | 50.0344 | 19.9838 | 49.4341 | 9.7600 |
| | -0.0010 | 0.0000 | 0.0001 | -0.0561 | -0.0051 | 0.0319 | -0.0026 | -0.0256 | -0.0105 | -0.0006 |
| 80514-2RC | -0.0023 | -0.0001 | 2.0150 | -0.0632 | 0.0046 | 0.0566 | -0.0113 | -0.0351 | -0.0098 | -0.0037 |
| | 0.4859 | 0.4890 | 0.4889 | 49.2139 | 20.2867 | 19.3517 | 50.2877 | 19.7769 | 50.2573 | 9.8575 |
| | 0.0000 | 0.0000 | 0.0001 | -0.0571 | -0.0020 | 0.0490 | 0.0007 | -0.0244 | -0.0071 | -0.0002 |

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

# QUALITY ASSURANCE SUMMARY REPORTS

6

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0804083
TEST Am, Pu, U, Sr, Po
METHOD Prep
SOP/REV (PREP) Various
SOP/REV (ANAL) _____

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

The following applies to samples 0804083 –1 and –2: 1C 5/13/08

1. The entire sample of ~0.5g was used for the sequential prep of Am-241, Pu-ISO, U-ISO, Po-210, and Sr-90 analysis. Actual weights are noted on the benchsheets.
2. Due to limited sample volume, an LCS-D was prepped to meet QC requirements.
3. The samples were aliquotted into 220ml polypropylene cups, spiked and traced, and digested per SOP 773/10 sect. 8.3.5 to 8.3.8

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH Generic $^{90}Sr$
TEST $^{90}Sr$
METHOD Prep
SOP/REV (PREP) 707 R9
SOP/REV (ANAL) _____

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

DLB 4/19/07

Due to matrix interference in these samples, the following procedure was performed:

STRONTIUM PROCEDURE MODIFICATION TO REMOVE INTERFERING ALPHA ACTIVITY

The following changes may be utilized at the technician's discretion for samples believed to have elevated actinides, especially Pu.

- Follow SOP 707 R9 through step 8.2.14. (if the matrix is soil) or 8.3.9 (if the matrix is water) and evaporate samples to dryness on the steam bath.

DLB

PARAGON ANALYTICS
225 Commerce Drive ◆ Fort Collins, CO 80524 ◆ (800) 443-1511 ◆ (970) 490-1511 ◆ FAX (970) 490-1522

NCR #: 10679

# CONTROLLED
## NON-CONFORMANCE REPORT

## Non-Conformance

**Initiated By:** Jason J. Haner on 6/2/2008

**Event Type:** Lab QC Criteria Not Met -- MB

**Event Explanation:** The method blank associated with this batch has activity greater than the requested MDC of 0.06 pCi/g at 1.42 pCi/g. A recount of this sample confirmed the presence of activity greater than the MDC (0.262 pCi/g) at a value of 0.39 pCi/L. It is believed that the presence of an unknown, short-lived beta contaminant is present. It is suggested that the entire batch be held for at least 5-7 days from 6/2/08, and then recount the entire batch to confirm non-presence of the beta contaminant in the blank. Results should be reported with a narrated potential high bias if the initial counts are to be reported; Otherwise, reporting of the analysis projected for 6/9/08 is suggested.

**Action To Prevent Reccurence:** under investigation

## Corrective Action

**Corrective Action:** See Corr. Action Comments

**Department Manager Approval:** Mike B. Clemmer

**Approval Date:** 6/5/2008

**Corrective Action Comments:** Recount after the recommended 5-7 day period and advise PM of results.

**Workorders Affected**

| Workorder -- Procedure | | Approved By | Approval Date |
|---|---|---|---|
| [redacted] | No client contact information. | Lance R. Steere | 6/11/2008 |

## Associated Batches

The samples were originally associated with the following Batch(es):

SR080514-2A prepared on 6/2/2008

All rework was completed in the following Batch(es):

SR080514-2B prepared on 6/11/2008

Outcome: Requested detection limits not met for the samples in the batch as well as the method blank. There is still measurable activity in the method blank as well. Please see comments tab for further info.

Outcome Approved By: Mike B. Clemmer

Approved on: 06/11/2008

NCR #: 10679

# PARAGON ANALYTICS

225 Commerce Drive ♦ Fort Collins, CO 80524 ♦ (970) 490-1511 ♦ (970) [illegible]

PARAGON ANALYTICS
Radiochemistry Data Package

Section 7

# LABORATORY BENCH SHEETS

7

# Radiochemistry Instrument Worksheet

**Paragon Analytics**

**Prep Batch: SR080514-2**

**Prep Procedure:** SR90

Analytical QASS / NCR? (Y) N 10679

| Prep Num | LabID | QC Type | Init Alq | Fin Alq | Units | Report Units | Residual Mass (mg) | Cnt 1 File | Cnt 1 Inst/Det | Cnt 1 Pos Chk By | Cnt 2 File | Cnt 2 Inst/Det | Cnt 2 Pos Chk By | Cnt 3 File | Cnt 3 Inst/Det | Cnt 3 Pos Chk By | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0804083-1 | SMP | 0.4585 | 0.4516 | g | pCi/g | | SRA0524 | 1 | JH for LT | SRB0609 | 13• | JH | SRA0610 | 1 | JH | ⊛ Recount to confirm activity JH 6/12/08 |
| 1 | 0804083-2 | SMP | 0.6008 | 0.5918 | g | pCi/g | | ↓ | 2 | ↓ | ↓ | 14 | ↓ | JH 6/12/08 | | | |
| 1 | SR080514-2 | MB | 0.5297 | 0.5217 | g | pCi/g | | ↓ | 3⊛ | ↓ | SRA0602B1 | | JH for LO | SRB0609 | 15•Δ | JH | • Recount due to daily checks not passing. JH 6/12/08 |
| 1 | SR080514-2 | LCS | 0.5297 | 0.5217 | g | pCi/g | | SRB0527 | 8 | JH | | | | | | | |
| 1 | SR080514-2 | LCSD | 0.5297 | 0.5217 | g | pCi/g | | SRB0529 | 8 | JH | JH 6/12/08 | | | JH 6/12/08 | | | |

Δ CT4 File SRA0610 CT4 Ins/Det 2 ✓by JH

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | STRONTIUM | 247960 | 2,004.008 | pCi/ml | NA | 0.5 | ml | AW013 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.82 | 49.433 | DPM/ml | 05/14/08 | 0.5 | ml | AW013 |

## Sample Barcodes

| | |
|---|---|
| 0804083-1<br>SR080514-2PS1 | 0804083-2<br>SR080514-2PS2 |
| SR080514-2MB<br>SR080514-2PS3 | SR080514-2LCS<br>SR080514-2PS4 |
| SR080514-2LCSD<br>SR080514-2PS5 | SR080514-2CAR<br>SR080514-2PS6 |

**Paragon Analytics**

# Radiochemistry Prep Worksheet

**Prep Batch: SR080514-2**

**Prep Procedure:** SR90

**Reviewed By:** DBC DBC **Review Date:** 5/20/2008

Non-Routine Pre-Treatment? Y / N **Batch:** QASB # 328377 **Re-Prep?** Y / N **Batch:** N/A **Prep QASB / NCR?** Y / N 328377, 323388

**Prep SOP:** PAI 707 **Rev:** 10
**Prep SOP:** NONE
**Matrix Class:** solid

**Prep Analyst:** Derek B. Caduff
**Prep Date:** 5/14/2008
**Prep Dept:** RS

**Balance:**
**Balance:**

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Aiq g | Fin Aiq g | Prep Basis | Column # | Ingrowth Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0804083-1 | SMP | | 0.4586 | 0.451645 | As Received | 9873 | 05/20/08 09:00 | T1 | |
| 2 | 1 | 0804083-2 | SMP | | 0.6008 | 0.591818 | As Received | 9874 | 05/20/08 09:00 | T1 | |
| 3 | 1 | SR080514-2 | MB | | 0.52965 | 0.521732 | As Received | 9875 | 05/20/08 09:00 | T1 | |
| 4 | 1 | SR080514-2 | LCS | | 0.52965 | 0.521732 | As Received | 9876 | 05/20/08 09:00 | T1,S1 | |
| 5 | 1 | SR080514-2 | LCSD | | 0.52965 | 0.521732 | As Received | 9877 | 05/20/08 09:00 | T1,S1 | |

DBC 5/14/08

DBC 5/14/08

Comments

DUE TO LIMITED SAMPLE VOLUME A CLIENT DUPLICATE WAS NOT PREPARED. A LCS DUPLICATE WAS PREPARED INSTEAD. Ascorbic Acid treatment applied to all samples.

**Spiked By:** Tambrae Eihart **Date:** 5/13/2008

**Witnessed By:** Jeffrey T. Lee **Date:** 5/13/2008

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | STRONTIUM | 247960 | 2,004.008 | ppm | NA | 0.5 | ppm | AW013 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.82 | 49.433 | DPM/ml | 05/14/08 | 0.5 | ml | AW013 |



**Supersedes:** 5/14/08 8:36 & 5/13/08 8:55

**Paragon Analytics**

# Radiochemistry Prep Worksheet

**Prep Batch: SR080514-2**

**Prep Procedure:** SR90

## Prep Batch Not Validated!!!

**Reviewed By:** **Review Date:**

**Non-Routine Pre-Treatment?** Y / N **Batch:** _____ **Re-Prep?** Y / N **Batch:** _____ **Prep QASS / NCR?** Y / N _____

**Prep SOP:** PAI 707 **Rev:** 10
**Prep SOP:** NONE
**Matrix Class:** solid

**Prep Analyst:** Derek B. Caduff DBC
**Prep Date:** 5/14/2008
**Prep Dept:** RS

**Balance:**
**Balance:**

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Alq g | Fin Alq g | Prep Basis | Column # | Ingrowth Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0804083-1 | SMP | | 0.5 | 0.5 | As Received | 9873 | 5/20/08 9:00 | T1 | 9779 |
| 2 | 1 | 0804083-2 | SMP | | 0.5 | 0.5 | As Received | 9874 | | T1 | 9782 |
| 3 | 1 | SR080514-2 | MB | | 0.5 | 0.5 | As Received | 9875 | | T1 | 9783 |
| 4 | 1 | SR080514-2 | LCS | | 0.5 | 0.5 | As Received | 9876 | | T1,S1 | 9785 |
| 5 | 1 | SR080514-2 | LCSD | | 0.5 | 0.5 | As Received | 9877 | | T1,S1 | 9786 |

Comments
DUE TO LIMITED SAMPLE VOLUME A CLIENT DUPLICATE WAS NOT PREPARED. A LCS DUPLICATE WAS PREPARED INSTEAD.

Spiked By: Tambrae Elhart Date: 5/13/2008

Witnessed By: Jeffrey T. Lee Date: 5/13/2008

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | STRONTIUM | 247960 | 2,004.008 | ppm | NA | 0.5 | ppm | AW013 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.82 | 49.433 | DPM/ml | 05/14/08 | 0.5 | ml | AW013 |

# Radiochemistry Prep Worksheet

**Paragon Analytics**

**Prep Batch: PL080513-1**

**Prep Procedure:** Po210, Am, Pu, U, Sr **Prep Batch Not Validated!!!** **Reviewed By:** **Review Date:**

Non-Routine Pre-Treatment? Y / N Batch: _____ Re-Prep? Y / N Batch: _____ Prep QASS / NCR? Y / N _____

Prep SOP: PAI 711 Rev: 7
Prep SOP: NONE
Matrix Class: solid

Prep Analyst: Tambrae Elhart TE
Prep Date: 5/13/2008
Prep Dept: AP

Balance:
Balance:

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Alq g | Fin Alq g | Prep Basis | Decay Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0804083-1 | SMP | | 0.5 | 0.5 | As Received | | T1,T2,T3,T4 ,T5 | .4585 |
| 2 | 1 | 0804083-2 | SMP | | 0.5 | 0.5 | As Received | | T1,T2,T3,T4 ,↓ | .6008 |
| 3 | 1 | PL080513-1 | MB | | 0.5 | 0.5 | As Received | | T1,T2,T3,T4 ↓ | |
| 4 | 1 | PL080513-1 | LCS | | 0.5 | 0.5 | As Received | | S1,S2,S3,S4,T1,T2,T3,T4 S5,T5 | |
| 5 | 1 | PL080513-1 | LCSD | | 0.5 | 0.5 | As Received | | S1,S2,S3,S4,T1,T2,T3,T4 S5,T5 | |

Comments

Spiked By: TE Date: _____
Witnessed By: JJL Date: 5/13/08

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | Soln ID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | Am-243 | ~~832.3020.76~~ 821 3020.61 TE 5/13/08 | 20.035 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T2 | U-232 | 837.3020.90 | 19.763 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T3 | Pu-242 | 846.3020.88 | 19.997 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T4 | Po-209 | 851.3020.87 | 16.014 | DPM/ml | 05/13/08 | 1 | ml | AW015 |

T5 Sr carrier 247960 .5mL AW013

T1 2/10/09
T2 1/13/09
T3 12/3/08
T4 12/5/08
T5 8/3/08

**Spike Solution Information**

| Soln # | Nuclide | Soln ID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | AM-241 | 616.2382.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-234 | 644.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-235 | 644.3020.52 | 0.948 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-238 | 644.3020.52 | 20.596 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S3 | Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S4 | Pb-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 1 | ml | AW015 |
| **S4** | **Po-210** | **823.3020.41** | **47.234** | **DPM/ml** | **05/13/08** | **1** | **ml** | **AW015** |

S5 Sr-90 600.3020.82 ~57 dpm/mL .5mL AW013

Exp

S1 10/8/08
S2 1/13/09
S3 10/11/08
S4 7/14/08
S5 8/3/08

# SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TC

ANALYSIS DATE: 5/13/08 METHOD: Prep

| WORK ORDER | SAMPLE ID | SAMPLE CONDITION | | |
|---|---|---|---|---|
| | | Dry/Wet | TEXTURE | Remarks |
| 0804083 | 1 | dry | Dust | As Rec'd |
| 〃 | 2 | 〃 | 〃 | 〃 |

TC 5/13/08

PARAGON ANALYTICS

Type: IS

| | | | | |
|---|---|---|---|---|
| 3/3/2007 | Reviewed By | JRK | on | 8/28/2007 |
| | Verified By | DBC | on | 8/3/2007 |
| | Deactivated By | | on | |

| nponent ID | Volume Added | Units |
|---|---|---|
| 56 Y07595 | 4.8406 | g |

| FinalConc | Summed Conc | Units |
|---|---|---|
| 2004.008 | | ppm |

82
PROJECT 600.3020.82 Sr-90 Notebook No. 3020

Continued From Page

Prepare a working standard from intermediate

PROJECT 600.2613.30 Sr-90

Notebook No. 2613

Continued From Page —

Transfer contents of ampoule 600 to a 125 mL glass bottle for a 1° solution.

1) Transfer ampoule 600 to a 125 mL bottle

| | | |
|---|---|---|
| mass of open ampoule + std. | 139.6110 g | |
| mass of empty ampoule | 89.5551 g | |
| Net mass of std. | 50.0559 g | |

Std ID: 600.2613.30
Description: Sr-90
Expiration: 2/27/07
Activity: 22341.71 dpm/mL
2s Uncertainty: 744.72 dpm/mL
Ref. Date: 12/1/01
Ref Time: N/A
Prep Date: 12/1/03
Matrix/Comp.: 0.1 M HCl
Half Life (y): 2.88E+01
Prep by: CRW

CPT Work

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

# CERTIFICATE OF CALIBRATION

PARAGON ANALYTICS
Radiochemistry Data Package

Section 9

# ADDITIONAL SUPPORTING DOCUMENTATION

9

# Gas Proportional Counter

# Instrument Calibration

# Background Calibration

## LB4100-A Weekly Instrument Calibration and Check
## Background Determinations

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.050 | 0.0287 | 0.1147 | PASS | 2.031 | 1.747 | 2.603 | PASS | A1 (01) |
| A2 (02) | 0.056 | 0.0249 | 0.0879 | PASS | 1.916 | 1.750 | 2.108 | PASS | A2 (02) |
| A3 (03) | 0.055 | 0.0309 | 0.0917 | PASS | 2.026 | 1.840 | 2.586 | PASS | A3 (03) |
| A4 (04) | 0.040 | 0.0282 | 0.0596 | PASS | 2.004 | 1.896 | 2.131 | PASS | A4 (04) |
| B1 (05) | #REF! | -0.1229 | 0.3597 | #REF! | #REF! | -54.809 | 122.121 | #REF! | B1 (05) |
| B2 (06) | #REF! | 0.0162 | 0.0891 | #REF! | #REF! | -10.460 | 23.690 | #REF! | B2 (06) |
| B3 (07) | #REF! | 0.0383 | 0.1245 | #REF! | #REF! | 1.794 | 2.441 | #REF! | B3 (07) |
| B4 (08) | #REF! | 0.0299 | 0.1241 | #REF! | #REF! | 1.583 | 1.955 | #REF! | B4 (08) |
| C1 (09) | #REF! | 0.0350 | 0.1166 | #REF! | #REF! | 1.381 | 1.824 | #REF! | C1 (09) |
| C2 (10) | #REF! | 0.0113 | 0.0827 | #REF! | #REF! | 1.593 | 1.997 | #REF! | C2 (10) |
| C3 (11) | #REF! | 0.0177 | 0.1197 | #REF! | #REF! | 1.625 | 1.896 | #REF! | C3 (11) |
| C4 (12) | #REF! | 0.0260 | 0.1276 | #REF! | #REF! | 1.784 | 2.001 | #REF! | C4 (12) |
| D1 (13) | #REF! | 0.0255 | 0.1581 | #REF! | #REF! | 1.648 | 1.991 | #REF! | D1 (13) |
| D2 (14) | #REF! | 0.0134 | 0.1448 | #REF! | #REF! | 1.548 | 1.829 | #REF! | D2 (14) |
| D3 (15) | #REF! | 0.0204 | 0.1022 | #REF! | #REF! | 1.275 | 1.624 | #REF! | D3 (15) |
| D4 (16) | #REF! | 0.0311 | 0.1135 | #REF! | #REF! | 1.407 | 1.940 | #REF! | D4 (16) |

Reviewed by: LO Date: 5/26/08

Control Limits set 03/17/08.
LJO 03/17/08



BKA0523W.XLD

Printed 5/24/08 10:07 AM

## LB4100-B Weekly Instrument Calibration and Check
## Background Determinations

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.043 | 0.03727 | 0.076 | PASS | 1.505 | 1.326 | 1.523 | PASS | A1 (01) |
| A2 (02) | 0.071 | 0.04705 | 0.105 | PASS | 1.444 | 1.218 | 1.585 | PASS | A2 (02) |
| A3 (03) | 0.059 | 0.03370 | 0.082 | PASS | 1.463 | 1.252 | 1.553 | PASS | A3 (03) |
| A4 (04) | 0.054 | 0.03284 | 0.073 | PASS | 1.698 | 1.310 | 1.600 | FLAG-HIGH | A4 (04) |
| B1 (05) | 0.049 | 0.02459 | 0.073 | PASS | 1.690 | 1.388 | 1.622 | FLAG-HIGH | B1 (05) |
| B2 (06) | 0.063 | 0.04129 | 0.106 | PASS | 1.490 | 1.295 | 1.534 | PASS | B2 (06) |
| B3 (07) | 0.050 | 0.04493 | 0.103 | PASS | 1.641 | 1.272 | 1.735 | PASS | B3 (07) |
| B4 (08) | 0.059 | 0.03382 | 0.151 | PASS | 1.587 | 1.390 | 1.672 | PASS | B4 (08) |
| C1 (09) | 0.046 | 0.03258 | 0.100 | PASS | 1.571 | 1.487 | 1.661 | PASS | C1 (09) |
| C2 (10) | 0.053 | 0.02752 | 0.107 | PASS | 1.506 | 1.360 | 1.609 | PASS | C2 (10) |
| C3 (11) | 0.044 | 0.03644 | 0.085 | PASS | 1.551 | 1.413 | 1.743 | PASS | C3 (11) |
| C4 (12) | 0.050 | 0.02405 | 0.112 | PASS | 1.608 | 1.574 | 1.902 | PASS | C4 (12) |
| D1 (13) | 0.062 | 0.04533 | 0.114 | PASS | 1.607 | 1.359 | 1.678 | PASS | D1 (13) |
| D2 (14) | 0.068 | 0.02718 | 0.129 | PASS | 1.717 | 1.422 | 1.786 | PASS | D2 (14) |
| D3 (15) | 0.056 | 0.01718 | 0.103 | PASS | 1.854 | 1.524 | 1.914 | PASS | D3 (15) |
| D4 (16) | 0.044 | 0.00813 | 0.155 | PASS | 4.446 | 1.069 | 4.387 | FLAG-HIGH | D4 (16) |

- See recount File BKB0524W. w 5/26/08

° Detector OL. B. w 5/26/08

Reviewed by: w Date: 5/26/08

Control Limits set 02/8/07
LJO 2/8/07



BKB0523W.XLD

Printed 5/24/08 10:10 AM

trument Calibration and Check
nd Determinations

| | Beta | | | | |
|---|---|---|---|---|---|
| | CPM | LCL | UCL | Flag | Detector ID |
| | #REF! | 1.326 | 1.523 | #REF! | A1 (01) |
| | #REF! | 1.218 | 1.585 | #REF! | A2 (02) |
| | #REF! | 1.252 | 1.553 | #REF! | A3 (03) |
| | 1.606 | 1.310 | 1.600 | FLAG-HIGH | A4 (04) |
| | 1.667 | 1.388 | 1.622 | FLAG-HIGH | B1 (05) |
| | #REF! | 1.295 | 1.534 | #REF! | B2 (06) |
| | #REF! | 1.272 | 1.735 | #REF! | B3 (07) |
| | #REF! | 1.390 | 1.672 | #REF! | B4 (08) |
| | #REF! | 1.487 | 1.661 | #REF! | C1 (09) |
| | #REF! | 1.360 | 1.609 | #REF! | C2 (10) |
| | #REF! | 1.413 | 1.743 | #REF! | C3 (11) |
| | #REF! | 1.574 | 1.902 | #REF! | C4 (12) |
| | #REF! | 1.359 | 1.678 | #REF! | D1 (13) |
| | #REF! | 1.422 | 1.786 | #REF! | D2 (14) |
| | #REF! | 1.524 | 1.914 | #REF! | D3 (15) |
| | #REF! | 1.069 | 4.387 | #REF! | D4 (16) |

For the week. 10 5/26/08

Date: 5/26/08

imits set 02/8/07
O 2/8/07

Printed 5/25/08 10:28 AM

## LB4100-A Weekly Instrument Calibration and Check
## Background Determinations

| Detector ID | Alpha | | | | Beta | | | | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| | CPM | LCL | UCL | Flag | CPM | LCL | UCL | Flag | |
| A1 (01) | 0.051 | 0.0287 | 0.1147 | PASS | 2.001 | 1.747 | 2.603 | PASS | A1 (01) |
| A2 (02) | 0.064 | 0.0249 | 0.0879 | PASS | 1.846 | 1.750 | 2.108 | PASS | A2 (02) |
| A3 (03) | 0.047 | 0.0309 | 0.0917 | PASS | 1.973 | 1.840 | 2.586 | PASS | A3 (03) |
| A4 (04) | 0.037 | 0.0282 | 0.0596 | PASS | 2.037 | 1.896 | 2.131 | PASS | A4 (04) |
| B1 (05) | #REF! | -0.1229 | 0.3597 | #REF! | #REF! | -54.809 | 122.121 | #REF! | B1 (05) |
| B2 (06) | #REF! | 0.0162 | 0.0891 | #REF! | #REF! | -10.460 | 23.690 | #REF! | B2 (06) |
| B3 (07) | #REF! | 0.0383 | 0.1245 | #REF! | #REF! | 1.794 | 2.441 | #REF! | B3 (07) |
| B4 (08) | #REF! | 0.0299 | 0.1241 | #REF! | #REF! | 1.583 | 1.955 | #REF! | B4 (08) |
| C1 (09) | #REF! | 0.0350 | 0.1166 | #REF! | #REF! | 1.381 | 1.824 | #REF! | C1 (09) |
| C2 (10) | #REF! | 0.0113 | 0.0827 | #REF! | #REF! | 1.593 | 1.997 | #REF! | C2 (10) |
| C3 (11) | #REF! | 0.0177 | 0.1197 | #REF! | #REF! | 1.625 | 1.896 | #REF! | C3 (11) |
| C4 (12) | #REF! | 0.0260 | 0.1276 | #REF! | #REF! | 1.784 | 2.001 | #REF! | C4 (12) |
| D1 (13) | #REF! | 0.0255 | 0.1581 | #REF! | #REF! | 1.648 | 1.991 | #REF! | D1 (13) |
| D2 (14) | #REF! | 0.0134 | 0.1448 | #REF! | #REF! | 1.548 | 1.829 | #REF! | D2 (14) |
| D3 (15) | #REF! | 0.0204 | 0.1022 | #REF! | #REF! | 1.275 | 1.624 | #REF! | D3 (15) |
| D4 (16) | #REF! | 0.0311 | 0.1135 | #REF! | #REF! | 1.407 | 1.940 | #REF! | D4 (16) |

Reviewed by: JH

Date: 6/9/08

Control Limits set 03/17/08.
LJO 03/17/08



BKA0606W.XLD

Printed 6/7/08 10:49 AM

**LB4100-B Weekly Instrument Calibration and Check**
**Background Determinations**

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.074 | 0.03727 | 0.076 | PASS | 1.499 | 1.326 | 1.523 | PASS | A1 (01) |
| A2 (02) | 0.079 | 0.04705 | 0.105 | PASS | 1.438 | 1.218 | 1.585 | PASS | A2 (02) |
| A3 (03) | 0.068 | 0.03370 | 0.082 | PASS | 1.456 | 1.252 | 1.553 | PASS | A3 (03) |
| A4 (04) | 0.058 | 0.03284 | 0.073 | PASS | 1.578 | 1.310 | 1.600 | PASS | A4 (04) |
| B1 (05) | 0.062 | 0.02459 | 0.073 | PASS | 2.418 | 1.388 | 1.622 | FLAG-HIGH | B1 (05) |
| B2 (06) | 0.074 | 0.04129 | 0.106 | PASS | 1.485 | 1.295 | 1.534 | PASS | B2 (06) |
| B3 (07) | 0.094 | 0.04493 | 0.103 | PASS | 1.574 | 1.272 | 1.735 | PASS | B3 (07) |
| B4 (08) | 0.120 | 0.03382 | 0.151 | PASS | 1.699 | 1.390 | 1.672 | FLAG-HIGH | B4 (08) |
| C1 (09) | 0.079 | 0.03258 | 0.100 | PASS | 1.602 | 1.487 | 1.661 | PASS | C1 (09) |
| C2 (10) | 0.068 | 0.02752 | 0.107 | PASS | 1.481 | 1.360 | 1.609 | PASS | C2 (10) |
| C3 (11) | 0.054 | 0.03644 | 0.085 | PASS | 1.505 | 1.413 | 1.743 | PASS | C3 (11) |
| C4 (12) | 0.089 | 0.02405 | 0.112 | PASS | 1.682 | 1.574 | 1.902 | PASS | C4 (12) |
| D1 (13) | 0.113 | 0.04533 | 0.114 | PASS | 1.563 | 1.359 | 1.678 | PASS | D1 (13) |
| D2 (14) | 0.067 | 0.02718 | 0.129 | PASS | 1.781 | 1.422 | 1.786 | PASS | D2 (14) |
| D3 (15) | 0.055 | 0.01718 | 0.103 | PASS | 1.734 | 1.524 | 1.914 | PASS | D3 (15) |
| D4 (16) | 0.059 | 0.00813 | 0.155 | PASS | 5.523 | 1.069 | 4.387 | FLAG-HIGH | D4 (16) |

—See recount file BKB0607W JH 6/9/08

Reviewed by: JH Date: 6/9/08

Control Limits set 02/8/07
LJO 2/8/07



BKB0606W.XLD

Printed 6/7/08 10:40 AM

## LB4100-B Weekly Instrument Calibration and Check
## Background Determinations

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | #REF! | 0.03727 | 0.076 | #REF! | #REF! | 1.326 | 1.523 | #REF! | A1 (01) |
| A2 (02) | #REF! | 0.04705 | 0.105 | #REF! | #REF! | 1.218 | 1.585 | #REF! | A2 (02) |
| A3 (03) | #REF! | 0.03370 | 0.082 | #REF! | #REF! | 1.252 | 1.553 | #REF! | A3 (03) |
| A4 (04) | #REF! | 0.03284 | 0.073 | #REF! | #REF! | 1.310 | 1.600 | #REF! | A4 (04) |
| B1 (05) | 0.052 | 0.02459 | 0.073 | PASS | 3.060 | 1.388 | 1.622 | FLAG-HIGH | B1 (05) |
| B2 (06) | #REF! | 0.04129 | 0.106 | #REF! | #REF! | 1.295 | 1.534 | #REF! | B2 (06) |
| B3 (07) | #REF! | 0.04493 | 0.103 | #REF! | #REF! | 1.272 | 1.735 | #REF! | B3 (07) |
| B4 (08) | 0.064 | 0.03382 | 0.151 | PASS | 1.543 | 1.390 | 1.672 | PASS | B4 (08) |
| C1 (09) | #REF! | 0.03258 | 0.100 | #REF! | #REF! | 1.487 | 1.661 | #REF! | C1 (09) |
| C2 (10) | #REF! | 0.02752 | 0.107 | #REF! | #REF! | 1.360 | 1.609 | #REF! | C2 (10) |
| C3 (11) | #REF! | 0.03644 | 0.085 | #REF! | #REF! | 1.413 | 1.743 | #REF! | C3 (11) |
| C4 (12) | #REF! | 0.02405 | 0.112 | #REF! | #REF! | 1.574 | 1.902 | #REF! | C4 (12) |
| D1 (13) | #REF! | 0.04533 | 0.114 | #REF! | #REF! | 1.359 | 1.678 | #REF! | D1 (13) |
| D2 (14) | #REF! | 0.02718 | 0.129 | #REF! | #REF! | 1.422 | 1.786 | #REF! | D2 (14) |
| D3 (15) | #REF! | 0.01718 | 0.103 | #REF! | #REF! | 1.524 | 1.914 | #REF! | D3 (15) |
| D4 (16) | 0.075 | 0.00813 | 0.155 | PASS | 5.344 | 1.069 | 4.387 | FLAG-HIGH | D4 (16) |

★ O.K.
— Offline JH 6/9/08

Reviewed by: JH Date: 6/9/08

Control Limits set 02/8/07
LJO 2/8/07



BKB0607W.XLD

Printed 6/8/08 9:08 AM

# Gas Proportional Counter

# Quality Control Data

# Daily Background Checks

## LB4100-B Daily Instrument Performance Checks
## Background Checks

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.033 | -0.037 | 0.123 | PASS | 1.533 | 1.030 | 1.980 | PASS | A1 (01) |
| A2 (02) | 0.050 | -0.032 | 0.174 | PASS | 1.300 | 0.979 | 1.909 | PASS | A2 (02) |
| A3 (03) | 0.033 | -0.035 | 0.153 | PASS | 1.217 | 0.995 | 1.931 | PASS | A3 (03) |
| A4 (04) | 0.000 | -0.036 | 0.146 | PASS | 1.467 | 1.115 | 2.097 | PASS | A4 (04) |
| B1 (05) | 0.033 | -0.036 | 0.138 | PASS | 1.700 | 1.167 | 2.167 | PASS | B1 (05) |
| B2 (06) | 0.117 | -0.034 | 0.160 | PASS | 1.450 | 1.017 | 1.963 | PASS | B2 (06) |
| B3 (07) | 0.050 | -0.037 | 0.137 | PASS | 1.667 | 1.145 | 2.137 | PASS | B3 (07) |
| B4 (08) | 0.050 | -0.035 | 0.153 | PASS | 1.850 | 1.099 | 2.075 | PASS | B4 (08) |
| C1 (09) | 0.050 | -0.037 | 0.129 | PASS | 1.733 | 1.086 | 2.056 | PASS | C1 (09) |
| C2 (10) | 0.067 | -0.036 | 0.142 | PASS | 1.433 | 1.031 | 1.981 | PASS | C2 (10) |
| C3 (11) | 0.067 | -0.037 | 0.125 | PASS | 1.433 | 1.069 | 2.033 | PASS | C3 (11) |
| C4 (12) | 0.033 | -0.037 | 0.137 | PASS | 1.417 | 1.117 | 2.099 | PASS | C4 (12) |
| D1 (13) | 0.067 | -0.034 | 0.158 | PASS | 1.600 | 1.116 | 2.098 | PASS | D1 (13) |
| D2 (14) | 0.033 | -0.033 | 0.169 | PASS | 1.383 | 1.210 | 2.224 | PASS | D2 (14) |
| D3 (15) | 0.067 | -0.036 | 0.148 | PASS | 1.800 | 1.327 | 2.381 | PASS | D3 (15) |
| D4 (16) | 0.033 | -0.037 | 0.125 | PASS | 6.700 | 3.629 | 5.263 | FLAG-HIGH | D4 (16) |

– offline
JH 5/27/08

Reviewed by: JH Date: 5/27/08

Control limits established from prevoius weekly background determinations.
Weekly Background File: BKB0523W Date: 5/23/08 Analyst: LNT



BKB0527.XLD

Printed 5/27/08 9:49 AM

## LB4100-B Daily Instrument Performance Checks
## Background Checks

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.033 | -0.037 | 0.123 | PASS | 1.433 | 1.030 | 1.980 | PASS | A1 (01) |
| A2 (02) | 0.050 | -0.032 | 0.174 | PASS | 1.300 | 0.979 | 1.909 | PASS | A2 (02) |
| A3 (03) | 0.033 | -0.035 | 0.153 | PASS | 1.683 | 0.995 | 1.931 | PASS | A3 (03) |
| A4 (04) | 0.067 | -0.036 | 0.146 | PASS | 1.367 | 1.115 | 2.097 | PASS | A4 (04) |
| B1 (05) | 0.067 | -0.036 | 0.138 | PASS | 1.183 | 1.167 | 2.167 | PASS | B1 (05) |
| B2 (06) | 0.067 | -0.034 | 0.160 | PASS | 1.367 | 1.017 | 1.963 | PASS | B2 (06) |
| B3 (07) | 0.083 | -0.037 | 0.137 | PASS | 1.617 | 1.145 | 2.137 | PASS | B3 (07) |
| B4 (08) | 0.067 | -0.035 | 0.153 | PASS | 1.167 | 1.099 | 2.075 | PASS | B4 (08) |
| C1 (09) | 0.033 | -0.037 | 0.129 | PASS | 1.450 | 1.086 | 2.056 | PASS | C1 (09) |
| C2 (10) | 0.033 | -0.036 | 0.142 | PASS | 1.250 | 1.031 | 1.981 | PASS | C2 (10) |
| C3 (11) | 0.050 | -0.037 | 0.125 | PASS | 1.283 | 1.069 | 2.033 | PASS | C3 (11) |
| C4 (12) | 0.000 | -0.037 | 0.137 | PASS | 1.517 | 1.117 | 2.099 | PASS | C4 (12) |
| D1 (13) | 0.067 | -0.034 | 0.158 | PASS | 1.283 | 1.116 | 2.098 | PASS | D1 (13) |
| D2 (14) | 0.100 | -0.033 | 0.169 | PASS | 1.650 | 1.210 | 2.224 | PASS | D2 (14) |
| D3 (15) | 0.000 | -0.036 | 0.148 | PASS | 2.000 | 1.327 | 2.381 | PASS | D3 (15) |
| D4 (16) | 0.050 | -0.037 | 0.125 | PASS | 6.733 | 3.629 | 5.263 | FLAG-HIGH | D4 (16) |

– offline JH 5/28/08

Reviewed by: JH Date: 5/28/08

Control limits established from prevoius weekly background determinations.
Weekly Background File: BKB0523W Date: 5/23/08 Analyst: LNT



BKB0528.XLD

Printed 5/28/08 9:36 AM

aily Instrument Performance Checks
Background Checks

| Flag | Beta CPM | LCL | UCL | Flag | Detector ID |
|---|---|---|---|---|---|
| PASS | 1.367 | 1.030 | 1.980 | PASS | A1 (01) |
| PASS | 1.417 | 0.979 | 1.909 | PASS | A2 (02) |
| PASS | 1.483 | 0.995 | 1.931 | PASS | A3 (03) |
| PASS | 1.400 | 1.115 | 2.097 | PASS | A4 (04) |
| PASS | 1.417 | 1.167 | 2.167 | PASS | B1 (05) |
| PASS | 1.500 | 1.017 | 1.963 | PASS | B2 (06) |
| PASS | 1.700 | 1.145 | 2.137 | PASS | B3 (07) |
| PASS | 1.633 | 1.099 | 2.075 | PASS | B4 (08) |
| PASS | 1.700 | 1.086 | 2.056 | PASS | C1 (09) |
| PASS | 1.417 | 1.031 | 1.981 | PASS | C2 (10) |
| PASS | 1.567 | 1.069 | 2.033 | PASS | C3 (11) |
| PASS | 1.400 | 1.117 | 2.099 | PASS | C4 (12) |
| LAG-HIGH | 1.583 | 1.116 | 2.098 | PASS | D1 (13) |
| PASS | 1.450 | 1.210 | 2.224 | PASS | D2 (14) |
| PASS | 1.700 | 1.327 | 2.381 | PASS | D3 (15) |
| PASS | 8.083 | 3.629 | 5.263 | FLAG-HIGH | D4 (16) |

5/29/08

JH Date: 5/29/08

from prevoius weekly background determinations.
KB0523W Date: 5/23/08 Analyst: LNT

nted 5/29/08 9:41 AM

| JCL | Flag | Detector ID |
|---|---|---|
| REF! | #REF! | A1 (01) |
| REF! | #REF! | A2 (02) |
| REF! | #REF! | A3 (03) |
| REF! | #REF! | A4 (04) |
| REF! | #REF! | B1 (05) |
| REF! | #REF! | B2 (06) |
| REF! | #REF! | B3 (07) |
| REF! | #REF! | B4 (08) |
| REF! | #REF! | C1 (09) |
| REF! | #REF! | C2 (10) |
| REF! | #REF! | C3 (11) |
| REF! | #REF! | C4 (12) |
| .098 | PASS | D1 (13) |
| REF! | #REF! | D2 (14) |
| REF! | #REF! | D3 (15) |
| .263 | FLAG-HIGH | D4 (16) |

Date: 5/21/08

minations.
nalyst: LNT

**LB4100-B Daily Instrument Performance Checks**
**Background Checks**

| Detector ID | Alpha | | | | Beta | | | | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| | CPM | LCL | UCL | Flag | CPM | LCL | UCL | Flag | |
| A1 (01) | 0.033 | -0.037 | 0.123 | PASS | 1.350 | 1.030 | 1.980 | PASS | A1 (01) |
| A2 (02) | 0.083 | -0.032 | 0.174 | PASS | 1.700 | 0.979 | 1.909 | PASS | A2 (02) |
| A3 (03) | 0.017 | -0.035 | 0.153 | PASS | 1.433 | 0.995 | 1.931 | PASS | A3 (03) |
| A4 (04) | 0.067 | -0.036 | 0.146 | PASS | 1.483 | 1.115 | 2.097 | PASS | A4 (04) |
| B1 (05) | 0.067 | -0.036 | 0.138 | PASS | 1.500 | 1.167 | 2.167 | PASS | B1 (05) |
| B2 (06) | 0.050 | -0.034 | 0.160 | PASS | 1.317 | 1.017 | 1.963 | PASS | B2 (06) |
| B3 (07) | 0.050 | -0.037 | 0.137 | PASS | 1.433 | 1.145 | 2.137 | PASS | B3 (07) |
| B4 (08) | 0.117 | -0.035 | 0.153 | PASS | 1.500 | 1.099 | 2.075 | PASS | B4 (08) |
| C1 (09) | 0.083 | -0.037 | 0.129 | PASS | 1.617 | 1.086 | 2.056 | PASS | C1 (09) |
| C2 (10) | 0.050 | -0.036 | 0.142 | PASS | 1.650 | 1.031 | 1.981 | PASS | C2 (10) |
| C3 (11) | 0.033 | -0.037 | 0.125 | PASS | 1.883 | 1.069 | 2.033 | PASS | C3 (11) |
| C4 (12) | 0.067 | -0.037 | 0.137 | PASS | 1.417 | 1.117 | 2.099 | PASS | C4 (12) |
| D1 (13) | 0.067 | -0.034 | 0.158 | PASS | 1.400 | 1.116 | 2.098 | PASS | D1 (13) |
| D2 (14) | 0.050 | -0.033 | 0.169 | PASS | 1.617 | 1.210 | 2.224 | PASS | D2 (14) |
| D3 (15) | 0.083 | -0.036 | 0.148 | PASS | 1.867 | 1.327 | 2.381 | PASS | D3 (15) |
| **D4 (16)** | **0.017** | **-0.037** | **0.125** | **PASS** | **4.183** | **3.629** | **5.263** | **PASS** | **D4 (16)** |

Reviewed by: JH Date: 5/30/08

Control limits established from prevoius weekly background determinations.
Weekly Background File: BKB0523W Date: 5/23/08 Analyst: LNT



BKB0530.XLD

Printed 5/30/08 10:22 AM

**LB4100-A Daily Instrument Performance Checks**
**Background Checks**

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.067 | -0.036 | 0.138 | PASS | 2.000 | 1.453 | 2.549 | PASS | A1 (01) |
| A2 (02) | 0.150 | -0.034 | 0.162 | PASS | 1.967 | 1.320 | 2.372 | PASS | A2 (02) |
| A3 (03) | 0.100 | -0.037 | 0.131 | PASS | 1.867 | 1.429 | 2.517 | PASS | A3 (03) |
| A4 (04) | 0.083 | -0.037 | 0.111 | PASS | 2.000 | 1.484 | 2.590 | PASS | A4 (04) |
| B1 (05) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | B1 (05) |
| B2 (06) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | B2 (06) |
| B3 (07) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | B3 (07) |
| B4 (08) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | B4 (08) |
| C1 (09) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | C1 (09) |
| C2 (10) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | C2 (10) |
| C3 (11) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | C3 (11) |
| C4 (12) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | C4 (12) |
| D1 (13) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | D1 (13) |
| D2 (14) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | D2 (14) |
| D3 (15) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | D3 (15) |
| D4 (16) | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | D4 (16) |

Reviewed by: JH Date: 6/10/08

Control limits established from prevoius weekly background determinations.
Weekly Background File: BKA0606W Date: 6/6/08 Analyst: LJO



BKA0610.XLD

Printed 6/10/08 9:31 AM

5/11/08 10:16 AM

**LB4100-B Daily Instrument Performance Checks**
**Background Checks**

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.167 | -0.031 | 0.179 | PASS | 1.383 | 1.025 | 1.973 | PASS | A1 (01) |
| A2 (02) | 0.117 | -0.030 | 0.188 | PASS | 1.550 | 0.974 | 1.902 | PASS | A2 (02) |
| A3 (03) | 0.050 | -0.033 | 0.169 | PASS | 1.433 | 0.989 | 1.923 | PASS | A3 (03) |
| A4 (04) | 0.100 | -0.035 | 0.151 | PASS | 1.550 | 1.091 | 2.065 | PASS | A4 (04) |
| B1 (05) | 0.083 | -0.036 | 0.140 | PASS | 1.683 | 2.383 | 3.737 | FLAG-LOW | B1 (05) |
| B2 (06) | 0.067 | -0.031 | 0.179 | PASS | 1.550 | 1.013 | 1.957 | PASS | B2 (06) |
| B3 (07) | 0.017 | -0.025 | 0.213 | PASS | 1.333 | 1.088 | 2.060 | PASS | B3 (07) |
| B4 (08) | 0.067 | -0.034 | 0.162 | PASS | 1.467 | 1.062 | 2.024 | PASS | B4 (08) |
| C1 (09) | 0.000 | -0.030 | 0.188 | PASS | 1.367 | 1.112 | 2.092 | PASS | C1 (09) |
| C2 (10) | 0.150 | -0.033 | 0.169 | PASS | 1.483 | 1.010 | 1.952 | PASS | C2 (10) |
| C3 (11) | 0.117 | -0.036 | 0.144 | PASS | 1.450 | 1.030 | 1.980 | PASS | C3 (11) |
| C4 (12) | 0.067 | -0.027 | 0.205 | PASS | 1.250 | 1.180 | 2.184 | PASS | C4 (12) |
| D1 (13) | 0.150 | -0.017 | 0.243 | PASS | 1.433 | 1.079 | 2.047 | PASS | D1 (13) |
| D2 (14) | 0.083 | -0.033 | 0.167 | PASS | 1.917 | 1.264 | 2.298 | PASS | D2 (14) |
| D3 (15) | 0.117 | -0.036 | 0.146 | PASS | 1.583 | 1.224 | 2.244 | PASS | D3 (15) |
| D4 (16) | 0.083 | -0.031 | 0.181 | PASS | 3.200 | 4.449 | 6.239 | FLAG-LOW | D4 (16) |

—offline JH 6/9/08

Reviewed by: JH Date: 6/9/08

Control limits established from prevoius weekly background determinations.
Weekly Background File: BKB0606W Date: 6/6/08 Analyst: JJH
BKB0607W 6/7/08 MBC



BKB0609.XLD

Printed 6/9/08 10:59 AM

**LB4100-B Daily Instrument Performance Checks**
**Background Checks**

| Detector ID | Alpha CPM | Alpha LCL | Alpha UCL | Alpha Flag | Beta CPM | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.083 | -0.031 | 0.179 | PASS | 1.583 | 1.025 | 1.973 | PASS | A1 (01) |
| A2 (02) | 0.117 | -0.030 | 0.188 | PASS | 1.267 | 0.974 | 1.902 | PASS | A2 (02) |
| A3 (03) | 0.033 | -0.033 | 0.169 | PASS | 1.367 | 0.989 | 1.923 | PASS | A3 (03) |
| A4 (04) | 0.083 | -0.035 | 0.151 | PASS | 1.700 | 1.091 | 2.065 | PASS | A4 (04) |
| B1 (05) | 0.033 | -0.036 | 0.140 | PASS | 2.067 | 2.383 | 3.737 | FLAG-LOW | B1 (05) |
| B2 (06) | 0.067 | -0.031 | 0.179 | PASS | 1.517 | 1.013 | 1.957 | PASS | B2 (06) |
| B3 (07) | 0.067 | -0.025 | 0.213 | PASS | 1.700 | 1.088 | 2.060 | PASS | B3 (07) |
| B4 (08) | 0.100 | -0.034 | 0.162 | PASS | 2.117 | 1.062 | 2.024 | FLAG-HIGH | B4 (08) |
| C1 (09) | 0.133 | -0.030 | 0.188 | PASS | 1.683 | 1.112 | 2.092 | PASS | C1 (09) |
| C2 (10) | 0.100 | -0.033 | 0.169 | PASS | 1.717 | 1.010 | 1.952 | PASS | C2 (10) |
| C3 (11) | 0.100 | -0.036 | 0.144 | PASS | 1.700 | 1.030 | 1.980 | PASS | C3 (11) |
| C4 (12) | 0.017 | -0.027 | 0.205 | PASS | 1.567 | 1.180 | 2.184 | PASS | C4 (12) |
| D1 (13) | 0.150 | -0.017 | 0.243 | PASS | 1.517 | 1.079 | 2.047 | PASS | D1 (13) |
| D2 (14) | 0.083 | -0.033 | 0.167 | PASS | 1.283 | 1.264 | 2.298 | PASS | D2 (14) |
| D3 (15) | 0.067 | -0.036 | 0.146 | PASS | 1.850 | 1.224 | 2.244 | PASS | D3 (15) |
| D4 (16) | 0.083 | -0.031 | 0.181 | PASS | 4.317 | 4.449 | 6.239 | FLAG-LOW | D4 (16) |

—See recant file BKB0610R JH 6/10/08

Reviewed by: JH Date: 6/10/08

Control limits established from prevoius weekly background determinations.
Weekly Background File: BKB0606W Date: 6/6/08 Analyst: JJH
BKB0607W 6/7/08 MBC

| ector D |
| --- |
| (01) |
| (02) |
| (03) |
| (04) |
| (05) |
| (06) |
| (07) |
| (08) |
| (09) |
| (10) |
| (11) |
| (12) |
| (13) |
| (14) |
| (15) |
| (16) |

# Gas Proportional Counter

# Quality Control Data

# Daily Instrument Performance Checks

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| a | | Beta | | | | Detector |
|---|---|---|---|---|---|---|
| UCL | Flag | Eff. | LCL | UCL | Flag | ID |
| 0.2635 | PASS | 0.8358 | 0.8206 | 0.8809 | PASS | A1 (01) |
| 0.2572 | PASS | 0.8502 | 0.8159 | 0.8781 | PASS | A2 (02) |
| 0.2601 | PASS | 0.8678 | 0.8334 | 0.8923 | PASS | A3 (03) |
| 0.2642 | PASS | 0.8285 | 0.8018 | 0.8543 | PASS | A4 (04) |
| 0.2643 | PASS | 0.8304 | 0.8184 | 0.8843 | PASS | B1 (05) |
| 0.2472 | PASS | 0.8033 | 0.8085 | 0.8621 | FLAG-LOW | B2 (06) |
| 0.2635 | PASS | 0.8238 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| 0.2606 | PASS | 0.8292 | 0.8055 | 0.8644 | PASS | B4 (08) |
| 0.2719 | PASS | 0.8325 | 0.8498 | 0.8988 | FLAG-LOW | C1 (09) |
| 0.2573 | PASS | 0.8255 | 0.8268 | 0.8770 | FLAG-LOW | C2 (10) |
| 0.2586 | PASS | 0.8196 | 0.8210 | 0.8910 | FLAG-LOW | C3 (11) |
| 0.2450 | PASS | 0.7932 | 0.7851 | 0.8547 | PASS | C4 (12) |
| 0.2612 | PASS | 0.8258 | 0.8130 | 0.8781 | PASS | D1 (13) |
| 0.2689 | PASS | 0.8155 | 0.8125 | 0.8914 | PASS | D2 (14) |
| 0.2674 | PASS | 0.8138 | 0.8094 | 0.8752 | PASS | D3 (15) |
| 0.2630 | PASS | 0.8501 | 0.8401 | 0.9052 | PASS | D4 (16) |

27R JH 5/27/08

JH

Date: 5/27/08

Control Limits Established 02/5/2007. LJO

Printed 5/27/08 8:59 AM

| Flag | Detector ID |
|---|---|
| ALUE! | A1 (01) |
| ALUE! | A2 (02) |
| ALUE! | A3 (03) |
| ALUE! | A4 (04) |
| ALUE! | B1 (05) |
| G-LOW | B2 (06) |
| G-LOW | B3 (07) |
| ALUE! | B4 (08) |
| G-LOW | C1 (09) |
| PASS | C2 (10) |
| G-LOW | C3 (11) |
| ALUE! | C4 (12) |
| ALUE! | D1 (13) |
| ALUE! | D2 (14) |
| ALUE! | D3 (15) |
| ALUE! | D4 (16) |

/27/08

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.2482 | 0.2375 | 0.2635 | PASS | 0.8343 | 0.8206 | 0.8809 | PASS | A1 (01) |
| A2 (02) | 0.2393 | 0.2346 | 0.2572 | PASS | 0.8327 | 0.8159 | 0.8781 | PASS | A2 (02) |
| A3 (03) | 0.2416 | 0.2349 | 0.2601 | PASS | 0.8634 | 0.8334 | 0.8923 | PASS | A3 (03) |
| A4 (04) | 0.2529 | 0.2329 | 0.2642 | PASS | 0.8268 | 0.8018 | 0.8543 | PASS | A4 (04) |
| B1 (05) | 0.2445 | 0.2370 | 0.2643 | PASS | 0.8393 | 0.8184 | 0.8843 | PASS | B1 (05) |
| B2 (06) | 0.2321 | 0.2197 | 0.2472 | PASS | 0.8076 | 0.8085 | 0.8621 | FLAG-LOW | B2 (06) |
| B3 (07) | 0.2417 | 0.2338 | 0.2635 | PASS | 0.8166 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | 0.2416 | 0.2217 | 0.2606 | PASS | 0.8037 | 0.8055 | 0.8644 | FLAG-LOW | B4 (08) |
| C1 (09) | 0.2500 | 0.2445 | 0.2719 | PASS | 0.8629 | 0.8498 | 0.8988 | PASS | C1 (09) |
| C2 (10) | 0.2354 | 0.2224 | 0.2573 | PASS | 0.8344 | 0.8268 | 0.8770 | PASS | C2 (10) |
| C3 (11) | 0.2446 | 0.2295 | 0.2586 | PASS | 0.8306 | 0.8210 | 0.8910 | PASS | C3 (11) |
| C4 (12) | 0.2342 | 0.2170 | 0.2450 | PASS | 0.8175 | 0.7851 | 0.8547 | PASS | C4 (12) |
| D1 (13) | 0.2213 | 0.2306 | 0.2612 | FLAG-LOW | 0.8077 | 0.8130 | 0.8781 | FLAG-LOW | D1 (13) |
| D2 (14) | 0.2488 | 0.2371 | 0.2689 | PASS | 0.8279 | 0.8125 | 0.8914 | PASS | D2 (14) |
| D3 (15) | 0.2618 | 0.2411 | 0.2674 | PASS | 0.8240 | 0.8094 | 0.8752 | PASS | D3 (15) |
| D4 (16) | 0.2545 | 0.2379 | 0.2630 | PASS | 0.8482 | 0.8401 | 0.9052 | PASS | D4 (16) |

– See recount file EFB0528R JH 5/28/08

Reviewed by: JH Date: 5/28/08

Control Limits Established 02/5/2007. LJO

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID | |
|---|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | #VALUE! | 0.2375 | 0.2635 | #VALUE! | #VALUE! | 0.8206 | 0.8809 | #VALUE! | A1 (01) | |
| A2 (02) | #VALUE! | 0.2346 | 0.2572 | #VALUE! | #VALUE! | 0.8159 | 0.8781 | #VALUE! | A2 (02) | |
| A3 (03) | #VALUE! | 0.2349 | 0.2601 | #VALUE! | #VALUE! | 0.8334 | 0.8923 | #VALUE! | A3 (03) | |
| A4 (04) | #VALUE! | 0.2329 | 0.2642 | #VALUE! | #VALUE! | 0.8018 | 0.8543 | #VALUE! | A4 (04) | |
| B1 (05) | #VALUE! | 0.2370 | 0.2643 | #VALUE! | #VALUE! | 0.8184 | 0.8843 | #VALUE! | B1 (05) | |
| B2 (06) | 0.2306 | 0.2197 | 0.2472 | PASS | 0.7955 | 0.8085 | 0.8621 | FLAG-LOW | B2 (06) | * |
| B3 (07) | 0.2391 | 0.2338 | 0.2635 | PASS | 0.8346 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) | * |
| B4 (08) | 0.2395 | 0.2217 | 0.2606 | PASS | 0.8167 | 0.8055 | 0.8644 | PASS | B4 (08) | |
| C1 (09) | #VALUE! | 0.2445 | 0.2719 | #VALUE! | #VALUE! | 0.8498 | 0.8988 | #VALUE! | C1 (09) | |
| C2 (10) | #VALUE! | 0.2224 | 0.2573 | #VALUE! | #VALUE! | 0.8268 | 0.8770 | #VALUE! | C2 (10) | |
| C3 (11) | #VALUE! | 0.2295 | 0.2586 | #VALUE! | #VALUE! | 0.8210 | 0.8910 | #VALUE! | C3 (11) | |
| C4 (12) | #VALUE! | 0.2170 | 0.2450 | #VALUE! | #VALUE! | 0.7851 | 0.8547 | #VALUE! | C4 (12) | |
| D1 (13) | 0.2411 | 0.2306 | 0.2612 | PASS | 0.8106 | 0.8130 | 0.8781 | FLAG-LOW | D1 (13) | * |
| D2 (14) | #VALUE! | 0.2371 | 0.2689 | #VALUE! | #VALUE! | 0.8125 | 0.8914 | #VALUE! | D2 (14) | |
| D3 (15) | #VALUE! | 0.2411 | 0.2674 | #VALUE! | #VALUE! | 0.8094 | 0.8752 | #VALUE! | D3 (15) | |
| D4 (16) | #VALUE! | 0.2379 | 0.2630 | #VALUE! | #VALUE! | 0.8401 | 0.9052 | #VALUE! | D4 (16) | |

*DETECTOR OFFLINE. MC 5/28/08

Reviewed by: MC Date: 5/28/08

Control Limits Established 02/5/2007. LJO

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.2399 | 0.2375 | 0.2635 | PASS | 0.8285 | 0.8206 | 0.8809 | PASS | A1 (01) |
| A2 (02) | 0.2503 | 0.2346 | 0.2572 | PASS | 0.8241 | 0.8159 | 0.8781 | PASS | A2 (02) |
| A3 (03) | 0.2499 | 0.2349 | 0.2601 | PASS | 0.8467 | 0.8334 | 0.8923 | PASS | A3 (03) |
| A4 (04) | 0.2466 | 0.2329 | 0.2642 | PASS | 0.8436 | 0.8018 | 0.8543 | PASS | A4 (04) |
| B1 (05) | 0.2506 | 0.2370 | 0.2643 | PASS | 0.8246 | 0.8184 | 0.8843 | PASS | B1 (05) |
| B2 (06) | 0.2314 | 0.2197 | 0.2472 | PASS | 0.8061 | 0.8085 | 0.8621 | FLAG-LOW | B2 (06) |
| B3 (07) | 0.2423 | 0.2338 | 0.2635 | PASS | 0.8347 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | 0.2387 | 0.2217 | 0.2606 | PASS | 0.8096 | 0.8055 | 0.8644 | PASS | B4 (08) |
| C1 (09) | 0.2603 | 0.2388 | 0.2675 | PASS | 0.8494 | 0.8152 | 0.8761 | PASS | C1 (09) |
| C2 (10) | 0.2395 | 0.2255 | 0.2581 | PASS | 0.8370 | 0.7940 | 0.8678 | PASS | C2 (10) |
| C3 (11) | 0.2423 | 0.2304 | 0.2565 | PASS | 0.8258 | 0.7780 | 0.8528 | PASS | C3 (11) |
| C4 (12) | 0.2379 | 0.2215 | 0.2456 | PASS | 0.8056 | 0.7598 | 0.8391 | PASS | C4 (12) |
| D1 (13) | 0.2338 | 0.2305 | 0.2610 | PASS | 0.8083 | 0.8130 | 0.8781 | FLAG-LOW | D1 (13) |
| D2 (14) | 0.2559 | 0.2371 | 0.2689 | PASS | 0.8261 | 0.8125 | 0.8914 | PASS | D2 (14) |
| D3 (15) | 0.2635 | 0.2411 | 0.2674 | PASS | 0.8266 | 0.8094 | 0.8752 | PASS | D3 (15) |
| D4 (16) | 0.2487 | 0.2379 | 0.2630 | PASS | 0.8665 | 0.8401 | 0.9052 | PASS | D4 (16) |

See recount file EFB0529R
JH 5/29/08

Reviewed by: JH Date: 5/29/08

Control Limits Established 02/5/2007. LJO

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | #VALUE! | 0.2375 | 0.2635 | #VALUE! | #VALUE! | 0.8206 | 0.8809 | #VALUE! | A1 (01) |
| A2 (02) | #VALUE! | 0.2346 | 0.2572 | #VALUE! | #VALUE! | 0.8159 | 0.8781 | #VALUE! | A2 (02) |
| A3 (03) | #VALUE! | 0.2349 | 0.2601 | #VALUE! | #VALUE! | 0.8334 | 0.8923 | #VALUE! | A3 (03) |
| A4 (04) | #VALUE! | 0.2329 | 0.2642 | #VALUE! | #VALUE! | 0.8018 | 0.8543 | #VALUE! | A4 (04) |
| B1 (05) | #VALUE! | 0.2370 | 0.2643 | #VALUE! | #VALUE! | 0.8184 | 0.8843 | #VALUE! | B1 (05) |
| B2 (06) | 0.2286 | 0.2197 | 0.2472 | PASS | 0.8045 | 0.8085 | 0.8621 | FLAG-LOW | B2 (06) |
| B3 (07) | 0.2399 | 0.2338 | 0.2635 | PASS | 0.8217 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | #VALUE! | 0.2217 | 0.2606 | #VALUE! | #VALUE! | 0.8055 | 0.8644 | #VALUE! | B4 (08) |
| C1 (09) | #VALUE! | 0.2388 | 0.2675 | #VALUE! | #VALUE! | 0.8152 | 0.8761 | #VALUE! | C1 (09) |
| C2 (10) | #VALUE! | 0.2255 | 0.2581 | #VALUE! | #VALUE! | 0.7940 | 0.8678 | #VALUE! | C2 (10) |
| C3 (11) | #VALUE! | 0.2304 | 0.2565 | #VALUE! | #VALUE! | 0.7780 | 0.8528 | #VALUE! | C3 (11) |
| C4 (12) | #VALUE! | 0.2215 | 0.2456 | #VALUE! | #VALUE! | 0.7598 | 0.8391 | #VALUE! | C4 (12) |
| D1 (13) | 0.2363 | 0.2305 | 0.2610 | PASS | 0.8180 | 0.8130 | 0.8781 | PASS | D1 (13) |
| D2 (14) | #VALUE! | 0.2371 | 0.2689 | #VALUE! | #VALUE! | 0.8125 | 0.8914 | #VALUE! | D2 (14) |
| D3 (15) | #VALUE! | 0.2411 | 0.2674 | #VALUE! | #VALUE! | 0.8094 | 0.8752 | #VALUE! | D3 (15) |
| D4 (16) | #VALUE! | 0.2379 | 0.2630 | #VALUE! | #VALUE! | 0.8401 | 0.9052 | #VALUE! | D4 (16) |

—offline JH 5/29/08

Reviewed by: JH Date: 5/29/08

Control Limits Established 02/5/2007. LJO

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.2480 | 0.2375 | 0.2635 | PASS | 0.8101 | 0.8206 | 0.8809 | FLAG-LOW | A1 (01) |
| A2 (02) | 0.2452 | 0.2346 | 0.2572 | PASS | 0.8318 | 0.8159 | 0.8781 | PASS | A2 (02) |
| A3 (03) | 0.2481 | 0.2349 | 0.2601 | PASS | 0.8543 | 0.8334 | 0.8923 | PASS | A3 (03) |
| A4 (04) | 0.2541 | 0.2329 | 0.2642 | PASS | 0.8162 | 0.8018 | 0.8543 | PASS | A4 (04) |
| B1 (05) | 0.2502 | 0.2370 | 0.2643 | PASS | 0.8316 | 0.8184 | 0.8843 | PASS | B1 (05) |
| B2 (06) | 0.2369 | 0.2197 | 0.2472 | PASS | 0.8118 | 0.8085 | 0.8621 | PASS | B2 (06) |
| B3 (07) | 0.2503 | 0.2338 | 0.2635 | PASS | 0.8202 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | 0.2365 | 0.2217 | 0.2606 | PASS | 0.8133 | 0.8055 | 0.8644 | PASS | B4 (08) |
| C1 (09) | 0.2539 | 0.2388 | 0.2675 | PASS | 0.8364 | 0.8152 | 0.8761 | PASS | C1 (09) |
| C2 (10) | 0.2422 | 0.2255 | 0.2581 | PASS | 0.8272 | 0.7940 | 0.8678 | PASS | C2 (10) |
| C3 (11) | 0.2435 | 0.2304 | 0.2565 | PASS | 0.8095 | 0.7780 | 0.8528 | PASS | C3 (11) |
| C4 (12) | 0.2345 | 0.2215 | 0.2456 | PASS | 0.8110 | 0.7598 | 0.8391 | PASS | C4 (12) |
| D1 (13) | 0.2376 | 0.2305 | 0.2610 | PASS | 0.7963 | 0.8130 | 0.8781 | FLAG-LOW | D1 (13) |
| D2 (14) | 0.2602 | 0.2371 | 0.2689 | PASS | 0.8407 | 0.8125 | 0.8914 | PASS | D2 (14) |
| D3 (15) | 0.2530 | 0.2411 | 0.2674 | PASS | 0.8228 | 0.8094 | 0.8752 | PASS | D3 (15) |
| D4 (16) | 0.2577 | 0.2379 | 0.2630 | PASS | 0.8632 | 0.8401 | 0.9052 | PASS | D4 (16) |

– See recount file EFB 0530R
JH 5/30/08

Reviewed by: JH Date: 5/30/08

Control Limits Established 02/5/2007. LJO

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.2475 | 0.2375 | 0.2635 | PASS | 0.8235 | 0.8206 | 0.8809 | PASS | A1 (01) |
| A2 (02) | #VALUE! | 0.2346 | 0.2572 | #VALUE! | #VALUE! | 0.8159 | 0.8781 | #VALUE! | A2 (02) |
| A3 (03) | #VALUE! | 0.2349 | 0.2601 | #VALUE! | #VALUE! | 0.8334 | 0.8923 | #VALUE! | A3 (03) |
| A4 (04) | #VALUE! | 0.2329 | 0.2642 | #VALUE! | #VALUE! | 0.8018 | 0.8543 | #VALUE! | A4 (04) |
| B1 (05) | #VALUE! | 0.2370 | 0.2643 | #VALUE! | #VALUE! | 0.8184 | 0.8843 | #VALUE! | B1 (05) |
| B2 (06) | #VALUE! | 0.2197 | 0.2472 | #VALUE! | #VALUE! | 0.8085 | 0.8621 | #VALUE! | B2 (06) |
| B3 (07) | 0.2507 | 0.2338 | 0.2635 | PASS | 0.8277 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | #VALUE! | 0.2217 | 0.2606 | #VALUE! | #VALUE! | 0.8055 | 0.8644 | #VALUE! | B4 (08) |
| C1 (09) | #VALUE! | 0.2388 | 0.2675 | #VALUE! | #VALUE! | 0.8152 | 0.8761 | #VALUE! | C1 (09) |
| C2 (10) | #VALUE! | 0.2255 | 0.2581 | #VALUE! | #VALUE! | 0.7940 | 0.8678 | #VALUE! | C2 (10) |
| C3 (11) | #VALUE! | 0.2304 | 0.2565 | #VALUE! | #VALUE! | 0.7780 | 0.8528 | #VALUE! | C3 (11) |
| C4 (12) | #VALUE! | 0.2215 | 0.2456 | #VALUE! | #VALUE! | 0.7598 | 0.8391 | #VALUE! | C4 (12) |
| D1 (13) | 0.2314 | 0.2305 | 0.2610 | PASS | 0.7963 | 0.8130 | 0.8781 | FLAG-LOW | D1 (13) |
| D2 (14) | #VALUE! | 0.2371 | 0.2689 | #VALUE! | #VALUE! | 0.8125 | 0.8914 | #VALUE! | D2 (14) |
| D3 (15) | #VALUE! | 0.2411 | 0.2674 | #VALUE! | #VALUE! | 0.8094 | 0.8752 | #VALUE! | D3 (15) |
| D4 (16) | #VALUE! | 0.2379 | 0.2630 | #VALUE! | #VALUE! | 0.8401 | 0.9052 | #VALUE! | D4 (16) |

-offline JH 5/30/08

Reviewed by: JH Date: 5/30/08

Control Limits Established 02/5/2007. LJO

EFB0530R.XLD

Printed 5/30/08 9:08 AM

-formance Check
ations

| | Beta | | | Detector |
|---|---|---|---|---|
| | LCL | UCL | Flag | ID |
| 76 | 0.3689 | 0.4117 | PASS | A1 (01) |
| 31 | 0.3711 | 0.4042 | PASS | A2 (02) |
| 46 | 0.3739 | 0.4104 | PASS | A3 (03) |
| 37 | 0.3377 | 0.3787 | PASS | A4 (04) |
| JE! | 0.3621 | 0.4456 | #VALUE! | B1 (05) |
| JE! | 0.3476 | 0.3828 | #VALUE! | B2 (06) |
| JE! | 0.3583 | 0.4011 | #VALUE! | B3 (07) |
| JE! | 0.3543 | 0.4114 | #VALUE! | B4 (08) |
| JE! | 0.3486 | 0.3691 | #VALUE! | C1 (09) |
| JE! | 0.3673 | 0.3898 | #VALUE! | C2 (10) |
| JE! | 0.3941 | 0.4233 | #VALUE! | C3 (11) |
| JE! | 0.3896 | 0.4174 | #VALUE! | C4 (12) |
| JE! | 0.3970 | 0.4253 | #VALUE! | D1 (13) |
| JE! | 0.4077 | 0.4300 | #VALUE! | D2 (14) |
| JE! | 0.3079 | 0.3945 | #VALUE! | D3 (15) |
| JE! | 0.3606 | 0.4318 | #VALUE! | D4 (16) |

Date: 6/10/08

O

Printed 6/10/088:25 AM

ıeck

| Beta | | | Detector |
|---|---|---|---|
| | UCL | Flag | ID |
| 9 | 0.4117 | PASS | A1 (01) |
| 1 | 0.4042 | PASS | A2 (02) |
| 9 | 0.4104 | PASS | A3 (03) |
| 7 | 0.3787 | PASS | A4 (04) |
| | 0.4456 | #VALUE! | B1 (05) |
| 5 | 0.3828 | #VALUE! | B2 (06) |
| 8 | 0.4011 | #VALUE! | B3 (07) |
| 8 | 0.4114 | #VALUE! | B4 (08) |
| 5 | 0.3691 | #VALUE! | C1 (09) |
| 8 | 0.3898 | #VALUE! | C2 (10) |
| | 0.4233 | #VALUE! | C3 (11) |
| 5 | 0.4174 | #VALUE! | C4 (12) |
| 9 | 0.4253 | #VALUE! | D1 (13) |
| | 0.4300 | #VALUE! | D2 (14) |
| | 0.3945 | #VALUE! | D3 (15) |
| 5 | 0.4318 | #VALUE! | D4 (16) |

Date: 6/11/08

Printed 6/11/089:05 AM

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.2449 | 0.2375 | 0.2635 | PASS | 0.8168 | 0.8206 | 0.8809 | FLAG-LOW | A1 (01) |
| A2 (02) | 0.2514 | 0.2346 | 0.2572 | PASS | 0.8210 | 0.8159 | 0.8781 | PASS | A2 (02) |
| A3 (03) | 0.2516 | 0.2349 | 0.2601 | PASS | 0.8588 | 0.8334 | 0.8923 | PASS | A3 (03) |
| A4 (04) | 0.2469 | 0.2329 | 0.2642 | PASS | 0.8035 | 0.8018 | 0.8543 | PASS | A4 (04) |
| B1 (05) | 0.2499 | 0.2370 | 0.2643 | PASS | 0.8199 | 0.8184 | 0.8843 | PASS | B1 (05) |
| B2 (06) | 0.2318 | 0.2197 | 0.2472 | PASS | 0.8159 | 0.8085 | 0.8621 | PASS | B2 (06) |
| B3 (07) | 0.2477 | 0.2338 | 0.2635 | PASS | 0.8313 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | 0.2390 | 0.2217 | 0.2606 | PASS | 0.8102 | 0.8055 | 0.8644 | PASS | B4 (08) |
| C1 (09) | 0.2497 | 0.2388 | 0.2675 | PASS | 0.8433 | 0.8152 | 0.8761 | PASS | C1 (09) |
| C2 (10) | 0.2402 | 0.2255 | 0.2581 | PASS | 0.8250 | 0.7940 | 0.8678 | PASS | C2 (10) |
| C3 (11) | 0.2449 | 0.2304 | 0.2565 | PASS | 0.8030 | 0.7780 | 0.8528 | PASS | C3 (11) |
| C4 (12) | 0.2389 | 0.2215 | 0.2456 | PASS | 0.7907 | 0.7598 | 0.8391 | PASS | C4 (12) |
| D1 (13) | 0.2411 | 0.2305 | 0.2610 | PASS | 0.8247 | 0.8130 | 0.8781 | PASS | D1 (13) |
| D2 (14) | 0.2509 | 0.2371 | 0.2689 | PASS | 0.8345 | 0.8125 | 0.8914 | PASS | D2 (14) |
| D3 (15) | 0.2511 | 0.2411 | 0.2674 | PASS | 0.8088 | 0.8094 | 0.8752 | FLAG-LOW | D3 (15) |
| D4 (16) | 0.2518 | 0.2379 | 0.2630 | PASS | 0.8485 | 0.8401 | 0.9052 | PASS | D4 (16) |

— See recount file EFB0609R JH 6/9/08

Reviewed by: JH Date: 6/9/08

Control Limits Established 02/5/2007. LJO

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.2477 | 0.2375 | 0.2635 | PASS | 0.8262 | 0.8206 | 0.8809 | PASS | A1 (01) |
| A2 (02) | #VALUE! | 0.2346 | 0.2572 | #VALUE! | #VALUE! | 0.8159 | 0.8781 | #VALUE! | A2 (02) |
| A3 (03) | #VALUE! | 0.2349 | 0.2601 | #VALUE! | #VALUE! | 0.8334 | 0.8923 | #VALUE! | A3 (03) |
| A4 (04) | #VALUE! | 0.2329 | 0.2642 | #VALUE! | #VALUE! | 0.8018 | 0.8543 | #VALUE! | A4 (04) |
| B1 (05) | #VALUE! | 0.2370 | 0.2643 | #VALUE! | #VALUE! | 0.8184 | 0.8843 | #VALUE! | B1 (05) |
| B2 (06) | #VALUE! | 0.2197 | 0.2472 | #VALUE! | #VALUE! | 0.8085 | 0.8621 | #VALUE! | B2 (06) |
| B3 (07) | 0.2403 | 0.2338 | 0.2635 | PASS | 0.8135 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | #VALUE! | 0.2217 | 0.2606 | #VALUE! | #VALUE! | 0.8055 | 0.8644 | #VALUE! | B4 (08) |
| C1 (09) | #VALUE! | 0.2388 | 0.2675 | #VALUE! | #VALUE! | 0.8152 | 0.8761 | #VALUE! | C1 (09) |
| C2 (10) | #VALUE! | 0.2255 | 0.2581 | #VALUE! | #VALUE! | 0.7940 | 0.8678 | #VALUE! | C2 (10) |
| C3 (11) | #VALUE! | 0.2304 | 0.2565 | #VALUE! | #VALUE! | 0.7780 | 0.8528 | #VALUE! | C3 (11) |
| C4 (12) | #VALUE! | 0.2215 | 0.2456 | #VALUE! | #VALUE! | 0.7598 | 0.8391 | #VALUE! | C4 (12) |
| D1 (13) | #VALUE! | 0.2305 | 0.2610 | #VALUE! | #VALUE! | 0.8130 | 0.8781 | #VALUE! | D1 (13) |
| D2 (14) | #VALUE! | 0.2371 | 0.2689 | #VALUE! | #VALUE! | 0.8125 | 0.8914 | #VALUE! | D2 (14) |
| D3 (15) | 0.2536 | 0.2411 | 0.2674 | PASS | 0.8190 | 0.8094 | 0.8752 | PASS | D3 (15) |
| D4 (16) | #VALUE! | 0.2379 | 0.2630 | #VALUE! | #VALUE! | 0.8401 | 0.9052 | #VALUE! | D4 (16) |

-offline JH 6/9/08

Reviewed by: JH Date: 6/9/08

Control Limits Established 02/5/2007. LJO



EFB0609R.XLD

Printed 6/9/08 8:50 AM

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.2434 | 0.2375 | 0.2635 | PASS | 0.8092 | 0.8206 | 0.8809 | FLAG-LOW | A1 (01) |
| A2 (02) | 0.2432 | 0.2346 | 0.2572 | PASS | 0.8154 | 0.8159 | 0.8781 | FLAG-LOW | A2 (02) |
| A3 (03) | 0.2453 | 0.2349 | 0.2601 | PASS | 0.8543 | 0.8334 | 0.8923 | PASS | A3 (03) |
| A4 (04) | 0.2498 | 0.2329 | 0.2642 | PASS | 0.8158 | 0.8018 | 0.8543 | PASS | A4 (04) |
| B1 (05) | 0.2488 | 0.2370 | 0.2643 | PASS | 0.8169 | 0.8184 | 0.8843 | FLAG-LOW | B1 (05) |
| B2 (06) | 0.2374 | 0.2197 | 0.2472 | PASS | 0.8193 | 0.8085 | 0.8621 | PASS | B2 (06) |
| B3 (07) | 0.2384 | 0.2338 | 0.2635 | PASS | 0.8227 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | 0.2510 | 0.2217 | 0.2606 | PASS | 0.8263 | 0.8055 | 0.8644 | PASS | B4 (08) |
| C1 (09) | 0.2553 | 0.2388 | 0.2675 | PASS | 0.8449 | 0.8152 | 0.8761 | PASS | C1 (09) |
| C2 (10) | 0.2432 | 0.2255 | 0.2581 | PASS | 0.8368 | 0.7940 | 0.8678 | PASS | C2 (10) |
| C3 (11) | 0.2485 | 0.2304 | 0.2565 | PASS | 0.8118 | 0.7780 | 0.8528 | PASS | C3 (11) |
| C4 (12) | 0.2344 | 0.2215 | 0.2456 | PASS | 0.8086 | 0.7598 | 0.8391 | PASS | C4 (12) |
| D1 (13) | 0.2402 | 0.2305 | 0.2610 | PASS | 0.8101 | 0.8130 | 0.8781 | FLAG-LOW | D1 (13) |
| D2 (14) | 0.2574 | 0.2371 | 0.2689 | PASS | 0.8218 | 0.8125 | 0.8914 | PASS | D2 (14) |
| D3 (15) | 0.2536 | 0.2411 | 0.2674 | PASS | 0.7993 | 0.8094 | 0.8752 | FLAG-LOW | D3 (15) |
| D4 (16) | 0.2506 | 0.2379 | 0.2630 | PASS | 0.8552 | 0.8401 | 0.9052 | PASS | D4 (16) |

—See recount file EFB0610R JH 6/10/08

Reviewed by: JH Date: 6/10/08

Control Limits Established 02/5/2007. LJO



EFB0610.XLD

Printed 6/10/08 8:14 AM

## LB4100 - B

**Daily Instrument Performance Check**
**Efficiency Determinations**

| Detector ID | Alpha Eff. | Alpha LCL | Alpha UCL | Alpha Flag | Beta Eff. | Beta LCL | Beta UCL | Beta Flag | Detector ID |
|---|---|---|---|---|---|---|---|---|---|
| A1 (01) | 0.2519 | 0.2375 | 0.2635 | PASS | 0.8287 | 0.8206 | 0.8809 | PASS | A1 (01) |
| A2 (02) | 0.2407 | 0.2346 | 0.2572 | PASS | 0.8205 | 0.8159 | 0.8781 | PASS | A2 (02) |
| A3 (03) | #VALUE! | 0.2349 | 0.2601 | #VALUE! | #VALUE! | 0.8334 | 0.8923 | #VALUE! | A3 (03) |
| A4 (04) | #VALUE! | 0.2329 | 0.2642 | #VALUE! | #VALUE! | 0.8018 | 0.8543 | #VALUE! | A4 (04) |
| B1 (05) | 0.2531 | 0.2370 | 0.2643 | PASS | 0.8380 | 0.8184 | 0.8843 | PASS | B1 (05) |
| B2 (06) | #VALUE! | 0.2197 | 0.2472 | #VALUE! | #VALUE! | 0.8085 | 0.8621 | #VALUE! | B2 (06) |
| B3 (07) | 0.2405 | 0.2338 | 0.2635 | PASS | 0.8293 | 0.8402 | 0.8963 | FLAG-LOW | B3 (07) |
| B4 (08) | #VALUE! | 0.2217 | 0.2606 | #VALUE! | #VALUE! | 0.8055 | 0.8644 | #VALUE! | B4 (08) |
| C1 (09) | #VALUE! | 0.2388 | 0.2675 | #VALUE! | #VALUE! | 0.8152 | 0.8761 | #VALUE! | C1 (09) |
| C2 (10) | #VALUE! | 0.2255 | 0.2581 | #VALUE! | #VALUE! | 0.7940 | 0.8678 | #VALUE! | C2 (10) |
| C3 (11) | #VALUE! | 0.2304 | 0.2565 | #VALUE! | #VALUE! | 0.7780 | 0.8528 | #VALUE! | C3 (11) |
| C4 (12) | #VALUE! | 0.2215 | 0.2456 | #VALUE! | #VALUE! | 0.7598 | 0.8391 | #VALUE! | C4 (12) |
| D1 (13) | 0.2412 | 0.2305 | 0.2610 | PASS | 0.7906 | 0.8130 | 0.8781 | FLAG-LOW | D1 (13) |
| D2 (14) | #VALUE! | 0.2371 | 0.2689 | #VALUE! | #VALUE! | 0.8125 | 0.8914 | #VALUE! | D2 (14) |
| D3 (15) | 0.2548 | 0.2411 | 0.2674 | PASS | 0.8024 | 0.8094 | 0.8752 | FLAG-LOW | D3 (15) |
| D4 (16) | #VALUE! | 0.2379 | 0.2630 | #VALUE! | #VALUE! | 0.8401 | 0.9052 | #VALUE! | D4 (16) |

– Offline JH 6/10/08

Reviewed by: JH Date: 6/10/08

Control Limits Established 02/5/2007. LJO



EFB0610R.XLD

Printed 6/10/08 8:25 AM

# Gas Proportional Counter

# Instrument Calibration

# Initial Efficiency Calibration
# Standards Traceability

Instrument: LB4100-A

Calibration: Sr-90 Flat Planchet

Date of Calibration: 09/27/2007

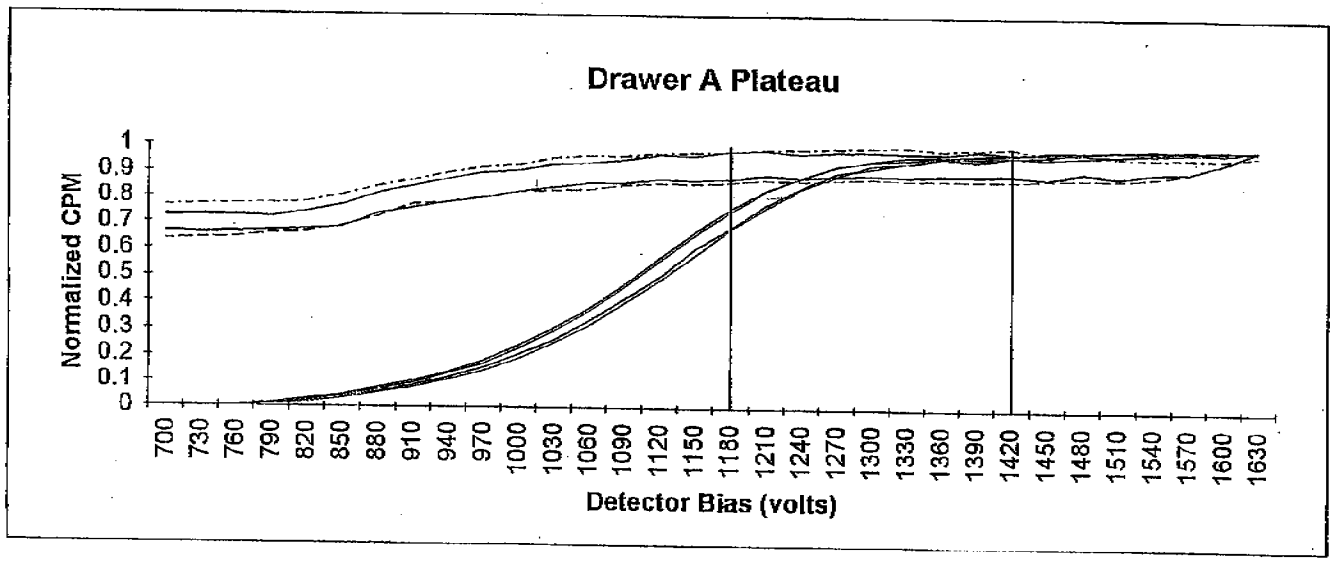
Efficiency Log Files: Sr90F-09/07

Efficiency Files: ESF0927A
ESF0927B

Source ID's: Sr-90 514-1572-73

Unit Type: LB4100/W-A
Date Performed: 9/18/07 09:58
FileName: PTA0918A
Batch ID: PLATEAU

Unit Id: Orange
Application Revision: B
Application Version: Standard




Optimum alpha beta simultaneous operating voltage: 1420

Optimum alpha only operating voltage: 1180

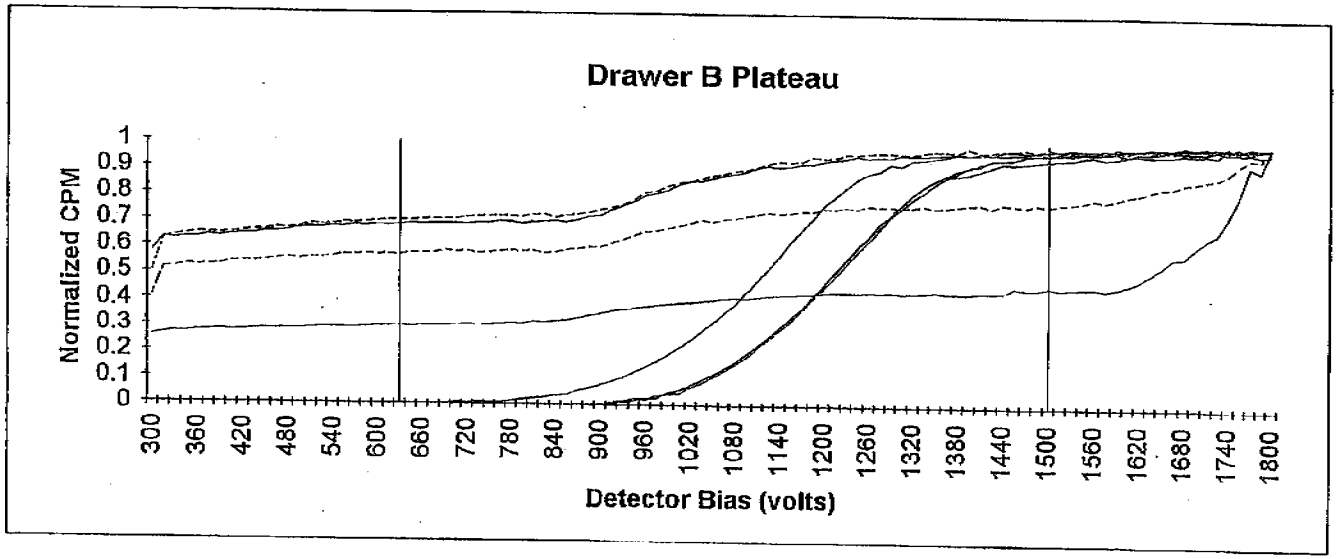
Archieved

| | A1 | A2 | A3 | A4 |
|---|---|---|---|---|
| Beta slope at beta voltage | 1.99% | 1.77% | 2.19% | 0.99% |
| Alpha slope at beta voltage | 0.06% | 0.88% | 0.76% | -0.99% |
| Alpha slope at alpha voltage | 0.96% | 1.53% | 1.44% | 1.63% |

Printed 9/18/07 4:11 PM

Unit Type: LB4100/W-A
Date Performed: 9/24/07 12:21
FileName: PTA0924B
Batch ID: PLATEAU

Unit Id: Orange
Application Revision: B
Application Version: Standard




Optimum alpha beta simultaneous operating voltage: 1500

Optimum alpha only operating voltage: 630

| | B1 | B2 | B3 | B4 |
|---|---|---|---|---|
| Beta slope at beta voltage | 1.73% | 2.36% | 1.03% | 1.73% |
| Alpha slope at beta voltage | 0.90% | 2.69% | 0.15% | -0.13% |
| Alpha slope at alpha voltage | 1.59% | 2.19% | 1.97% | 1.75% |

Archieved

4th plateau a working voltage was Found.

Starting Voltage 300
Ending Voltage 1800
15 Volts/step
15 min/step
60,000 ct preset
1000 min + For each source.

Printed 9/26/07 9:14 AM

Date 9/18/07

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100A**

*Daily Response and Background Checks*

Date 9/18/07

SOP 724r 1 6

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100A**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-4 | Plateaus | - - | - | 5 step | 954 | LO | PTA0918A | LO |
| 5-8 | ↓ | - | - | ↓ | ↓ | ↓ | PTA0918B | ↓ |

Date 9/24/07

SOP 724r/0

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100A**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ☆ | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | ☆ | | | |
| Dr B | | | | |
| Dr C | | | | |
| Dr D | | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 1300 | Dr A | 0.15 |
| | ↓ | Dr B | |
| Tank 2 | 1400 | Dr C | |
| | ↓ | Dr D | ↓ |

Comments: ☆ Drawers C and D are offline. Drawers A & B have no working control limits due to no plateaus or ROIs archieved officially. LO 9/24/07

Page No.: 326267 A

Form 780r8.doc (6/23/06)

Reviewed By / Date LO 9/24/07

Date 9/24/07 SOP 724r10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100A**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 5-8 | Plateau | - | - | 15 Step | 1210 | LO | PtA0924B | LO |

Comments:

Page No.: 326267 B

(cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By / Date 9/26/07

9/8/07 LTS Plateaus for Drawers A and B

| Source Used β | Detector | Source used α |
|---|---|---|
| Sr/Y 90 - 406 | A1 B1 | 410 - Am 241 |
| 29,600 dpm - 407 | A2 B2 | 411 - 17,800 dpm |
| 9/15/92 - 408 | A3 B3 | 412 - 2/06/95 |
| ↓ - 409 | A4 B4 | 413 - ↓ |

Parameters
Starting Voltage - 700
Ending Voltage - 1650
30 Volts / step
5 min / step
40,000 count preset

Filenames:
PTA0918A
PTA0918B

9/18/07 LTS A working voltage could not be found for Drawer B. Another plateau will be run using the same sources as above but different parameters.

Parameters
Starting Voltage: 700
Ending Voltage: 1650
15 Volts / step

Filename:
PTA0919B

9/24/07 LD A working voltage could still not be found. It was assumed that the count preset was what governed how many counts were being recorded. Turns out that the plateau file was only gathering the counts for 5 minutes and not trying to hit the count preset. This was remedied by increasing the minutes per step to 15 minutes instead of 5 minutes. Two seperate plateaus were run (seperate alpha & beta ones) on 9/21/07 and 9/22/07.

| Parameters | Filenames: |
|---|---|
| Starting Voltage: 300 | PTA0921 ⇒ alpha |
| Ending Voltage: 1800 | PLA0922 ⇒ beta |
| 15 Volts per step | |
| 15 min per step | PTA0924B ⇒ both Archieved |
| 50000 count preset ← over 1000 min | |

9/26/07 LD ROIs set for drawer A and drawer B using the Sr/Y 90 Plateau sources.

9/27/07 LD

Daily Efficiency

New "daily efficiency" Interim control limits using the efficiency run after new ROIs were set. (EFA0926) Historical control limits will be set after 30 data points have been accumulated.

Weekly & Daily Backgrounds

New "weekly background" Interim control limits using the weekly background run after new ROIs were set. (BKA0926W). Historical control limits will be set after 10 data points have been

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH GFPC Calibrations
TEST LB4100A
METHOD
SOP/REV (PREP)
SOP/REV (ANAL) 724 R10

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

Paragon SOP 724 R10 states that efficiency calibrations must be within 5% of the previous value. Prior to the current calibration, Instrument A suffered from exposure to acid fumes from improperly dried sample planchets. Instrument A was dissassembled in an effort to clean the affected detectors.

The detectors were properly recalibrated and returned to service. Some detectors showed new counting efficiencies more than 5% different from the previous calibration.

The cause of the change has been identified and the detectors properly re-calibrated. Therefore, all calibration and sample data is unaffected and will be used without qualification.

09/28/07

TECHNICIAN/ANALYST [signature] DATE 9/28/07

DEPARTMENT MANAGER [signature] DATE 10/1/07

323262

FORM 302r6.doc (4/22/04)

Sr-90 Flat Planchet Efficiency Calibration
LB4100-A
Date: 9/27/2007
Source ID: 1176

| Det ID | A1 | A2 | A3 | A4 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|
| File Name | ESF0927A | ESF0927A | ESF0927A | ESF0927A | ESF0927B | ESF0927B | ESF0927B | ESF0927B |
| Cnt Time | 27.00 | 27.11 | 26.99 | 27.21 | 22.00 | 27.59 | 25.90 | 26.40 |
| Tot Cnts | 10003 | 10002 | 10006 | 10005 | 10009 | 10004 | 10003 | 10003 |
| Bkg CPM | 2.120 | 1.898 | 2.164 | 1.995 | 87.075 | 5.871 | 2.157 | 1.692 |
| CPM | 368.3615 | 367.0434 | 368.5659 | 365.7007 | 367.880 | 356.724 | 384.059 | 377.210 |
| Alpha EFF | 0.000731 | 0.000573 | 0.000237 | 0.00068 | 0.001411 | 0.001320 | 0.000747 | 0.000820 |
| Beta EFF | 0.407485 | 0.406027 | 0.407711 | 0.404542 | 0.406952 | 0.394612 | 0.424851 | 0.417273 |
| **Efficiency** | **0.4075** | **0.4060** | **0.4077** | **0.4045** | **0.4070** | **0.3946** | **0.4249** | **0.4173** |

| vent | Recycle |
|---|---|
| 1 | 1 |

| e/Time | Official | Bias | Step |
|---|---|---|---|
| 07 9:58 | TRUE | 1420 | 0 |
| 7 12:21 | TRUE | 1500 | 0 |
| UM! | #NUM! | #NUM! | 0 |
| UM! | #NUM! | #NUM! | 0 |

| e/Time | Official | Thres | bLL | bUL | aLL | aUL |
|---|---|---|---|---|---|---|
| 07 0:00 | TRUE | 0.1 | 0 | 29.79 | 57.53 | 100 |
| 07 0:00 | TRUE | 0.1 | 0 | 33.08 | 62.27 | 100 |
| 07 0:00 | TRUE | 0.1 | 0 | 25.42 | 49.42 | 100 |
| 07 0:00 | TRUE | 0.1 | 0 | 27.3 | 52.3 | 100 |
| 07 0:00 | TRUE | 0.1 | 0 | 48.74 | 90.2 | 100 |
| 07 0:00 | TRUE | 0.1 | 0 | 17.26 | 39.75 | 100 |
| 07 0:00 | TRUE | 0.1 | 0 | 17.53 | 37.8 | 100 |
| 07 0:00 | TRUE | 0.1 | 0 | 15.75 | 35.31 | 100 |



Printed 9/27/075:34 PM

Date 9/27/07

SOP 724r 10

**Paragon Analytics**
Low Background Gas Flow Proportional Counter Log
**Instrument: LB4100A**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | WO | ☆ | | | WO | P | | | P |
| 2 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | HB | | | OLBW |
| 6 | | | | | | LB | | | ↓ |
| 7 | | | | | | P | | | P |
| 8 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 9 | OL | OL | | | OL | OL | | | OL |
| 10 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKA0926W | | | |
| Dr B | ↓ | | | |
| Dr C | OL | | | |
| Dr D | ↓ | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 800 | Dr A | 0.15 |
| | ↓ | Dr B | ↓ |
| Tank 2 | 1400 | Dr C | ↓ |
| | ↓ | Dr D | ↓ |

Comments: ☆ Pass fail Flags do not count due to ~~interim~~ Historical limits being set. WO 9/27/07 WO 9/27/07

Page No.: 326269 A

Form 780r8.doc (6/23/06)

Reviewed By / Date WO 9/28/07

Date 9/27/07

SOP 724r10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100A**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-8 | 1130 | Daily EFF | – | 30 | 947 | LO | EFA0927 | LO |
| 1-8 | Daily BKG | – | – | 60 | 1021 | LO | BKA0927 | LO |
| 1 | 1171 | Am Wipe EFF | α | 30 | 1140 | LO | EAW0927 | LO |
| 2 | | | | | 1147 | | A | |
| 3 | | | | | 1154 | | B | |
| 4 | | | | | 1201 | | C | ↓ |
| 5 | | | | | 1506 | | D | LO |
| 6 | | | | | 1512 | | E | |
| 7 | | | | | 1519 | | F | |
| 8 | ↓ | ↓ | ↓ | | 1532 | | ↓ G | ↓ |
| 1 | 1172 | Sr Wipe EFF | β | | 1219 | | ESW0927 | LO |
| 2 | | | | | 1215 | | A | |
| 3 | | | | | 1211 | | B | |
| 4 | | | | | 1208 | | C | ↓ |
| 5 | | | | | 1154 | | D | LO |
| 6 | | | | | 1151 | | E | |
| 7 | | | | | 1146 | | F | |
| 8 | ↓ | ↓ | ↓ | ↓ | 1140 | ↓ | ↓ G | ↓ |
| 1-4 | 1173 | Sr89 EFF | β | ~~30~~ 60 | 1349 | LO | ESE0927A | LO 9/27/07 |
| 5-8 | ↓ | ↓ | ↓ | ↓ | 1158 | ↓ | ↓ B | ↓ |
| 1-4 | 1174 | Am241 EFF | α | 60 | 1303 | LO | EAM0927A | LO |
| 5-8 | ↓ | ↓ | ↓ | ↓ | 1250 | ↓ | EAM0927B | ↓ |
| 1-4 | 1175 | Sr90R EFF | β | 60 | 1223 | LO | ESR0927A | LO |
| 5-8 | ↓ | ↓ | ↓ | ↓ | 1245 | ↓ | ↓ B | ↓ |
| 1-4 | 1176 | Sr90F EFF | β | 60 | 1230 | LO | ESF0927A | LO |
| 5-8 | ↓ | ↓ | ↓ | ↓ | 1303 | ↓ | ↓ B | ↓ |
| 1-4 | 1177 | Th230 EFF | α | 60 | 1323 | LO | ETH0927A | LO |
| 5-8 | ↓ | ↓ | ↓ | ↓ | 1439 | ↓ | ↓ B | ↓ |
| 1-4 | 1178 | Cl36 EFF | β | 60 | 1316 | LO | ECL0927A | LO |
| 5-8 | ↓ | ↓ | ↓ | ↓ | 1334 | ↓ | ↓ B | ↓ |
| 1-4 | 1179 | I129 EFF | β | 60 | 1437 | LO | EI00927A | LO |
| 5-8 | ↓ | ↓ | ↓ | ↓ | 1341 | ↓ | ↓ B | ↓ |
| 1 | 0714506-B1MB | SR070220-1 | Sr90 | 30 | 1548 | LO | SRB0927 A | LO |
| 7 | -B2MB | | | | | | | |
| 4 | -B3MB | | | | | | LO 9/27/07 | |
| 2 | -S1LCS | | | | | | | |
| 3 | -S2LCS | | | | | | | |
| 8 | -S3LCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 6 | 0714506-B1MB | SR070220-1 | Sr90 | 30 | 1623 | LO | SRA0927A | LO |
| 2 | 601 | Wipe ICVs | αβ | 10 | 1714 | LO | ABA0927 | LO |
| 4 | 729 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 729 | Wipe ICVs | αβ | 10 | 1729 | LO | ABA0927A | LO |
| 3 | 601 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 6 | 601 | Wipe ICVs | αβ | 10 | 1743 | LO | ABA0927B | LO |
| 8 | 729 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| | | | | | | | | LO 9/28/07 |

Comments:

Page No.: 326269 B

(cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By/ Date LO 9/28/07

Source Database for OSUM for LB4100-A
Number of sources in table: 157

Application Revision: A

| Control ID | Isotope | Type | Half-Life (Days) | DPM | Std dev | Date | Status | Alpha/Beta Archive File |
|---|---|---|---|---|---|---|---|---|
| 1171 | Am-241 | Alpha | 157856.728 | 9342 | 467.10 | 6-Apr-04 | PA | Am241Wipe-09/07 |
| 1172 | Sr-90/Y-90 | Beta | 10518.912 | 37044 | 1852.20 | 10-Dec-01 | PA | Sr90Wipe-09/07 |
| 1173 | Sr-89 | Beta | 50.53 | 14982 | 749.10 | 16-Feb-07 | PA | Sr89-09/07 |
| 1174 | Am-241 | Alpha | 157783.68 | 5514.295 | 275.71 | 19-Mar-99 | PA | Am241-09/07 |
| 1175 | Sr-90 | Beta | 10518.912 | 19986.92 | 999.35 | 2-Dec-04 | PA | Sr90R-09/07 |
| 1176 | Sr-90 | Beta | 10518.912 | 1110 | 55.50 | 18-Mar-99 | PA | Sr90F-09/07 |
| 1177 | Th-230 | Alpha | 27539096 | 2653.3957 | 132.67 | 13-Jul-04 | PA | Th230-09/07 |
| 1178 | Cl-36 | Beta | 109937240 | 9959.7 | 497.99 | 13-Dec-04 | PA | Cl36-09/07 |
| 1179 | I-129 | Beta | 5734268000 | 4414 | 220.70 | 15-Apr-93 | PA | I129-09/07 |

*Paragon Analytics*

Lab

ical Batch _____

| | Filename | POS Ckd By |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

S? ( Y / N ) No. _____

| shed by / Date | Received by / Date |
|---|---|
| 1/15/04 | |
| | |
| | |
| | |

279055 B

# WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES / Ra/Sr Lab

Initials [illegible] Date 12/15/04 Method (SOP / Rev) 907R8 Matrix LIQUID

**COMMENTS**

$^{90}Sr$ CALIBRATION

- ~2.5 ml 16N $HNO_3$ ADDED TO PLANCHETS
- SPIKE ADDED TO PLANCHETS
- DRIED ON HOTPLATE

[illegible] 12/15/04

Reviewed by / Date [illegible] 12/15/04

Sr-90 Calculatons

| Sample ID | Sample D & T | Sep. D & T | Count D & T | Ct Dur | Init Vol | Calc Vol | Gross CPM | BKG CPM | Net CPM | Efficiency | Yield | Act | 2 sig TPU | MDC | MS Recov | LCS Recov |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0424028-S1 | 3/18/1999 12:00 | 12/15/2004 12:00 | ########### | 10 | 1.0000 | 0.980 | 406.500 | 1.453 | 405.047 | 0.4337 | 1.000 | 258.05 | 60.71 | 1.30 | 103.2% | 103.2% |
| 0424028-S2 | 3/18/1999 12:00 | 12/15/2004 12:00 | ########### | 10 | 1.0000 | 0.980 | 409.000 | 1.453 | 407.547 | 0.4337 | 1.000 | 259.64 | 61.09 | 1.30 | 103.9% | 103.9% |
| 0424028-S3 | 3/18/1999 12:00 | 12/15/2004 12:00 | ########### | 10 | 1.0000 | 0.980 | 411.200 | 1.453 | 409.747 | 0.4337 | 1.000 | 261.04 | 61.41 | 1.30 | 104.4% | 104.4% |
| 0424028-S4 | 3/18/1999 12:00 | 12/15/2004 12:00 | ########### | 10 | 1.0000 | 0.980 | 420.500 | 1.453 | 419.047 | 0.4337 | 1.000 | 266.97 | 62.79 | 1.30 | 106.8% | 106.8% |
| 0424028-S5 | 3/18/1999 12:00 | 12/15/2004 12:00 | ########### | 10 | 1.0000 | 0.980 | 396.200 | 1.453 | 394.747 | 0.4337 | 1.000 | 251.49 | 59.18 | 1.30 | | 100.6% |
| | | | | | | | | | | | MEAN= | 259.44 | | | | |
| | | | | | | | | | | | STDEV= | 5.58 | | | Ave Recovery = | 104.6% 103.8% |
| | | | | | | | | | | | 2SIG LCL | 248.28 | | | | |
| | | | | | | | | | | | 2SIG UCL | 270.59 | | | | |

| Sample ID | Spike Soln | Ref Date | Sr-90 Activity DPM/mL | Sr-90 Spike Vol mL | Sr-90 Act pCi Added |
|---|---|---|---|---|---|
| 0 | 514.1572.73 | 3/18/1999 | 55.50 | 0.0 | #DIV/0! |
| 0424028-S1 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |
| 0 | 514.1572.73 | 3/18/1999 | 55.50 | 0.0 | #DIV/0! |
| 0424028-S2 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |
| 0 | 514.1572.73 | 3/18/1999 | 55.50 | 0.0 | #DIV/0! |
| 0424028-S3 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |
| 0 | 514.1572.73 | 3/18/1999 | 55.50 | 0.0 | #DIV/0! |
| 0424028-S4 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |
| 0 | 514.1572.73 | 3/18/1999 | 55.50 | 0.0 | #DIV/0! |
| 0424028-S5 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |

1σ 4 + 5

Using 5as outlier
LO 11/16/06

t½ 28.8yrs

r:\inst\gfp\0424028SRFOUT.xls

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision:
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111
Batch ID: OUTLIER
Count Preset (m): 10
2 Batch Ended: 11/11/06 13:19

Background logfile: BKCABW
Date of Bkg. Cal: 11/11/06
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM8186
Beta efficiency logfile: Sr99R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(a*(mass-x0)) | | y = b*m^(a*(mass-x0)) | |
| Alpha b= | 1.16970 | Beta b= | 0.9791 |
| m= | 0.99300 | m= | 0.9999 |
| a= | 0.7998 | a= | 1.3099 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b*m^-mass | | y = b*mass + m | |
| a ->b xtalk b= | 0.2319 | b ->a xtalk b= | -2.71E-06 |
| a ->b xtalk m= | 0.9997 | b ->a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity | | | | | | | Beta Activity | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Gross CPM | Bkg. CPM | b>a xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. | Gross CPM | Bkg. CPM | a>b xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. |
| A1 | 0424028-S1 | 11/11/06 13:19 | 10.00 | 0.0 | 0.500 | 0.052 | 0.203 | 0.2316 | 1.170 | n/a | n/a | 408.500 | 1.453 | 0.1159 | 0.4337 | 0.979 | n/a | n/a |





LO 9/27/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision: 2
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111B
Batch ID: OUTLIER
Count Preset (m): 10
Batch Ended: 11/11/06 15:00

Background logfile: BKGABW
Date of Bkg. Cal: 11/11/06
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM0106
Beta efficiency logfile: Sr90R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration y = b*m^(a*(mass-x0)) | | Beta Attenuation Calibration y = b*m^(a*(mass-x0)) | |
|---|---|---|---|
| Alpha b= | 1.16910 | Beta b= | 0.9791 |
| m= | 0.95390 | m= | 0.9998 |
| a= | 0.7986 | a= | 1.3098 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk y = b*m^-mass | | Beta to Alpha X-talk y = b*mass + m | |
| a -> b xtalk b= | 0.2316 | b -> a xtalk b= | -2.71E-06 |
| a -> b xtalk m= | 0.9997 | b -> a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Activity Bkg. CPM | Alpha Activity b>a xtlk CPM | Alpha Activity Base Eff | Alpha Activity Base Cor.Fact. | Alpha Activity Progeny Eff | Alpha Activity Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Activity Bkg. CPM | Beta Activity a>b xtlk CPM | Beta Activity Base Eff | Beta Activity Base Cor.Fact. | Beta Activity Progeny Eff | Beta Activity Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0424028-S2 | 11/11/06 15:00 | 10.00 | 0.0 | 0.400 | 0.052 | 0.205 | 0.2316 | 1.170 | n/a | n/a | 409.000 | 1.453 | 0.0927 | 0.4337 | 0.979 | n/a | n/a |





LO 9/27/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision:
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111D
Batch ID: OUTLIER
Count Preset (m): 10
Batch Ended: 11/11/08 15:21

Background logfile: BKGABW
Date of Bkg. Cal: 11/11/08
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM0108
Beta efficiency logfile: Sr90R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(a*(mass-x0)) | | y = b*m^(a*(mass-x0)) | |
| Alpha b= | 1.16970 | Beta b= | 0.9791 |
| m= | 0.99300 | m= | 0.9999 |
| a= | 0.7986 | a= | 1.3099 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b*m^-mass | | y = b*mass + m | |
| a ->b xtalk b= | 0.2310 | b ->a xtalk b= | -2.71E-06 |
| a ->b xtalk m= | 0.9997 | b ->a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity | | | | | | | Beta Activity | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Gross CPM | Bkg. CPM | b>a xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. | Gross CPM | Bkg. CPM | a>b xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. |
| A1 | 0424028-S3 | 11/11/08 15:21 | 10.00 | 0.0 | 0.900 | 0.052 | 0.206 | 0.2316 | 1.170 | n/a | n/a | 411.200 | 1.453 | 0.2086 | 0.4337 | 0.979 | n/a | n/a |





LO
9/27/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision:
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111F
Batch ID: OUTLIER
Count Preset (m): 10
2 Batch Ended: 11/11/06 15:37

Background logfile: BKGABW
Date of Bkg. Cal: 11/11/06
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM6106
Beta efficiency logfile: Sr90R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration y = b*m^(x*(mass-x0)) | | Beta Attenuation Calibration y = b*m^(x*(mass-x0)) | |
|---|---|---|---|
| Alpha b= | 1.16970 | Beta b= | 0.9791 |
| m= | 0.99300 | m= | 0.9998 |
| x= | 0.7586 | x= | 1.3099 |
| x0= | 0.0000 | x0= | 0.0000 |
| **Alpha to Beta X-talk y = b *m^-mass** | | **Beta to Alpha X-talk y = b*mass + m** | |
| a -> b xtalk b= | 0.2318 | b -> a xtalk b= | -2.71E-09 |
| a -> b xtalk m= | 0.9997 | b -> a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Activity Bkg. CPM | Alpha Activity b>a xtlk CPM | Alpha Activity Base Eff | Alpha Activity Base Cor.Fact. | Alpha Activity Progeny Eff | Alpha Activity Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Activity Bkg. CPM | Beta Activity a>b xtlk CPM | Beta Activity Base Eff | Beta Activity Base Cor.Fact. | Beta Activity Progeny Eff | Beta Activity Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 042402B-S4 | 11/11/06 15:37 | 10.00 | 0.0 | 0.600 | 0.052 | 0.210 | 0.2316 | 1.170 | n/a | n/a | 420.500 | 1.453 | 0.1391 | 0.4337 | 0.979 | n/a | n/a |





9/27/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision:
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111H
Batch ID: OUTLIER
Count Preset (m): 10
2 Batch Ended: 11/11/06 15:55

Background logfile: BKGABW
Date of Bkg. Cal: 11/11/06
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM0106
Beta efficiency logfile: Sr90R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration y = b*m^(a*(mass-x0)) | | Beta Attenuation Calibration y = b*m^(a*(mass-x0)) | |
|---|---|---|---|
| Alpha b= | 1.16970 | Beta b= | 0.9791 |
| m= | 0.99700 | m= | 0.9998 |
| a= | 0.7986 | a= | 1.3098 |
| x0= | 0.0000 | x0= | 0.0000 |
| **Alpha to Beta X-talk y = b *m^-mass** | | **Beta to Alpha X-talk y = b*mass + m** | |
| a ->b xtalk b= | 0.2316 | b ->a xtalk b= | -2.71E-06 |
| a ->b xtalk m= | 0.9997 | b ->a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Bkg. CPM | Alpha b>a xtlk CPM | Alpha Base Eff | Alpha Base Cor.Fact. | Alpha Progeny Eff | Alpha Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Bkg. CPM | Beta a>b xtlk CPM | Beta Base Eff | Beta Base Cor.Fact. | Beta Progeny Eff | Beta Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0424028-S5 | 11/11/06 15:55 | 10.00 | 0.0 | 0.680 | 0.052 | 0.198 | 0.2316 | 1.170 | n/a | n/a | 396.200 | 1.463 | 0.1391 | 0.4337 | 0.979 | n/a | n/a |





VO 9/27/07

Date 11/11/06

SOP 724r 9

**Paragon Analytics**
Low Background Gas Flow Proportional Counter Log
**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | ☆ Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LO | P | | | | | | | P |
| 2 | | | | | | | | | Hα |
| 3 | | | | | | | | | P |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | Hα |
| 15 | | | | | | | | | P |
| 16 | | | | | | | | | HB |

LO 11/11/06

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKB1110W | LO | 2HB | BKB1111W |
| Dr B | | | | |
| Dr C | | | | |
| Dr D | | LO | 14P 16HB | BKB1111W |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 2000 | Dr A | 6.15 |
| | | Dr B | |
| Tank 2 | 1200 | Dr C | |
| | | Dr D | |

☆ Daily Bkg not run due to Weekly Bkg run the night before. LO 11/11/06

Comments:

Page No.: 318142 A

Form 780r8.doc (6/23/06)

Reviewed By: / Date 11/21/06

Date 11/11/06

SOP 724r 9

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| | | | | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|

PROJECT 514.1572.73 Notebook No. _____ 73

Continued From Page _____

Sr-90 Working Standard

1) Transfer a fraction of std 514.1572.72 to a 500 ml poly bottle + dilute w/ 0.1 M HCl to a final ~~activity~~ conc of approx 25 pCi/ml

a) 500 ml bottle empty 37.9693 g (Bal 12)
" + 1° std 40.5067
Net 1° std transferred 2.5374 g

b) 500 ml bottle empty 37.9693 g from above
bottle + std + 0.1 M HCl 542.5 g (Bal 20)
Total diluted mass ~~216.5~~ 504.5 g

2) Calculation

$$\frac{(4984.3\ pCi/g)(2.5374\ g)(.9971\ g/ml)}{504.5\ g\ \cancel{216.5\ g}} = \cancel{24.50\ pCi/ml} = 25.00\ pCi/ml$$

Ref Date = 3/18/99
Exp Date = 3/23/04

Verified 3/25/99 DCB

Stnd ID: 514.1572.73 RG 12/13/04

Description: Sr-90
Expiration: 11/29/05
Activity: 55.50 dpm/mL
2s Uncertainty: 1.48 dpm/mL
Ref. Date: 3/18/99
Ref Time: N/A
Prep Date: 3/23/99 Prep by: DCB
Matrix/Comp. 0.1 M HCl
Half Life (y): 2.88E+01
NCR required for ICPT work

RG 12/13/04

12/13/04

RG 12/6/05 Standard reverified & new label added after Z-out. RG 12/13/04

RG 12/6/05
Stnd ID: 514.1572.73

Description: Sr-90
Expiration: 11/4/06
Activity: 55.50 dpm/mL
2s Uncertainty: 1.48 dpm/mL
Ref. Date: 3/18/99
Ref Time: N/A
Prep Date: 3/23/99 Prep by: DCB
Matrix/Comp. 0.1M HCl
Half Life (y): 2.88E+01

RG 12/6/05

RG 12/6/05

RG 12/6/05

Continued on Page

72
PROJECT 514.1572.72

Notebook No. _____

Continued From Page _____

5-90 Primary Standard

1) Transfer RSO#514 (Analytics 573170-307) to a a 250 ml poly bottle + dilute to final conc of approx 500 pCi/ml w/ 0.1 M HCl.

a) Ampule, full w/ beaker 36.5911 g (Bal 12)
Ampule, empty w/ beaker 31.7310
Net std transferred 4.8601 g

b) 250 ml poly, empty 26.4146 g (Bal 12)
bottle w/ std 0.1 M HCl 223.6 g (Bal 16)
Total diluted std mass 197.2 g

2) Density of 0.1 M HCl using 100 ml class A flask

99.7100 g / 100 ml = .9971 g/ml.

3) Calculations

orig. std: $\left(\frac{3.757 \text{ EH dps}}{5.02081 \text{ g}}\right)\left(\frac{60 \text{ s/m}}{2.22 \text{ dpm/pCi}}\right) = 202,239.4$ pCi/g

del. std by mass $\frac{(202,239.4 \text{ pCi/g})(4.8601 \text{ g})}{(197.2 \text{ g})}$

= 4984.3 pCi/g

del std by vol (4984.3 pCi/g)(.9971 g/ml) = 4969.8 pCi/ml

Ref Date = 3/18/99 Verified 3/25/99 [illegible]
Exp Date = 3/23/04

Continued on Page

Read and Understood By

[illegible] 3/23/99 [illegible] 3/24/99

Signed Date Signed Date

ANALYTICS

PAL 514
rcd 3-23-99

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.
Phone (404) 352-8677
Fax (404) 352-2837

# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

57370-307

Sr-90 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master liquid radionuclide solution source. The master source was calibrated by liquid scintillation counting.

ANALYTICS maintains traceability to the National Institute of

ICVs, ICBs

Sr-90 Calculatons

| Det | Sample ID | Sample D & T | Sep. D & T | Count D & T | Ct Dur | Init Vol (L) | Calc Vol (L) | Gross CPM | BKG CPM | Net CPM | Efficieny | Yield | Decay | ngrowth | k | Act pCi/L | 1 sig CU | 1 sig TPU | 2 sig TPU | MDC | LCS Recov |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0714506-B1MB | 2/20/2007 12:00 | 2/22/2007 15:07 | 9/27/2007 15:49 | 30 | 1 | 0.9801049 | 2.000 | 2.120 | -0.120 | 0.4075 | 0.943 | 0.8817597 | 2 | 1.4742 | -0.08 | 0.18 | 0.18 | 0.36 | 0.90 | |
| A4 | 0714506-B3MB | 2/20/2007 12:00 | 2/22/2007 15:07 | 9/27/2007 15:49 | 30 | 1 | 0.9801049 | 1.900 | 1.995 | -0.095 | 0.4045 | 0.924 | 0.8817597 | 2 | 1.4334 | -0.07 | 0.18 | 0.18 | 0.36 | 0.90 | |
| B2 | 0714506-B1MB | 2/20/2007 12:00 | 2/22/2007 15:07 | 9/27/2007 16:24 | 30 | 1 | 0.9801049 | 1.533 | 2.167 | -0.634 | 0.3946 | 0.943 | 0.8817597 | 2 | 1.4275 | -0.44 | 0.16 | 0.17 | 0.34 | 0.94 | |
| B3 | 0714506-B2MB | 2/20/2007 12:00 | 2/22/2007 15:07 | 9/27/2007 15:49 | 30 | 1 | 0.9801049 | 2.033 | 2.157 | -0.124 | 0.4249 | 0.955 | 0.8817597 | 2 | 1.5574 | -0.08 | 0.17 | 0.17 | 0.34 | 0.86 | |
| A2 | 0714506-S1LCS | 2/20/2007 12:00 | 2/22/2007 15:07 | 9/27/2007 15:49 | 30 | 1 | 0.9801049 | 16.500 | 1.898 | 14.602 | 0.4060 | 0.943 | 0.8817597 | 2 | 1.4695 | 9.94 | 0.51 | 1.27 | 2.55 | 0.86 | 98.5% |
| A3 | 0714506-S2LCS | 2/20/2007 12:00 | 2/22/2007 15:07 | 9/27/2007 15:49 | 30 | 1 | 0.9801049 | 18.100 | 2.164 | 15.936 | 0.4077 | 0.913 | 0.8817597 | 2 | 1.4275 | 11.16 | 0.55 | 1.42 | 2.84 | 0.94 | 110.7% |
| B4 | 0714506-S3LCS | 2/20/2007 12:00 | 2/22/2007 15:07 | 9/27/2007 15:49 | 30 | 1 | 0.9801049 | 17.467 | 1.692 | 15.775 | 0.4173 | 0.989 | 0.8817597 | 2 | 1.5522 | 10.16 | 0.49 | 1.29 | 2.58 | 0.77 | 100.7% |

| Sample ID | Spike Soln | Ref Date | Sr-90 Activity DPM/mL | Sr-90 Spike Vol mL | Sr-90 Act pCi/L Added |
|---|---|---|---|---|---|
| 0714506-S1LCS | 600.3020.50 | 12/1/2001 | 49.78 | 0.5 | 10.088 |
| 0714506-S2LCS | | | 49.78 | 0.5 | 10.088 |
| 0714506-S3LCS | | | 49.78 | 0.5 | 10.088 |

Ave Recovery = 103.3%



r:\Inst\gfp\calibration\outliers and icvs\sr90sept07

0714506-SICS Det A2

**Final Al:**

$$1000\,ml\left(\frac{10-0.1}{10}\right)\left(\frac{1000.5-10}{1000.5}\right) = \boxed{980.1049\,ml}$$

vs 980.1 ml = 100%

**% Yield**

$[ICP]_1 = 1.0108\,ug/ml$ dilution $\left(\frac{10}{10}\right)$ Vol = ~~1000~~ 1001 ml

$$1.0108\,\frac{ug}{ml}\left(\frac{10}{10}\right)(1001\,ml) = 1011.8108\,ug\left(\frac{10-0.1}{10}\right) = \boxed{1001.6927\,ug}$$

vs 1001.708 ug = 99.999%

$[ICP]_{Ref} = 1.0076\,ug/ml$ dilution $\left(\frac{10}{10}\right)$ Vol = 1000.5 ml

$$1.0076\,\frac{ug}{ml}\left(\frac{10}{10}\right)(1000.5\,ml) = 1008.1038\,ug\left(\frac{10-0.1}{10}\right) = \boxed{998.0228\,ug}$$

99.999% = vs 998.0328 ug

$[ICP]_F = 0.9449\,ug/ml$ dilution $\left(\frac{10}{0.1}\right)$ Vol = 10 ml

$$0.9449\,\frac{ug}{ml}\left(\frac{10}{0.1}\right)(10\,ml) = \boxed{944.9\,ug}$$

vs 944.9 ug = 100%

$$\%\,Yield = \frac{944.9\,ug}{1001.6927\,ug} = 0.9433 \times 100 = \boxed{94.33\%}$$

vs 94.33% = 100%

**InGrowth Fx**

$$1 - e^{\ln 1/2\,(t_e/t_{1/2})}$$

$t_{1/2}D = 64.1$ hrs

9/27/07 15:49
2/22/07 15:07

7 + 5 + :42

$$218\,days\left(\frac{24\,hrs}{1\,day}\right) = 5113.36\,hrs + 0.70\,hr$$

$$= 5114.06\,hrs$$

$$1 - e^{\ln 1/2\left(\frac{5114.06\,hrs}{64.1\,hrs}\right)} = 1 - 9.618 \times 10^{-25} = 1.0$$

**Decay Fx** $e^{\left(-\ln 2 / 28.8\,yrs\right)t}$

2/22/07 15:07
−12/1/01 12:00
10 ~~21~~ 6 3:07
6/10/1/07
21

6.0575 yrs + 0.0004 = 6.0579 yrs

6.0579 yrs − 0.8333 yrs = 5.2246 yrs

$$e^{\left(-\ln 2 / 28.8\,yrs\right)(5.2246\,yrs)} = e^{-0.125743} = 0.8818$$

**Act**

$$\frac{16.500\ \text{Gross} - 1.898\ \text{Bkg}}{2.22 \cdot 0.4060 \cdot (1+1) \cdot 0.9433 \cdot 0.8818 \cdot 0.9801049 = k}$$

$$\frac{14.602}{1.469607 = k} = \boxed{9.936\ pCi/L}$$

vs 9.94 pCi/L = 100%

**CU**

$$\frac{\sqrt{\left(\frac{16.500}{30}\right) + \left(\frac{1.898}{1000}\right)}}{1.4696} = \boxed{0.5055}$$

vs 0.51 = 100%

**TPU**

$$\sqrt{(0.5055)^2 + (0.1033 \cdot 9.936)^2 + (0.0561 \cdot 9.936)^2} = \boxed{1.2727}$$

vs 1.267 = ~~101.0+%~~ 100%
6/10/1/07 6/10/1/07

**MDC**

$$\frac{4.65\sqrt{1.898/30} + 2.71/30}{1.4696} = \boxed{0.8573}$$

vs 0.86 = 100%

**% Recovery**

$$\frac{9.936}{10.088} = 0.9849 \times 100 = \boxed{98.49\%}$$

vs 98.5% = 100%

# Radiochemistry Instrument Worksheet

Prep Batch: SR070220-1

Analytical QASS / NCR? Y / N NA

| Cnt 1 File | Cnt 1 Inst/Det | Cnt 1 Pos Chk By | Cnt 2 File | Cnt 2 Inst/Det | Cnt 2 Pos Chk By | Cnt 3 File | Cnt 3 Inst/Det | Cnt 3 Pos Chk By | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 0927 | 1 | W | SRA0927A | 6 | W | | | | |
| | 09/27/07 07 | | | | | | | | |
| | 4 | | | | | | | | |
| | 2 | | | | | | | | |
| | 3 | | | | | | | | |
| | 8 | | 09/27/07 | | | | | | 09/27/07 |

| Aliquot | Units | Pipet ID |
|---|---|---|
| 0.5 | ppm | RS004 |

Spike Solution Information

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.50 | 43.895 | DPM/ml | 02/20/07 | 0.5 | ml | RS004 |

0714506-S3LCS

0714506-S1LCS

0714506-B1MB



Supersedes: N/A

**Paragon Analytics**

# Radiochemistry Prep Worksheet

Prep Batch: SR070220-1

Prep Procedure: SR90

Reviewed By: LNT

Review Date: 2/25/2007

Non-Routine Pre-Treatment? Y (N) Batch: NA

Re-Prep? Y (N) Batch: NA

Prep QASS / NCR? Y (N) NA

Prep SOP: PAI 707 Rev: 9

Prep SOP: NONE

Matrix Class: liquid

Prep Analyst: Lindsay Tearman

Prep Date: 2/20/2007

Prep Dept: RS

Balance:

Balance:

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Alq ml | Fin Alq ml | Prep Basis | Column # | Ingrowth Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0714506-B1 | MB | | 1000 | 980.1049 | Unfiltered | 8769 | 02/22/07 15:07 | T1 | |
| 2 | 1 | 0714506-B2 | MB | | 1000 | 980.1049 | Unfiltered | 8770 | 02/22/07 15:07 | T1 | |
| 3 | 1 | 0714506-B3 | MB | | 1000 | 980.1049 | Unfiltered | 8771 | 02/22/07 15:07 | T1 | |
| 4 | 1 | 0714506-S1 | LCS | | 1000 | 980.1098 | Unfiltered | 8772 | 02/22/07 15:07 | T1,S1 | |
| 5 | 1 | 0714506-S2 | LCS | | 1000 | 980.1098 | Unfiltered | 8773 | 02/22/07 15:07 | T1,S1 | |
| 6 | 1 | 0714506-S3 | LCS | | 1000 | 980.1098 | Unfiltered | 8774 | 02/22/07 15:07 | T1,S1 | |

2/25/07

Spiked By: Lindsay Tearman Date: 2/20/2007

Witnessed By: MaryNeal Plazza Date: 2/20/2007

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | STRONTIUM | 247942 | 2,004.671 | ppm | NA | 0.5 | ppm | RS004 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.50 | 43.895 | DPM/ml | 02/20/07 | 0.5 | ml | RS004 |

Comments

**Paragon Analytics**

# Radiochemistry ICP Worksheet

Prep Batch: **SR070220-1**

Prep Procedure: **SR90**

Reviewed By: LNT

Review Date: 2/25/2007

## STRONTIUM Recovery Results

### Reference Carrier

| LabID | QC Type | Carr Vol | Ref Carr Dil Vol | Ref Carr ICP Alq | Ref Carr ICP Dil Vol | Ref Carr ICP Run | Ref Carr ICP Conc |
|---|---|---|---|---|---|---|---|
| 0714506-RC1 | CAR | 0.5 | 1000.5 | 10 | 10 | | 1.0076 |

### Samples

| Prep Num | LabID | QC Type | Init Samp Alq (ml) | Car Vol (ml) | Samp Dil Vol (ml) | Init ICP Alq (ml) | Init ICP Dil Vol (ml) | Pre-Con Vol (ml) | Post Con Vol (ml) | Pre-Sep Vol (ml) | Post Sep Vol (ml) | Fin ICP Alq (ml) | Fin ICP Dil Vol (ml) | Initial ICP Run | Final ICP Run | Init ICP Conc (ug/ml) | Fin ICP Conc (ug/ml) | Init Samp Mass (ug) | Ref Mass (ug) | Flag | Fin Samp Mass (ug) | % Yield | Final Sample Alq |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0714506-B1 | MB | 1000 | 0.5 | 1000.5 | 10 | 10 | 990.5 | 990.5 | 990.5 | 10 | 0.1 | 10 | | | 1.0101 | 0.9433 | 1000.504 | 998.0278 | | 943.3 | 94.28% | 980.1 |
| 1 | 0714506-B2 | MB | 1000 | 0.5 | 1000.5 | 10 | 10 | 990.5 | 990.5 | 990.5 | 10 | 0.1 | 10 | | | 1.0098 | 0.9554 | 1000.207 | 998.0278 | | 955.4 | 95.52% | 980.1 |
| 1 | 0714506-B3 | MB | 1000 | 0.5 | 1000.5 | 10 | 10 | 990.5 | 990.5 | 990.5 | 10 | 0.1 | 10 | | | 1.0211 | 0.934 | 1011.4 | 998.0278 | | 934 | 92.35% | 980.1 |
| 1 | 0714506-S1 | LCS | 1000 | 0.5 | 1001 | 10 | 10 | 991 | 991 | 991 | 10 | 0.1 | 10 | | | 1.0108 | 0.9449 | 1001.703 | 998.0328 | | 944.9 | 94.33% | 980.1 |
| 1 | 0714506-S2 | LCS | 1000 | 0.5 | 1001 | 10 | 10 | 991 | 991 | 991 | 10 | 0.1 | 10 | | | 1.0199 | 0.9223 | 1010.721 | 998.0328 | | 922.2999 | 91.25% | 980.1 |
| 1 | 0714506-S3 | LCS | 1000 | 0.5 | 1001 | 10 | 10 | 991 | 991 | 991 | 10 | 0.1 | 10 | | | 1.0085 | 0.9688 | 999.4235 | 998.0328 | | 968.8 | 96.94% | 980.1 |

W 2/25/07



Date Printed: 2/25/2007 10:01

*Paragon Analytics*

LIMS Version: 5.482A

FLAG - LB: low bias (<= 15%) 15%: low bias (>15%)

Z: Negative init. conc. treated as zer

Supersedes: _____

120

**Paragon Analytics**

# Radiochemistry Prep Worksheet

Prep Batch: SR070220-1

Prep Procedure: SR90

## Prep Batch Not Validated!!!

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: _____ Re-Prep? Y / N Batch: _____ Prep QASS / NCR? Y / N _____

Prep SOP: PAI 707 Rev: 9
Prep SOP: NONE
Matrix Class: liquid

Prep Analyst: Lindsay Tearman LS
Prep Date: 2/20/2007
Prep Dept: RS

Balance:
Balance:

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Alq ml | Fin Alq ml | Prep Basis | Column # | Ingrowth Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0714506-B1 | MB | | 1000 | 980.1049 | Unfiltered | 8769 | 2/22/07 | T1 | |
| 2 | 1 | 0714506-B2 | MB | | 1000 | 980.1049 | Unfiltered | 8770 | 3:07 PM | T1 | |
| 3 | 1 | 0714506-B3 | MB | | 1000 | 980.1049 | Unfiltered | 8771 | | T1 | |
| 4 | 1 | 0714506-S1 | LCS | | 1000 | 980.1098 | Unfiltered | 8772 | | T1,S1 | |
| 5 | 1 | 0714506-S2 | LCS | | 1000 | 980.1098 | Unfiltered | 8773 | | T1,S1 | |
| 6 | 1 | 0714506-S3 | LCS | | 1000 | 980.1098 | Unfiltered | 8774 | | T1,S1 | |

Spiked By: Lindsay Tearman LS Date: 2/20/2007 2/20/07

Witnessed By: MAP Date: 2-20-07

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | STRONTIUM | 247942 | 2,004.671 | ppm | NA | 0.5 | ppm | RS004 |

ex: 5/8/07

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.50 | 43.895 | DPM/ml | 02/20/07 | 0.5 | ml | RS004 |

ex: 11/8/07

DRAFT

Comments

| Sample Id1 | Ba | Sr | Y | Fe | Ni |
|---|---|---|---|---|---|
| I 0702098-16 | 0.2005 | 0.0682 | 0.0013 | 5.9108 | 2.1681 |
| F 0702098-16 | 0.0010 | -0.0002 | -0.0063 | 0.0475 | 1.7754 |
| I 0702098-17 | 0.2501 | 0.0601 | 0.0016 | 7.0286 | 2.1849 |
| F 0702098-17 | 0.0009 | -0.0003 | -0.0065 | 0.0129 | 1.7377 |
| I 0702098-18 | 0.2474 | 0.0565 | 0.0015 | 6.6862 | 2.1583 |
| F 0702098-18 | 0.0010 | -0.0002 | -0.0068 | 0.0263 | 1.7442 |
| I 0702098-19 | 0.1724 | 0.0898 | 0.0017 | 6.3755 | 2.1823 |
| F 0702098-19 | 0.0009 | -0.0002 | -0.0066 | 0.0379 | 1.7561 |
| CCV | 0.4939 | 0.4973 | 10.0338 | 21.1606 | 0.5094 |
| CCB | 0.0002 | 0.0002 | 0.0042 | 0.0138 | 0.0013 |
| I NI070220-1MB | 0.0008 | -0.0003 | -0.0058 | -0.0249 | 2.2212 |
| F NI070220-1MB | 0.0008 | -0.0002 | -0.0059 | 0.0056 | 1.7668 |
| I NI070220-1LCS | 0.0007 | -0.0003 | -0.0064 | -0.0285 | 2.1777 |
| F NI070220-1LCS | 0.0009 | -0.0002 | -0.0063 | 0.0082 | 1.7655 |
| NI070220-1RC | 0.0008 | -0.0003 | -0.0064 | -0.0137 | 2.1945 |
| I 0702062-9 | 0.0085 | 0.1026 | -0.0065 | -0.0024 | 0.0071 |
| F 0702062-9 | 0.0664 | 0.0010 | -0.0067 | -0.0012 | 0.0217 |
| I 0702062-10 | 0.0051 | 1.0559 | -0.0068 | -0.0104 | 0.0327 |
| F 0702062-10 | 0.0660 | 0.0064 | -0.0068 | -0.0118 | 0.0205 |
| I 0702062-11 | 0.0079 | 0.5344 | -0.0067 | -0.0112 | 0.0063 |
| CCV | 0.4952 | 0.4982 | 10.0979 | 21.3844 | 0.5189 |
| CCB | 0.0004 | 0.0003 | 0.0047 | 0.0143 | 0.0017 |
| F 0702062-11 | 0.0640 | 0.0030 | -0.0059 | 0.0134 | 0.0206 |
| I 0702062-12 | 0.0095 | 0.3182 | -0.0061 | -0.0096 | 0.0059 |
| F 0702062-12 | 0.0640 | 0.0040 | -0.0064 | 0.0103 | 0.0211 |
| I 0702062-13 | 0.0084 | 0.0326 | -0.0064 | 0.2255 | 0.0061 |
| F 0702062-13 | 0.0633 | 0.0001 | -0.0066 | 0.0038 | 0.0208 |
| I 0702062-14 | 0.0040 | 0.1264 | -0.0066 | 0.0348 | 0.0052 |
| F 0702062-14 | 0.0642 | 0.0007 | -0.0067 | -0.0037 | 0.0208 |
| **I 0702062-15** | **0.0350** | **3.6667** | **-0.0068** | **-0.0222** | **0.0046** |
| F 0702062-15 | 0.0673 | 0.0482 | -0.0067 | 0.0092 | 0.0213 |
| I 0702062-15D | 0.0352 | 3.6486 | -0.0066 | 0.0008 | 0.0054 |
| CCV | 0.4927 | 0.4942 | 10.0482 | 21.3325 | 0.5141 |
| CCB | 0.0003 | 0.0008 | 0.0050 | 0.0243 | 0.0009 |
| F 0702062-15D | 0.0653 | 0.0470 | -0.0058 | 0.0187 | 0.0212 |
| I TR070222-1MB | 0.0000 | 0.0002 | -0.0062 | 0.0050 | 0.0045 |
| F TR070222-1MB | 0.0627 | 0.0000 | -0.0064 | 0.0091 | 0.0209 |
| I TR070222-1LCS | 0.0001 | -0.0001 | -0.0064 | -0.0154 | 0.0101 |
| F TR070222-1LCS | 0.0642 | -0.0002 | -0.0066 | -0.0010 | 0.0211 |
| TR070222-1RC | 1.6304 | 0.0003 | -0.0066 | -0.0157 | 0.0050 |
| I 0714506-B1 | 0.0014 | 1.0101 | -0.0066 | -0.0127 | 0.0020 |
| F 0714506-B1 | 0.0008 | 0.9433 | -0.0067 | -0.0181 | 0.0167 |
| I 0714506-B2 | 0.0000 | 1.0098 | -0.0068 | -0.0277 | 0.0021 |
| F 0714506-B2 | 0.0007 | 0.9554 | -0.0067 | -0.0158 | 0.0173 |

| Sample Id1 | Ba | Sr | Y | Fe | Ni |
|---|---|---|---|---|---|
| CCV | 0.5036 | 0.5033 | 10.0724 | 20.9468 | 0.5057 |
| CCB | 0.0004 | 0.0010 | 0.0073 | 0.0085 | 0.0009 |
| I 0714506-B3 | -0.0002 | 1.0211 | -0.0060 | -0.0212 | 0.0016 |
| F 0714506-B3 | 0.0007 | 0.9340 | -0.0062 | 0.0175 | 0.0177 |
| I 0714506-S1 | -0.0001 | 1.0108 | -0.0063 | -0.0169 | 0.0039 |
| F 0714506-S1 | 0.0007 | 0.9449 | -0.0064 | 0.0130 | 0.0174 |
| I 0714506-S2 | -0.0002 | 1.0199 | -0.0067 | -0.0263 | 0.0026 |
| F 0714506-S2 | 0.0006 | 0.9223 | -0.0066 | -0.0059 | 0.0173 |
| I 0714506-S3 | -0.0002 | 1.0085 | -0.0066 | -0.0106 | 0.0023 |
| F 0714506-S3 | 0.0007 | 0.9688 | -0.0065 | 0.0073 | 0.0183 |
| 0714506-RC | -0.0002 | 1.0076 | -0.0068 | -0.0065 | 0.0021 |
| I 0702061-1 | 0.0075 | 0.0605 | -0.0066 | 0.0078 | 0.0055 |
| CCV | 0.4947 | 0.4941 | 10.0385 | 21.1385 | 0.5077 |
| CCB | 0.0000 | 0.0005 | 0.0010 | 0.0109 | -0.0004 |
| F 0702061-1 | 0.0646 | 0.0005 | -0.0057 | 0.0131 | 0.0281 |
| I RE070222-1MB | 0.0000 | -0.0003 | -0.0062 | -0.0115 | 0.0052 |
| F RE070222-1MB | 0.0655 | -0.0002 | -0.0064 | -0.0020 | 0.0204 |
| I RE070222-1LCS | 0.0000 | -0.0003 | -0.0064 | -0.0037 | 0.0049 |
| F RE070222-1LCS | 0.0677 | -0.0002 | -0.0066 | 0.0115 | 0.0208 |
| I RE070222-1LCSD | -0.0001 | -0.0004 | -0.0066 | -0.0192 | 0.0048 |
| F RE070222-1LCSD | 0.0641 | -0.0003 | -0.0068 | 0.0022 | 0.0202 |
| RE070222-1RC | 1.6003 | 0.0000 | -0.0066 | -0.0034 | 0.0052 |
| CCV | 0.4948 | 0.4965 | 10.0858 | 21.2778 | 0.5112 |
| CCB | 0.0002 | 0.0004 | 0.0024 | 0.0168 | 0.0004 |
| I 0702139-1 | 0.1697 | 1.0447 | 0.0304 | 7.8570 | 0.0260 |
| F 0702139-1 | 0.0012 | 0.9955 | -0.0066 | 0.0183 | 0.0213 |
| I 0702139-1D | 0.1706 | 1.0463 | 0.0296 | 7.9080 | 0.0256 |
| F 0702139-1D | 0.0013 | 0.9756 | -0.0065 | 0.0189 | 0.0209 |
| I 0702139-2 | 0.0354 | 0.9905 | -0.0054 | 1.9375 | 0.0193 |
| **F 0702139-2** | **0.0009** | **0.9455** | **-0.0067** | **0.0133** | **0.0205** |
| I SR070222-1MB | 0.0006 | 0.9989 | -0.0067 | 0.0021 | 0.0166 |
| F SR070222-1MB | 0.0008 | 0.9774 | -0.0067 | 0.0066 | 0.0207 |
| I SR070222-1LCS | 0.0007 | 1.0168 | -0.0067 | 0.0099 | 0.0166 |
| F SR070222-1LCS | 0.0007 | 0.9703 | -0.0068 | -0.0046 | 0.0200 |
| CCV | 0.4946 | 0.4932 | 10.0065 | 21.0050 | 0.5048 |
| CCB | 0.0001 | 0.0006 | 0.0025 | 0.0129 | 0.0007 |
| SR070222-1RC | 0.0008 | 1.0146 | -0.0059 | 0.0058 | 0.0175 |
| CCV | 0.4964 | 0.4964 | 10.0640 | 21.2203 | 0.5090 |
| CCB | 0.0003 | 0.0007 | 0.0043 | 0.0150 | 0.0007 |

| Alpha Attenuation Calibration<br>y = b*m^(a*(mass-x0)) | | Beta Attenuation Calibration<br>y = b*m^(a*(mass-x0)) | |
|---|---|---|---|
| Alpha b= | 1.02258 | Beta b= | 1.9999 |
| m= | 0.94868 | m= | 0.9991 |
| a= | 0.1293 | a= | 1.0000 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk<br>y = b*m^-x | | Beta to Alpha X-talk<br>y = b*mass + m | |
| a ->b xtalk b= | 0.2398 | b ->a xtalk b= | 5.713E-07 |
| a ->b xtalk m= | 1.0062 | b ->a xtalk m= | 0.0012 |

Beta Activity

| o xtlk<br>PM | Base<br>Eff | Base<br>Cor.Fact. | Progeny<br>Eff | Progeny<br>Cor.Fact. |
|---|---|---|---|---|
| 0080 | 0.4073 | 1.020 | n/a | n/a |
| 0160 | 0.4060 | 1.020 | n/a | n/a |
| 0320 | 0.4077 | 1.020 | n/a | n/a |
| 0000 | 0.4045 | 1.020 | n/a | n/a |
| 0000 | 0.4249 | 1.020 | n/a | n/a |
| 0000 | 0.4173 | 1.020 | n/a | n/a |

W
9/27/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
Counting Unit ID: Orange
High Voltage Mode: Simultaneous
Application Revision: C
Application Version: PA
Rev.12/29/03 JE

Data file name: SRA0927A
Batch ID: SR90 ICB
Count Preset (m): 30
Batch Ended: 9/27/07 16:54

Background logfile: BKGAB
Date of Bkg. Cal: 9/27/07
Alpha efficiency logfile: Am241-09/07
Alpha attenuation calibration: Am0306
Beta efficiency logfile: Sr90F-09/07
Beta attenuation calibration: Sr-90-06/07

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration y = b*m^(a*(mass-x0)) | | Beta Attenuation Calibration y = b*m^(a*(mass-x0)) | |
|---|---|---|---|
| Alpha b= | 1.02260 | Beta b= | 1.0199 |
| m= | 0.94860 | m= | 0.9998 |
| a= | 0.1293 | a= | 1.0000 |
| x0= | 0.0000 | x0= | 0.0000 |
| **Alpha to Beta X-talk y = b*m^-x** | | **Beta to Alpha X-talk y = b*mass + m** | |
| a ->b xtalk b= | 0.2398 | b ->a xtalk b= | 0.7135E-07 |
| a ->b xtalk m= | 1.0092 | b ->a xtalk m= | 0.9612 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Activity Bkg. CPM | Alpha Activity b>a xtlk CPM | Alpha Activity Base Eff | Alpha Activity Base Cor.Fact. | Alpha Activity Progeny Eff | Alpha Activity Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Activity Bkg. CPM | Beta Activity a>b xtlk CPM | Beta Activity Base Eff | Beta Activity Base Cor.Fact. | Beta Activity Progeny Eff | Beta Activity Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D2 | 0714506-B1MB | 9/27/07 16:54 | 30.00 | 0.0 | 0.087 | 0.039 | 0.002 | 0.2484 | 1.023 | n/a | n/a | 1.533 | 5.871 | 0.0160 | 0.3946 | 1.020 | n/a | n/a |





W 9/27/07

Date 9/27/07

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

Date 9/27/07

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100A**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-8 | 1130 | Daily EFF | – | 30 | 947 | LO | EFA0927 | LO |
| 1-8 | Daily BKG | – | – | 60 | 1021 | LO | BKA0927 | LO |
| 1 | 1171 | Am Wipe EFF | α | 30 | 1140 | LO | EAW0927 | LO |
| 2 | | | | | 1147 | | A | |
| 3 | | | | | 1154 | | B | |
| 4 | | | | | 1201 | | C | |
| 5 | | | | | 1506 | | D | LO |
| 6 | | | | | 1512 | | E | |
| 7 | | | | | 1519 | | F | |
| 8 | | | | | 1532 | | G | |
| 1 | 1172 | Sr Wipe EFF | β | | 1219 | | ESW0927 | LO |
| 2 | | | | | 1215 | | A | |
| 3 | | | | | 1211 | | B | |
| 4 | | | | | 1208 | | C | |
| 5 | | | | | 1154 | | D | LO |
| 6 | | | | | 1151 | | E | |

# Stable Chemistry Solution Report

| | | | | | |
|---|---|---|---|---|---|
| Solution Id | 247942 | Name | Strontium Carrier+1<2> | Type | IR |
| Lot | multiple | Vendor Name | multiple | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Final Vol: | 1000 | Dept: | RS | Prep By | ALB | on | 5/8/2006 | Reviewed By | JRK | on | 5/10/2006 |
| Units: | mL | Location: | SR/RA | Opened By | | on | | Verified By | | on | |
| Matrix: | LIQUID | ExpireDate: | 5/8/2007 | Received By | | on | | Deactivated By | | on | |

Comment:

| Component Name | Component ID | Volume Added | Units |
|---|---|---|---|
| Strontium Stable Carrier Source | ST050517-5 | 4.8422 | g |

| Constituent Name | Conc of Primary Soln | FinalConc | Summed Conc | Units |
|---|---|---|---|---|
| STRONTIUM | 414000 | 2004.671 | | ppm |

## Associated Parent IDs

ST050517-5

Abbreviations: NC = Not Calculated for reagents when the volume added is not entered.
NE = Not Entered

50
PROJECT 600.3020.50 $^{90}Sr$ Notebook No. 3020
Continued From Page

Prepare a working level dilution of 600.2613.30 at ~50 dpm/mL

Balance

① Determine density of 0.1 N HCl

Mass of 100 mL vol. flask: 68.5659 g 12

Lot# 061842 Mass of flask + 100 mL 0.1N HCl: 168.4196 g

Mass of 100 mL 0.1N HCl: 99.8537 g

$\rho = 0.9985$ g/mL

② Transfer standard to 1L Nalgene

Mass of bottle w/o lid: 74.7746 g 12

PROJECT 600.2613.30 Sr-90

Notebook No. 2613

Continued From Page —

3.90

dpm/mL

dpm/mL

Prep by: CRW

3/9/06

Ck calculate of ... 600 ... 125 mL

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

PAI 0600
rec'd 12-05-01

62751-307

Sr-90 50 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by the Department Des Applications Et De La Metrologie Des Rayonnements Ionisants (DAMRI), Paris, France, as Number 25931.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

| | |
|---|---|
| ISOTOPE: | Sr-90 |
| ACTIVITY (dps): | 1.868 E4 |
| HALF-LIFE: | 28.79 years |
| CALIBRATION DATE: | December 1, 2001 12:00 EST |

Instrument: LB4100-B

Calibration: Sr-90 Flat Planchet

Date of Calibration: 7/11/2007 & 11/12/2007

Efficiency Log Files: Sr90F-11/07
Sr90F-07/07

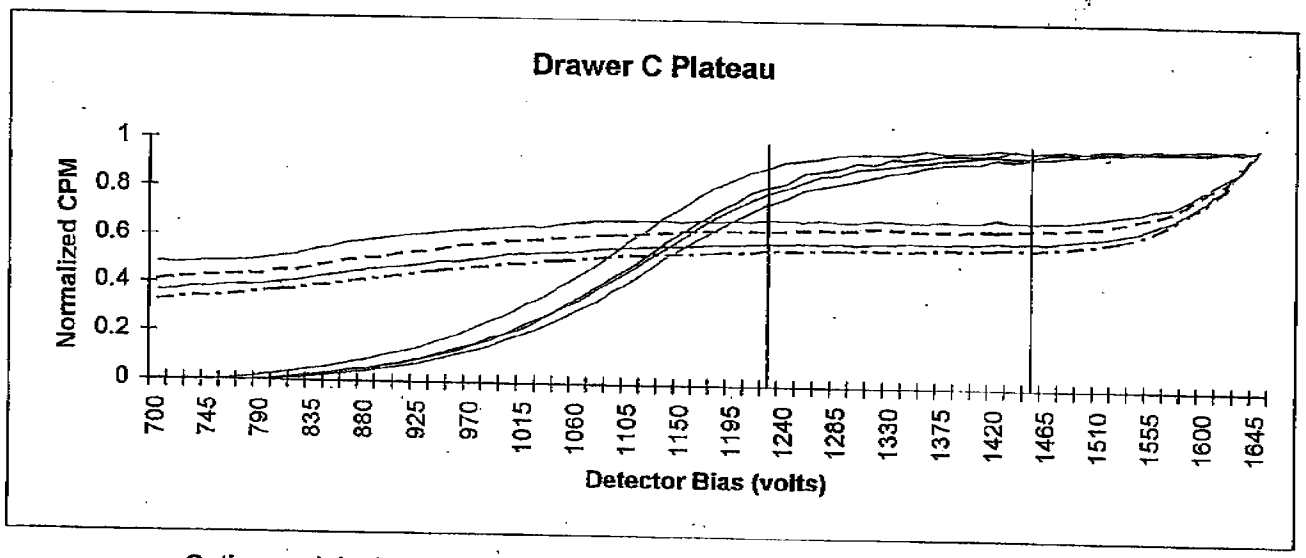
OK
MC
11/23/07

Source ID's: Sr-90 514.1572.73

# Instrument Plateaus

Unit Type: LB4100/W
Date Performed: 5/17/07 10:55
FileName: PTB0517C
Batch ID: PLATEAU

Unit Id: Aqua
Application Revision: 2
Application Version: Standard




Optimum alpha beta simultaneous operating voltage: 1447.5

Optimum alpha only operating voltage: 1225

| | C1 | C2 | C3 | C4 |
|---|---|---|---|---|
| Beta slope at beta voltage | 0.11% | 0.53% | 3.38% | 2.91% |
| Alpha slope at beta voltage | -0.98% | 2.95% | 2.05% | 2.37% |
| Alpha slope at alpha voltage | 1.11% | 1.75% | 2.27% | 2.86% |

Printed 5/18/07 9:11 AM

Date 5/17/07

SOP 724r 9

**Paragon Analytics**
Low Background Gas Flow Proportional Counter Log
**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | JH | P | JH | P | JH | P | | | P |
| 2 | | | | | | HB | JH | P | |
| 3 | | | | | | P | JH | | |
| 4 | | | | | | | JH 5/18/07 | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | OL |
| 10 | | α, LB | | α, LB | | | | | |
| 11 | | | | P | | | | | |
| 12 | | | | α, LB | | | | | |
| 13 | | P | | P | | | | | P |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | Hα, HB | | | OL α β |

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKB051 1.W | | | |
| Dr B | | | | |
| Dr C | | | | |
| Dr D | | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 1400 | Dr A | 0.15 |
| | | Dr B | |
| Tank 2 | 2000 | Dr C | |
| | | Dr D | |

Comments:

Page No.: 324898 A

Form 780r8.doc (6/23/06)

Reviewed By / Date JH 5/18/07

Date 5/17/07

SOP 724r 9

**Paragon Analytics**
Low Background Gas Flow Proportional Counter Log
**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily Eff | — | — | 30 | 809 | JH | EFB0517 | JH |
| 1-16 | Daily BKG | — | — | 60 | 820 | JH | BKB0517 | JH |
| 2 | Daily BKG | — | — | 60 | 928 | JH | BKB0517R | JH |
| 1-16 | Daily Eff | — | — | 30 | 1037 | JH | EFB0517R | JH |
| 9-12 | αβ | Plateau | — | 5 step | 1055 | JH | PTB0517C | JH |
| 1 | 0705016-1 | RA070510-1 | Ra228 | 256 | 1301 | LO | RAB0517 | LO |
| 2 | -2 | | | | | | | |
| 3 | -3 | | | | | | | |
| 4 | 0705037-1 | | | | | | | |
| 13 | -2 | | | | | | | |
| 14 | -3 | | | | | | | |
| 15 | RA070510-1MB | | | | | | | |
| 5 | -1LCS | RA070510-1 | Ra228 | 60 | 1304 | LO | RAB0517A | JH |
| 6 | -1LCSD | | | | | | | |
| 5 | 0705065-2 | AB070515-1 | αβ | 1000 | 1530 | JH | ABB0517 | JH |
| 6 | -2D | | | | | | | |
| 7 | -3 | | | | | | | |
| 8 | -4 | | | | | | | |
| 1 | 0705043-2 | AB070515-2 | αβ | 450 | 1719 | LO | ABB0517A | JH |
| 2 | AB070515-2MB | | | | | | | |
| 3 | 0705056165-1 | AB070515-1 | αβ | 1050 | 1721 | LO | ABB0517B | JH |
| 4 | -7 | | | 400 | 1722 | | ABB0517C | JH |
| 13 | 0705074-5 | | | | | | | |
| 14 | 0705065-5 | | | 220 | 1724 | | ABB0517D | JH |
| 15 | -6 | | | | | | | |

LO 5/17/07

JH 5/16/07

5/17/07 Drawer C Calibration

Plateaus for Drawer C

| Source β used: | | Detector | Source α used: | |
|---|---|---|---|---|
| Sr/Y 90 | - 406 | C1 | 410 - | Am 241 |
| 29,600 dpm | - 407 | C2 | 411 - | 17,800 dpm |
| 9/15/02 | - 408 | C3 | 412 - | 2/04/95 |
| ↓ | - 409 | C4 | 413 - | ↓ |

Parameters:

Start Voltage: 700
Ending Voltage: 1650
30 volts/step
5 min/step
40,000 Count preset

Filename:

PTB0516C

5/17/07 A working voltage could not be found. A plateau will be run again using the same sources but different parameters.

Parameters:

Start voltage: 700
Ending Voltage: 1650
15 volts/step
5 min/step
60,000 count preset

Filename:

PTB0517C

Continued on Page

Read and Understood By

Signed 5/17/07 Date Signed 7/12/07 Date

7/10/07 JH ROI's set for drawer C using Sr/Y 90 planchets from plateaus.

7/11/07 JH Sample Pucks and carriers were cleaned with Radiac Wash on 7/10/07, for drawer C. The drawer was then wiped out with methanol.

7/11/07 JH New "daily efficiency" Interim control limits ~~for~~ JH 7/11/07 for drawer C will be set using files EFB0709A, EFB0710A and EFB0712. Historical control limits will be set JH 7/11/07 after 30 data points are collected.

AM241 Wipe Calibration (Drawer C)

7/11/07 JH

Source: #746 Source ID: 1166 Logfile: AmWipe-07/07

JH 7/11/07
Filenames: EAW0711 → C

* Alpha to beta crosstalk was calculated for each detector using the following equation:

$$\frac{\text{counts in beta channel}}{\text{counts in alpha channel}}$$

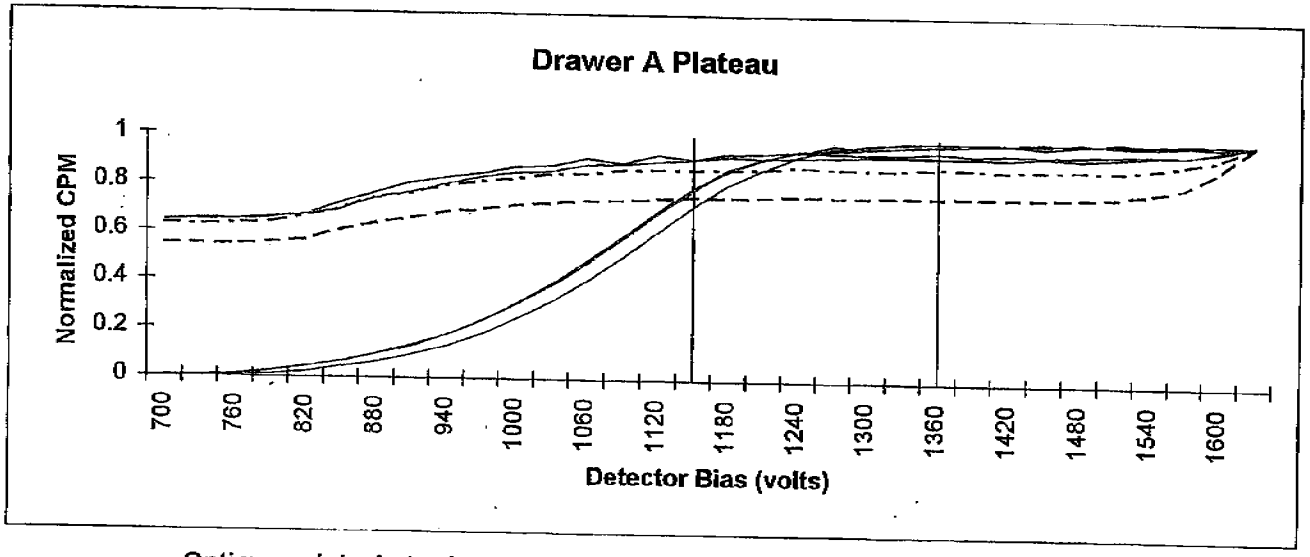
Sr90 Wipe Calibration (Drawer C)

Source: #602 Source ID: 1167 Logfile: SrWipe-07/07

Filenames: ESW0711 → C

Unit Type: LB4100/W
Date Performed: 11/6/07 10:11
FileName: PTB1106A
Batch ID: PLATEAU

Unit Id: Aqua
Application Revision: 2
Application Version: Standard




Optimum alpha beta simultaneous operating voltage: 1357.5

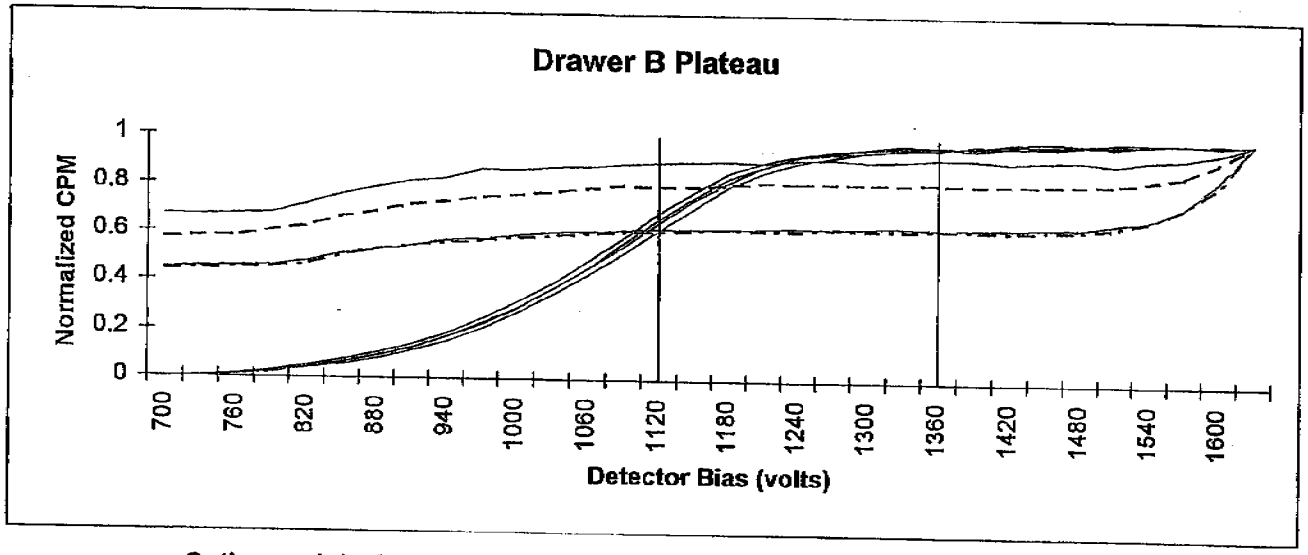
Optimum alpha only operating voltage: 1150

| | A1 | A2 | A3 | A4 |
|---|---|---|---|---|
| Beta slope at beta voltage | 2.43% | 1.21% | 1.72% | 0.92% |
| Alpha slope at beta voltage | -0.31% | 0.57% | 0.24% | 0.47% |
| Alpha slope at alpha voltage | 2.90% | 1.98% | 3.45% | 0.50% |

Printed 11/6/07 5:40 PM

Unit Type: LB4100/W
Date Performed: 11/6/07 10:11
FileName: PTB1106B
Batch ID: PLATEAU

Unit Id: Aqua
Application Revision: 2
Application Version: Standard




Optimum alpha beta simultaneous operating voltage: 1357.5

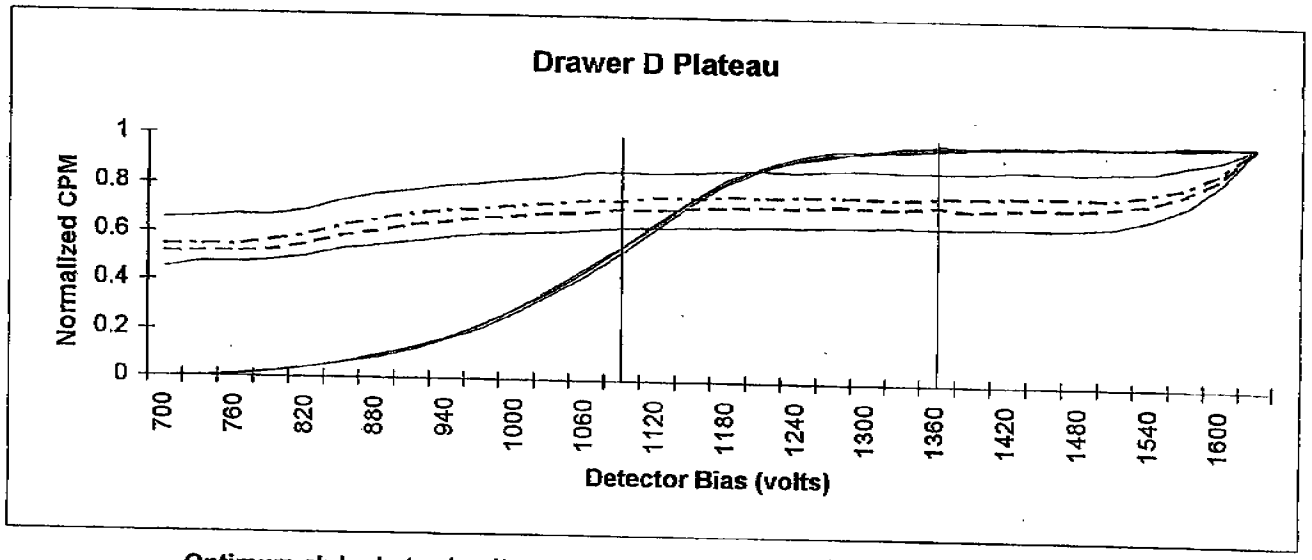
Optimum alpha only operating voltage: 1120

| | B1 | B2 | B3 | B4 |
|---|---|---|---|---|
| Beta slope at beta voltage | 1.59% | 1.87% | 2.27% | 2.56% |
| Alpha slope at beta voltage | 0.61% | -0.09% | 0.13% | 0.17% |
| Alpha slope at alpha voltage | 2.65% | 1.46% | 2.06% | 3.21% |

Printed 11/6/07 5:40 PM

Unit Type: LB4100/W
Date Performed: 11/7/07 09:36
FileName: PTB1107D
Batch ID: PLATEAU

Unit Id: Aqua
Application Revision: 2
Application Version: Standard




Optimum alpha beta simultaneous operating voltage: 1357.5

Optimum alpha only operating voltage: 1090

| | D1 | D2 | D3 | D4 |
|---|---|---|---|---|
| Beta slope at beta voltage | 2.11% | 3.05% | 2.40% | 1.91% |
| Alpha slope at beta voltage | 0.44% | 0.03% | 0.31% | 1.23% |
| Alpha slope at alpha voltage | 3.50% | 3.30% | 2.16% | 3.43% |

Printed 11/8/07 9:50 AM

Date 11/6/07

SOP 724r 10

**Paragon Analytics**
Low Background Gas Flow Proportional Counter Log
**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | JH | P | | | JH | P | | | P |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | αβW |
| 6 | | | | | | | | | P |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | LB | JH | P | | | | | |
| 11 | | P | | | | | | | |
| 12 | | | | | | | | | αβW |
| 13 | | | | | | | | | P |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKB 1102W ~~+03W~~ | JH 11/6/07 | | |
| Dr B | +03W | | | |
| Dr C | | | | |
| Dr D | | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 1000 | Dr A | 0.15 |
| | | Dr B | |
| Tank 2 | 700 | Dr C | |
| | | Dr D | |

Comments:

Page No.: 357312 A

Form 780r8.doc (6/23/06)

Reviewed By / Date JH 11/7/07

Date 11/6/07

SOP 724r 16

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily Eff | — | — | 30 | 821 | JH | EFB1106 | JH |
| 10 | Daily Eff | — | — | 30 | 833 | JH | EFB1106R | JH |
| 1-16 | Daily BKG | — | — | 60 | 844 | JH | BKB1106 | JH |
| 9 | 0711026-1 | AB071105-1 | αβ | 10 | 1000 | JH | ABB1106 | JH |
| 10 | ↓ -3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -9 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | ALPHA | PTB1106A | Plateau α | 5Step | 1011 | JH | PTB1106A | ↓ |
| 2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 4 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 5 | Beta | PTB1106B | Plateau β | 5Step | 1012 | JH | PTB1106B | ↓ |
| 6 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 7 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 8 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0711026-10 | AB071105-1 | αβ | 10 | 1018 | JH | ABB1106A | JH |
| 10 | ↓ -17 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -18 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0710135-37 | AB071030-1 | αβ | 30 | 1057 | ↓ | ~~RAB~~ ABB1106B | ↓ |
| 10 | ↓ -38 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ 11/6/07 | ↓ |
| 11 | ↓ -39 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0710135-38MS | AB071030-1 | αβ | 30 | 1129 | ↓ | ABB1106C | ↓ |
| 10 | AB071030-1MB | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -1LCS | | | | | | | |
| 9 | 0710233-1D | RA071101-2 | αβ | 250 | 1201 | ↓ | RAB1106 | ↓ |
| 10 | RA071101-2MB | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -2LCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0710261-28 | AB071105-5 | αβ | 90 | 1618 | ↓ | ABB1106D | ↓ |
| 10 | ↓ -29 | | | | | | | |
| 11 | ↓ -32 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0710261-33D | AB071105-5 | αβ | 90 | 1752 | ↓ | ABB1106E | JH |
| 10 | ↓ -34 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -35 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |

JH 11/7/07

Comments:

Page No.: 357312 B

(cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By/Date: JH 11/7/07

Date 11/7/07

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Lab

Date 11/7/07

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

JH
11/6/07 Drawers A, B and D Calibration

Plateaus for Drawers A, B + D

| Source β used: | Detectors | Source α used: |
|---|---|---|
| Sr/Y 90 - 406 | A1 B1 D1 | 410 - Am 241 |
| 29,600 dpm - 407 | A2 B2 D2 | 411 - 17,800 dpm |
| 9/15/02 - 408 | A3 B3 B3 | 412 - 2/06/95 |
| ↓ - 409 | A4 B4 D4 | 413 - ↓ |

Parameters:

Start Voltage: 700
Ending Voltage: 1650
30 volts/step
5 min/step
40,000 count preset

Filenames:

PTB1106A, B
PTB1107D

★note: Plateau voltage did not change therefore historical limits are still in place.

JH
11/7/07 Am241 Calibration on a Ringed Planchet (Drawers A, B + D)

Benchsheet: 290486A Source ID: 1172

Logfile Am241 11/07

| Source: | Detectors | Filenames: |
|---|---|---|
| 06/5044 - S2 | A1 B1 D1 | EAM1107, B |
| ↓ - S3 | A2 B2 D2 | EAM1108 |
| - S4 | A3 B3 D3 | |
| - S5 | A4 B4 D4 | |

Continued on Page

Read and Understood By

Signed 11/6/07 Date Signed 11/24/07 Date

# Instrument ROIs

Batch Specific:

| | Event | Recycle |
|---|---|---|
| Aqua | 1 | 0.01 |

Drawer Specific:

| | Date/Time | Official | Bias | Step |
|---|---|---|---|---|
| A | 11-6-06 15:37 | TRUE | 1357.5 | 0 |
| B | 11-6-06 15:38 | TRUE | 1357.5 | 0 |
| C | 5-17-07 10:55 | TRUE | 1447.5 | 0 |
| D | 11-8-06 16:05 | TRUE | 1360 | 0 |

etector Specific:

| | Date/Time | Official | Thres | bLL | bUL | aLL | aUL | Time |
|---|---|---|---|---|---|---|---|---|
| A1 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 18.94 | 36.63 | 100 | 75 |
| A2 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 21.97 | 39.12 | 100 | 75 |
| A3 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 20.17 | 37.58 | 100 | 75 |
| A4 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 22.41 | 41.61 | 100 | 75 |
| B1 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 27.15 | 50.15 | 100 | 75 |
| B2 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 24.37 | 45.1 | 100 | 75 |
| B3 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 22.97 | 45.47 | 100 | 75 |
| B4 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 24.37 | 45.93 | 100 | 75 |
| C1 | 7-10-07 0:00 | TRUE | 0.1 | 0 | 52.42 | 95.97 | 100 | 75 |
| C2 | 7-10-07 0:00 | TRUE | 0.1 | 0 | 47.08 | 90.08 | 100 | 75 |
| C3 | 7-10-07 0:00 | TRUE | 0.1 | 0 | 46.76 | 94.74 | 100 | 75 |
| C4 | 7-10-07 0:00 | TRUE | 0.1 | 0 | 42.44 | 82.44 | 100 | 75 |
| D1 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 20.24 | 38.16 | 100 | 75 |
| D2 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 20.9 | 39.29 | 100 | 75 |
| D3 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 23.29 | 43.71 | 100 | 75 |
| D4 | 11-9-06 0:00 | TRUE | 0.1 | 0 | 24 | 45.27 | 100 | 75 |

# Efficiencies

7/11/07 JH

## Sr-89 Calibration - Sr-89 on a Flat Planchet

Benchsheet: 315029A Source ID: 1168

Logfile: Sr89-07/07

| Source: ~~1168~~ JH 7/11/07 | Detector: | Filename: |
|---|---|---|
| 0717502-S2 | C1 | ESE0711 |
| -S3 | C2 | |
| -S4 | C3 | |
| -S5 | C4 | |

7/11/07 JH

## Sr-90 Calibration on a Flat Planchet

Benchsheet: 279055A Source ID: 1169

| Source: ~~1169~~ JH 7/11/07 | Detector: | Filename: |
|---|---|---|
| C424028-S1 | C1 | ESE0711 |
| -S2 | C2 | |
| -S3 | C3 | |
| -S4 | C4 | |

7/11/07 JH

## Sr-90 Calibration on a Ringed Planchet

Benchsheet: 290476A Source ID: 1170

Logfile: Sr90-07/07

JH 11/7/07

Sr90 Calibration on a Ringed Planchet (Drawers A, B + D)

Benchsheet: 2904764 Source ID: 1173

Log file Sr90R-11/07 JH 11/7/07

| Source: | Detectors | File names |
|---|---|---|
| 0614030 - S1 | A1 B1 D1 | ESR1107, B |
| - S2 | A2 B2 D2 | ESR1108 |
| - S3 | A3 B3 D3 | |
| - S4 | A4 B4 D4 | |

Sr-90 Calibration on a Flat Planchet (Drawers A, B + D)

JH 11/7/07

Benchsheet: 2790557A Source ID: 1174

Logfile Sr90F11/07

| Source: | Detectors | Filenames |
|---|---|---|
| 0429028 - S1 | A1 B1 D1 | ESF1107, B |
| - S2 | A2 [illegible] | [illegible] |

Sr-90 FLAT Planchet Efficiency Calibration
LB4100-B
Date: 11/13/2007
Source ID: 1169 & 1174

| Det ID | A1 | A2 | A3 | A4 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|
| File Name | ESF1107 | ESF1107 | ESF1107 | ESF1107 | ESF1107B | ESF1107B | ESF1107B | ESF1107B |
| Cnt Time | 25.60 | 25.95 | 24.41 | 24.88 | 24.41 | 25.38 | 25.89 | 24.90 |
| Tot Cnts | 10003 | 10004 | 10005 | 10005 | 10002 | 10003 | 10004 | 10002 |
| Bkg CPM | 1.421 | 1.584 | 1.486 | 1.525 | 2.080 | 1.491 | 1.562 | 1.595 |
| CPM | 389.3212 | 383.9266 | 408.387 | 400.6052 | 407.670 | 392.638 | 384.842 | 400.092 |
| Alpha EFF | 0.000347 | 0.000218 | 0.000101 | 0.000351 | 0.000271 | 0.000260 | 0.000290 | 0.000241 |
| Beta EFF | 0.431831 | 0.425848 | 0.452979 | 0.444347 | 0.452185 | 0.435512 | 0.426864 | 0.443779 |
| **Efficiency** | **0.4318** | **0.4258** | **0.4529** | **0.4443** | **0.4522** | **0.4355** | **0.4269** | **0.4438** |

| Det ID | C1 | C2 | C3 | C4 | D1 | D2 | D3 | D4 |
|---|---|---|---|---|---|---|---|---|
| File Name | ESF0711 | ESF0711 | ESF0711 | ESF0711 | ESF1108 | ESF1108 | ESF1108 | ESF1108 |
| Cnt Time | 24.75 | 25.21 | 25.54 | 25.64 | 25.55 | 25.33 | 25.77 | 24.39 |
| Tot Cnts | 10001 | 10003 | 10001 | 10001 | 10008 | 10006 | 10003 | 10003 |
| Bkg CPM | 1.622 | 1.279 | 1.508 | 1.670 | 1.55 | 1.66 | 1.77 | 3.08 |
| CPM | 402.4588 | 395.5080 | 390.0738 | 388.3846 | 390.1575 | 393.3627 | 386.3975 | 407.0451 |
| Alpha EFF | 0.000986 | 0.000663 | 0.000405 | 0.000357 | 0.001112 | 0.000806 | 0.000171 | 0.000162 |
| Beta EFF | 0.442922 | 0.435272 | 0.429292 | 0.427433 | 0.432787 | 0.436430 | 0.428617 | 0.451520 |
| **Efficiency** | **0.4429** | **0.4353** | **0.4293** | **0.4274** | **0.4328** | **0.4364** | **0.4286** | **0.4515** |

Date 7/11/07

SOP 724r 9

**Paragon Analytics**
Low Background Gas Flow Proportional Counter Log
**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | JH | P | | | JH | P | | | P |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | HB | | | OLBW |
| 6 | | | | | | P | | | P |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | Lα | | | | | | | OLα |
| 13 | | P | | | | | | | P |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | HB | | | OLBW |

JH 7/11/07

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKB0700W 707W | | | |
| Dr B | | | | |
| Dr C | | | | |
| Dr D | | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 650 | Dr A | 0.15 |
| | | Dr B | |
| Tank 2 | 1600 | Dr C | |
| | | Dr D | |

Comments:

Page No.: 356664 A

Form 780r8.doc (6/23/06)

Reviewed By / Date JH 7/12/07

Date 7/11/07

SOP 724r 9

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily Eff | — | — | 30 | 810 | JH | EFB0711 | JH |
| 1-16 | Daily BKG | — | — | 60 | 831 | JH | BKG0711 | JH |
| 3 | Filter Blank 1 | 1-070627-1 | 1129 | 60 | 1126 | 60 | 1080711 | 60 |
| 6 | ↓ 2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 14 | ↓ 3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 1166 | Am Wipe Eff. | α | 30 | 1204 | JH | EAW0711 | JH |
| 12 | 1167 | Sr Wipe Eff. | β | 30 | 1204 | JH | ESW0711 | ↓ |
| 10 | 1166 | Am Wipe Eff | α | 30 | 1209 | JH | EAW0711A | ↓ |
| 11 | 1167 | Sr Wipe Eff | β | 30 | 1210 | JH | ESW0711A | ↓ |
| 11 | 1166 | Am Wipe Eff | α | 30 | 1215 | JH | EAW0711B | ↓ |
| 10 | 1167 | Sr Wipe Eff | β | 30 | 1216 | JH | ESW0711B | ↓ |
| 12 | 1166 | Am Wipe Eff | α | 30 | 1221 | JH | ~~EAW0711C~~ | JH 7/11/07 |
| 9 | 1167 | Sr Wipe Eff | β | 30 | 1221 | JH | ESW0711C | ↓ |
| 9 | 0717502-S2 | Sr89 eff | β | 75 | 1403 | JH | ESE0711 | JH |
| 10 | ↓ -S3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -S4 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | ↓ -S5 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0424028-S1 | Sr90 Eff | β | 75 | 1453 | JH | ESF0711 | JH |
| 10 | ↓ -S2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -S3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | ↓ -S4 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0614030-S1 | Sr90 R eff | β | 75 | 1536 | JH | ESR0711 | JH |
| 10 | ↓ -S2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -S3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | ↓ -S4 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0615044-S2 | Am241 R eff | α | 75 | 1558 | JH | EAM0711 | JH |
| 10 | ↓ -S3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -S4 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | ↓ -S5 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |

JH 7/12/07

Comments: ★ ~~ESW0711~~ JH 7/11/07
EAW0711C JH 7/11/07

Page No.: **356664 B**

(cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By / Date: JH 7/12/07 RG 7/12/07

Date 11/7/07

SOP 724r 10

**Paragon Analytics**
Low Background Gas Flow Proportional Counter Log
**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | JH | P | | | JH | P | | | P |
| 2 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | OL/W |
| 6 | | | | | | | | | P |
| 7 | | | | | | | | | ↓ |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | ↓ | | | |
| 11 | | | | | | HL | JH | P | ↓ |
| 12 | | | | | | P | | | OL/W |
| 13 | | | | | | ↓ | | | P |
| 14 | | | | | | | | | ↓ |
| 15 | | | | | | | | | |
| 16 | ↓ | ↓ | | | ↓ | ↓ | | | ↓ |

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKB 1102W | | | |
| Dr B | ↓ 1103W | | | |
| Dr C | ↓ | | | |
| Dr D | ↓ | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 1000 | Dr A | 0.15 |
| | ↓ | Dr B | |
| Tank 2 | 500 | Dr C | ↓ |
| | ↓ | Dr D | ↓ |

Comments:

Page No.: 357313 A

Form 780r8.doc (6/23/06)

Reviewed By / Date JH 11/8/07

Date 11/7/07

SOP 724r 10

# Paragon Analytics

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily Eff | — | — | 30 | 806 | JH | EFB1107 | JH |
| 1-16 | Daily BKG | — | — | 60 | 818 | JH | BKB1107 | JH |
| 11 | Daily BKG | — | — | 60 | 931 | JH | BKB1107R | JH |
| 9 | 0710261-360 | AB071105-5 | αβ | 90 | 930 | JH | AB01107 | JH |
| 10 | ↓ -37 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 13-16 | ALPHA | Plateau | α | 5 step | 937 | JH | PTB11070 | |
| ~~1-4~~ | ~~Am241 eff~~ | ~~Am241~~ | | | ~~952~~ | | | |
| JH 11/7/07 1 | 0715044-52 | Am241eff.R | α 1172 | 75 | 952 | JH | EAM1107 | JH JH 11/7/07 |
| 2 | -53 | JH 11/7/07 | | | | | | |
| 3 | -54 | | | | | | | |
| 4 | -55 | | | | | | | |
| 5 | 0615044-52 | Am241EffR | 1172 | 75 | 1014 | JH | EAM1107B | JH |
| 6 | -53 | | | | | | | |
| 7 | -54 | | | | | | | |
| 8 | -55 | | | | | | | |
| JH 11/7/07 1 | 0614030-51 | Sr90eff R | 1173 | 75 | 1020 | JH | ESR1107 | JH |
| 2 | -52 | | | | | | | |
| 3 | - 3 | | | | | | | |
| 4 | - 4 | | | | | | | |
| 5 | 0614030-51 | Sr90eff R | 1173 | 75 | 1031 | JH | ESR1107B | JH |
| 6 | -52 | | | | | | | |
| 7 | -53 | | | | | | | |
| 8 | -54 | | | | | | | |
| 1 | 0424028-51 | Sr90eff F | 1174 | 75 | 1037 | JH | ESF1107 | JH |
| 2 | -52 | | | | | | | |
| 3 | -53 | | | | | | | |
| 4 | -54 | | | | | | | |
| 5 | Am Wipe Eff | #746 * | 1175 | 75 | 1100 | JH. | EAW1107 | JH |
| 8 | Sr Wipe Eff | #602 ↓ | 1176 | ↓ | 1101 | ↓ | ESW1107 | JH |
| 9 | 0710261-38 | AB071105-5 | αβ | 90 | 1106 | JH | ABB1107A | JH |
| 10 | -40 | | | | | | | |
| 11 | -41 | | | | | | | |
| 6 | Am Wipe Eff | #746 * | 1175 | 75 | 1108 | JH | EAW1107B | JH |

Date 11/8/07

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check | | | | Background Check | | | | Det. |
|---|---|---|---|---|---|---|---|---|---|
| | Start 1 | Status | Start 2 | Status | Start 1 | Status | Start 2 | Status | Status |
| 1 | JH | P | | | JH | P | | | P |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | HL | | | OLBW |
| 6 | | LB | JH | LB | | P | | | OLBD |
| 7 | | P | | | | HL | JH | P | P |
| 8 | | | | | | P | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | OLBW |
| 13 | | | | | | | | | P |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | LB | | | |

Data Qualifiers — Alpha: A = Beta: B = Pass: H = High: L = Low: OL = Offline: R = Recount: W = Weekly: NP = Not Processed

Date 11/8/07

SOP 724r 10

# Paragon Analytics

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily Eff | — | — | 30 | 830 | JH | EFB1108 | JH |
| 6 | Daily Eff | — | — | 30 | 838 | JH | EFB1108R | JH |
| 1-16 | Daily BKG | — | — | 60 | 853 | JH | BKB1108 | JH |
| 9 | 0710261-73 | AB071105-7 | αβ | 90 | 1001 | JH | ABB1108 | JH |
| 10 | -74 | | | | | | | |
| 11 | -75 | | | | | | | |
| 13 | AmWipe Eff | 746 | 1175 | 75 | 1003 | JH | EAW1108 | JH |
| 16 | SrWipe Eff | 602 | 1176 | | 1004 | | ESW1108 | JH |
| 1 | ICV TEST | ICV TEST | α | 10 | 1205 | JH | ABB1108D | JH |
| 4 | | | β | | | | | |
| 7 | Daily BKG | — | — | 60 | 1007 | JH | BKB1108R | JH |
| 8 | 0710274-4 | TR071102-1 | RaTot | 45 | 1008 | JH | TRB1108 | JH |
| 14 | AmWipe Eff | 746 | 1175 | 75 | 1011 | JH | EAW1108A | JH |
| 15 | SrWipe Eff | 602 | 1176 | | 1012 | | ESW1108A | |
| 1 | 0710274-5 | TR071102-1 | RaTot | 45 | 1015 | JH | TRB1108A | JH |
| 2 | -8 | | | | | | | |
| 3 | -9 | | | | | | | |
| 4 | -10 | | | | | | | |
| 14 | AmWipe Eff | 746 | 1175 | 75 | 1020 | JH | EAW1108B | JH |
| 15 | SrWipe Eff | 602 | 1176 | | 1021 | | ESW1108B | |
| 13 | SrWipe Eff | 602 | 1176 | 75 | 1027 | JH | ESW1108C | JH |
| 16 | AmWipe Eff | 746 | 1175 | | | | EAW1108C | |
| 13 | 0424028-S1 | Sr90 eff F | 1174 | 75 | 1034 | JH | ESF1108 | JH |
| 14 | -S2 | | | | | | | |
| 15 | -S3 | | | | | | | |
| 16 | -S4 | | | | | | | |
| 1 | 0710274-11 | TR071102-1 | RaTot | 45 | 1108 | JH | TRB1108B | JH |
| 2 | TR071102-1LC | | | | | | | |
| 13 | 0614030-S1 | Sr90 eff R | 1173 | 75 | 1114 | JH | ESR1108 | JH |
| 14 | -S2 | | | | | | | |
| 15 | -S3 | | | | | | | |
| 16 | -S4 | | | | | | | |
| 13 | 0615044-S2 | Am241 eff R | 1172 | 75 | 1121 | JH | EAM1108 | JH |
| 14 | -S3 | | | | | | | |
| 15 | -S4 | | | | | | | |
| 14 | -S5 | | | | | | | |
| 13 | 0717502-S1 | Sr89 eff F | 1177 | 75 | 1133 | JH | ESE1108 | JH |
| 14 | -S2 | | | | | | | |
| 15 | -S3 | | | | | | | |
| 16 | -S4 | | | | | | | |
| 7 | ICV TEST | ICV TEST | α | 10 | 1143 | JH | ABB1108A | JH |
| 8 | | | β | | | | | |
| 9 | 0710261-740 | AB071105-7 | αβ | 40 | 1155 | JH | ABB1108B | JH for LD |
| 10 | -67 | AB071105-6 | | | 1156 | | ABB1108C | |
| 11 | -68 | | | | | | | |
| 14 | ICV TEST | ICV TEST | α | 10 | 1221 | JH | ABB1108E | JH |
| 15 | | | β | | | | | |

JH 11/8/07

Comments:

Page No.: **357315 B**

(cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By / Date: JH 11/9/07

***Source Database for OSUM for LB4100-B***

Number of sources in table: 96

Application Revision: A

| Control ID | Isotope | Type | Half-Life (days) | DPM | Std dev | Date | Status | Alpha/Beta Archive File |
|---|---|---|---|---|---|---|---|---|
| 1169 | Sr-90/Y-90 | Beta | 10519.2 | 1110 | 55.50 | 18-Mar-99 | PA | Sr90F-07/07 |
| 1170 | Sr-90/Y-90 | Beta | 10519.2 | 19986.92 | 999.35 | 2-Dec-04 | PA | Sr90R-07/07 |
| 1171 | AM-241 | Alpha | 157783.68 | 5514.295 | 275.71 | 6-Jul-01 | PA | Am241-07/07 |
| 1172 | AM-241 | Alpha | 157783.68 | 5514.295 | 275.71 | 6-Jul-01 | PA | Am241-11/07 |
| 1173 | Sr-90/Y-90 | Beta | 10519.2 | 19986.92 | 999.35 | 2-Dec-04 | PA | Sr90R-11/07 |
| 1174 | Sr-90/Y-90 | Beta | 10519.2 | 1110 | 55.50 | 18-Mar-99 | PA | Sr90F-11/07 |

*Paragon Analytics*

## OR RUSH SAMPLES / Ra/Sr Lab

nalyte 90Sr Analytical Batch _____

Superseded _____

| ion | Remarks | Det. No. | Filename | POS Ckd By |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| 021 | | | | |

.K Date 12/15/04 QASS? ( Y / (N) ) No. _____

PIPET 12/15/04

| (dpm) | ~~Decay~~ Corrected | | Relinquished by / Date | Received by / Date |
|---|---|---|---|---|
| 500 | RS-007 | 1 | 12/15/04 | |
| | | | | |
| 12/15/04 | | 2 | | |
| | | | | |

e 12/15/04

L79055 B

# WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES / Ra/Sr Lab

Date 12/15/04 Method (SOP / Rev) 907R8 Matrix LIQUID

**COMMENTS**

$^{90}Sr$ CALIBRATION

- ~2.5 ml 16N $HNO_3$ ADDED TO PLANCHETS
- SPIKE ADDED TO PLANCHETS
- DRIED ON HOTPLATE

12/15/04

Viewed by / Date 12/15/04

## Sr-90 Calculatons

| Sample ID | Sample D & T | Sep. D & T | Count D & T | Ct Dur | Init Vol | Calc Vol | Gross CPM | BKG CPM | Net CPM | Efficieny | Yield |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0424028-S1 | 3/18/1999 12:00 | 12/15/2004 12:00 | 11/11/2006 13:09 | 10 | 1.0000 | 0.980 | 406.500 | 1.453 | 405.047 | 0.4337 | 1.000 |
| 0424028-S2 | 3/18/1999 12:00 | 12/15/2004 12:00 | 11/11/2006 14:50 | 10 | 1.0000 | 0.980 | 409.000 | 1.453 | 407.547 | 0.4337 | 1.000 |
| 0424028-S3 | 3/18/1999 12:00 | 12/15/2004 12:00 | 11/11/2006 15:11 | 10 | 1.0000 | 0.980 | 411.200 | 1.453 | 409.747 | 0.4337 | 1.000 |
| 0424028-S4 | 3/18/1999 12:00 | 12/15/2004 12:00 | 11/11/2006 15:27 | 10 | 1.0000 | 0.980 | 420.500 | 1.453 | 419.047 | 0.4337 | 1.000 |
| 0424028-S5 | 3/18/1999 12:00 | 12/15/2004 12:00 | 11/11/2006 15:45 | 10 | 1.0000 | 0.980 | 396.200 | 1.453 | 394.747 | 0.4337 | 1.000 |

| Sample ID | Spike Soln | Ref Date | Sr-90 Activity DPM/mL | Sr-90 Spike Vol mL | Sr-90 Act pCi Added |
|---|---|---|---|---|---|
| 0424028-S1 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |
| 0424028-S2 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |
| 0424028-S3 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |
| 0424028-S4 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |
| 0424028-S5 | 514.1572.73 | 3/18/1999 | 55.50 | 10.0 | 249.992 |

| | | | |
|---|---|---|---|
| Mean= | 408.680 | | |
| StDev= | 8.756 | | |
| 2 Sig LCL= | 391.168 | 1 Sig LCL= | 399.924 |
| 2 Sig UCL= | 426.192 | 1 Sig UCL= | 417.436 |

**0424028-S5 is rejected as the outlier**

gfile: BKGABW
. Cal: 11/11/05
gfile: AmR-11/05
ation: AM0106
gfile: Sr90R-11/05
ation: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(a*(mass-x0)) | | y = b*m^(a*(mass-x0)) | |
| Alpha b= | 1.16970 | Beta b= | 0.9751 |
| m= | 0.99300 | m= | 0.9998 |
| a= | 0.7996 | a= | 1.3098 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b*m^-mass | | y = b*mass + m | |
| a -> b xtalk b= | 0.2318 | b -> a xtalk b= | -2.71E-05 |
| a -> b xtalk m= | 0.9997 | b -> a xtalk m= | 0.0005 |

| | | | Beta Activity | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| se act. | Progeny Eff | Progeny Cor.Fact. | Gross CPM | Bkg. CPM | a>b xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. |
| 70 | n/a | n/a | 406.500 | 1.453 | 0.1159 | 0.4337 | 0.979 | n/a | n/a |

LD
9/27/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision: 2
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111B
Batch ID: OUTLIER
Count Preset (m): 10
Batch Ended: 11/11/05 15:00

Background logfile: BKGABW
Date of Bkg. Cal: 11/11/05
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM0106
Beta efficiency logfile: Sr90R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(a*(mass-x0)) | | y = b*m^(a*(mass-x0)) | |
| Alpha b= | 1.16970 | Beta b= | 0.9751 |
| m= | 0.99300 | m= | 0.9996 |
| a= | 0.1996 | a= | 1.3098 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b *m*-mass | | y = b*mass + m | |
| a -> b xtalk b= | 0.2316 | b -> a xtalk b= | -2.71E-05 |
| a -> b xtalk m= | 0.9997 | b -> a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Bkg. CPM | Alpha b>a xtlk CPM | Alpha Base Eff | Alpha Base Cor.Fact. | Alpha Progeny Eff | Alpha Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Bkg. CPM | Beta a>b xtlk CPM | Beta Base Eff | Beta Base Cor.Fact. | Beta Progeny Eff | Beta Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0424028-S2 | 11/11/05 15:00 | 10.00 | 0.0 | 0.400 | 0.052 | 0.205 | 0.2316 | 1.170 | n/a | n/a | 409.000 | 1.453 | 0.0927 | 0.4337 | 0.979 | n/a | n/a |





10 9/22/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision: 2
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111D
Batch ID: OUTLIER
Count Preset (m): 10
Batch Ended: 11/11/06 15:21

Background logfile: BKGABW
Date of Bkg. Cal: 11/11/06
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM0105
Beta efficiency logfile: Sr90R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(a*(mass-x0)) | | y = b*m^(a*(mass-x0)) | |
| Alpha b= | 1.16970 | Beta b= | 0.9791 |
| m= | 0.99300 | m= | 0.9998 |
| a= | 0.7885 | a= | 1.3099 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b*m^-mass | | y = b*mass + m | |
| a ->b xtalk b= | 0.2319 | b ->a xtalk b= | -2.71E-06 |
| a ->b xtalk m= | 0.9957 | b ->a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity | | | | | | | Beta Activity | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Gross CPM | Bkg. CPM | b>a xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. | Gross CPM | Bkg. CPM | a>b xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. |
| A1 | 0424028-S3 | 11/11/06 15:21 | 10.00 | 0.0 | 0.900 | 0.052 | 0.206 | 0.2316 | 1.170 | n/a | n/a | 411.200 | 1.453 | 0.2086 | 0.4337 | 0.979 | n/a | n/a |





LP 2/12/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision:
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111F
Batch ID: OUTLIER
Count Preset (m): 10
2 Batch Ended: 11/11/06 15:37

Background logfile: BXGABW
Date of Bkg. Cal: 11/11/06
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM0186
Beta efficiency logfile: Sr90R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^[a*(mass-x0)] | | y = b*m^[a*(mass-x0)] | |
| Alpha b= | 1.16970 | Beta b= | 0.9791 |
| m= | 0.99300 | m= | 0.9999 |
| a= | 0.7296 | a= | 1.3998 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b *m^-mass | | y = b*mass + m | |
| a ->b xtalk b= | 0.2316 | b ->a xtalk b= | -2.71E-06 |
| a ->b xtalk m= | 0.2997 | b ->a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity | | | | | | | Beta Activity | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Gross CPM | Bkg. CPM | b>a xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. | Gross CPM | Bkg. CPM | a>b xtlk CPM | Base Eff | Base Cor.Fact. | Progeny Eff | Progeny Cor.Fact. |
| A1 | 0424028-S4 | 11/11/06 15:37 | 10.00 | 0.0 | 0.600 | 0.052 | 0.210 | 0.2316 | 1.170 | n/a | n/a | 420.500 | 1.453 | 0.1391 | 0.4337 | 0.979 | n/a | n/a |





W 12/21/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision:
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1111H
Batch ID: OUTLIER
Count Preset (m): 10
2 Batch Ended: 11/11/06 15:55

Background logfile: BKGABW
Date of Bkg. Cal: 11/11/06
Alpha efficiency logfile: AmR-11/05
Alpha attenuation calibration: AM81D6
Beta efficiency logfile: Sr90R-11/05
Beta attenuation calibration: SR1105

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(a*(mass-x0)) | | y = b*m^(a*(mass-x0)) | |
| Alpha b= | 1.16979 | Beta b= | 0.9191 |
| m= | 0.99306 | m= | 0.9998 |
| a= | 0.7996 | a= | 1.3098 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b*m^mass | | y = b*mass + m | |
| a ->b xtalk b= | 0.2316 | b ->a xtalk b= | -2.71E-05 |
| a ->b xtalk m= | 0.9997 | b ->a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Bkg. CPM | Alpha b>a xBk CPM | Alpha Base Eff | Alpha Base Cor.Fact. | Alpha Progeny Eff | Alpha Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Bkg. CPM | Beta a>b xtlk CPM | Beta Base Eff | Beta Base Cor.Fact. | Beta Progeny Eff | Beta Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0424020-S5 | 11/11/06 15:55 | 10.00 | 0.0 | 0.500 | 0.052 | 0.198 | 0.2316 | 1.176 | n/a | n/a | 396.200 | 1.453 | 0.1391 | 0.4337 | 9.979 | n/a | n/a |





10 11/27/06

Date 11/11/06

SOP 724r 9

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LO | P | | | | | | | P |
| 2 | | | | | | | | | H α |
| 3 | | | | | | | | | P |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | H α |
| 15 | | | | | | | | | P |
| 16 | | | | | | | | | H β |

LO 11/11/06

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

Date 11/11/06

SOP 724r 9

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily EFF | — | — | 30 | 1039 | LO | EFB1111 | LO |
| 1 | 1156 | Ra226 EFF | Ra226 | 30 | 1103 | LO | ERA1111A | LO |
| 2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 4 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 5 | 1156 | Ra226EFF | Ra226 | 30 | 1118 | LO | ERA1111B | LO |
| 6 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 7 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 8 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 1156 | Ra226EFF | Ra226 | 30 | 1130 | LO | ERA1111C | LO |
| 10 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 13 | 1156 | Ra226EFF | Ra226 | 30 | 1141 | LO | ERA1111D | LO |
| 14 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 15 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 16 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | Alpha | R01 Test | α | 10 | 1117 | LO | ABB1111 | LO |
| 7 | Alpha | R01 Test | α | 10 | 1130 | LO | ABB1111A | LO |
| 1 | Beta | R01 Test | β | 10 | 1143 | LO | ABB1111B | LO |
| 3 | Alpha | ↓ | α | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | Beta | R01 Test | β | 10 | 1200 | LO | ABB1111C | LO |
| 4 | Alpha | ↓ | α | ↓ | ↓ | ↓ | ↓ | ↓ |
| 3 | Beta | ↓ | ↓ | ↓ | 1216 | LO | ABB1111D | LO |
| 5 | Alpha | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 0424028-S1 | Outlier | Sr90 | 10 | 1308 | LO | SRB1111 | LO |
| 5 | 0615044-S1 | Outlier | α β | 10 | 1310 | LO | ABB1111E | |
| 9 | 0614030-S1 | Outlier | β | 10 | 1312 | LO | ABB1111F | |

Sr90 Working Standard

1) Transfer a fraction of std 574.1572.72 to a 500 ml poly bottle + dilute w/ 0.1M HCl to a final activity conc of approx 25 pCi/ml

a) 500 ml bottle empty 37.9693 g (Bal 12)
" + 1° std 40.5067
Net 1° std transferred 2.5374 g

b) 500 ml bottle empty 37.9693 g from above
Bottle + std + acid [illegible] g (Bal 12)

72
PROJECT 514.1572.72

Notebook No. _____
Continued From Page _____

5-90 Primary Standard

1) Transfer RSO# 514 (Analytics 573070-307) to a a 250 ml poly bottle & dilute to final conc of approx 5000 pCi/ml w/ 0.1 M HCl.

a) Ampule full w/ beaker 36.5941 g (Bal 12)
Ampule empty w/ beaker 31.7330
Net std transferred 4.8601 g

b) 250 ml poly empty 26.4116 g (Bal 12)
bottle w/ std & 0.1 M HCl 223.6 g (Bal 16)
Total diluted std mass 197.2 g

2) Density of 0.1 M HCl using 100 ml class A flask

99.7100 g / 100 ml = .9971 g/ml

3) Calculations

orig. std: $\left(\frac{3.757 \text{ EH dpm}}{5020.81 \text{ g}}\right)\left(\frac{60 \text{ s/m}}{2.22 \text{ dpm/pCi}}\right) = 202,239.4$ pCi/g

dil std by mass $\frac{(202,239.4 \text{ pCi/g})(4.860 \text{ g})}{(197.2 \text{ g})} = 4984.3$ pCi/g

dil std by vol (4984.3 pCi/g)(.9971 g/ml) = 4969.8 pCi/ml

Ref Date = 3/18/99 Verified 3/25/99
Exp Date = 3/23/04

Continued on Page

Read and Understood By

Signed _____ Date 3/23/99 Signed _____ Date 3/24/99

ANALYTICS

DAL 514
rcd 3-23-99

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.
Phone (404) 352-8677
Fax (404) 352-2837

# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

57370-307

Sr-90 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master liquid radionuclide solution source. The master source was calibrated by liquid scintillation counting.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

| | |
|---|---|
| ISOTOPE: | Sr-90 |
| ACTIVITY (dps): | 3.757 E+04 |
| HALF-LIFE: | 28.74 years |
| CALIBRATION DATE: | March 18, 1999 12:00 EST |
| TOTAL UNCERTAINTY: | 4.0% |
| SYSTEMATIC: | 3.5% |
| RANDOM: | 0.5% |

5.02081 grams of solution 30 ppm Sr carrier in 0.1M HCl.

P O NUMBER 22170, Item 2

# ICBs
# &
# ICVs

Sr-90 Calculations

| Sample ID | Sample D & T | Sep. D & T | Count D & T | Ct Dur | Ini Vol | Calc Vol | Gross CPM | BKG CPM | Net CPM | Efficiency | Yield | Decay | Ingrowth | k | Act | 1 sig Ctd | 1 sig TPU | 2 sig TPU | MDC | LCS Recov |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0714506-S1MB | 2/20/2007 12:00 | 2/22/2007 15:07 | 11/8/2007 13:10 | 30 | 1.0000 | 0.980 | 1.157 | 1.421 | -0.254 | 0.4316 | 0.943 | 0.9998597 | 2 | 1.7713 | -0.14 | 0.11 | 0.11 | 0.23 | 0.62 | |
| 0714506-S2MB | 2/20/2007 12:00 | 2/22/2007 15:07 | 11/8/2007 13:10 | 30 | 1.0000 | 0.980 | 1.587 | 1.582 | 0.005 | 0.4299 | 0.966 | 0.9998597 | 2 | 1.7749 | 0.00 | 0.13 | 0.13 | 0.26 | 0.65 | |
| 0714506-S3MB | 2/20/2007 12:00 | 2/22/2007 15:07 | 11/8/2007 13:10 | 30 | 1.0000 | 0.980 | 1.600 | 1.545 | 0.055 | 0.4328 | 0.924 | 0.9998597 | 2 | 1.7391 | 0.03 | 0.13 | 0.13 | 0.27 | 0.68 | |
| 0714506-S1MB | 2/20/2007 12:00 | 2/22/2007 15:07 | 11/12/2007 10:37 | 30 | 1.0000 | 0.980 | 1.800 | 1.577 | 0.323 | 0.4429 | 0.943 | 0.9998597 | 2 | 1.9169 | 0.16 | 0.14 | 0.14 | 0.28 | 0.64 | |
| 0714506-S1LCS | 2/20/2007 12:00 | 2/22/2007 15:07 | 11/8/2007 13:10 | 30 | 1.0000 | 0.980 | 17.967 | 1.486 | 16.481 | 0.4530 | 0.943 | 0.9998597 | 2 | 1.8593 | 8.96 | 0.42 | 1.11 | 2.23 | 0.81 | 89.7% |
| 0714506-S2LCS | 2/20/2007 12:00 | 2/22/2007 15:07 | 11/8/2007 13:10 | 30 | 1.0000 | 0.980 | 16.367 | 1.595 | 14.772 | 0.4436 | 0.913 | 0.9998597 | 2 | 1.7620 | 8.38 | 0.42 | 1.06 | 2.13 | 0.88 | 84.8% |
| 0714506-S3LCS | 2/20/2007 12:00 | 2/22/2007 15:07 | 11/8/2007 13:10 | 30 | 1.0000 | 0.980 | 16.533 | 1.767 | 14.766 | 0.4286 | 0.969 | 0.9998597 | 2 | 1.8078 | 8.17 | 0.41 | 1.04 | 2.07 | 0.87 | 82.6% |
| 0714506-S1LCS | 2/20/2007 12:00 | 2/22/2007 15:07 | 11/12/2007 10:37 | 30 | 1.0000 | 0.980 | 18.287 | 1.475 | 16.782 | 0.4353 | 0.943 | 0.9998597 | 2 | 1.7868 | 9.40 | 0.44 | 1.16 | 2.36 | 0.83 | 95.1% |

| Sample ID | Spike Soln | Ref Date | Sr-90 Activity DPM/mL | Sr-90 Spike Vol mL | Sr-90 Act pCi Added |
|---|---|---|---|---|---|
| 0714506-S1LCS | 600.3020L59 | 2/20/2007 | 43.90 | 0.5 | 9.886 |
| 0714506-S2LCS | | | 43.90 | 0.5 | 9.886 |
| 0714506-S3LCS | | | 43.90 | 0.5 | 9.886 |
| 0714506-S1LCS | | | 43.90 | 0.5 | 9.886 |

Ave Recovery = 88.0%

r:\inst\g/p\Sr-90 Worksheet.xls

Final Aliquot $= 1000ml\left(\frac{10-0.1}{10}\right)\left(\frac{1000.5-10}{1000.5}\right) = 980.1049ml$

% Yield $= [ICP_i] = 1.0108 mg/ml$, dilution $= \frac{10}{10}$, volume $= 1000ml$

$= 1.0108 mg/ml\left(\frac{10}{10}\right)(1001ml) = 1,011.81$

$1,011.81\left(\frac{10-0.1}{10}\right) = 1001.69mg$ vs 1001.703

$[ICP_{ref}] = 1.0076 mg/ml$, dilution $= \frac{10}{10}$, volume $= 1000.5ml$

$= 1.0076 mg/ml\left(\frac{10}{10}\right)(1000.5ml) = 1,008.1038mg$

$1,008.1038mg\left(\frac{10-0.1}{10}\right) = 998.0227mg$

vs 998.0328

$[ICP_p] = 0.9449 mg/ml$, dilution $\left(\frac{10}{0.1}\right)$, volume $= 10ml$

$= 0.9449 mg/ml\left(\frac{10}{0.1}\right)(10ml) = 944.9mg$

vs 944.9mg

% Yield $= \frac{944.9mg}{1001.69mg} = 0.9433 \times 100\% = 94.33\%$

vs 94.33%

% Recovery $= \frac{9.06}{\cancel{10.080}\ 9.886} = \cancel{0.8980} = 0.916 \times 100\% = \cancel{89.80\%}\ 91.6\%$

vs 89.7%

0714506-51 (A3)

Ingrowth

2/22/2007 15:07
11/8/2007 13:10

8 mo ~~16~~ 15 day 1:57

= 6,121.95 hours

$= 2 - e^{(-0.01814)(6121.95)}$

$= 2$

Decay

11/8/2007 13:10
2/20/2007 12:00

8 mo 18 d 1:10

= 6,193.166 hours

$= e^{(-0.000003)(6,193.166)}$

$= 0.9816$

Activity $\frac{17.967 - 1.486}{(.20)(.0)(.0011)(.980)(.4830)(.94)} = \frac{16.481}{1.8187} = 9.06$ vs

**Paragon Analytics**

# Radiochemistry Instrument Worksheet

**Prep Batch: SR070220-1**

**Prep Procedure:** SR90

Analytical QASS / NCR? Y / (N) NA

| Prep Num | LabID | QC Type | Init Alq | Fin Alq | Units | Residual Mass (mg) | Cnt 1 File | Cnt 1 Inst/Det | Cnt 1 Pos Chk By | Cnt 2 File | Cnt 2 Inst/Det | Cnt 2 Pos Chk By | Cnt 3 File | Cnt 3 Inst/Det | Cnt 3 Pos Chk By | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0714506-B1 | MB | 1000 | 980.1049 | ml | SRB1108 | 1 | 10 | | SRB1112B | 9 | JH | | | | |
| 1 | 0714506-B2 | MB | 1000 | 980.1049 | ml | | 7 | | | | | | | | | |
| 1 | 0714506-B3 | MB | 1000 | 980.1049 | ml | | 13 | | | | JH 11/13/07 | | | | JH 11/13/07 | |
| 1 | 0714506-S1 | LCS | 1000 | 980.1098 | ml | | 3 | | | SRB1112B | 10 | JH | | | | |
| 1 | 0714506-S2 | LCS | 1000 | 980.1098 | ml | | 8 | | | | | | | | | |
| 1 | 0714506-S3 | LCS | 1000 | 980.1098 | ml | | 15 | | | | JH 11/13/07 | | | | | |

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | STRONTIUM | 247942 | 2,004.671 | ppm | NA | 0.5 | ppm | RS004 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.50 | 43.895 | DPM/ml | 02/20/07 | 0.5 | ml | RS004 |

**Sample Barcodes**

0714506-RC1CAR

0714506-S2LCS

0714506-B2MB

0714506-B3MB

0714506-S3LCS

0714506-S1LCS

0714506-B1MB

# diochemistry Prep Worksheet

**Prep Batch: SR070220-1**

Reviewed By: LNT DS  Review Date: 2/25/2007

Re-Prep? Y / N  Batch: NA  Prep QASS / NCR? Y N NA

st: Lindsay Tearman  Balance:
te: 2/20/2007  Balance:
pt: RS

| Column # | Ingrowth Date/Time | Standards | Prep Notes |
|---|---|---|---|
| 8769 | 02/22/07 15:07 | T1 | |
| 8770 | 02/22/07 15:07 | T1 | |
| 8771 | 02/22/07 15:07 | T1 | DS 2/25/07 |
| 8772 | 02/22/07 15:07 | T1,S1 | |
| 8773 | 02/22/07 15:07 | T1,S1 | |
| 8774 | 02/22/07 15:07 | T1,S1 | |

| Units | Pipet ID |
|---|---|
| ppm | RS004 |

Spike Solution Information

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.50 | 43.895 | DPM/ml | 02/20/07 | 0.5 | ml | RS004 |

# ochemistry ICP Worksheet

Prep Batch: SR070220-1

Reviewed By: LNT

Review Date: 2/25/2007

## STRONTIUM Recovery Results

| Ref Carr ICP Run | Ref Carr ICP Conc |
|---|---|
| | 1.0076 |

| Post Con Vol (ml) | Pre-Sep Vol (ml) | Post Sep Vol (ml) | Fin ICP Alq (ml) | Fin ICP Dil Vol (ml) | Initial ICP Run | Final ICP Run | Init ICP Conc (ug/ml) | Fin ICP Conc (ug/ml) | Init Samp Mass (ug) | Ref Mass (ug) | Flag | Fin Samp Mass (ug) | % Yield | Final Sample Alq |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 990.5 | 990.5 | 10 | 0.1 | 10 | | | 1.0101 | 0.9433 | 1000.504 | 998.0278 | | 943.3 | 94.28% | 980.1 |
| 990.5 | 990.5 | 10 | 0.1 | 10 | | | 1.0098 | 0.9554 | 1000.207 | 998.0278 | | 955.4 | 95.52% | 980.1 |
| 990.5 | 990.5 | 10 | 0.1 | 10 | | | 1.0211 | 0.934 | 1011.4 | 998.0278 | | 934 | 92.35% | 980.1 |
| 991 | 991 | 10 | 0.1 | 10 | | | 1.0108 | 0.9449 | 1001.703 | 998.0328 | | 944.9 | 94.33% | 980.1 |
| 991 | 991 | 10 | 0.1 | 10 | | | 1.0199 | 0.9223 | 1010.721 | 998.0328 | | 922.2999 | 91.25% | 980.1 |
| 991 | 991 | 10 | 0.1 | 10 | | | 1.0085 | 0.9688 | 999.4235 | 998.0328 | | 968.8 | 96.94% | 980.1 |

02/25/07

*Paragon Analytics*

LIMS Version: 5.482A

FLAG - LB: low bias (<= 15%) 15%: low bias (>15%)

Z: Negative init. conc. treated as zer

Supersedes: _____

Paragon Analytics

# Radiochemistry Prep Worksheet

Prep Batch: SR070220-1

Prep Procedure: SR90

## Prep Batch Not Validated!!!

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: _____ Re-Prep? Y / N Batch: _____ Prep QASS / NCR? Y / N _____

Prep SOP: PAI 707 Rev: 9
Prep SOP: NONE
Matrix Class: liquid

Prep Analyst: Lindsay Tearman LS
Prep Date: 2/20/2007
Prep Dept: RS

Balance:
Balance:

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Alq ml | Fin Alq ml | Prep Basis | Column # | Ingrowth Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0714506-B1 | MB | | 1000 | 980.1049 | Unfiltered | 8769 | 2/22/07 | T1 | |
| 2 | 1 | 0714506-B2 | MB | | 1000 | 980.1049 | Unfiltered | 8770 | 3:07 PM | T1 | |
| 3 | 1 | 0714506-B3 | MB | | 1000 | 980.1049 | Unfiltered | 8771 | | T1 | |
| 4 | 1 | 0714506-S1 | LCS | | 1000 | 980.1098 | Unfiltered | 8772 | | T1,S1 | |
| 5 | 1 | 0714506-S2 | LCS | | 1000 | 980.1098 | Unfiltered | 8773 | | T1,S1 | |
| 6 | 1 | 0714506-S3 | LCS | | 1000 | 980.1098 | Unfiltered | 8774 | | T1,S1 | |

Spiked By: Lindsay Tearman LS Date: 2/20/2007 2/20/07

Witnessed By: MMD Date: 2-20-07

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | STRONTIUM | 247942 | 2,004.671 | ppm | NA | 0.5 | ppm | RS004 |

ex: 5/8/07

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | Sr-90 | 600.3020.50 | 43.895 | DPM/ml | 02/20/07 | 0.5 | ml | RS004 |

ex: 11/8/07

DRAFT

Comments

| Sample Id1 | Ba | Sr | Y | Fe | Ni |
|---|---|---|---|---|---|
| I 0702098-16 | 0.2005 | 0.0682 | 0.0013 | 5.9108 | 2.1681 |
| F 0702098-16 | 0.0010 | -0.0002 | -0.0063 | 0.0475 | 1.7754 |
| I 0702098-17 | 0.2501 | 0.0601 | 0.0016 | 7.0286 | 2.1849 |
| F 0702098-17 | 0.0009 | -0.0003 | -0.0065 | 0.0129 | 1.7377 |
| I 0702098-18 | 0.2474 | 0.0565 | 0.0015 | 6.6862 | 2.1583 |
| F 0702098-18 | 0.0010 | -0.0002 | -0.0068 | 0.0263 | 1.7442 |
| I 0702098-19 | 0.1724 | 0.0898 | 0.0017 | 6.3755 | 2.1823 |
| F 0702098-19 | 0.0009 | -0.0002 | -0.0066 | 0.0379 | 1.7561 |
| CCV | 0.4939 | 0.4973 | 10.0338 | 21.1606 | 0.5094 |
| CCB | 0.0002 | 0.0002 | 0.0042 | 0.0138 | 0.0013 |
| I NI070220-1MB | 0.0008 | -0.0003 | -0.0058 | -0.0249 | 2.2212 |
| F NI070220-1MB | 0.0008 | -0.0002 | -0.0059 | 0.0056 | 1.7668 |
| I NI070220-1LCS | 0.0007 | -0.0003 | -0.0064 | -0.0285 | 2.1777 |
| F NI070220-1LCS | 0.0009 | -0.0002 | -0.0063 | 0.0082 | 1.7655 |
| NI070220-1RC | 0.0008 | -0.0003 | -0.0064 | -0.0137 | 2.1945 |
| I 0702062-9 | 0.0085 | 0.1026 | -0.0065 | -0.0024 | 0.0071 |
| F 0702062-9 | 0.0664 | 0.0010 | -0.0067 | -0.0012 | 0.0217 |
| I 0702062-10 | 0.0051 | 1.0559 | -0.0068 | -0.0104 | 0.0327 |
| F 0702062-10 | 0.0660 | 0.0064 | -0.0068 | -0.0118 | 0.0205 |
| I 0702062-11 | 0.0079 | 0.5344 | -0.0067 | -0.0112 | 0.0063 |
| CCV | 0.4952 | 0.4982 | 10.0979 | 21.3844 | 0.5189 |
| CCB | 0.0004 | 0.0003 | 0.0047 | 0.0143 | 0.0017 |
| F 0702062-11 | 0.0640 | 0.0030 | -0.0059 | 0.0134 | 0.0206 |
| I 0702062-12 | 0.0095 | 0.3182 | -0.0061 | -0.0096 | 0.0059 |
| F 0702062-12 | 0.0640 | 0.0040 | -0.0064 | 0.0103 | 0.0211 |
| I 0702062-13 | 0.0084 | 0.0326 | -0.0064 | 0.2255 | 0.0061 |
| F 0702062-13 | 0.0633 | 0.0001 | -0.0066 | 0.0038 | 0.0208 |
| I 0702062-14 | 0.0040 | 0.1264 | -0.0066 | 0.0348 | 0.0052 |
| **F 0702062-14** | **0.0642** | **0.0007** | **-0.0067** | **-0.0037** | **0.0208** |
| I 0702062-15 | 0.0350 | 3.6667 | -0.0068 | -0.0222 | 0.0046 |
| F 0702062-15 | 0.0673 | 0.0482 | -0.0067 | 0.0092 | 0.0213 |
| I 0702062-15D | 0.0352 | 3.6486 | -0.0066 | 0.0008 | 0.0054 |
| CCV | 0.4927 | 0.4942 | 10.0482 | 21.3325 | 0.5141 |
| CCB | 0.0003 | 0.0008 | 0.0050 | 0.0243 | 0.0009 |
| F 0702062-15D | 0.0653 | 0.0470 | -0.0058 | 0.0187 | 0.0212 |
| I TR070222-1MB | 0.0000 | 0.0002 | -0.0062 | 0.0050 | 0.0045 |
| F TR070222-1MB | 0.0627 | 0.0000 | -0.0064 | 0.0091 | 0.0209 |
| I TR070222-1LCS | 0.0001 | -0.0001 | -0.0064 | -0.0154 | 0.0101 |
| F TR070222-1LCS | 0.0642 | -0.0002 | -0.0066 | -0.0010 | 0.0211 |
| TR070222-1RC | 1.6304 | 0.0003 | -0.0066 | -0.0157 | 0.0050 |
| I 0714506-B1 | 0.0014 | 1.0101 | -0.0066 | -0.0127 | 0.0020 |
| F 0714506-B1 | 0.0008 | 0.9433 | -0.0067 | -0.0181 | 0.0167 |
| I 0714506-B2 | 0.0000 | 1.0098 | -0.0068 | -0.0277 | 0.0021 |
| F 0714506-B2 | 0.0007 | 0.9554 | -0.0067 | -0.0158 | 0.0173 |

| Fe | Ni |
|---|---|
| 0.9468 | 0.5057 |
| 0.0085 | 0.0009 |
| 0.0212 | 0.0016 |
| 0.0175 | 0.0177 |
| 0.0169 | 0.0039 |
| 0.0130 | 0.0174 |
| 0.0263 | 0.0026 |
| 0.0059 | 0.0173 |
| 0.0106 | 0.0023 |
| 0.0073 | 0.0183 |
| 0.0065 | 0.0021 |
| 0.0078 | 0.0055 |
| 1.1385 | 0.5077 |
| 0.0109 | -0.0004 |
| 0.0131 | 0.0281 |
| 0.0115 | 0.0052 |
| -0.0020 | 0.0204 |
| 0.0037 | 0.0049 |
| 0.0115 | 0.0208 |
| 0.0192 | 0.0048 |
| 0.0022 | 0.0202 |
| 0.0034 | 0.0052 |
| 1.2778 | 0.5112 |
| 0.0168 | 0.0004 |
| 7.8570 | 0.0260 |
| 0.0183 | 0.0213 |
| 7.9080 | 0.0256 |
| 0.0189 | 0.0209 |
| **1.9375** | **0.0193** |
| 0.0133 | 0.0205 |
| 0.0021 | 0.0166 |
| 0.0066 | 0.0207 |
| 0.0099 | 0.0166 |
| 0.0046 | 0.0200 |
| 1.0050 | 0.5048 |
| 0.0129 | 0.0007 |
| 0.0058 | 0.0175 |
| 1.2203 | 0.5090 |
| 0.0150 | 0.0007 |

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision: 2
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1108
Batch ID: SR070220-1
Count Preset (m): 30
Batch Ended: 11/8/07 13:40

Background logfile: BKGABW
Date of Bkg. Cal: 11/3/07
Alpha efficiency logfile: AmWipe-11/07
Alpha attenuation calibration: AAM1106
Beta efficiency logfile: Sr90F-11/07
Beta attenuation calibration: ASR1106

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(a*(mass-x0)) | | y = b*m^(a*(mass-x0)) | |
| Alpha b= | 1.00740 | Beta b= | 1.0677 |
| m= | 0.99346 | m= | 0.9992 |
| a= | 0.9865 | a= | 0.9156 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b*m^-mass | | y = b*mass + m | |
| a ->b xtalk b= | 0.2760 | b ->a xtalk b= | -2.43E-06 |
| a ->b xtalk m= | 0.9960 | b ->a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Bkg. CPM | Alpha b>a xtlk CPM | Alpha Base Eff | Alpha Base Cor.Fact. | Alpha Progeny Eff | Alpha Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Bkg. CPM | Beta a>b xtlk CPM | Beta Base Eff | Beta Base Cor.Fact. | Beta Progeny Eff | Beta Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0714506-B1MB | 11/8/07 13:40 | 30.00 | 0.0 | 0.000 | 0.039 | 0.001 | 0.2848 | 1.007 | n/a | n/a | 1.167 | 1.421 | 0.0000 | 0.4318 | 1.058 | n/a | n/a |
| A3 | 0714506-S1LCS | 11/8/07 13:40 | 30.00 | 0.0 | 0.333 | 0.073 | 0.009 | 0.2910 | 1.007 | n/a | n/a | 17.987 | 1.486 | 0.0733 | 0.4530 | 1.058 | n/a | n/a |
| B3 | 0714506-B2MB | 11/8/07 13:40 | 30.00 | 0.0 | 0.067 | 0.096 | 0.001 | 0.2805 | 1.007 | n/a | n/a | 1.567 | 1.552 | 0.0147 | 0.4269 | 1.058 | n/a | n/a |
| B4 | 0714506-S2LCS | 11/8/07 13:40 | 30.00 | 0.0 | 0.167 | 0.104 | 0.008 | 0.2750 | 1.007 | n/a | n/a | 16.367 | 1.595 | 0.0367 | 0.4438 | 1.058 | n/a | n/a |
| D1 | 0714506-B3MB | 11/8/07 13:40 | 30.00 | 0.0 | 0.033 | 0.093 | 0.001 | 0.2685 | 1.007 | n/a | n/a | 1.800 | 1.545 | 0.0073 | 0.4328 | 1.058 | n/a | n/a |
| D3 | 0714506-S3LCS | 11/8/07 13:40 | 30.00 | 0.0 | 0.133 | 0.040 | 0.008 | 0.2861 | 1.007 | n/a | n/a | 18.533 | 1.787 | 0.0293 | 0.4286 | 1.058 | n/a | n/a |





W 11/8/07

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100 -B
Counting Unit ID: Aqua
High Voltage Mode: Simultaneous
Application Revision: 2
Application Version: Standard
Rev.12/29/03 JE

Data file name: SRB1112B
Batch ID: SR070220-1
Count Preset (m): 30
Batch Ended: 11/12/07 11:07

Background logfile: BKGABW
Date of Bkg. Cal: 11/11/07
Alpha efficiency logfile: Am241-11/05
Alpha attenuation calibration: AAM1106
Beta efficiency logfile: Sr90F-07/07
Beta attenuation calibration: ASR1106

Alpha prog. logfile: n/a
Alpha prog. attenuation: n/a
Beta prog. logfile: n/a
Beta prog. attenuation: n/a

| Alpha Attenuation Calibration | | Beta Attenuation Calibration | |
|---|---|---|---|
| y = b*m^(e^(mass-x0)) | | y = b*m^(e^(mass-x0)) | |
| Alpha b= | 1.00740 | Beta b= | 1.0577 |
| m= | 0.99340 | m= | 0.9992 |
| e= | 0.9865 | e= | 0.9156 |
| x0= | 0.0000 | x0= | 0.0000 |
| Alpha to Beta X-talk | | Beta to Alpha X-talk | |
| y = b *m^-mass | | y = b*mass + m | |
| a ->b xtalk b= | 0.2200 | b ->a xtalk b= | -2.43E-06 |
| a ->b xtalk m= | 0.9980 | b ->a xtalk m= | 0.0005 |

| Det. ID | Sample ID | Count End Date & Time | Count Dur. (min) | Resid. Mass (mg) | Alpha Activity Gross CPM | Alpha Bkg. CPM | Alpha b>a xtlk CPM | Alpha Base Eff | Alpha Base Cor.Fact. | Alpha Progeny Eff | Alpha Progeny Cor.Fact. | Beta Activity Gross CPM | Beta Bkg. CPM | Beta a>b xtlk CPM | Beta Base Eff | Beta Base Cor.Fact. | Beta Progeny Eff | Beta Progeny Cor.Fact. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | 0714506-B1MB | 11/12/07 11:07 | 30.00 | 0.0 | 0.167 | 0.084 | 0.001 | 0.2741 | 1.007 | n/a | n/a | 1.900 | 1.577 | 0.0367 | 0.4429 | 1.058 | n/a | n/a |
| C2 | 0714506-S1LCS | 11/12/07 11:07 | 30.00 | 0.0 | 0.167 | 0.099 | 0.009 | 0.2502 | 1.007 | n/a | n/a | 18.267 | 1.475 | 0.0367 | 0.4353 | 1.058 | n/a | n/a |

Date 11/8/07

SOP 724r 10

# Paragon Analytics

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check Start 1 | Status | Start 2 | Status | Background Check Start 1 | Status | Start 2 | Status | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | JH | P | | | JH | P | | | P |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | HL | | | OLBW |
| 6 | | LB | JH | LB | | P | | | OLBD |
| 7 | | P | | | | HL | JH | P | P |
| 8 | | | | | | P | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | OLBW |
| 13 | | | | | | | | | P |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | LB | | | |

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

*Weekly Background Calibration*

| | Current Calib. File ID | Weekly Calib. Started | Status | File ID |
|---|---|---|---|---|
| Dr A | BKB1102W | | | |
| Dr B | 103W | | | |
| Dr C | | | | |
| Dr D | | | | |

Dr = Drawer

*Gas Supply*

| P-10 Supply | | P-10 Flow | |
|---|---|---|---|
| Tank 1 | 1000 | Dr A | 0.15 |
| | | | |

Date 11/8/07

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1 | 0714506-B1MB | SR070220-1 | Sr90 | 30 | 1301 | JH | SRB1108 | JH for LB |
| 7 | -B2MB | | | | | | | |
| 13 | -B3MB | | | | | | | |
| 3 | -S1LCS | | | | | | | |
| 8 | -S2LCS | | | | | | | |
| 15 | -S3LCS | | | | | | | |
| 9 | 07102261-69 | AB071105-6 | αβ | 90 | 1355 | LO | ABB1108F | JH |
| 10 | -70 | | | | | | | |
| 11 | -71 | | | | | | | |
| 9 | 07102261-710 | AB071105-6 | αβ | 90 | 1539 | JH | ABB1108G | LO |
| 10 | -72 | | | | | | | |
| 11 | AB071105-6MB | | | | | | | |
| 1 | 0710268-4 | TR071102-1 | RaTot | 500 | 1542 | JH | TRB1108C | JH |
| 2 | -5 | | | | | | | |
| 3 | -5D | | | | | | | |
| 4 | 0710274-3 | | | | | | | |
| 7 | 0710198-1 | AB071105-3 | αβ | 70 | 1616 | JH | ABB1108H | LO |
| 8 | -2 | | | | | | | |
| 13 | -3 | | | | | | | |
| 14 | -4 | | | | | | | |
| 15 | -5 | | | | 1616 | | | |
| 7 | 0710198-6 | AB071105-3 | αβ | 70 | 1904 | LO | ABB1108 I | LO |
| 8 | -7 | | | | | | | |
| 13 | AB071105-3MB | | | | | | | |
| 14 | -3LCS | | | | | | | |
| 15 | -3LCSD | | | | | | | |
| 9 | 07102261-71D | AB071105-6 | αβ | 90 | 1906 | | ABB1108 J | |
| 10 | 0711039-6 | AB071106-4 | αβ | 80 | 1908 | | ABB1108 K | |
| 11 | -6 | | | | | | | |
| 7 | 0716093-1 | SR071106-1 | Sr90 | 250 | 2259 | LO | SRB1108A | JH |
| 8 | SR071106-1MB | | | | | | | |
| 13 | 0710140-8 | SR071105-1 | Sr90 | 210 | 2301 | LO | SRB1108B | JH |
| 14 | -7 | | | | | | | |
| 15 | 0710193-12 | | | | | | | |

JH 11/9/07

Comments:

Page No.: 357316 B

(cont. from page 357315 B)

Form 780r8.doc (6/23/06)

Reviewed By/Date: JH 11/9/07

Date 11/12/07

SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

*Instrument Daily Response and Background Checks*

| Det. | Daily Response Check | | | | Background Check | | | | Det. Status |
|---|---|---|---|---|---|---|---|---|---|
| | Start 1 | Status | Start 2 | Status | Start 1 | Status | Start 2 | Status | |

Date 11/12/07 SOP 724r 10

**Paragon Analytics**

Low Background Gas Flow Proportional Counter Log

**Instrument: LB4100B**

| Det. | Sample ID | Batch | Test | Count Dur. (min) | Start Time | Analyst Initials | File ID | Output Initials |
|---|---|---|---|---|---|---|---|---|
| 1-16 | Daily Eff | — | — | 30 | 815 | JH | EFB11112 | JH 11/12/07 |
| 15 | Daily Eff | — | — | 30 | 835 | JH | EFB1112R | JH |
| 1,3-16 | Daily BKG | — | — | 60 | 846 | JH | BKB1112 | JH |
| 1 | 0710140-140 | SR071105-2 | Sr-90 | 60 | 953 | JH | SRB1112 | JH |
| 2 | ↓ -15 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 7 | ↓ -16 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 8 | 0710140-5 | SR071105-1 | Sr-90 | 60 | 954 | JH | SRB1112A | JH |
| 9 | 0711012-11 | AB071109-2 | LB | 10 | 1000 | JH | ABB1112 | JH |
| 10 | ↓ -12 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | AB071109-2MB | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | 0711012-14 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 13 | ↓ -19 | ↓ | ↓ | ↓ | 1003 | ↓ | ABB1112A | JH |
| 14 | ↓ -20 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 15 | AB071109-2LCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0711012-4 | AB071109-2 | LB | 10 | 1021 | JH | ABB1112B | JH |
| 10 | ↓ -5 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ ~~-7~~ -20 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | ↓ ~~-12~~ -6 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 13 | 0711012-24 | AB071109-4 | LB | 10 | 1019 | JH | ABB1112C | JH |
| 14 | ↓ -27 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 15 | ↓ -30 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 13 | AB071105-6LCS | AB071105-6 | LB | 30 | 1044 | JH | ABB11120 | JH |
| 14 | AB071105-5MB | AB071105-5 | LB | 90 | 1043 | JH | ABB1112E | |
| 15 | 0711012-31 | AB071109-4 | LB | 10 | 1045 | JH | ABB1112F | JH |
| 12 | | | | | | | | |
| 9 | 0714506-BMB | SR070220-1 | Sr-90 | 30 | 1037 | JH | SRB1112B | JH |
| 10 | ↓ -5LCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 0711086-1 | AB071112-1 | LB | 10 | 1117 | JH | ABB1112G | JH |
| 2 | ↓ -2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 7 | ↓ -3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 8 | ↓ -4 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | ↓ -5 | ↓ | ↓ | ↓ | 1118 | ↓ | ABB1112H | JH |
| 10 | ↓ -6 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -7 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | ↓ -14 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 9 | 0711086-11 | AB071112-1 | LB | 10 | 1134 | JH | ABB1112I | JH |
| 10 | ↓ -12 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 11 | ↓ -140 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 12 | ↓ -13 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | ↓ -70 | ↓ | ↓ | ↓ | 1137 | ↓ | ABB1112J | JH |
| 2 | ↓ -8 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 7 | ↓ -9 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 8 | ↓ -10 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |

JH 11/12/07

Comments:

Page No.: 357322 B

(cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By / Date JH 11/12/07

Type: IR

By JRK on 5/10/2006
By on
By on

ded Units
g

ued Conc Units
ppm

50
PROJECT 600.3020.50 905

Notebook No. 3020
Continued From Page

Prepare a working level dilution of 600.2613.30
at ~50 dpm/mL

Balance

(1) Determine density of 0.1 N HCl
Mass of 100 mL vol. flask: 68.5659 g
Lot # 061842
Mass of flask + 100 mL 0.1N HCl: 168.4196 g
Mass of 100 mL 0.1N HCl: 99.8537 g
$\rho = 0.9985$ g/mL

12

(2) Transfer standard to 1L Nalgene
Mass of bottle w/o lid: 74.7716 g
Mass of bottle + standard: 77.0681 g
Net mass of standard: 2.2965 g

12

(3) Dilute to 1L w/ 0.1N HCl
Mass of bottle + standard + 0.1N HCl: 1181.1 g
Mass of bottle (from above): 74.7716 g
Net mass of standard: 1026.3284 g

20

(4) Final Activity Calculation

PROJECT 600.2613.30 Sr-90

Notebook No. 2613

Continued From Page —

Transfer contents of ampoule 600 to a 125 mL glass bottle for a 1° solution.

1) Transfer ampoule 600 to a 125 mL bottle

| | |
|---|---|
| mass of open ampoule + std | 139.6110 g |
| mass of empty ampoule | 89.5551 g |
| Net mass of std | 50.0559 g |

2) Density from following page D = 0.997789 mL

3) Final Activity Calculation

(1.968×10⁴ dps)(60 dpm/dps) = 22,390.967 dpm / (50.0559 g)(0.997789 mL) = 22,341.71 dpm/mL

50.0559
50.3054 g
CW 12/10/03

Description: Sr-90
Expiration: 12/2/04
Activity: 22341.71 dpm/mL
2s Uncertainty: 744.72 dpm/mL
Ref. Date: 12/1/01
Ref Time: N/A
Prep Date: 12/1/03
Prep by: CW
Matrix/Comp. 0.1 M HCl
Half Life (y): 2.88E+01

Std ID: 600.2613.30

Continued on Page

Signed: Chad Wright 12/10/03 Date

Read and Understood By: 12/10/03

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

# CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

PAI 00600
rec'd 12-05-01

62751-307

# Paragon Analytics

## Radiochemistry Case Narrative
## Isotopic Uranium

---

## Los Alamos National Laboratory SMO

08-939

PA WO 0804083

1. This report consists of the analytical results and supporting documentation for two solid samples received by Paragon on 04/09/08.
2. These samples were prepared according to procedures PA SOP773R10 and PA SOP778R12. Modifications were made to the method as described on QASS 328377 and 357740.
3. The samples were analyzed for the presence of isotopic uranium according to procedure PA SOP714R11. The analyses were completed on 05/29/08.
4. The isotopic analysis results for these samples are reported on an 'as received" basis in units of pCi/gram.
5. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate. Please refer to QASS 328377.
6. This analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to

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

06/03/08
Date

Radiochemistry Final Data Review

6/4/08
Date

1

PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

# CHAIN OF CUSTODY

# Paragon Analytics

## Sample Number(s) Cross-Reference Table

**Paragon OrderNum:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939
**Client PO Number:** 33204-001-06 F3

| Client Sample Number | Lab Sample Number | COC Number | Matrix | Date Collected | Time Collected |
|---|---|---|---|---|---|
| SFB08-08-11838 | 0804083-1 | | SOLID | 08-Feb-08 | |
| SFB08-08-11839 | 0804083-2 | | SOLID | 08-Feb-08 | |

0804083



Tuesday, April 08, 2008

**LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 08-939C**

**REQUEST NUMBER: 08-939**

## LOS ALAMOS

**NATIONAL LABORATORY**

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 5/8/2008

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS:

| | SAMPLE ID | CTNR | CTNR DESC | ORDER | PRESERV | MATRIX |
|---|---|---|---|---|---|---|
| 1 | SFB08-08-11838 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |
| 2 | SFB08-08-11839 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |

| Relinquished By: | Date | Time | Received By: | Date | Time |
|---|---|---|---|---|---|
| [illegible] | 4/8/08 | 1400 | Cheryl Trimble Cheryl Trimble | 4-9-08 | 0930 |
| Printed Name / Signature | | | Printed Name / Signature | | |
| Printed Name / Signature | | | Printed Name / Signature | | |
| Printed Name / Signature | | | Printed Name / Signature | | |

**Received for DISPOSAL By:** **Date** **Time** **Remarks:**

Printed Name / Signature

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

# LOS ALAMOS
**NATIONAL LABORATORY**

ATTN: Lance Steere
Paragon Analytics, Inc.
225 Commerce
Fort Collins, CO 80524

These Samples are on:
LANL Request Number:08-939
Per Agreement Number:1-800-443-1511
Project Cost Code: WEPR13110300

Please analyse the enclosed samples according to the schedule indicated:

**SHIP DATE: 4/8/2008**
**TURNAROUND/REPORT DUE: 5/8/2008**
**TURNAROUND REQ'D: 30 Days**

**RAD SCREENING: Not Required**
**LAB REQUEST COMMENTS:**

LANL ER SMO CONTACT:
Signature:

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:ISOPU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:ISOU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:PO-210 | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |

6

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:PO-210 | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |

**Final Page of REQUEST NUMBER 08-939**

CONDITION OF SAMPLE UPON RECEIPT FORM

**Paragon Analytics**

Client: LANL

Workorder No: 0804083

Project Manager: LS

Initials: CT

Date: 4-9-08

| | | | |
|---|---|---|---|
| 1. Does this project require any **special handling** in addition to standard Paragon procedures? | | YES | (NO) |
| 2. Are custody **seals** on **shipping containers** intact? | NONE | (YES) | NO |
| 3. Are Custody seals on **sample containers** intact? | **NONE** | (YES) | NO |
| 4. Is there a **COC (Chain-of-Custody) present** or other representative documents? | | (YES) | NO |
| 5. Are the **COC and bottle labels complete and legible**? | | (YES) | NO |
| 6. Is the **COC in agreement** with samples received? (IDs, dates, times, no. of samples, no. | | (YES) | NO |

ORIGIN ID: SAFA (505) 665-9968
JOYLENE VALDEZ
LOS ALAMOS NATL LAB.
TA00 BLDG 1237 DPU 03

LOS ALAMOS, NM 87545
UNITED STATES US

Ship Date: 08APR08
ActWgt: 31.0 LB MAN
System#: 0014176/CAFE2355
Account: S *********

0804083

LANCE STEERE
PARAGON
225 COMMERCE

FORT COLLINS, CO 80524

f: 6b010amr1a01401hco

16

2

6c

(800) 443-1511
FedEx
Express

CL585187/22/23

Delivery Address
Barcode

2

PARAGON ANALYTICS
Radiochemistry Data Package

Section 2

# SAMPLE RESULTS SUMMARY

# Isotopic Uranium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083


**Reported on:** Tuesday, June 03, 2008 3:40:05 PM

| Lab Sample ID | Client Sample ID | Sample Type | Nuclide | Result +/- 1 s TPU | MDC | Units | Matrix | Prep Batch | Date Analyzed | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SFB08-08-11838 | Sample | U-234 | 1.01 +/- 0.10 | 0.06 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | M3 |
| 0804083-1 | SFB08-08-11838 | Sample | U-235 | 0.040 +/- 0.019 | 0.053 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | U,M |
| 0804083-1 | SFB08-08-11838 | Sample | U-238 | 0.811 +/- 0.089 | 0.070 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | M3 |
| 0804083-2 | SFB08-08-11839 | Sample | U-234 | 0.643 +/- 0.071 | 0.049 | pCi/g | SOLID | AS080513-2 | 5/29/2008 | M3 |
| 0804083-2 | SFB08-08-11839 | Sample | U-235 | 0.016 +/- 0.014 | 0.049 | pCi/g | SOLID | AS080513-2 | 5/29/2008 | U,M |
| 0804083-2 | SFB08-08-11839 | Sample | U-238 | 0.619 +/- 0.068 | 0.042 | pCi/g | SOLID | AS080513-2 | 5/29/2008 | M3 |

**Comments:**

**Data Package ID:** *UR0804083-1*

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
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)

BDL - Below Detection Limit

3

PARAGON ANALYTICS
Radiochemistry Data Package

Section 3

# QC RESULTS SUMMARY

# Isotopic Uranium By Alpha Spectroscopy

## PAI 714 Rev 11

## Method Blank Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** AS080513-2MB

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2C
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13966-29-5 | U-234 | -0.010 +/- 0.022 | 0.083 | 0.01 | U,M |
| 15117-96-1 | U-235 | 0.0040 +/- 0.0098 | 0.0372 | 0.01 | U,M |
| 7440-61-1 | U-238 | -0.024 +/- 0.015 | 0.066 | 0.01 | U,M |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| U-232 | 4.200 | 3.43 | pCi/g | 81.6 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Data Package ID:** *UR0804083-1*

# Isotopic Uranium By Alpha Spectroscopy

## PAI 714 Rev 11

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** AS080513-2LCS

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2C
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 13966-29-5 | U-234 | 4.39 +/- 0.37 | 0.04 | 4.22 | 104 | 82 - 122 | P,M3 |
| 7440-61-1 | U-238 | 4.51 +/- 0.38 | 0.06 | 4.38 | 103 | 82 - 122 | P,M3 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| U-232 | 4.200 | 3.28 | pCi/g | 78.2 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

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

Abbreviations:

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

**Data Package ID:** *UR0804083-1*

# Isotopic Uranium By Alpha Spectroscopy

## PAI 714 Rev 11

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** AS080513-2LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2C
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 13966-29-5 | U-234 | 4.01 +/- 0.34 | 0.03 | 4.22 | 95.0 | 82 - 122 | P,M3 |
| 7440-61-1 | U-238 | 4.69 +/- 0.39 | 0.03 | 4.38 | 107 | 82 - 122 | P,M3 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| U-232 | 4.200 | 3.53 | pCi/g | 84.1 | 30 - 110 % | |

**Comments:**

# Isotopic Uranium By Alpha Spectroscopy

## PAI 714 Rev 11

## Duplicate Sample Results (DER)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:**
**Lab ID:** AS080513-2LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2C
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Analyte | Sample Result +/- 1s TPU | Duplicate Result +/- 1s TPU | DER | Control Limit | Lab Qualifiers |
|---|---|---|---|---|---|---|
| 13966-29-5 | U-234 | 4.39 +/- 0.37 | 4.01 +/- 0.34 | 0.38 | 2.13 | P,M3 |
| 7440-61-1 | U-238 | 4.51 +/- 0.38 | 4.69 +/- 0.39 | 0.17 | 2.13 | P,M3 |

### Comments:

**Duplicate Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13
LT - Result is less than Request MDC, greater than sample specific MDC
M - Requested MDC not met.
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
L - LCS Recovery below lower control limit.
H - LCS Recovery above upper control limit.
P - LCS, Matrix Spike Recovery within control limits.
N - Matrix Spike Recovery outside control limits

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
DER - Duplicate Error Ratio (see PAI SOP 715)
BDL - Below Detection Limit
NR - Not Reported

**Data Package ID:** *UR0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

4

Section 4

# INDIVIDUAL SAMPLE RESULTS

# Isotopic Uranium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics

**Work Order Number:** 0804083

**Client Name:** Los Alamos National Laboratory SMO

# Isotopic Uranium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2C
**Count Time:** 1000 minutes
**Report Basis:** As Received

**Final Aliquot:** 0.595 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13966-29-5 | U-234 | 0.643 +/- 0.071 | 0.049 | 0.01 | M3 |
| 15117-96-1 | U-235 | 0.016 +/- 0.014 | 0.049 | 0.01 | U,M |
| 7440-61-1 | U-238 | 0.619 +/- 0.068 | 0.042 | 0.01 | M3 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| U-232 | 3.703 | 2.83 | pCi/g | 76.3 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

**Data Package ID:** *UR0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

5

Section 5

# RAW DATA

# Isotopic Uranium By Alpha Spectroscopy Raw Data Report

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Prep SOP:** PAI 778
**Analytical SOP:** PAI 714

**Reported on:** Friday, May 30, 2008
3:18:16 PM

| Sample ID QC Type | Nuclide Type | Sample Date/Time | Prep Batch QCBatchID | Ingrowth Date /Time | Decay Date/Time | Matrix %Moist. | Samp Alq Analy Alq | Inst ID Det ID | AnRunID File Name | Count Date/Time | Net Cnts Bkg Cnts | BaseEff Bkg(min) | CntDur(min) Yield | Activity +/- 1 s TPU | MDC DecLev | ReportUnits ReportBasis | DER RPD | %Spk. Recov Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | U-232 | 2/8/2008 | AS080513-2 | NA | NA | SOLID | 0.458 g | AlphaSpec2 | AS080513-2C | 5/28/2008 | 1149.000 | 32.50% | 1000 | 3.51 | 0.07 | pCi/g | NA | |
| SMP | Tracer | | AS080513-2-1 | NA | NA | NA | 0.454 g | 64 | Spectrum #1 | 5:45 PM | 21.000 | 1000 | 72.3% | 0.28 | NA | As Received | NA | |
| 0804083-1 | U-234 | 2/8/2008 | AS080513-2 | NA | NA | SOLID | 0.458 g | AlphaSpec2 | AS080513-2C | 5/28/2008 | 238.000 | 32.50% | 1000 | 1.01 | 0.06 | pCi/g | NA | |
| SMP | Trg. Analyte | | AS080513-2-1 | NA | NA | NA | 0.454 g | 64 | Spectrum #1 | 5:45 PM | 6.000 | 1000 | 72.3% | 0.10 | NA | As Received | NA | M3 |
| 0804083-1 | U-235 | 2/8/2008 | AS080513-2 | NA | NA | SOLID | 0.458 g | AlphaSpec2 | AS080513-2C | 5/28/2008 | 8.000 | 32.50% | 1000 | 0.040 | 0.053 | pCi/g | NA | |
| SMP | Trg. Analyte | | AS080513-2-1 | NA | NA | NA | 0.454 g | 64 | Spectrum #1 | 5:45 PM | 3.000 | 1000 | 72.3% | 0.019 | NA | As Received | NA | U,M |
| 0804083-1 | U-238 | 2/8/2008 | AS080513-2 | NA | NA | SOLID | 0.458 g | AlphaSpec2 | AS080513-2C | 5/28/2008 | 192.000 | 32.50% | 1000 | 0.811 | 0.070 | pCi/g | NA | |
| SMP | Trg. Analyte | | AS080513-2-1 | NA | NA | NA | 0.454 g | 64 | Spectrum #1 | 5:45 PM | 9.000 | 1000 | 72.3% | 0.089 | NA | As Received | NA | M3 |
| 0804083-2 | U-232 | 2/8/2008 | AS080513-2 | NA | NA | SOLID | 0.601 g | AlphaSpec2 | AS080513-2C | 5/29/2008 | 1059.000 | 28.37% | 1000 | 2.83 | 0.06 | pCi/g | NA | |
| SMP | Tracer | | AS080513-2-1 | NA | NA | NA | 0.595 g | 25 | Spectrum #1 | 2:34 PM | 21.000 | 1000 | 76.3% | 0.22 | NA | As Received | NA | |
| 0804083-2 | U-234 | 2/8/2008 | AS080513-2 | NA | NA | SOLID | 0.601 g | AlphaSpec2 | AS080513-2C | 5/29/2008 | 184.000 | 28.37% | 1000 | 0.643 | 0.049 | pCi/g | NA | |
| SMP | Trg. Analyte | | AS080513-2-1 | NA | NA | NA | 0.595 g | 25 | Spectrum #1 | 2:34 PM | 6.000 | 1000 | 76.3% | 0.071 | NA | As Received | NA | M3 |
| 0804083-2 | U-235 | 2/8/2008 | AS080513-2 | NA | NA | SOLID | 0.601 g | AlphaSpec2 | AS080513-2C | 5/29/2008 | 4.000 | 28.37% | 1000 | 0.016 | 0.049 | pCi/g | NA | |
| SMP | Trg. Analyte | | AS080513-2-1 | NA | NA | NA | 0.595 g | 25 | Spectrum #1 | 2:34 PM | 4.000 | 1000 | 76.3% | 0.014 | NA | As Received | NA | U,M |
| 0804083-2 | U-238 | 2/8/2008 | AS080513-2 | NA | NA | SOLID | 0.601 g | AlphaSpec2 | AS080513-2C | 5/29/2008 | 177.000 | 28.37% | 1000 | 0.619 | 0.042 | pCi/g | NA | |
| SMP | Trg. Analyte | | AS080513-2-1 | NA | NA | NA | 0.595 g | 25 | Spectrum #1 | 2:34 PM | 4.000 | 1000 | 76.3% | 0.068 | NA | As Received | NA | M3 |
| AS080513-2 | U-232 | 5/13/2008 | AS080513-2 | NA | NA | SOLID | 0.53 g | AlphaSpec2 | AS080513-2C | 5/29/2008 | 1234.000 | 30.94% | 1000 | 3.43 | 0.07 | pCi/g | NA | |
| MB | Tracer | 9:46:35 AM | AS080513-2-1 | NA | NA | NA | 0.524 g | 26 | Spectrum #1 | 2:34 PM | 25.000 | 1000 | 81.6% | 0.27 | NA | As Received | NA | |
| AS080513-2 | U-234 | 5/13/2008 | AS080513-2 | NA | NA | SOLID | 0.53 g | AlphaSpec2 | AS080513-2C | 5/29/2008 | -3.000 | 30.94% | 1000 | -0.010 | 0.083 | pCi/g | NA | |
| MB | Trg. Analyte | 9:46:35 AM | AS080513-2-1 | NA | NA | NA | 0.524 g | 26 | Spectrum #1 | 2:34 PM | 22.000 | 1000 | 81.6% | 0.022 | NA | As Received | NA | U,M |
| AS080513-2 | U-235 | 5/13/2008 | AS080513-2 | NA | NA | SOLID | 0.53 g | AlphaSpec2 | AS080513-2C | 5/29/2008 | 1.000 | 30.94% | 1000 | 0.0040 | 0.0372 | pCi/g | NA | |
| MB | Trg. Analyte | 9:46:35 AM | AS080513-2-1 | NA | NA | NA | 0.524 g | 26 | Spectrum #1 | 2:34 PM | 2.000 | 1000 | 81.6% | 0.0098 | NA | As Received | NA | U,M |

**Comments:**

## Data Package ID: *UR0804083-1*

### 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

+ - Duplicate RPD not within limits.

LT - Result is less than Request MDC, greater than sample specific MDC

* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.

\# - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

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

NC - Not Calculated for duplicate results less than 5 times MDC

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

### Notes:

1) The Tracer results are not yield corrected (i.e. activity measured not activity added).

2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

### Abbreviations:

TR- Tracer TA - Target Analyte

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

# Report

ported on: Friday, May 30, 2008
3:18:16 PM

| Dur(min) Yield | Activity +/- 1 s TPU | MDC DecLev | ReportUnits ReportBasis | DER RPD | %Spk. Recov Flags |
|---|---|---|---|---|---|
| 1000 | -0.024 | 0.066 | pCi/g | NA | |
| 1.6% | 0.015 | NA | As Received | NA | U,M |
| 1000 | 3.28 | 0.09 | pCi/g | NA | |
| 8.2% | 0.26 | NA | As Received | NA | |
| 1000 | 4.39 | 0.04 | pCi/g | NA | 104 |
| 8.2% | 0.37 | NA | As Received | NA | P,M3 |
| 1000 | 4.51 | 0.06 | pCi/g | NA | 103 |
| 8.2% | 0.38 | NA | As Received | NA | P,M3 |
| 1000 | 3.53 | 0.06 | pCi/g | NA | |
| 4.1% | 0.28 | NA | As Received | NA | |
| 1000 | 4.01 | 0.03 | pCi/g | 0.38 | 95.0 |
| 4.1% | 0.34 | NA | As Received | NA | P,M3 |
| 1000 | 4.69 | 0.03 | pCi/g | 0.17 | 107 |
| 4.1% | 0.39 | NA | As Received | NA | P,M3 |

ts are not yield corrected (i.e. activity measured not activity added).
ime is not available, 12:00 PM (Mountain) is used for decay correction.

- Target Analyte
gated Uncertainty (see PAI SOP 743)
etectable Concentration (see PAI SOP 709)
ror Ratio
tion Limit

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 0804083-1
Spectrum #1 Analysis #1

Sample Size : 0.45

### Acquisition

Detector: 64
Batch Name: UAS080513-2_A
Nuclide Library: Uranium Default
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Uranium Default

Acquisition Start Date: 5/28/2008 5:45:21PM
Live Time: 1,000.00 min.
Real Time: 1,000.03 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08052764; Det: 64; Spectrum #1; May-27-2008 17:12

Calibration Date: 5/27/2008 2:56:30PM

Efficiency Calibration: C08052764

Efficiency: 32.50% +/- 0.13% TPU(2 sigma)

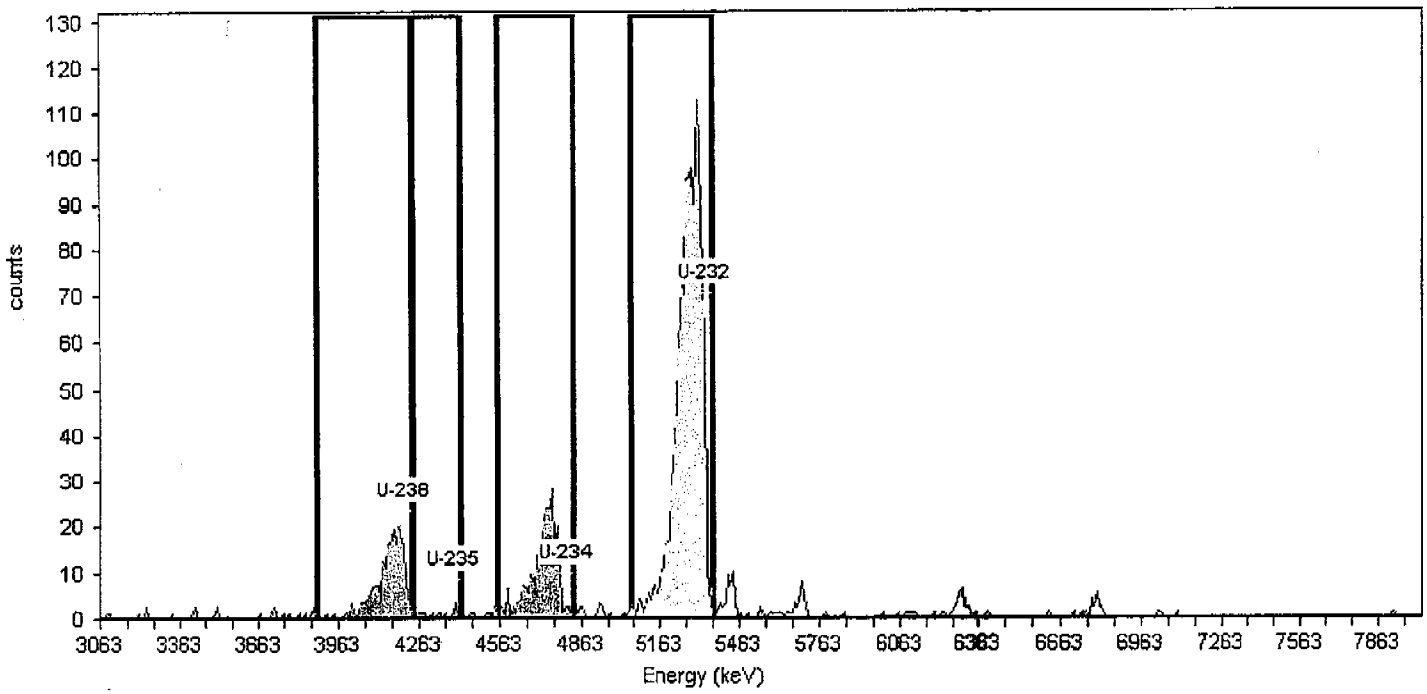
Energy Calibration: C08052764

Energy Cal: Gain = 9.7289 keV / Ch
Offset = 3,053.57 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 837.3020.90 U-232
Tracer Activity: 19.77 DPM/mL x (Vol.)0.25 mL = 4.94 DPM

Tracer Nuclide: U-232
Tracer Recovery: 72.32%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-238 | 4201.6 | 3880.5 | 4230.8 | 36.9 | 100.2 | 201.00 | 9.00 | 192.00 | 8.2E-001 | 1.6E-001 | 3.0E-002 | 7.1E-002 |
| U-235 | 4386.4 | 4240.5 | 4415.6 | 14.6 | 99.7 | 11.00 | 3.00 | 8.00 | 3.4E-002 | 3.2E-002 | 1.7E-002 | 4.6E-002 |
| U-234 | 4804.8 | 4551.8 | 4833.9 | 79.1 | 100.0 | 244.00 | 6.00 | 238.00 | 1.0E+000 | 1.8E-001 | 2.4E-002 | 6.0E-002 |
| U-232 | 5330.1 | 5048.0 | 5359.3 | 55.0 | 100.1 | 1,170.00 | 21.00 | 1,149.00 | 3.6E+000 | 2.2E-001 | 4.6E-002 | 1.0E-001 |

Reviewed By: GB JP

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 0804083-2
Spectrum #1 Analysis #1

Sample Size : 0.59

### Acquisition

Detector: 25
Batch Name: UAS080513-2_B
Nuclide Library: Uranium Default
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Uranium Default

Acquisition Start Date: 5/29/2008 2:34:43PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08052725; Det: 25; Spectrum #1; May-27-2008 17:12

Calibration Date: 5/27/2008 3:38:10PM

Efficiency Calibration: C08052725A

Efficiency: 28.37% +/- 0.20% TPU(2 sigma)

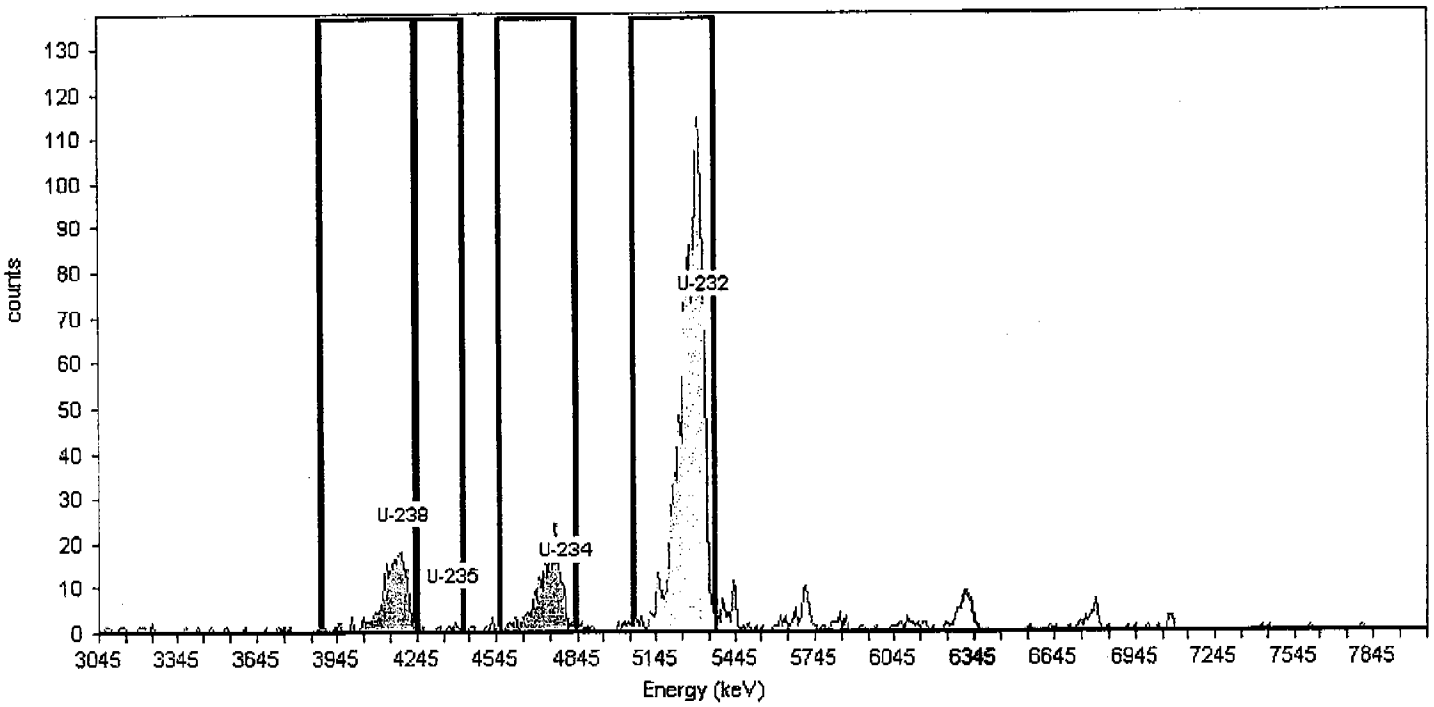
Energy Calibration: C08052725A

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 837.3020.90 U-232
Tracer Activity: 19.77 DPM/mL x (Vol.)0.25 mL = 4.94 DPM

Tracer Nuclide: U-232
Tracer Recovery: 76.34%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-238 | 4193.0 | 3879.2 | 4232.2 | 36.6 | 100.2 | 181.00 | 4.00 | 177.00 | 6.2E-001 | 1.2E-001 | 1.6E-002 | 4.2E-002 |
| U-235 | 4379.3 | 4242.0 | 4418.5 | 17.1 | 99.7 | 8.00 | 4.00 | 4.00 | 1.4E-002 | 2.4E-002 | 1.6E-002 | 4.2E-002 |
| U-234 | 4800.9 | 4555.7 | 4840.1 | 83.3 | 100.0 | 190.00 | 6.00 | 184.00 | 6.4E-001 | 1.2E-001 | 2.0E-002 | 4.9E-002 |
| U-232 | 5330.3 | 5055.8 | 5369.5 | 57.5 | 100.1 | 1,080.00 | 21.00 | 1,059.00 | 2.9E+000 | 1.8E-001 | 3.8E-002 | 8.5E-002 |

Reviewed By: GB JP

Print Date: 5/30/2008 11:11:16AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS080513-2MB
Spectrum #1 Analysis #1

Sample Size : 0.52

### Acquisition

Detector: 26
Batch Name: UAS080513-2_B
Nuclide Library: Uranium Default
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Uranium Default

Acquisition Start Date: 5/29/2008 2:34:43PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08052726; Det: 26; Spectrum #1; May-27-2008 17:12

Calibration Date: 5/27/2008 11:29:03AM

Efficiency Calibration: C08052726

Efficiency: 30.94% +/- 0.15% TPU(2 sigma)

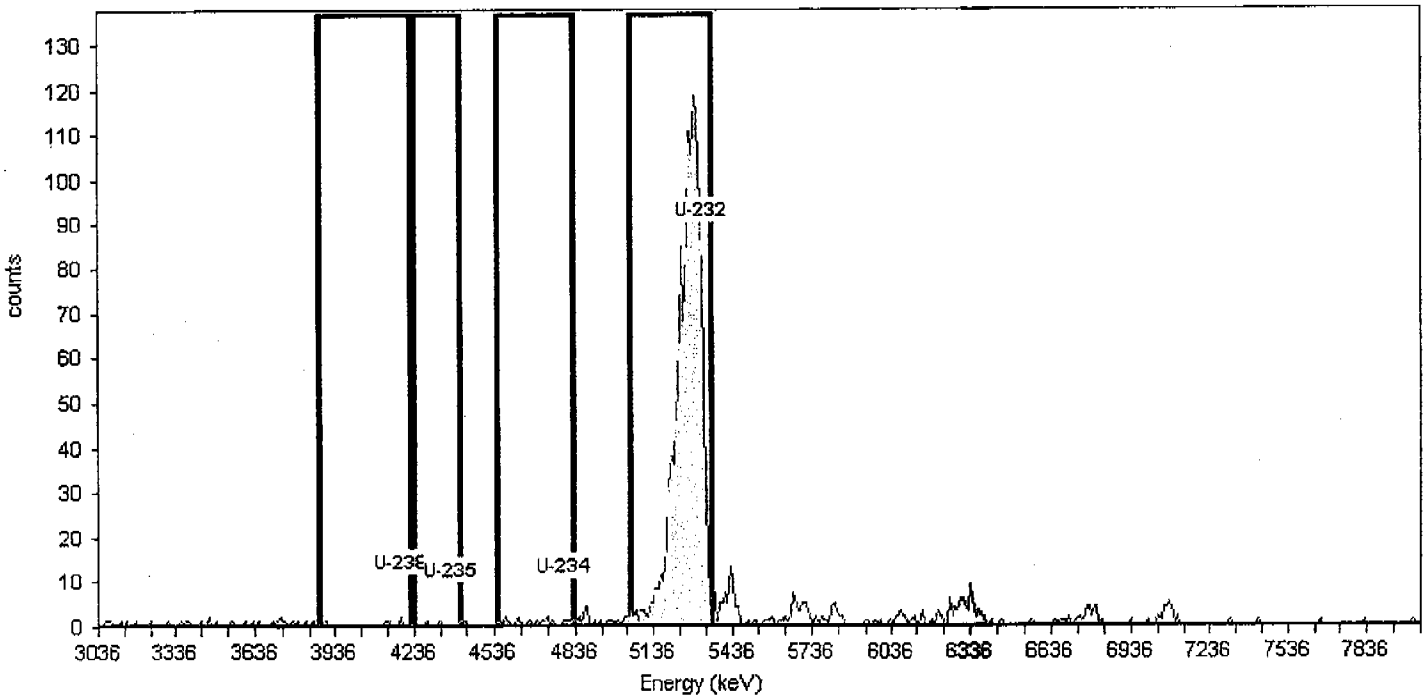
Energy Calibration: C08052726

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,026.20 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 837.3020.90 U-232
Tracer Activity: 19.77 DPM/mL x (Vol.)0.25 mL = 4.94 DPM

Tracer Nuclide: U-232
Tracer Recovery: 81.58%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-238 | 4183.2 | 3869.4 | 4222.4 | 12.7 | 100.2 | 6.00 | 13.00 | -7.00 | -2.4E-002 | 3.0E-002 | 2.8E-002 | 6.6E-002 |
| U-235 | 4369.5 | 4232.2 | 4408.7 | .4 | 99.7 | 3.00 | 2.00 | 1.00 | 3.4E-003 | 1.5E-002 | 1.1E-002 | 3.2E-002 |
| U-234 | 4791.1 | 4545.9 | 4830.3 | 423.2 | 100.0 | 19.00 | 22.00 | -3.00 | -1.0E-002 | 4.4E-002 | 3.7E-002 | 8.3E-002 |
| U-232 | 5320.5 | 5046.0 | 5359.7 | 62.7 | 100.1 | 1,259.00 | 25.00 | 1,234.00 | 3.5E+000 | 2.0E-001 | 4.0E-002 | 8.9E-002 |

Reviewed By: gb JP

Print Date: 5/30/2008 11:12:09AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## *Alpha-Spectroscopy Analysis Report*

### *Sample*

Sample: AS080513-2LCS
Spectrum #1 Analysis #1

Sample Size : 0.52

### *Acquisition*

Detector: 27
Batch Name: UAS080513-2_B
Nuclide Library: Uranium Default
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Uranium Default

Acquisition Start Date: 5/29/2008 2:34:44PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

### *Calibration*

Bkgd Info: Sample: B08052727; Det: 27; Spectrum #1; May-27-2008 17:12

Calibration Date: 5/27/2008 11:29:26AM

Efficiency Calibration: C08052727

Efficiency: 29.83% +/- 0.16% TPU(2 sigma)

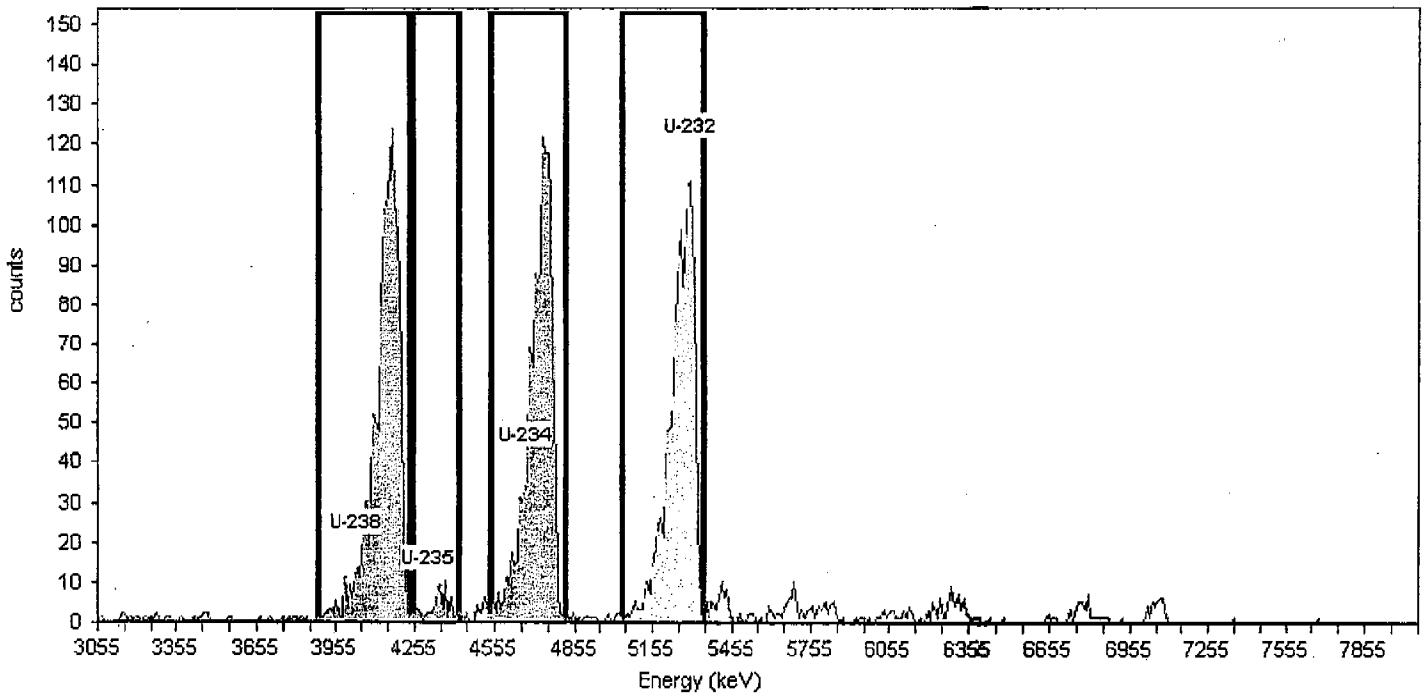
Energy Calibration: C08052727

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,045.81 keV
Quadratic = 0.0000 keV / $Ch^2$

### *Tracer*

Tracer Name: 837.3020.90 U-232
Tracer Activity: 19.77 DPM/mL x (Vol.)0.25 mL = 4.94 DPM

Tracer Nuclide: U-232
Tracer Recovery: 78.18%




### *Nuclide Summary (ROI)*

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-238 | 4026.3 | 3879.2 | 4232.2 | 62.3 | 100.2 | 1,233.00 | 10.00 | 1,223.00 | 4.5E+000 | 5.9E-001 | 2.7E-002 | 6.4E-002 |
| U-235 | 4300.8 | 4242.0 | 4418.5 | 55.7 | 99.7 | 62.00 | 2.00 | 60.00 | 2.2E-001 | 6.5E-002 | 1.2E-002 | 3.4E-002 |
| U-234 | 4668.5 | 4536.1 | 4820.5 | 88.4 | 100.0 | 1,195.00 | 4.00 | 1,191.00 | 4.4E+000 | 5.7E-001 | 1.7E-002 | 4.4E-002 |
| U-232 | 5300.9 | 5036.2 | 5349.9 | 49.6 | 100.1 | 1,174.00 | 34.00 | 1,140.00 | 3.3E+000 | 2.0E-001 | 5.1E-002 | 1.1E-001 |

Reviewed By: gb JP

Print Date: 5/30/2008 11:12:18AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## *Alpha-Spectroscopy Analysis Report*

### *Sample*

Sample: AS080513-2LCSD
Spectrum #1 Analysis #1

Sample Size : 0.52

### *Acquisition*

Detector: 28
Batch Name: UAS080513-2_B
Nuclide Library: Uranium Default
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Uranium Default

Acquisition Start Date: 5/29/2008 2:34:44PM
Live Time: 1,000.00 min.
Real Time: 1,000.01 min.
Dead Time: 0.00 %

### *Calibration*

Bkgd Info: Sample: B08052728; Det: 28; Spectrum #1; May-27-2008 17:12

Calibration Date: 5/27/2008 11:29:45AM

Efficiency Calibration: C08052728

Efficiency: 28.76% +/- 0.20% TPU(2 sigma)

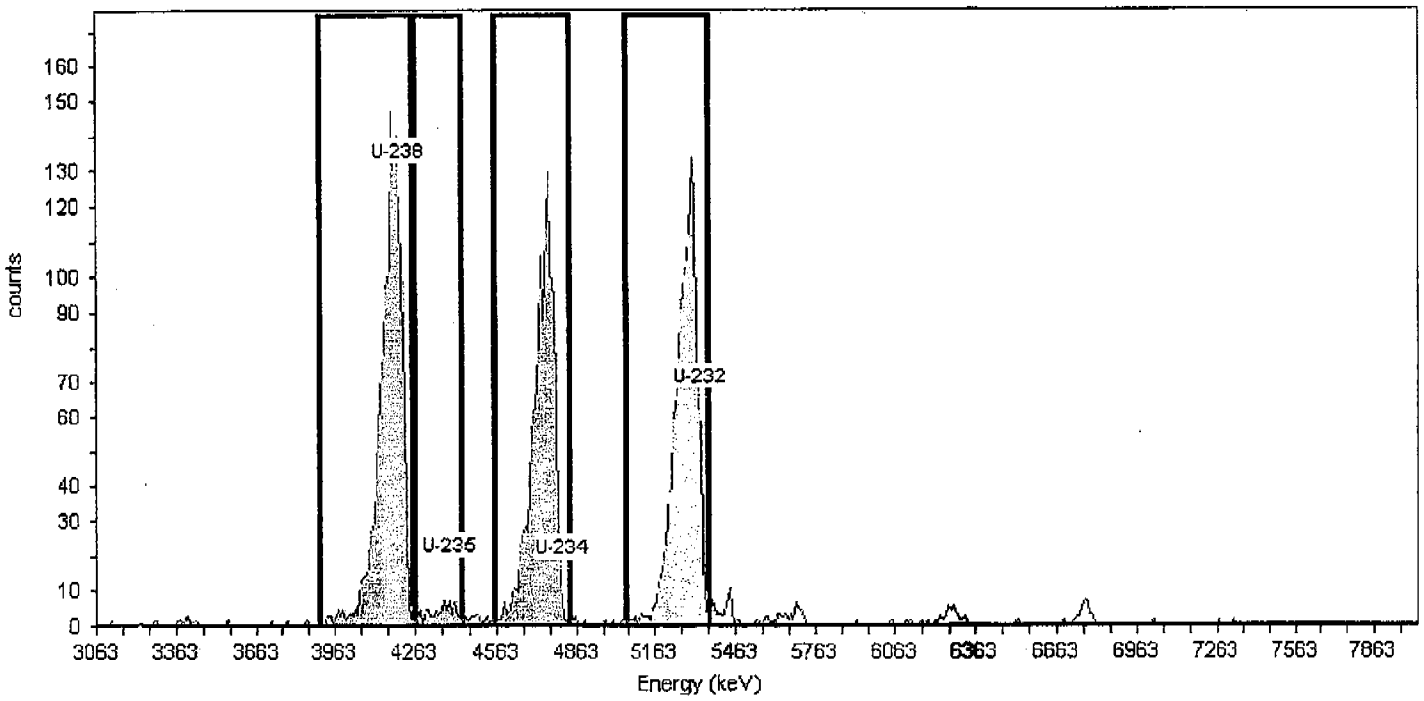
Energy Calibration: C08052728

Energy Cal: Gain = 9.7289 keV / Ch
Offset = 3,053.57 keV
Quadratic = 0.0000 keV / $Ch^2$

### *Tracer*

Tracer Name: 837.3020.90 U-232
Tracer Activity: 19.77 DPM/mL x (Vol.)0.25 mL = 4.94 DPM

Tracer Nuclide: U-232
Tracer Recovery: 84.14%




### *Nuclide Summary (ROI)*

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-238 | 4201.6 | 3900.0 | 4250.2 | 56.9 | 100.2 | 1,323.00 | 1.00 | 1,322.00 | 4.7E+000 | 6.0E-001 | 8.2E-003 | 2.6E-002 |
| U-235 | 4386.4 | 4259.9 | 4435.1 | 161.3 | 99.7 | 62.00 | 2.00 | 60.00 | 2.1E-001 | 6.2E-002 | 1.2E-002 | 3.3E-002 |
| U-234 | 4804.8 | 4551.8 | 4833.9 | 86.0 | 100.0 | 1,131.00 | 2.00 | 1,129.00 | 4.0E+000 | 5.2E-001 | 1.2E-002 | 3.3E-002 |
| U-232 | 5330.1 | 5048.0 | 5359.3 | 50.8 | 100.1 | 1,197.00 | 14.00 | 1,183.00 | 3.6E+000 | 2.1E-001 | 3.1E-002 | 7.2E-002 |

Reviewed By: GB JP

Print Date: 5/30/2008 11:12:25AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

5/28/06

| ion | Initial |
|---|---|
| 00 | GB |
| | |
| | |
| 0 | GB |
| | |
| | |
| | |
| 0 | GB |
| | |
| | |
| | |
| | |
| 0 | GB |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| 3 | 5/29/06 |

GB
29/06

FORM 746r8.xls (10/2/07)

# *Paragon Analytics*

**366010** Alpha Spectrometer Instrument Run Log

Date: 5/29/08

| Detector | Batch ID | Sample ID | Iso/Matrix | Duration | Initial |
|---|---|---|---|---|---|
| 25 | UAS080513-2_B | 0804083-2 | U/S | 1000 | dS |
| 26 | ↓ | AS080513-2MB | ↓ | ↓ | ↓ |
| 27 | ↓ | ↓ -2LCS | ↓ | ↓ | ↓ |
| 28 | ↓ | ↓ -2LCSD | ↓ | ↓ | ↓ |
| 29 | UAS080516-5_C | 0805107-3 | U/S | 180 | dS |
| 30 | ↓ | ↓ -13 | ↓ | ↓ | ↓ |
| 31 | UAS080521-1_B | 0805087-24D | U/W | 180 | dS |
| 32 | UAS080522-6_A | 0805153-3 | U/S | 360 | ↓ |
| 57 | ↓ | ↓ -3D | ↓ | ↓ | ↓ |
| 58 | ↓ | ↓ -4 | ↓ | ↓ | ↓ |
| 59 | ↓ | ↓ -5 | ↓ | ↓ | ↓ |
| 60 | ↓ | ↓ -6 | ↓ | ↓ | ↓ |
| 61 | ↓ | ↓ -7 | ↓ | ↓ | ↓ |
| 62 | ↓ | AS080522-6MB | ↓ | ↓ | ↓ |
| 63 | ↓ | ↓ -6LCS | ↓ | ↓ | ↓ |
| 64 | ↓ | ↓ -6LCSD | ↓ | ↓ | ↓ |
| 33 | PAS080513-2_B | AS080513-2MB | Pu/S | 1000 | dS |
| 34 | NAS080516-6_D | 0805107-13 | Np/S | 360 | ↓ |
| 35 | ↓ | ↓ -13SYS | ↓ | ↓ | ↓ |
| 36 | ↓ | AS080516-6MB | ↓ | ↓ | ↓ |
| 37 | NAS080519-4_C | 0805113-10 | Np/W | 1000 | dS |
| 39 | ↓ | ↓ -10SYS | ↓ | ↓ | ↓ |
| 40 | AAS080516-7_C | 0805113-10 | ~~Np/W~~ U/S 5/30/08 | 660 | dS |
| 42 | ↓ | 0805121-10 | ↓ | ↓ | ↓ |

| Detector | Batch ID | Sample ID | Iso/Matrix | Duration | Initial |
|---|---|---|---|---|---|
| 43 | AAS080516-7_C | 0805139-5 | Am/W | 660 | dS |
| 17 | TAS080522-7_B | AS080522-7MB | Th/W | 360 | dS |
| 18 | ↓ | ↓ -7LCS | ↓ | ↓ | ↓ |
| 19 | ↓ | ↓ -7LCSD | ↓ | ↓ | ↓ |
| 21 | TAS080522-5_A | 0805155-12 | Th/W | 360 | dS |
| 22 | ↓ | ↓ -13 | ↓ | ↓ | ↓ |
| 23 | ↓ | ↓ -14 | ↓ | ↓ | ↓ |
| 24 | ↓ | ↓ -15 | ↓ | ↓ | ↓ |
| 1 | NAS080527-1_A | 0805144-5 | Np/W | 1000 | dS |
| 2 | ↓ | ↓ -5SYS | ↓ | ↓ | ↓ |
| 4 | ↓ | 0805173-5 | ↓ | ↓ | ↓ |
| 5 | ↓ | ↓ -5SYS | ↓ | ↓ | ↓ |
| 6 | ↓ | ↓ -10 | ↓ | ↓ | ↓ |
| 7 | ↓ | ↓ -10SYS | ↓ | ↓ | ↓ |
| 8 | ↓ | ↓ -15 | ↓ | ↓ | ↓ |
| 49 | ↓ | ↓ -15SYS | ↓ | ↓ | ↓ |
| 50 | ↓ | 0805195-5 | ↓ | ↓ | ↓ |
| 51 | ↓ | ↓ -5SYS | ↓ | ↓ | ↓ |
| 52 | ↓ | AS080527-1SYS | ↓ | ↓ | ↓ |
| 53 | ↓ | ↓ -1MB | ↓ | ↓ | ↓ |
| 54 | ↓ | ↓ -1LCS | ↓ | ↓ | ↓ |
| 45 | ↓ | ↓ -1LCSD | ↓ | ↓ | ↓ |
| 46 | AAS080516-5_B | AS080516-5MB | Am/S | 660 | dS |
| 47 | ↓ | ↓ -5LCS | ↓ | ↓ | ↓ |

Notes:

366011

Reviewed by: TB

Date: 5/30/08

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

# QUALITY ASSURANCE

6

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0804083
TEST Am, Pu, U, Sr, Po
METHOD Prep
SOP/REV (PREP) Various
SOP/REV (ANAL)

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

1 Es 1/13/08

The following applies to samples 0804083 –1 and –2:

1. The entire sample of ~0.5g was used for the sequential prep of Am-241, Pu-ISO, U-ISO, Po-210, and Sr-90 analysis. Actual weights are noted on the benchsheets.
2. Due to limited sample volume, an LCS-D was prepped to meet QC requirements.
3. The samples were aliquotted into 220ml polypropylene cups, spiked and traced,

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0804083
TEST Am, Pu, U
METHOD Prep
SOP/REV (PREP) 778/12
SOP/REV (ANAL)

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency,

PARAGON ANALYTICS
Radiochemistry Data Package

Section 7

# LABORATORY BENCH SHEETS

7

Batch: AS080513-2

NCR? Y / (N) NA

Notes

SB 5/30/08

| Units | Pipet ID |
|---|---|
| ml | AW016 |
| ml | AW016 |
| ml | AW016 |
| ml | AW016 |
| ml | AW016 |

: NA

# Radiochemistry Prep Worksheet

**Paragon Analytics**

**Prep Batch: AS080513-2**

**Prep Procedure:** UISO

**Reviewed By:** tde TDE **Review Date:** 5/27/2008

**Non-Routine Pre-Treatment?** (Y) N **Batch:** See QASS **Re-Prep?** Y / (N) **Batch:** NA **Prep QASS / NCR?** (Y) / N 328377, 357740

**Prep SOP:** PAI 778 **Rev:** 12
**Prep SOP:** NONE
**Matrix Class:** solid

**Prep Analyst:** Tambrae Elhart TE
**Prep Date:** 5/13/2008
**Prep Dept:** AP

**Balance:** 27
**Balance:**

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Aiq g | Fin Aiq g | Prep Basis | Total Digestate Vol(ml) | Digestate Vol Taken(ml) | Micro Init | Micro Date | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0804083-1 | SMP | | 0.4585 | 0.453916 | As Received | 100 | 99 | TE | 5/23/08 | T1,T2,T3 | |
| 2 | 1 | 0804083-2 | SMP | | 0.6008 | 0.594792 | As Received | 100 | 99 | | | T1,T2,T3 | |
| 3 | 1 | AS080513-2 | MB | | 0.52965 | 0.524354 | As Received | 100 | 99 | | | T1,T2,T3 | TE 5/27/08 |
| 4 | 1 | AS080513-2 | LCS | | 0.52965 | 0.524354 | As Received | 100 | 99 | | | S1,S2,S3,T1,T2,T3 | |
| 5 | 1 | AS080513-2 | LCSD | | 0.52965 | 0.524354 | As Received | 100 | 99 | | | S1,S2,S3,T1,T2,T3 | |

Comments
A PEG treatment was performed on all samples.

**Spiked By:** Tambrae Elhart **Date:** 5/13/2008

**Witnessed By:** Jeffrey T. Lee **Date:** 5/13/2008

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | Am-243 | 821.3020.61 | 19.995 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T2 | U-232 | 837.3020.90 | 19.763 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T3 | Pu-242 | 846.3020.88 | 19.997 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | AM-241 | 616.2382.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-234 | 644.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-235 | 644.3020.52 | 0.948 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-238 | 644.3020.52 | 20.598 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S3 | Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |

p Batch: P-080513-1

Review Date:

Y / N _____

| Units | Pipet ID |
|---|---|
| ml | AW016 |
| ml | AW016 |
| ml | AW016 |
| ml | AW016 |
| ml | AW016 |
| ml | AW015 |
| ml | AW015 |

ml AW013

des: NA

# SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TE

ANALYSIS DATE: 5/13/08 METHOD: Prep

| WORK ORDER | SAMPLE ID | SAMPLE CONDITION | | |
|---|---|---|---|---|
| | | Dry/Wet | TEXTURE | Remarks |
| 0804083 | 1 | dry | Dust | As Rec'd |
| | 2 | | | |

TE 5/13/08

PARAGON ANALYTICS
Radiochemistry Data Package

Section 8

# STANDARDS TRACEABILITY DOCUMENTS

8

Prepare a working dilution of ~20 dpm/ml of U-232 from primary dilution 837.3020.72.

1) Calculate density of 1M $HNO_3$ lot ~~X~~074741 bal

Mass of 100 ml Volumetric flask 68.2982 g 12

Mass of flask and 100 ml 1M $HNO_3$ 171.2114 g 1

Net mass of 100 ml 1M $HNO_3$ 102.9132 g

$\rho = 1.0291$ g/ml

2) Determine Mass of Std. Transferred.

Prepare a primary dilution of U-232, RSO #837, by diluting Contents (#74682-307) to a final volume of approx 40 ml.

1) Prepare a 1.0 M $HNO_3$ solution by diluting 63 ml conc $HNO_3$, Fischer lot # 065460, in 1 L DI water.

2) Determine density of ~~0.5~~ 1.0 M $HNO_3$ lot # 065460 (Bal 12)
Mass of 100 ml volumetric flask: 62.4704 g
Mass of flask + acid: 165.3413 g
Net mass of acid: 102.8709 g
∴ 100 ml = density of 1.0 M $HNO_3$: 1.029 g/ml

3) Transfer contents of vial to a 40 ml VOA vial (Bal 12)
Mass of VOA vial (w/ lid): 24.7623 g
Mass of VOA vial + std: 29.9487 g
Net mass of std transferred: 5.1864 g

4) Dilute with 1.0 M $HNO_3$ (Bal 12)
Mass of vial + std + acid: 63.2324 g
Mass of vial from above: 24.7623 g
Net mass of primary std: 38.4701 g

5) Final Activity Calculation:

$$\frac{4375\ dps\ (60\ s/min)(5.1864\ g)}{(5.24665\ g)(38.4701\ g)} = 6745.123\ dpm/g$$

Continued on Page

Read and Understood By

Krystal Brown 3/28/07 Renee Hallegoz 4/11/07
Signed Date Signed Date

RSO #837
Rcvd 3/14/07 MMP

Eckert & Ziegler
Analytics

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

# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

74682-307

U-232 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by the Department Des Applications Et De La Metrologie Des Rayonnements Ionisants (DAMRI), Paris, France, as Number 23236.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

| | |
|---|---|
| ISOTOPE: | U-232 |
| ACTIVITY (Bq): | 4.375 E3 |
| HALF-LIFE: | 68.9 years |
| CALIBRATION DATE: | March 7, 2007 12:00 EST |
| RELATIVE EXPANDED UNCERTAINTY (k=2): | 5.0% |

Impurities: γ-impurities <0.1%
U-233 <0.3%
Am-241 <0.15%

5.24665 grams 1M $HNO_3$ solution.

PO NUMBER 72905, Item 1

SOURCE PREPARED BY: M. Dimitrova
M. D. Dimitrova, Radiochemist

Q A APPROVED: M. M. 3-8-07



Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Prepare a working level dilution of ampoule 644 to approximately 20 dpm/mL by diluting with 1M $HNO_3$

① Determine the density of 1M $HNO_3$

Mass of empty Class A volumetric flask (100mL): 68.3017 g Bal 12
Mass of flask + 100mL of 1M $HNO_3$: 171.2390 g
Mass of 100mL of 1M $HNO_3$: 102.9373 g
Lot # 063544 $\rho = 1.029$ g/mL

② Transfer 644 to a ~~5~~ 1L nalgene bottle

Mass of empty nalgene w/o lid: 73.6290 g Bal 12
Mass of nalgene + standard: 75.0630 g
Net mass of standard transferred: 1.434 g

③ Dilute with 1M $HNO_3$

Mass of empty nalgene w/o lid (from above): 73.6290 g Bal 12
Mass of bottle, standard and 1M $HNO_3$: 1113.9 g Bal 26
Net mass of standard + 1M $HNO_3$: 1040.271 g

④ Final Activity Calculation

U-238: $\frac{(242.0\ Bq/g)(60\ dpm/Bq)(5.25)(1.434\ g)(1.029\ g/mL)}{1040.271\ g} = 20.6\ dpm/mL$

U-235: 0.948 dpm/mL

U-234: 19.84 dpm/mL

RG 2/23/07

Stnd ID: 644.3020.52

Description: U-238
Expiration: ~~1/27/2007~~ 1/27/08 RG 1/09
Activity: 20.60 dpm/mL
2s Uncertainty: 0.60 dpm/mL
Ref. Date: 8/1/1997
Ref Time: N/A
Prep Date: 11/28/2006 Prep by: AB
Matrix/Comp. 1M HNO3
Half Life (y): 4.47E+09

RG 2/23/07

| Reverification Log | | |
|---|---|---|
| Analysis Date | Initials | Expiration Date |
| 1/13/~~07~~ 08 | MC | 1/13/~~08~~ 09 |
| | | |
| | | |
| | | |
| | | |

RG 2/23/07

RG 2/23/07

Continued on Page

Read and Understood By

| Signed | Date | Signed | Date |
|---|---|---|---|
| A Barbaye | 11/28/06 | Bruce Heller | 2/23/07 |

# National Institute of Standards & Technology

# Certificate

PAT DO 0644
rec'd 10-18-02

## Standard Reference Material 4321C
## Natural Uranium Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive natural uranium nitrate and nitric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of alpha-particle counting instruments and for the monitoring of radiochemical procedures.

**Radiological Hazard**

**Recommended Procedure for Opening the SRM Ampoule**

1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.

PROPERTIES OF SRM 4321C
**(Certified values are shown in bold type)**

| | | | |
|---|---|---|---|
| Source identification number | NIST SRM 4321C | | |
| Physical Properties: | | | |
| Source description | Liquid in flame-sealed NIST borosilicate-glass ampoule | | |
| Ampoule specifications | Body outside diameter<br>Wall Thickness<br>Barium content<br>Lead-oxide content<br>Other heavy elements | (16.5 ± 0.5) mm<br>(0.60 ± 0.04) mm<br>Less than 2.5%<br>Less than 0.02%<br>Trace quantities | |
| **Solution density** | **(1.053 ± 0.001) g•mL$^{-1}$ at 21.4 °C [b]*** | | |
| **Solution mass** | **(5.258 ± 0.002) g [b]** | | |
| Chemical Properties: | | | |
| Solution composition | Chemical Formula | Concentration (mol•L$^{-1}$) | Mass Fraction (g•g$^{-1}$) |
| | $H_2O$ | 53 | 0.91 |
| | $HNO_3$ | 1.0 | 0.06 |
| | $UO_2(NO_3)_2$ | 0.09 | 0.03 |
| Radiological Properties: | | | |
| **Radionuclide** | **Natural Uranium (Mixture of U-238, U-235, and U-234)** | | |
| **Reference time** | **1200 EST, 1 August 1997** | | |
| **Massic activity of the solution** [c] | **U-238: 242.0 Bq•g$^{-1}$**<br>**U-235: 11.14 Bq•g$^{-1}$**<br>**U-234: 233.1 Bq•g$^{-1}$** | | |
| **Relative expanded uncertainty ($k$=2)** | **U-238: 0.60%** [d] [e]<br>**U-235: 0.62%** [d] [e]<br>**U-234: 0.98%** [d] [e] | | |
| **Mass fraction of uranium** | **(0.01960 ± 0.00010) g•g$^{-1}$** [b] | | |
| Photon-emitting impurities | None detected [f] | | |
| Half lives used | Uranium-238: (4.468 ± 0.003) × $10^9$ **a** [g]<br>Uranium-235: (7.038 ± 0.005) × $10^8$ **a** [g]<br>Uranium-234: (2.455 ± 0.006) × $10^5$ **a** [g] | | |
| Measuring instruments | Mass spectrometer, silicon surface-barrier detector, and 4π(α+β) liquid-scintillation counting systems. | | |



*Notes and references are on pages 5 and 6.

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

| Input Quantity $x_i$, the source of uncertainty (and individual uncertainty components where appropriate) | Method Used To Evaluate $u(x_i)$, the standard uncertainty of $x_i$ (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods | Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [h] | Relative Sensitivity Factor, $\lvert\partial y/\partial x_i\rvert \cdot (x_i/y)$ [i] | Relative Uncertainty Of Output Quantity, $u_i(y)/y$, (%) [j] |
|---|---|---|---|---|
| Isotopic uranium atom fraction in SRM 960 | Standard deviation of the mean for repeated mass-spectrometric measurements (A) | U-238: 0.001<br>U-235: 0.07<br>U-234: 0.31 | 1.0<br>1.0<br>1.0 | 0.001<br>0.07<br>0.31 |
| Half life | Standard uncertainty of the half life (A) | U-238: 0.07<br>U-235: 0.07<br>U-234: 0.25 | 1.0<br>1.0<br>1.0 | 0.07<br>0.07<br>0.25 |
| Uranium mass fraction in SRM 960 | Certificate value (B) | 0.003 | 1.0 | 0.003 |
| Quantitative dissolution | Estimated (B) | 0.25 | 1.0 | 0.25 |
| Gravimetric measurements | Estimated (B) | 0.10 | 1.0 | 0.10 |
| Photon-emitting impurities | Limit of detection (B) [k] | 100. | 0.001 | 0.10 |
| Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%) | | | U-238:<br>U-235:<br>U-234: | 0.30<br>0.31<br>0.49 |
| Coverage Factor, $k$ | | | | x 2 |
| Relative Expanded Uncertainty of the Output Quantity, $U/y$, (%) | | | U-238:<br>U-235:<br>U-234: | 0.60<br>0.62<br>0.98 |



*Notes and references are on pages 5 and 6.

## NOTES

[a] The Sievert is the SI unit for dose equivalent. See reference [1]. One $\mu$Sv is equal to 0.1 mrem.

| Distance from Ampoule (cm): | 1 | 30 | 100 |
|---|---|---|---|
| Approximate Dose Rate ($\mu$Sv/h): | <0.1 | - | - |

[b] The stated uncertainty is two times the standard uncertainty.

[c] **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].

[d] The reported value, $y$, of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \ldots x_n)$, where $f$ is a mathematical function derived from the assumed model of the measurement process.

The value, $x_i$, used for each input quantity $i$ has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in $y$, $u_i(y) \equiv |\partial y/\partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of $y$.

The **combined standard uncertainty** of $y$, $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.

The combined standard uncertainty is multiplied by a **coverage factor** of $k = 2$ to obtain $U$, the **expanded uncertainty** of $y$.

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

[h] Relative standard uncertainty of the input quantity $x_i$.

[i] The relative change in the output quantity $y$ divided by the relative change in the input quantity $x_i$. If $|\partial y/\partial x_i| \cdot (x_i/y) = 1.0$, then a 1% change in $x_i$ results in a 1% change in $y$. If $|\partial y/\partial x_i| \cdot (x_i/y) = 0.05$, then a 1% change in $x_i$ results in a 0.05% change in $y$.

[j] Relative component of combined standard uncertainty of output quantity $y$, rounded to two significant figures or less. The relative component of combined standard uncertainty of $y$ is given by $u_i(y)/y \equiv |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent or uncorrelated. Hence the covariances are zero or negligible.

PARAGON ANALYTICS
Radiochemistry Data Package

Section 9

# ADDITIONAL SUPPORTING DOCUMENTATION

9

# Alpha Spectroscopy

# Quality Control Data

# Weekly Background, Energy, and Efficiency Calibrations

# Calibration Data Summary

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Prep SOP:** PAI 778
**Analytical SOP:** PAI 714

**Reported on:** Friday, May 30, 2008
3:18:16 PM

| Lab Sample ID<br>Spectrum<br>Analysis Date | QC Type | Batch ID<br>Analysis Run | Test Name | Detector Id | Eff Spectrum<br>Bkg Spectrum<br>Egy Spectrum | Eff Date<br>Bkg Date<br>Egy Date | RESULTS<br>%Efficiency<br>Bkg CPM<br>Energy keV | FLAGS<br>Efficiency<br>Background<br>Energy | LCL<br>%Efficiency<br>Bkg CPM<br>Energy keV | LWL<br>%Efficiency<br>Bkg CPM<br>Energy keV | UWL<br>%Efficiency<br>Bkg CPM<br>Energy keV | UCL<br>%Efficiency<br>Bkg CPM<br>Energy keV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SMP | AS080513-2 | UISO | 64 | C08052764 | 5/27/2008 | 32.50 | Pass | 30.88 | 31.42 | 33.58 | 34.13 |
| Spectrum #1 | | AS080513-2C | | | B08052764 | 5/27/2008 | 0.2160 | Pass | 0.0000 | 0.0500 | 0.5000 | 0.7500 |
| 5/28/2008 | | | | | C08052764 | 5/27/2008 | 5544.2 | Pass | 5494.2 | 5504.2 | 5584.2 | 5594.2 |
| 0804083-2 | SMP | AS080513-2 | UISO | 25 | C08052725A | 5/27/2008 | 28.37 | Pass | 26.95 | 27.42 | 29.32 | 29.79 |
| Spectrum #1 | | AS080513-2C | | | B08052725 | 5/27/2008 | 0.3150 | Pass | 0.0000 | 0.0500 | 0.5000 | 0.7500 |
| 5/29/2008 | | | | | C08052725A | 5/27/2008 | 5546.0 | Pass | 5496.0 | 5506.0 | 5586.0 | 5596.0 |
| AS080513-2 | MB | AS080513-2 | UISO | 26 | C08052726 | 5/27/2008 | 30.94 | Pass | 29.40 | 29.92 | 31.98 | 32.50 |
| Spectrum #1 | | AS080513-2C | | | B08052726 | 5/27/2008 | 0.4120 | Pass | 0.0000 | 0.0498 | 0.4998 | 0.7500 |
| 5/29/2008 | | | | | C08052726 | 5/27/2008 | 5536.2 | Pass | 5496.0 | 5506.0 | 5586.0 | 5596.0 |
| AS080513-2 | LCS | AS080513-2 | UISO | 27 | C08052727 | 5/27/2008 | 29.83 | Pass | 28.26 | 28.76 | 30.74 | 31.24 |
| Spectrum #1 | | AS080513-2C | | | B08052727 | 5/27/2008 | 0.3830 | Pass | 0.0000 | 0.0500 | 0.5000 | 0.7500 |
| 5/29/2008 | | | | | C08052727 | 5/27/2008 | 5555.8 | Pass | 5494.2 | 5504.2 | 5584.2 | 5594.2 |
| AS080513-2 | LCSD | AS080513-2 | UISO | 28 | C08052728 | 5/27/2008 | 28.76 | Pass | 27.32 | 27.80 | 29.72 | 30.20 |
| Spectrum #1 | | AS080513-2C | | | B08052728 | 5/27/2008 | 0.1560 | Pass | 0.0000 | 0.0500 | 0.5000 | 0.7500 |
| 5/29/2008 | | | | | C08052728 | 5/27/2008 | 5544.2 | Pass | 5513.0 | 5523.0 | 5603.0 | 5613.0 |

**Data Package ID:** *UR0804083-1*

| Abbreviations: | | | | |
|---|---|---|---|---|
| | Eff - Efficiency | Bkg - Background | LCL - Lower Control Limit | UWL - Upper Warning Limit |
| | Egy - Energy | CPM - Counts per Minute | LWL - Lower Warning Limit | UCL - Upper Control Limit |

CI - The Analysis Date exceeds the Calibration Date by more than 7 days.

# Alpha Spec Calibration Source Re-Certification

R:\INST/ALPHASPEC\CLCRT0607.XLS

**Primary Certified Source**

Source PA ID 190 was recalibrated by Isotope Products Laboratories on 6/1/2007 and received by PA on 6/6/2007

| | | | |
|---|---|---|---|
| Source ID: | 92MIX223027; PA ID 190 (Labled #9) | | |
| Total Activity: | 3780.66 dpm | | |
| Ref. Date: | 6/1/07 | | |
| Count Date: | 6/6/07 | | |
| U-234 Activity: | 79.16% | = | 2994.78 dpm (decay corrected) |
| U-235 Activity: | 1.74% | = | 65.93 dpm (decay corrected) |
| Am-241 Activity: | 19.09% | = | 719.92 dpm (decay corrected) |
| Combined Activity: | | | 3780.64 dpm (decay corrected) |

**Detector 9 Efficiency Determination**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | count dur (s) | Combined cpm | Known dpm | Detector efficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX223027 | 190 | 97-19-103-09 | 6/6/07 | 7202 | 30313 | 686 | 2100 | 1091.46 | 3780.64 | 28.87% |

**Sources 1 through 8 activity determination**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | count dur (s) | Detector Efficiency | **Am-241 dpm** | **U-234 dpm** | **U-235 dpm** | **Combined dpm** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX2203026 | 182 | 97-19-103-01 | 6/6/07 | 12708 | 78469 | 1739 | 2100 | 28.87% | **1257.67** | **7567.91** | **172.10** | **8997.68** |
| 92MIX2203026 | 183 | 97-19-103-02 | 6/6/07 | 14855 | 144735 | 3046 | 2100 | 28.87% | **1470.15** | **14323.99** | **301.66** | **16095.79** |
| 92MIX2203024 | 184 | 97-19-103-03 | 6/6/07 | 67825 | 69896 | 1458 | 2100 | 28.87% | **6712.44** | **6917.40** | **144.29** | **13774.13** |
| 92MIX2203021 | 185 | 97-19-103-04 | 6/6/07 | 21522 | 59231 | 1483 | 2100 | 28.87% | **2129.97** | **5861.91** | **146.77** | **8138.65** |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:24:12AM 6/11/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO 190 (source 9)
Description:

Analysis Date: 6/11/2007 8:23:31AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

### Acquisition

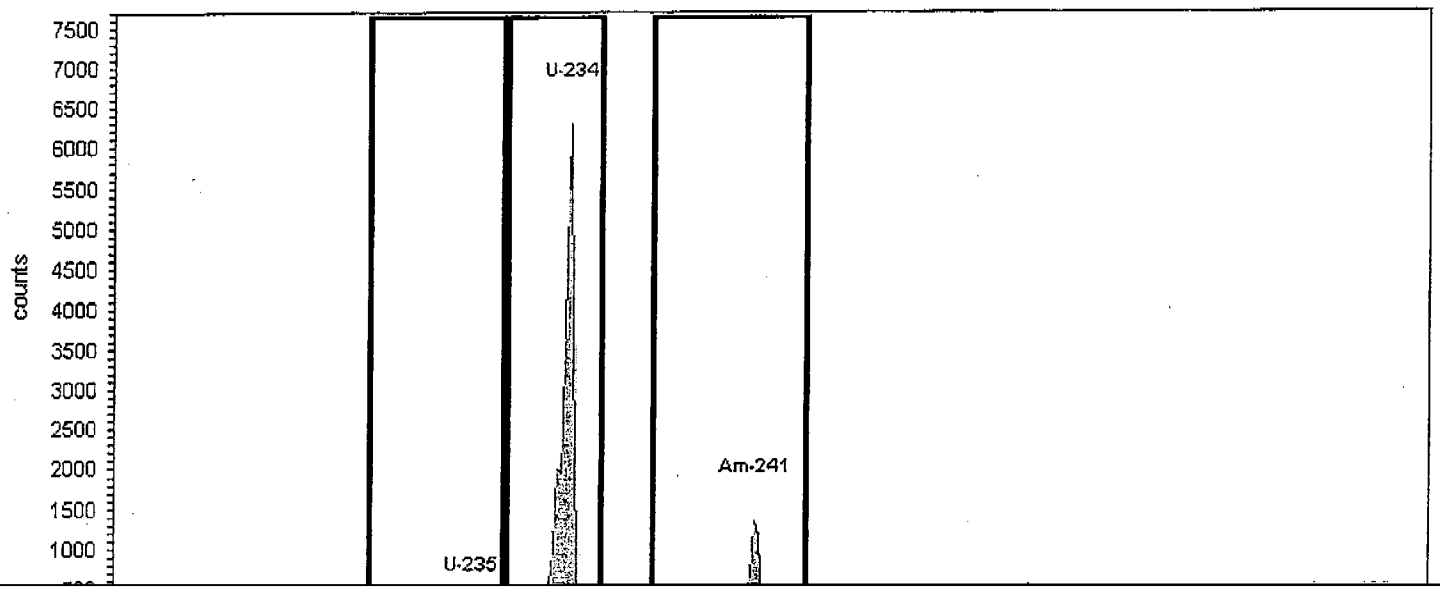
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 6:45:14AM

Live Time: 35.00 min.
Real Time: 35.01 min.

Efficiency Calibration Name: RSO 190 (source 9)

Energy Calibration Equation:
Gain = 9.9003 keV / Ch
Offset = 3,011.38 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.87% +/- 0.30% TPU(2 sigma)



**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:55:35AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO182
Description:

Analysis Date: 6/8/2007 8:20:44AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A1 RSO#182
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:24PM

### Acquisition

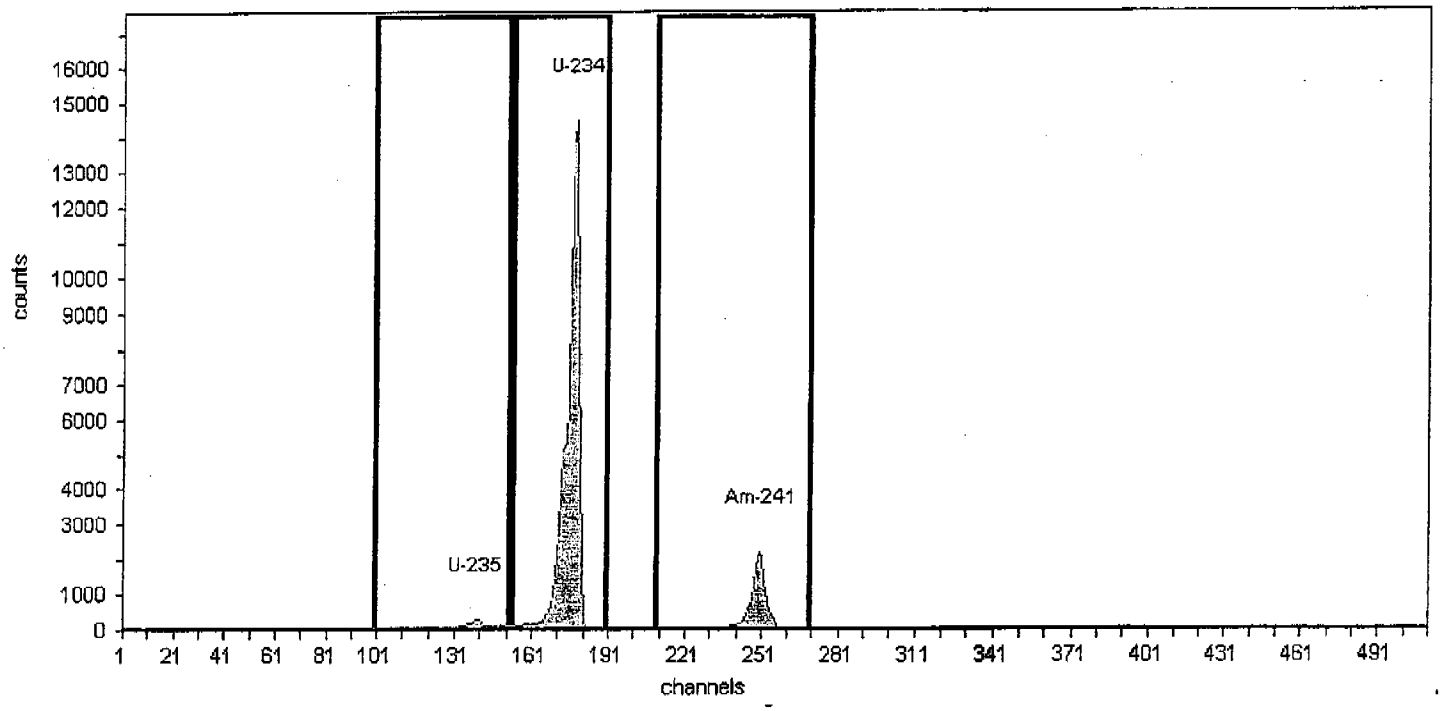
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 7:29:34AM

Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO182

Energy Calibration Equation:
Gain = 9.8224 keV / Ch
Offset = 3,029.39 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.20% +/- 0.20% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,739.00 | 49.69 |
| U-234 | 178 | 4.78 | 153 | 190 | 76,469.00 | 2,184.83 |
| Am-241 | 250 | 5.49 | 210 | 270 | 12,708.00 | 363.09 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
9:01:19AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO183
Description:

Analysis Date: 6/8/2007 9:01:07AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A2 RSO#183
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:00PM

### Acquisition

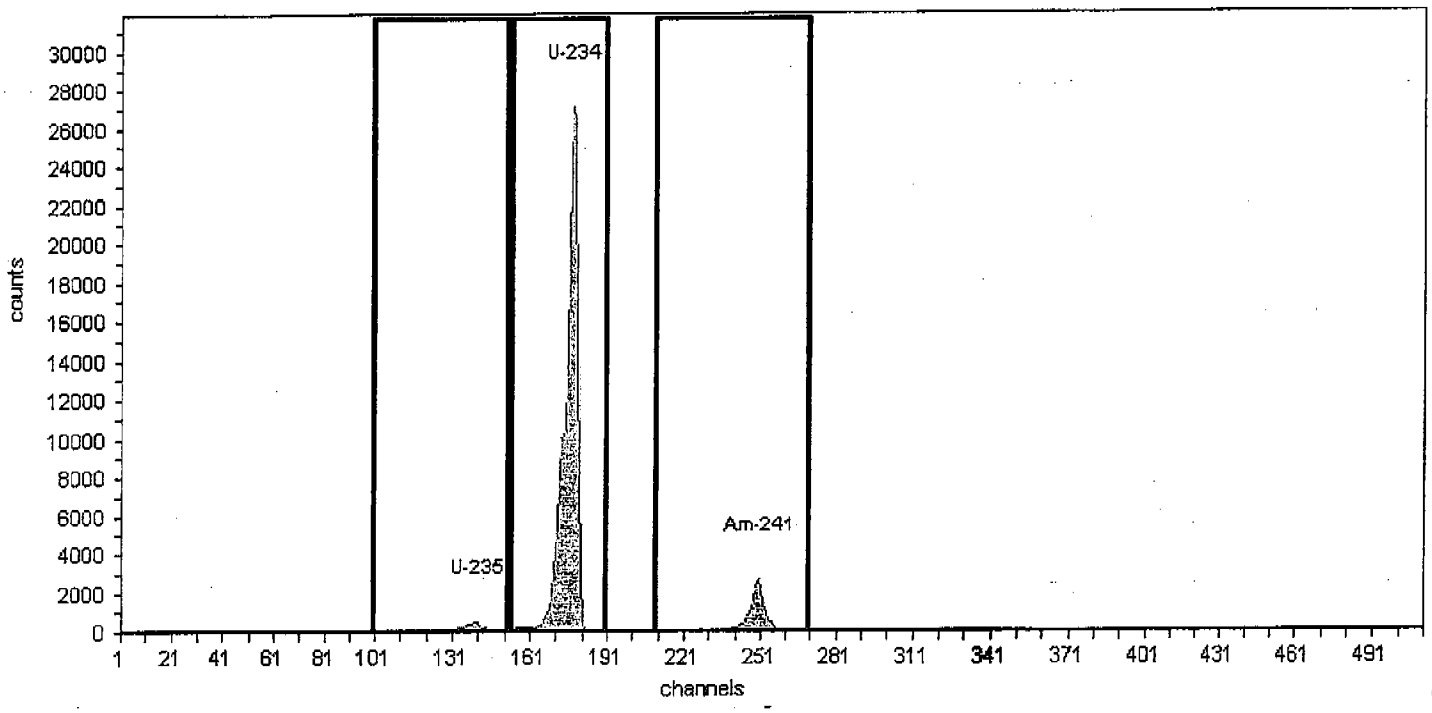
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 8:21:55AM

Live Time: 35.00 min.
Real Time: 35.05 min.

Efficiency Calibration Name: RSO183

Energy Calibration Equation:
Gain = 9.8810 keV / Ch
Offset = 3,018.33 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.98% +/- 0.15% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 3,048.00 | 87.09 |
| U-234 | 177 | 4.78 | 153 | 190 | 144,735.00 | 4,135.29 |
| Am-241 | 250 | 5.49 | 210 | 270 | 14,855.00 | 424.43 |

**AlphaVision v5.3**

# *Alpha-Spectroscopy Calibration Report*

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 23

9:55:46AM 6/8/2007

## *Calibration*

Energy Calibration: RSO184
Description:

Analysis Date: 6/8/2007 9:55:40AM
Calibration Type: Energy And Efficiency

## *Source Info*

Certificate ID: A3 RSO#184
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:00PM

## *Acquisition*

Detector: 23 SN:

Energy Calibration Equation:

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
10:40:41AM 6/8/2007

Analyst: ORTEC
Detector: 23

***Calibration***

Energy Calibration: RSO185
Description:

Analysis Date: 6/8/2007 10:40:28AM
Calibration Type: Energy And Efficiency

***Source Info***

Certificate ID: A4 RSO#185
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

***Acquisition***

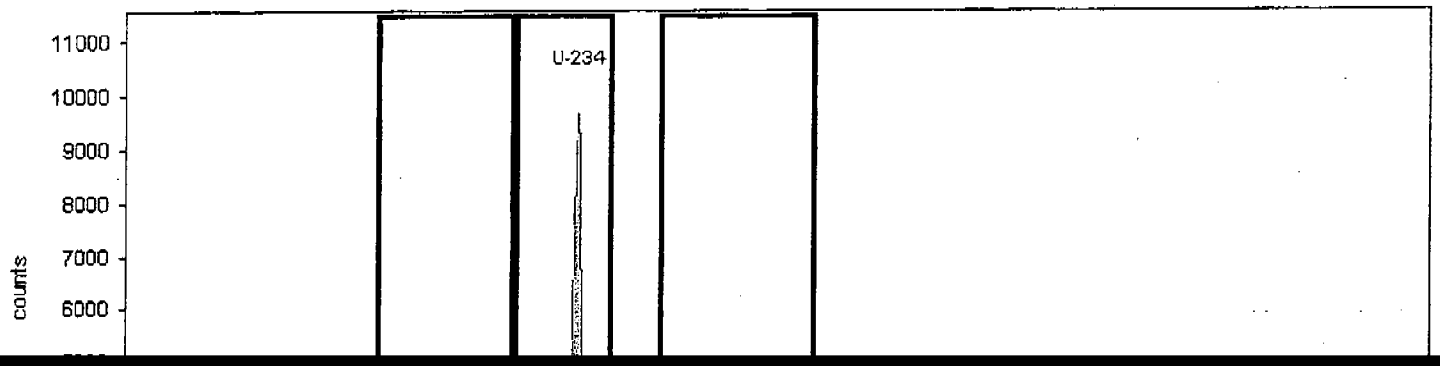
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 9:56:22AM

Live Time: 35.00 min.
Real Time: 35.02 min.

Efficiency Calibration Name: RSO185

Energy Calibration Equation:
Gain = 9.8810 keV / Ch
Offset = 3,018.33 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.41% +/- 0.20% TPU(2 sigma)



**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
11:17:39AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO186
Description:

Analysis Date: 6/8/2007 11:17:32AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A5 RSO#186
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

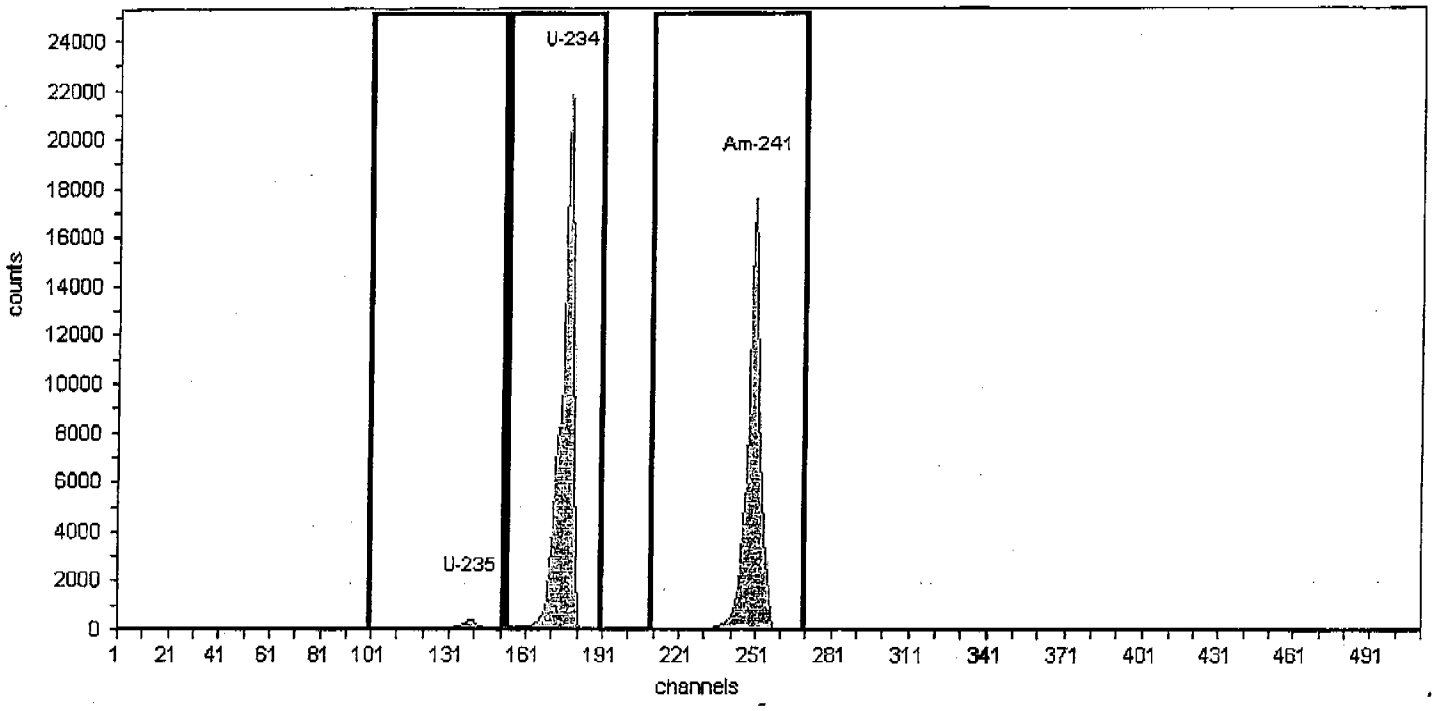
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 10:41:40AM

Live Time: 35.00 min.
Real Time: 35.06 min.

Efficiency Calibration Name: RSO186

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.13% +/- 0.13% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 2,472.00 | 70.63 |
| U-234 | 177 | 4.78 | 153 | 190 | 117,668.00 | 3,361.94 |
| Am-241 | 250 | 5.49 | 210 | 270 | 96,147.00 | 2,747.06 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
11:53:54AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO187
Description:

Analysis Date: 6/8/2007 11:53:46AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A6 RSO#187
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

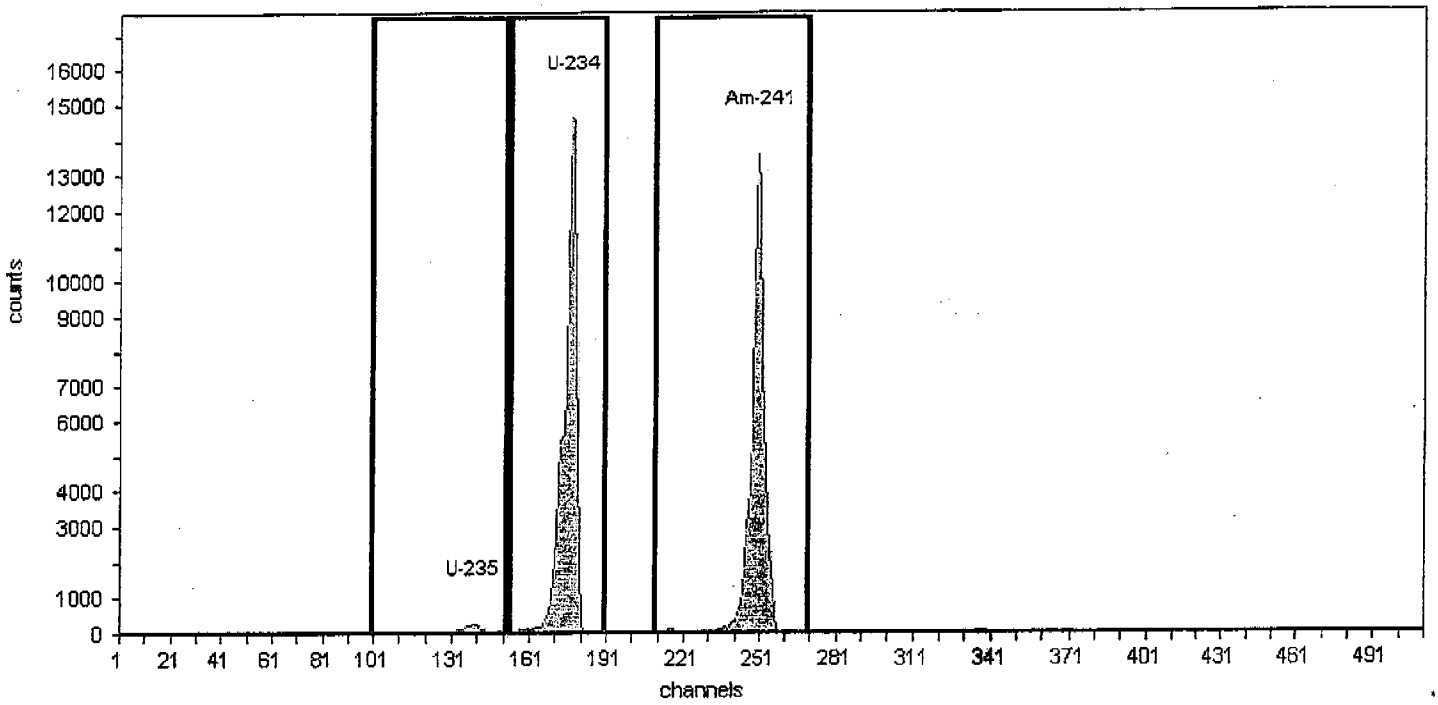
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 11:18:09AM

Live Time: 35.00 min.
Real Time: 35.05 min.

Efficiency Calibration Name: RSO187

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.66% +/- 0.15% TPU(2 sigma)




Method: Interactive ROI

Initial Calibration: Yes

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:34:50PM 6/8/2007

Analyst: ORTEC
Detector: 23

***Calibration***

Energy Calibration: RSO188
Description:

Analysis Date: 6/8/2007 12:34:43PM
Calibration Type: Energy And Efficiency

***Source Info***

Certificate ID: A7 RSO#188
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

***Acquisition***

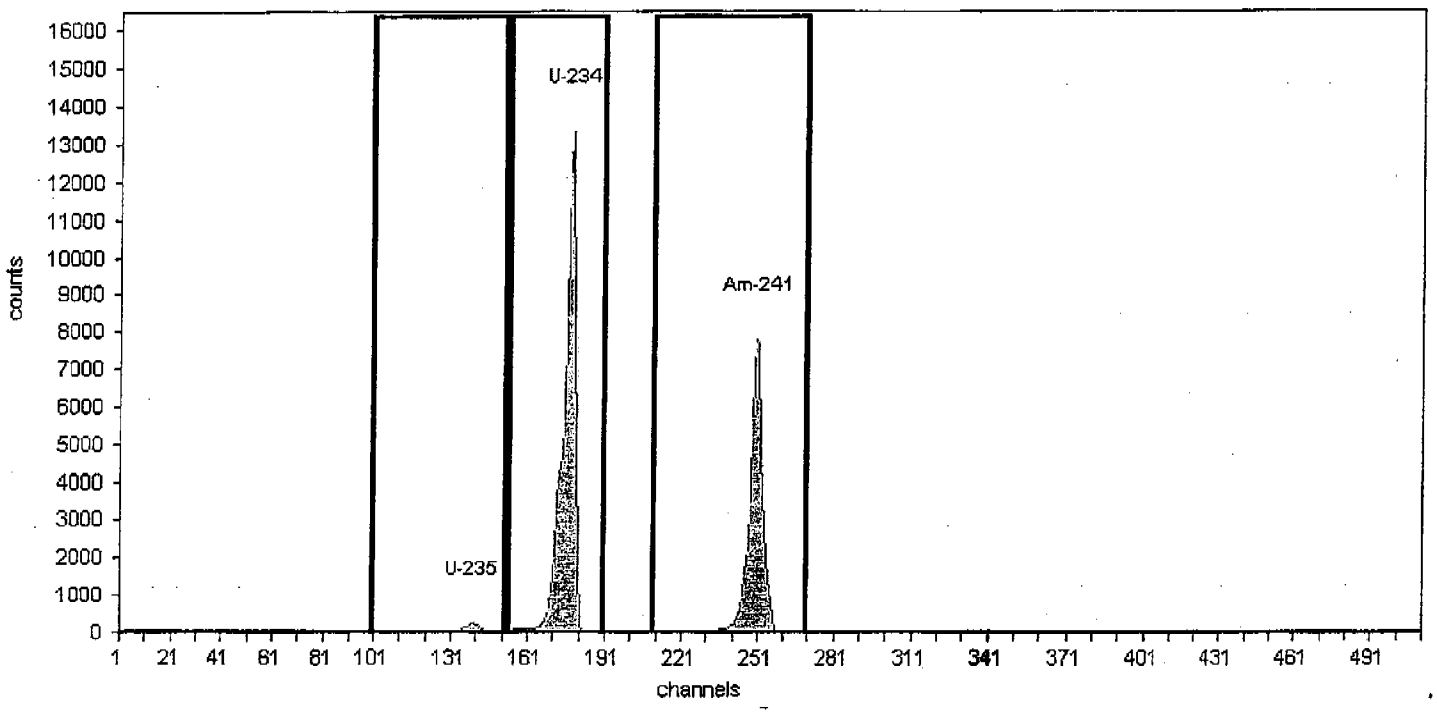
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 11:54:29AM

Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO188

Energy Calibration Equation:
Gain = 9.8224 keV / Ch
Offset = 3,029.39 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.21% +/- 0.18% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

***Nuclide Activity Summary***

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,369.00 | 39.11 |
| U-234 | 178 | 4.78 | 153 | 190 | 66,752.00 | 1,907.20 |
| Am-241 | 250 | 5.49 | 210 | 270 | 42,962.00 | 1,227.49 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 23

1:11:17PM 6/8/2007

***Calibration***

Energy Calibration: RSO189
Description:

Analysis Date: 6/8/2007 1:11:09PM
Calibration Type: Energy And Efficiency

***Source Info***

Certificate ID: A8 RSO#189
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

***Acquisition***

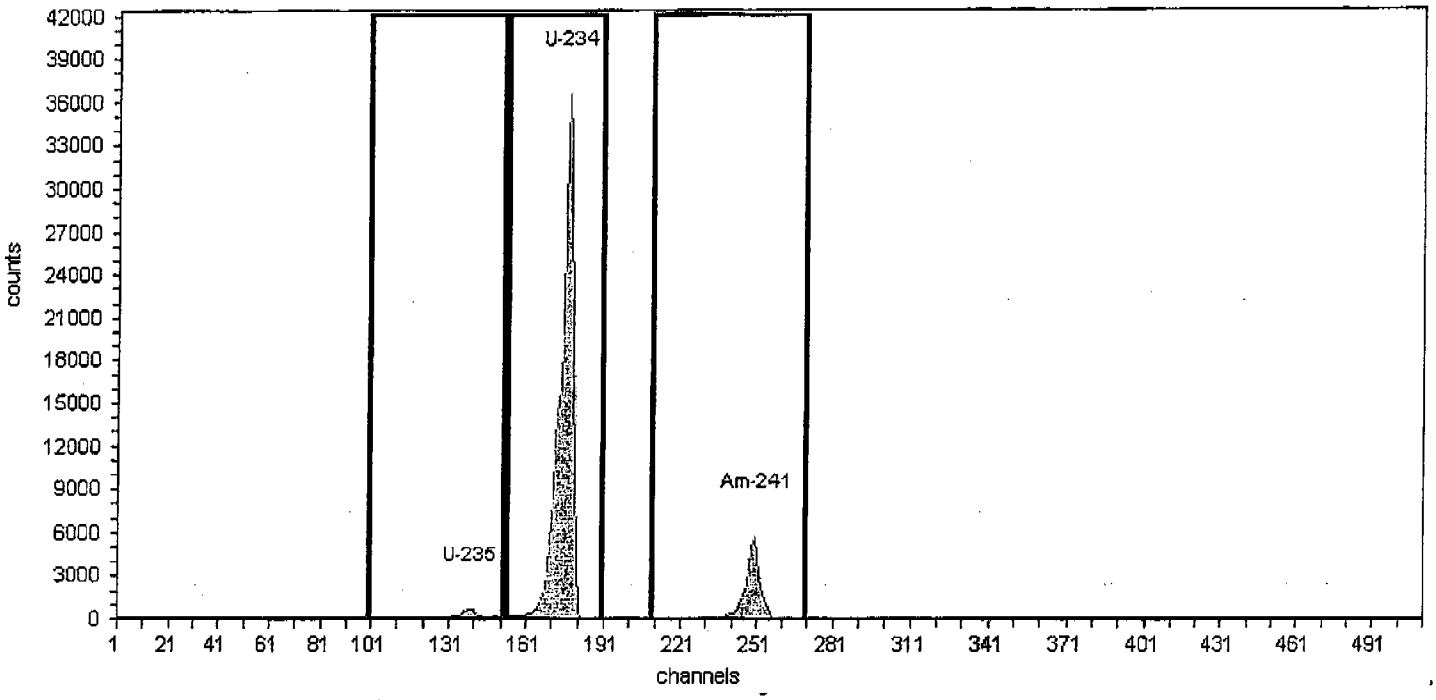
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 12:35:13PM

Live Time: 35.00 min.
Real Time: 35.07 min.

Efficiency Calibration Name: RSO189

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.15% +/- 0.12% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

***Nuclide Activity Summary***

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 4,335.00 | 123.86 |
| U-234 | 177 | 4.78 | 153 | 190 | 204,218.00 | 5,834.80 |
| Am-241 | 250 | 5.49 | 210 | 270 | 32,537.00 | 929.63 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 23

8:30:24AM 6/11/2007

### Calibration

Energy Calibration: RSO190
Description:

Analysis Date: 6/11/2007 8:30:16AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

### Acquisition

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 1:11:41PM

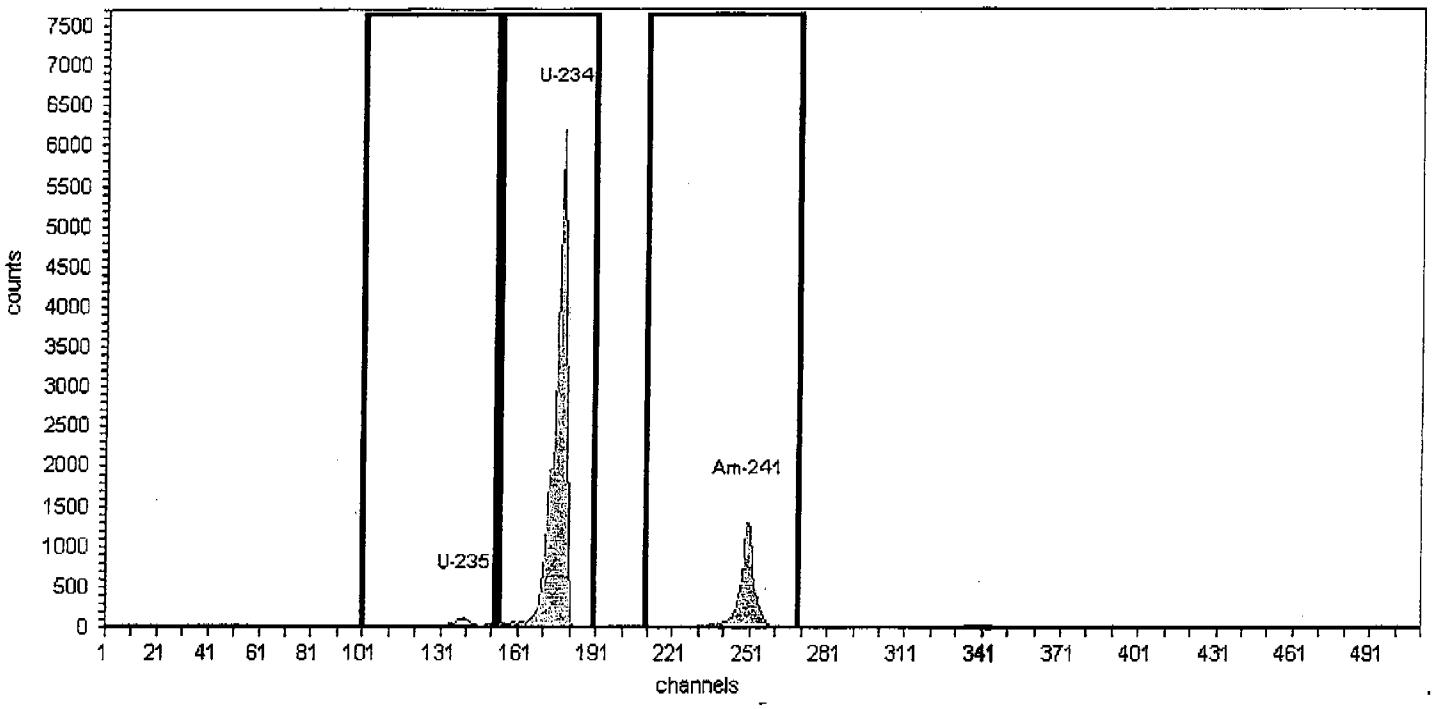
Live Time: 35.00 min.
Real Time: 35.01 min.

Efficiency Calibration Name: RSO190

Energy Calibration Equation:
Gain = 9.9003 keV / Ch

Offset = 3,011.38 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.67% +/- 0.30% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 730.00 | 20.86 |
| U-234 | 178 | 4.78 | 153 | 190 | 30,147.00 | 861.34 |
| Am-241 | 250 | 5.49 | 210 | 270 | 7,083.00 | 202.37 |

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α1
reverified 6/8/07
expires 6/8/08
PAI 187
recalibrate 4-15-03

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203026 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 3.354 | nCi | (124.1 Bq) | Am-241: | 0.5793 | nCi | (21.43 Bq) |
| U-235: | 0.06566 | nCi | (2.429 Bq) | Total Activity: | 3.999 | nCi | (148.0 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.7% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4483 α/min in 2π on 11 Apr 03.

Daniel James Van Dalsem
**Quality Control**

15-Apr-03
**Date Signed**

IPL Ref. No.: 987-7

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α2

reverified 6/8/07
expires 6/8/08
PAI 183
recalibrated 4-15-03

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203028 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 6.467 | nCi | (239.3 Bq) | Am-241: | 0.6366 | nCi | (23.55 Bq) |
| U-235: | 0.1135 | nCi | (4.200 Bq) | Total Activity: | 7.217 | nCi | (267.1 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.7% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 8091 α/min in 2π on 11 Apr 03.

Daniel James Van Dalsem
**Quality Control**

15-Apr-03
**Date Signed**

IPL Ref. No.: 987-7

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α3 reverified 6/8/07
expires 6/8/08
PAT I.D 184
recalibrated 4-15-08

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203024 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 3.227 | nCi | (119.4 Bq) | Am-241: | 2.866 | nCi | (106.0 Bq) |
| U-235: | 0.05205 | nCi | (1.926 Bq) | Total Activity: | 6.145 | nCi | (227.3 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.6% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 6889 α/min in 2π on 11 Apr 03.

Daniel James Van Dalsem
**Quality Control**

15-Apr-03
**Date Signed**

IPL Ref. No.: 987-7

Isotope Products
Laboratories

An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α4

reverified 6/8/07
expireds 6/8/08
GW 6/22/07

PAI ID 00185
recd from recalibration
3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | [illegible] |

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α5

reverified 6/8/07
expires 6/8/08
PAI ID 00186
recalibration
received ~~186~~
3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

**Radionuclide A:** U-234
**Radionuclide B:** U-235
**Radionuclide C:** Am-241
**Half Life (U-234):** (2.454 ± 0.006)E+05 years
**Half Life (U-235):** (7.037 ± 0.011)E+08 years
**Half Life (Am-241):** 432.17 ± 0.66 years

**Customer:** PARAGON ANALYTICS, INC.
**P.O. No.:** EW030603/R2155
**Catalog No.:** MISC-STD
**Reference Date:** 1-Apr-03 12:00 PST
**Source No.:** 92MIX2203025

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 5.486 | nCi | (203.0 Bq) | Am-241: | 3.958 | nCi | (146.4 Bq) |
| U-235: | 0.09221 | nCi | (3.412 Bq) | Total Activity: | 9.536 | nCi | (352.8 Bq) |

**Physical description:**

A. Capsule type: Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit: Electrodeposited and diffusion bonded oxides
C. Active Diameter: 19 mm
D. Backing: Stainless steel
E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty: ± 0.8%
B. Type B (systematic) uncertainty: ± 3.1%
C. Uncertainty in aliquot weighing: ± 0.0%
D. Total uncertainty at the 99% confidence level: ± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 10690 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
Quality Control

19-Mar-03
Date Signed

IPL Ref. No.: 987-2

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α6 reverified 6/8/01 expires 6/8/08
PAID 00187
recd from recalibrate 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

**Radionuclide A:** U-234
**Radionuclide B:** U-235
**Radionuclide C:** Am-241
**Half Life (U-234):** (2.454 ± 0.006)E+05 years
**Half Life (U-235):** (7.037 ± 0.011)E+08 years
**Half Life (Am-241):** 432.17 ± 0.66 years

**Customer:** PARAGON ANALYTICS, INC.
**P.O. No.:** EW030603/R2155
**Catalog No.:** MISC-STD
**Reference Date:** 1-Apr-03 12:00 PST
**Source No.:** 92MIX2203022

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 3.592 | nCi | (132.9 Bq) | Am-241: | 3.279 | nCi | (121.3 Bq) |
| U-235: | 0.08556 | nCi | (3.166 Bq) | Total Activity: | 6.957 | nCi | (257.4 Bq) |

**Physical description:**

A. Capsule type: Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit: Electrodeposited and diffusion bonded oxides
C. Active Diameter: 19 mm
D. Backing: Stainless steel
E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty: ± 0.8%
B. Type B (systematic) uncertainty: ± 3.1%
C. Uncertainty in aliquot weighing: ± 0.0%
D. Total uncertainty at the 99% confidence level: ± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 7799 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
**Quality Control**

19-Mar-03
**Date Signed**

IPL Ref. No.: 987-2

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α 7

reverified 6/8/07
expires 6/8/08
GW 6/22/07
PAIP 188
recd for recalibration 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |

Isotope Products
Laboratories

24937 Avenue Tibbitts
Valencia, California 91355

28

reverified 6/8/07
expires 6/8/08

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

RSO #190
Rec'd 6/6/07 GW
Recertification 6/1/07

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

α 9

| | | | |
|---|---|---|---|
| **Radionuclide:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide:** | U-235 | **P.O. No.:** | 73179/R3768 |
| **Radio: 23** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half-life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Jun-07 12:00 PST |

# Paragon Analytics

## Radiochemistry Case Narrative
## Isotopic Polonium

---

## Los Alamos National Laboratory SMO

08-939

PA WO 0804083

1. This report consists of the analytical results and supporting documentation for two solid samples received by Paragon on 04/09/08.
2. These samples were prepared according to procedures PA SOP773R10 and PA SOP776R11. Modifications were made to the method as described on QASS 328377.
3. The samples were analyzed for the presence of Polonium-210 according to procedure PA SOP714R11. The analyses were completed on 05/15/08.
4. The isotopic analysis results for these samples are reported on an 'as received' basis in units of pCi/gram.
5. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate.
6. Results of this analysis are decay-corrected to the sampling date, based on the 138.4 day half-life of Po-210. This decay correction makes no assumptions as to the equilibrium state of Po-210 with the Pb-210 parent nuclide, which has a half-life of 22.3 years.
7. Paragon Analytics follows the convention outlined in ANSI N42.23 for reporting significant digits in the TPU and MDC results. ANSI N42.23 states that the TPU result should be rounded to two significant digits and that the MDC result should be rounded to the same decimal place as the TPU result. In practice, this could result in an MDC result with a reported value of 0 for samples with significant activity, including the batch laboratory control sample.
8. The tracer recovery of 102% for the laboratory control sample is within the requested 30-110% limit. However, in such cases PA assumes a 100% quantitative recovery in the calculations. While the 'Tracer Yield' on the report form shows the observed recovery (102%), a 'Y1' flag signifies this calculation convention. Results are submitted without further qualification.
9. No further anomalous situations were encountered during the preparation or analysis of these samples. All remaining quality control criteria were met.

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

Rhonda Miller
Radiochemistry Primary Reviewer

5/28/08
Date

Emily Bitler
Radiochemistry Final Data Review

5/29/08
Date

1

PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

# CHAIN OF CUSTODY

# Paragon Analytics

## Sample Number(s) Cross-Reference Table

**Paragon OrderNum:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939
**Client PO Number:** 33204-001-06 F3

| Client Sample Number | Lab Sample Number | COC Number | Matrix | Date Collected | Time Collected |
|---|---|---|---|---|---|
| SFB08-08-11838 | 0804083-1 | | SOLID | 08-Feb-08 | |
| SFB08-08-11839 | 0804083-2 | | SOLID | 08-Feb-08 | |

0804083



Tuesday, April 08, 2008

**LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 08-939C**

**REQUEST NUMBER: 08-939**

## LOS ALAMOS

**NATIONAL LABORATORY**

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 5/8/2008

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS:

| | SAMPLE ID | CTNR | CTNR DESC | ORDER | PRESERV | MATRIX |
|---|---|---|---|---|---|---|
| 1 | SFB08-08-11838 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |
| 2 | SFB08-08-11839 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |

| Relinquished By: | | Date | Time | Received By: | | Date | Time |
|---|---|---|---|---|---|---|---|
| [illegible] | | 4/8/08 | 1400 | Cheryl Trimble | Cheryl Trimble | 4-9-08 | 0930 |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |

**Received for DISPOSAL By:** **Date** **Time** **Remarks:**

Printed Name Signature

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

# LOS ALAMOS
## NATIONAL LABORATORY

ATTN: Lance Steere
Paragon Analytics, Inc.
225 Commerce
Fort Collins, CO 80524

These Samples are on:
LANL Request Number:08-939
Per Agreement Number:1-800-443-1511
Project Cost Code: WEPR13110300

Please analyse the enclosed samples according to the schedule indicated:

**SHIP DATE: 4/8/2008**
**TURNAROUND/REPORT DUE: 5/8/2008**
**TURNAROUND REQ'D: 30 Days**

**RAD SCREENING: Not Required**
**LAB REQUEST COMMENTS:**

LANL ER SMO CONTACT:
Signature:

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:ISOPU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:ISOU | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | HASL-300:PO-210 | 1 | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:PO-210 | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |

**Final Page of REQUEST NUMBER 08-939**

CONDITION OF SAMPLE UPON RECEIPT FORM

**Paragon Analytics**

Client: LANL

Workorder No: 0804083

Project Manager: LS

Initials: CT

Date: 4-9-08

| | | | |
|---|---|---|---|
| 1. Does this project require any **special handling** in addition to standard Paragon procedures? | | YES | (NO) |
| 2. Are custody **seals** on **shipping containers** intact? | NONE | (YES) | NO |
| 3. Are Custody seals on **sample containers** intact? | NONE | (YES) | NO |
| 4. Is there a **COC (Chain-of-Custody) present** or other representative documents? | | (YES) | NO |
| 5. Are the **COC and bottle labels complete and legible**? | | (YES) | NO |
| 6. Is the **COC in agreement** with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.) | | (YES) | NO |
| 7. Were **airbills / shipping documents** present and/or removable? | DROP OFF | (YES) | NO |
| 8. Are all aqueous **samples requiring preservation preserved correctly?** (excluding volatiles) | (N/A) | YES | NO |
| [illegible] | (N/A) | YES | NO |

ORIGIN ID: SAFA (505) 665-9988
JOYLENE VALDEZ
LOS ALAMOS NATL LAB.
TA00 BLDG 1237 DPU 03

LOS ALAMOS, NM 87545
UNITED STATES US

Ship Date: 08APR08
ActWgt: 31.0 LB MAN
System#: 0014176/CAFE2355
Account: S *********

0804083

LANCE STEERE
PARAGON
225 COMMERCE

16

(800) 443-1511
FedEx
Express

FORT COLLINS, CO 80524

2

f: 6b010amr1a01401hco

CLS5018 7/22/23

Delivery Address
Barcode

BILL SENDER

PRIORITY OVERNIGHT

WED
Deliver By:
09APR08

# 7209 7844 0486

Form
0201

DEN
AA

0524 -CO-US

XH FTCA

2

# Polonium-210 by Alpha Spectroscopy Sample Results Summary

**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083


**Reported on:** Wednesday, May 28, 2008 7:42:08 AM

| Lab Sample ID | Client Sample ID | Sample Type | Nuclide | Result +/- 1 s TPU | MDC | Units | Matrix | Prep Batch | Date Analyzed | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SFB08-08-11838 | Sample | Po-210 | 343 +/- 25 | 0 | pCi/g | SOLID | PL080513-1 | 5/15/2008 | |
| 0804083-2 | SFB08-08-11839 | Sample | Po-210 | 25.4 +/- 1.9 | 0.1 | pCi/g | SOLID | PL080513-1 | 5/15/2008 | |

**Comments:**

**Data Package ID:** *PL0804083-1*

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
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)

BDL - Below Detection Limit

3

PARAGON ANALYTICS
Radiochemistry Data Package

Section 3

# QC RESULTS SUMMARY

# Polonium-210 by Alpha Spectroscopy

## PAI 714 Rev 11

## Method Blank Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** PL080513-1MB

**Sample Matrix:** SOLID
**Prep SOP:** PAI 711 Rev 7
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 15-May-08

**Prep Batch:** PL080513-1
**QCBatchID:** PL080513-1-1
**Run ID:** PL080513-1A
**Count Time:** 1000 minutes

**Final Aliquot:** 0.262 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13981-52-7 | Po-210 | 0.057 +/- 0.034 | 0.110 | 0.25 | U |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Po-209 | 13.76 | 12.34 | pCi/g | 89.7 | 20 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Data Package ID:** *PL0804083-1*

# Polonium-210 by Alpha Spectroscopy

## PAI 714 Rev 11

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** PL080513-1LCS

**Sample Matrix:** SOLID
**Prep SOP:** PAI 711 Rev 7
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 15-May-08

**Prep Batch:** PL080513-1
**QCBatchID:** PL080513-1-1
**Run ID:** PL080513-1A
**Count Time:** 1000 minutes

**Final Aliquot:** 0.262 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 13981-52-7 | Po-210 | 43.9 +/- 3.2 | 0.1 | 40.6 | 108 | 83 - 117 | P,Y1 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Po-209 | 13.76 | 14.0 | pCi/g | 102 | 20 - 110 % | Y1 |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

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

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

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

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

**Data Package ID:** *PL0804083-1*

# Polonium-210 by Alpha Spectroscopy

## PAI 714 Rev 11

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** PL080513-1LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 711 Rev 7
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 15-May-08

**Prep Batch:** PL080513-1
**QCBatchID:** PL080513-1-1
**Run ID:** PL080513-1A
**Count Time:** 1000 minutes

**Final Aliquot:** 0.262 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 13981-52-7 | Po-210 | 41.9 +/- 3.1 | 0.1 | 40.6 | 103 | 83 - 117 | P |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Po-209 | 13.76 | 11.07 | pCi/g | 80.5 | 20 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

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

Abbreviations:

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

**Data Package ID:** *PL0804083-1*

# Polonium-210 by Alpha Spectroscopy

## PAI 714 Rev 11

## Duplicate Sample Results (DER)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:**
**Lab ID:** PL080513-1LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 711 Rev 7
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 15-May-08

**Prep Batch:** PL080513-1
**QCBatchID:** PL080513-1-1
**Run ID:** PL080513-1A
**Count Time:** 1000 minutes

**Final Aliquot:** 0.262 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Analyte | Sample Result +/- 1s TPU | Duplicate Result +/- 1s TPU | DER | Control Limit | Lab Qualifiers |
|---|---|---|---|---|---|---|
| 13981-52-7 | Po-210 | 43.9 +/- 3.2 | 41.9 +/- 3.1 | 0.23 | 2.13 | P |

### Comments:

**Duplicate Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13
LT - Result is less than Request MDC, greater than sample specific MDC
M - Requested MDC not met.
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
L - LCS Recovery below lower control limit.
H - LCS Recovery above upper control limit.
P - LCS, Matrix Spike Recovery within control limits.
N - Matrix Spike Recovery outside control limits

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
DER - Duplicate Error Ratio (see PAI SOP 715)
BDL - Below Detection Limit
NR - Not Reported

**Data Package ID:** *PL0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

4

Section 4

# INDIVIDUAL SAMPLE RESULTS

# Polonium-210 by Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

| | | | |
|---|---|---|---|
| **Field ID:** SFB08-08-11838 | **Sample Matrix:** SOLID | **Prep Batch:** PL080513-1 | **Final Aliquot:** 0.227 g |
| **Lab ID:** 0804083-1 | **Prep SOP:** PAI 711 Rev 7 | **QCBatchID:** PL080513-1-1 | **Prep Basis:** As Received |
| | **Date Collected:** 08-Feb-08 | **Run ID:** PL080513-1A | **Moisture(%):** NA |

# Polonium-210 by Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** ASP-A-019

**Sample Matrix:** SOLID
**Prep SOP:** PAI 711 Rev 7
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 15-May-08

**Prep Batch:** PL080513-1
**QCBatchID:** PL080513-1-1
**Run ID:** PL080513-1A
**Count Time:** 1000 minutes
**Report Basis:** As Received

**Final Aliquot:** 0.297 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13981-52-7 | Po-210 | 25.4 +/- 1.9 | 0.1 | 0.25 | |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Po-209 | 12.13 | 11.84 | pCi/g | 97.7 | 20 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

**Data Package ID:** *PL0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

5

Section 5

# RAW DATA

# y Raw Data Report

**Reported on:** Friday, May 16, 2008
9:06:21 AM

| Count Date/Time | Net Cnts Bkg Cnts | BaseEff Bkg(min) | CntDur(min) Yield | Activity +/- 1 s TPU | MDC DecLev | ReportUnits ReportBasis | DER RPD | %Spk. Recov Flags |
|---|---|---|---|---|---|---|---|---|
| 5/15/2008 | 2030.000 | 28.84% | 1000 | 14.0 | 0.1 | pCi/g | NA | |
| 3:12 PM | 1.000 | 1000 | 87.9% | 1.0 | NA | As Received | NA | |
| 5/15/2008 | 26872.000 | 28.84% | 1000 | 343 | 0 | pCi/g | NA | |
| 3:12 PM | 3.000 | 1000 | 87.9% | 25 | NA | As Received | NA | |
| 5/15/2008 | 2420.000 | 30.95% | 1000 | 11.84 | 0.04 | pCi/g | NA | |
| 3:12 PM | 1.000 | 1000 | 97.7% | 0.84 | NA | As Received | NA | |
| 5/15/2008 | 3105.000 | 30.95% | 1000 | 25.4 | 0.1 | pCi/g | NA | |
| 3:12 PM | 2.000 | 1000 | 97.7% | 1.9 | NA | As Received | NA | |
| 5/15/2008 | 2197.000 | 30.59% | 1000 | 12.34 | 0.06 | pCi/g | NA | |
| 3:12 PM | 3.000 | 1000 | 89.7% | 0.88 | NA | As Received | NA | |
| 5/15/2008 | 9.000 | 30.59% | 1000 | 0.057 | 0.110 | pCi/g | NA | |
| 3:12 PM | 10.000 | 1000 | 89.7% | 0.034 | NA | As Received | NA | U |
| 5/15/2008 | 2504.000 | 30.74% | 1000 | 14.0 | 0.1 | pCi/g | NA | |
| 3:12 PM | 4.000 | 1000 | 102.0% | 1.0 | NA | As Received | NA | Y1 |
| 5/15/2008 | 7853.000 | 30.74% | 1000 | 43.9 | 0.1 | pCi/g | NA | 108 |
| 3:12 PM | 3.000 | 1000 | 102.0% | 3.2 | NA | As Received | NA | P,Y1 |
| 5/15/2008 | 1966.000 | 30.52% | 1000 | 11.07 | 0.10 | pCi/g | NA | |
| 3:12 PM | 10.000 | 1000 | 80.5% | 0.80 | NA | As Received | NA | |
| 5/15/2008 | 5981.000 | 30.52% | 1000 | 41.9 | 0.1 | pCi/g | 0.23 | 103 |
| 3:12 PM | 8.000 | 1000 | 80.5% | 3.1 | NA | As Received | NA | P |

**Notes:**

1) The Tracer results are not yield corrected (i.e. activity measured not activity added).

2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

TR- Tracer TA - Target Analyte

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

uested MDC.

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 0804083-1
Spectrum #1 Analysis #1

Sample Size : 0.23

### Acquisition

Detector: 1
Batch Name: PL080513-1_A
Nuclide Library: Po-210
Analysis Method: Absolute ROI Analysis, Set Name = Po-210
ROI Set: Po-210

Acquisition Start Date: 5/15/2008 3:12:14PM
Live Time: 1,000.00 min.
Real Time: 1,000.03 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08051401; Det: 1; Spectrum #1; May-14-2008 12:03

Calibration Date: 5/14/2008 10:26:51AM

Efficiency Calibration: C08051401

Efficiency: 28.84% +/- 0.20% TPU(2 sigma)

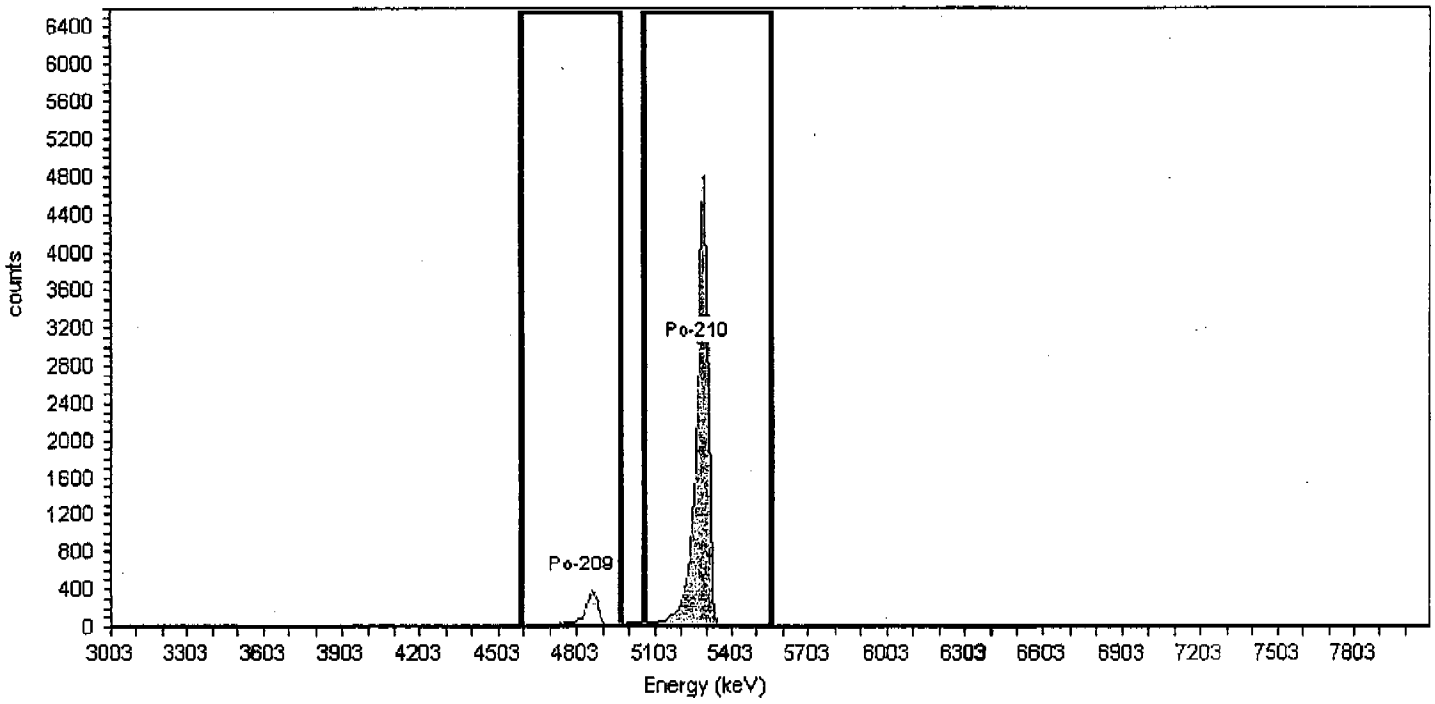
Energy Calibration: C08051401

Energy Cal: Gain = 9.9784 keV / Ch
Offset = 2,993.25 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 851.3020.87
Tracer Activity: 17.63 DPM/mL x (Vol.)0.50 mL = 8.82 DPM

Tracer Nuclide: Po-209
Tracer Recovery: 88.06%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Po-209 | 4859.2 | 4589.8 | 4969.0 | 48.4 | 99.7 | 2,031.00 | 1.00 | 2,030.00 | 1.5E+001 | 6.8E-001 | 2.0E-002 | 6.3E-002 |
| Po-210 | 5308.3 | 5058.8 | 5557.7 | 64.1 | 100.0 | 26,875.00 | 3.00 | 26,872.00 | 2.1E+002 | 2.3E+001 | 3.1E-002 | 8.3E-002 |

Reviewed By: GB JP

Print Date: 5/16/2008 8:52:24AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 0804083-2
Spectrum #1 Analysis #1

Sample Size : 0.30

### Acquisition

Detector: 2
Batch Name: PL080513-1_A
Nuclide Library: Po-210
Analysis Method: Absolute ROI Analysis, Set Name = Po-210
ROI Set: Po-210

Acquisition Start Date: 5/15/2008 3:12:14PM
Live Time: 1,000.00 min.
Real Time: 1,000.03 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08051402; Det: 2; Spectrum #1; May-14-2008 12:03

Calibration Date: 5/14/2008 10:27:08AM

Efficiency Calibration: C08051402

Efficiency: 30.95% +/- 0.15% TPU(2 sigma)

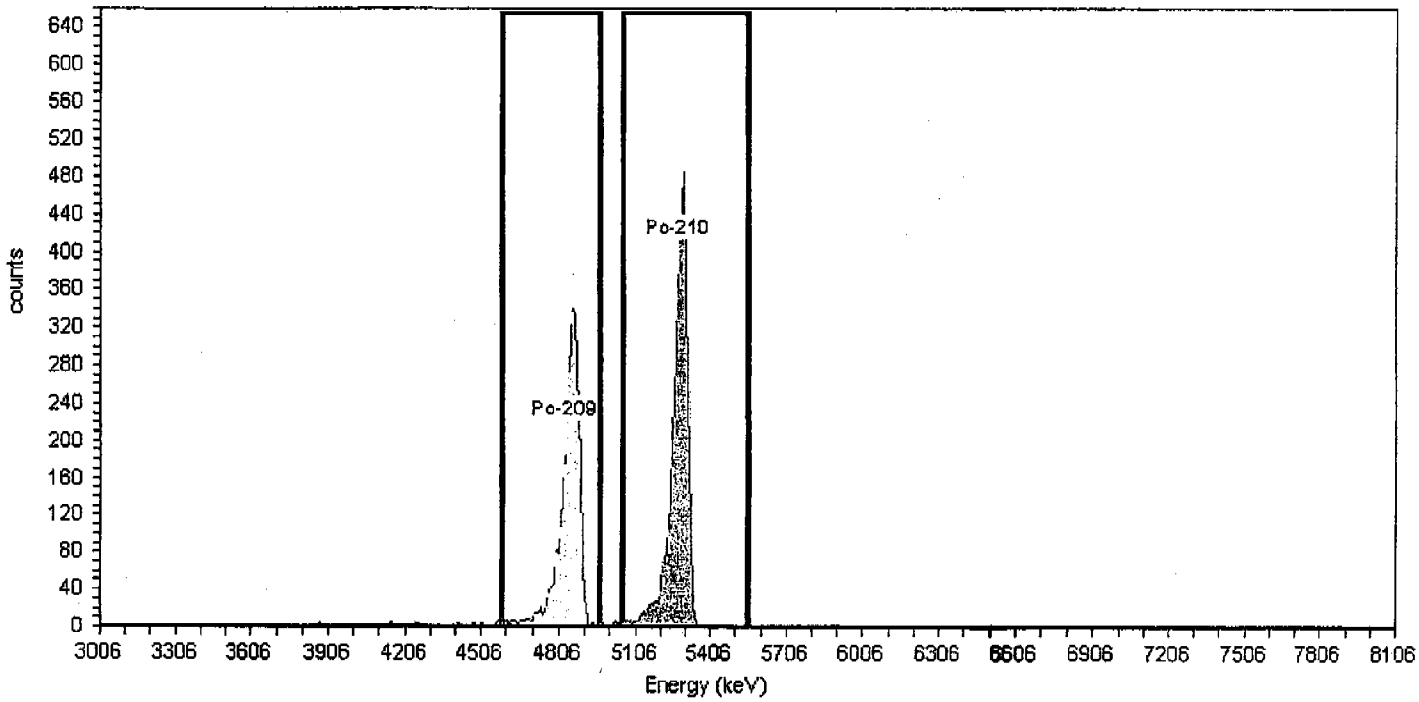
Energy Calibration: C08051402

Energy Cal: Gain = 9.9974 keV / Ch
Offset = 2,996.32 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 851.3020.87
Tracer Activity: 17.63 DPM/mL x (Vol.)0.50 mL = 8.82 DPM

Tracer Nuclide: Po-209
Tracer Recovery: 97.83%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Po-209 | 4855.8 | 4585.9 | 4965.8 | 69.3 | 99.7 | 2,421.00 | 1.00 | 2,420.00 | 1.3E+001 | 5.3E-001 | 1.3E-002 | 4.0E-002 |
| Po-210 | 5305.7 | 5055.8 | 5555.7 | 69.7 | 100.0 | 3,107.00 | 2.00 | 3,105.00 | 1.5E+001 | 1.8E+000 | 1.6E-002 | 4.6E-002 |

Reviewed By: JP

Print Date: 5/16/2008 8:52:32AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: PL080513-1MB
Spectrum #1 Analysis #1

Sample Size : 0.26

### Acquisition

Detector: 4
Batch Name: PL080513-1_A
Nuclide Library: Po-210
Analysis Method: Absolute ROI Analysis, Set Name = Po-210
ROI Set: Po-210

Acquisition Start Date: 5/15/2008 3:12:15PM
Live Time: 1,000.00 min.
Real Time: 1,000.03 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08051404; Det: 4; Spectrum #1; May-14-2008 12:03

Calibration Date: 5/14/2008 10:27:30AM

Efficiency Calibration: C08051404

Efficiency: 30.59% +/- 0.21% TPU(2 sigma)

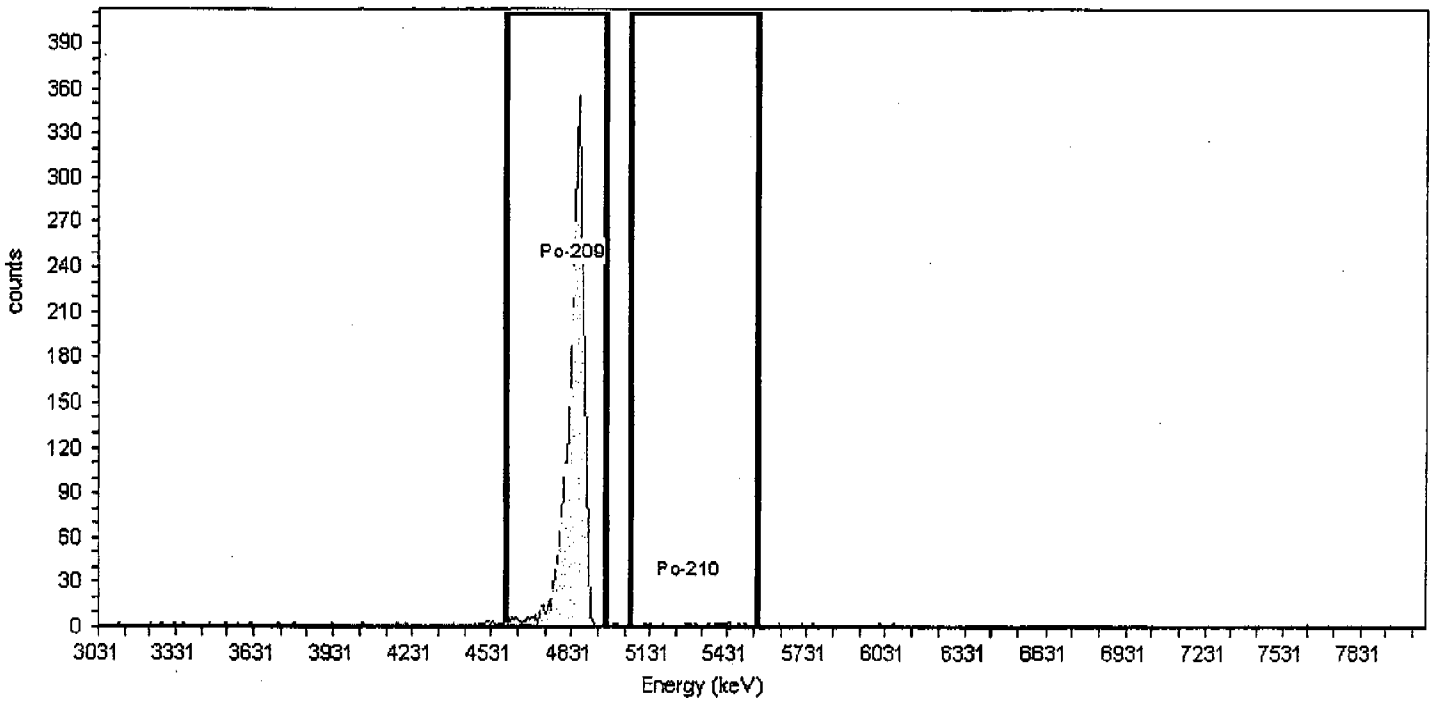
Energy Calibration: C08051404

Energy Cal: Gain = 9.9003 keV / Ch
Offset = 3,021.28 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 851.3020.87
Tracer Activity: 17.63 DPM/mL x (Vol.)0.50 mL = 8.82 DPM

Tracer Nuclide: Po-209
Tracer Recovery: 89.88%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Po-209 | 4852.8 | 4585.5 | 4961.7 | 77.1 | 99.7 | 2,200.00 | 3.00 | 2,197.00 | 1.4E+001 | 5.9E-001 | 2.8E-002 | 7.5E-002 |
| Po-210 | 5298.3 | 5050.8 | 5545.9 | 64.5 | 100.0 | 19.00 | 10.00 | 9.00 | 5.7E-002 | 6.8E-002 | 4.6E-002 | 1.1E-001 |

Reviewed By: GB JP

Print Date: 5/16/2008 8:52:39AM

AlphaVision v5.3
Custom Report Iteration: 06/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: PL080513-1LCS
Spectrum #1 Analysis #1

Sample Size : 0.26

### Acquisition

Detector: 5
Batch Name: PL080513-1_A
Nuclide Library: Po-210
Analysis Method: Absolute ROI Analysis, Set Name = Po-210
ROI Set: Po-210

Acquisition Start Date: 5/15/2008 3:12:15PM
Live Time: 1,000.00 min.
Real Time: 1,000.03 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08051405; Det: 5; Spectrum #1; May-14-2008 12:03

Calibration Date: 5/14/2008 10:27:58AM

Efficiency Calibration: C08051405

Efficiency: 30.74% +/- 0.13% TPU(2 sigma)

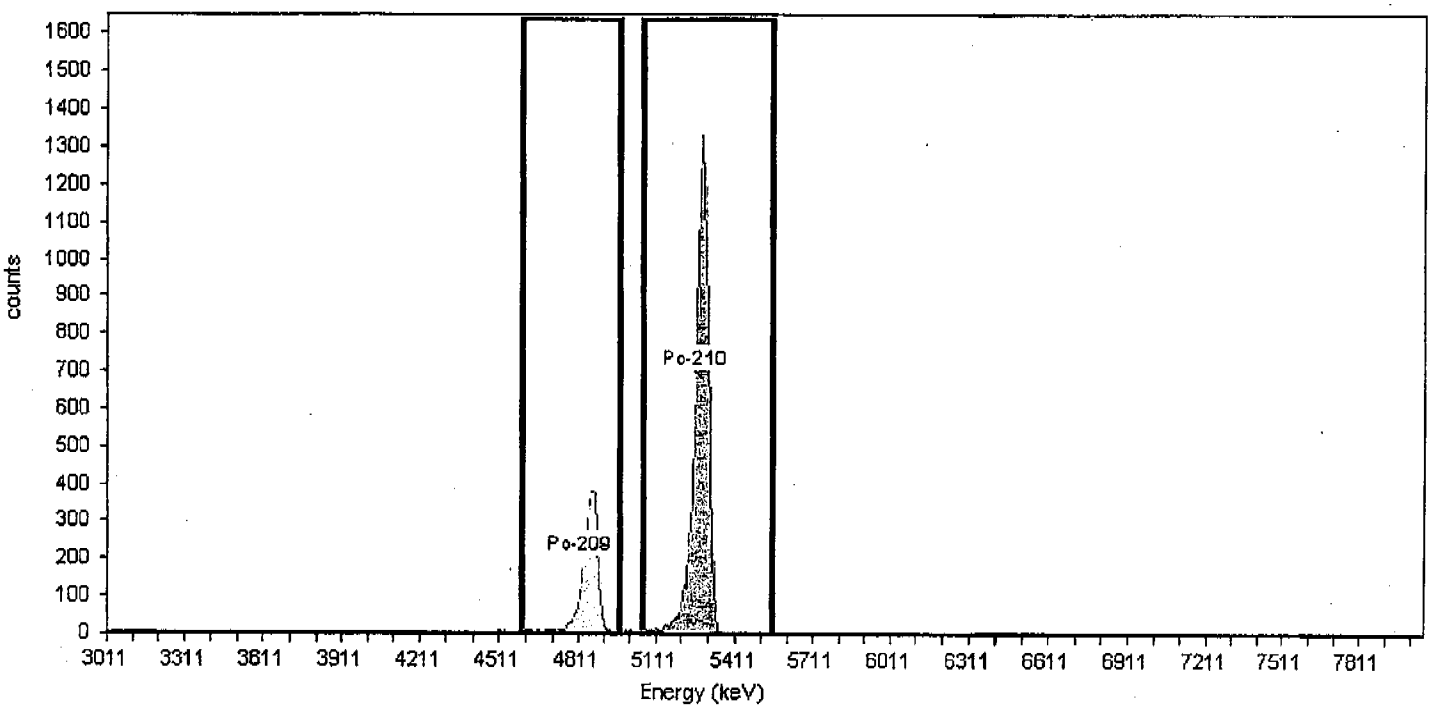
Energy Calibration: C08051405

Energy Cal: Gain = 9.9003 keV / Ch
Offset = 3,001.48 keV
Quadratic = 0.0000 keV / Ch$^2$

### Tracer

Tracer Name: 851.3020.87
Tracer Activity: 17.63 DPM/mL x (Vol.)0.50 mL = 8.82 DPM

Tracer Nuclide: Po-209
Tracer Recovery: 101.91%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Po-209 | 4862.7 | 4595.4 | 4971.6 | ~~26.9~~ | 99.7 | 2,508.00 | 4.00 | 2,504.00 | 1.6E+001 | 6.3E-001 | 2.8E-002 | 7.3E-002 |
| Po-210 | 5308.2 | 5060.7 | 5555.8 | 66.3 | 100.0 | 7,856.00 | 3.00 | 7,853.00 | 4.3E+001 | 4.8E+000 | 2.2E-002 | 6.0E-002 |

~70 GB 5/16/06

Reviewed By: GB JP

Print Date: 5/16/2008 8:52:46AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: PL080513-1LCSD
Spectrum #1 Analysis #1

Sample Size ; 0.26

### Acquisition

Detector: 6
Batch Name: PL080513-1_A
Nuclide Library: Po-210
Analysis Method: Absolute ROI Analysis, Set Name = Po-210
ROI Set: Po-210

Acquisition Start Date: 5/15/2008 3:12:16PM
Live Time: 1,000.00 min.
Real Time: 1,000.03 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08051406; Det: 6; Spectrum #1; May-14-2008 12:03

Calibration Date: 5/14/2008 10:28:38AM

Efficiency Calibration: C08051406

Efficiency: 30.52% +/- 0.15% TPU(2 sigma)

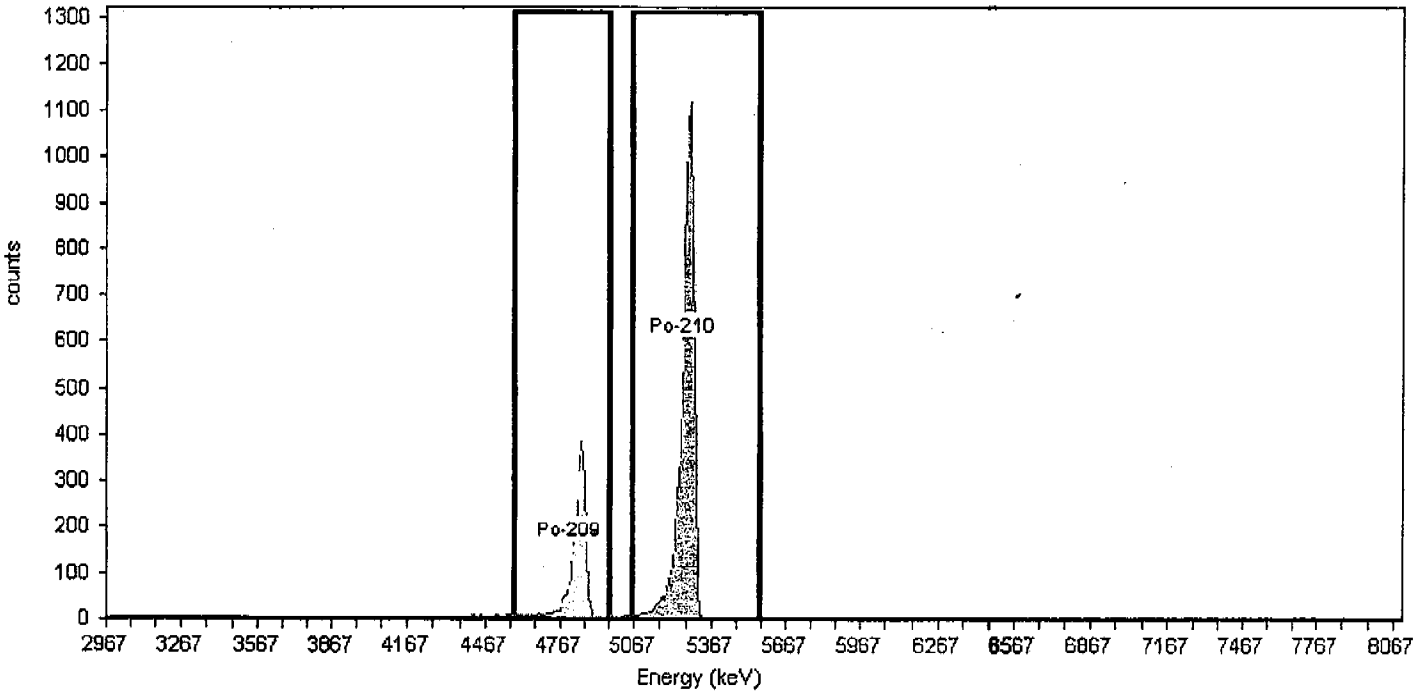
Energy Calibration: C08051406

Energy Cal: Gain = 10.0776 keV / Ch
Offset = 2,957.65 keV
Quadratic = 0.0000 keV / Ch$^2$

### Tracer

Tracer Name: 851.3020.87
Tracer Activity: 17.63 DPM/mL x (Vol.)0.50 mL = 8.82 DPM

Tracer Nuclide: Po-209
Tracer Recovery: 80.61%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Po-209 | 4852.2 | 4580.1 | 4963.1 | ~~37.8~~ | 99.7 | 1,976.00 | 10.00 | 1,966.00 | 1.2E+001 | 5.6E-001 | 5.7E-002 | 1.4E-001 |
| Po-210 | 5305.7 | 5053.8 | 5557.7 | 64.5 | 100.0 | 5,989.00 | 8.00 | 5,981.00 | 4.2E+001 | 4.8E+000 | 4.6E-002 | 1.1E-001 |

MSD 98 5/14/08

Reviewed By: GB JP

Print Date: 5/16/2008 8:52:54AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

***Paragon Analytics***

a Spectrometer Instrument Run Log

Date: 5/15/08

| Duration | Initial |
|---|---|
| 180 | JS |
| 1000 | JS |
| 1000 | GB |
| 1000 | GB |
| | GB 5/16/08 |

| Detector | Batch ID | Sample ID | Iso/Matrix | Duration | Initial |
|---|---|---|---|---|---|
| | | | | | GB 5/16/08 |

Reviewed by: GB

Date: 5/16/08

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

# QUALITY ASSURANCE SUMMARY REPORTS

6

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0804083

TEST Am, Pu, U, Sr, Po

METHOD Prep

SOP/REV (PREP) Various

SOP/REV (ANAL) _____

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor [illegible] DQO's or sample characteristics.

PARAGON ANALYTICS
Radiochemistry Data Package

Section 7

# LABORATORY BENCH SHEETS

7

t

**Prep Batch: PI-080513-1**

Analytical QASS / NCR? Y / (N) NA

| 3 Det | Cnt 3 Pos Chk By | Notes |
|---|---|---|
| | | |

/16/08 GB 5/16/08

nformation

| Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|
| DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| DPM/ml | 05/13/08 | 1 | ml | AW015 |
| DPM/ml | 05/13/08 | 1 | ml | AW015 |

Supersedes: NA

# Radiochemistry Prep Worksheet

**Paragon Analytics**

**Prep Batch: PL080513-1**

**Prep Procedure:** Po210

**Reviewed By:** tde 1DE **Review Date:** 5/15/2008

**Non-Routine Pre-Treatment?** (Y) / N **Batch:** See QASS **Re-Prep?** Y / (N) **Batch:** NA **Prep QASS / NCR?** (Y) N 328377

**Prep SOP:** PAI 711 **Rev:** 7
**Prep SOP:** NONE
**Matrix Class:** solid

**Prep Analyst:** Tambrae Elhart 1E
**Prep Date:** 5/13/2008
**Prep Dept:** AP

**Balance:** 27
**Balance:**

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Aiq g | Fin Aiq g | Prep Basis | Total Digestate Vol(ml) | Digestate Vol Taken(ml) | Decay Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0804083-1 | SMP | | 0.453915 | 0.226958 | As Received | 100 | 99 | 05/15/08 09:00 | T1,T2,T3,T4 | |
| 2 | 1 | 0804083-2 | SMP | | 0.594792 | 0.297396 | As Received | 100 | 99 | 05/15/08 09:00 | T1,T2,T3,T4 | |
| 3 | 1 | PL080513-1 | MB | | 0.524354 | 0.262177 | As Received | 100 | 99 | 05/15/08 09:00 | T1,T2,T3,T4 | |
| 4 | 1 | PL080513-1 | LCS | | 0.524354 | 0.262177 | As Received | 100 | 99 | 05/15/08 09:00 | S1,S2,S3,T1,S4,T2,T3,T4 | |
| 5 | 1 | PL080513-1 | LCSD | | 0.524354 | 0.262177 | As Received | 100 | 99 | 05/15/08 09:00 | S1,S2,S3,T1,S4,T2,T3,T4 | |

1E 5/15/08

Comments

**Spiked By:** Tambrae Elhart **Date:** 5/13/2008

**Witnessed By:** Jeffrey T. Lee **Date:** 5/13/2008

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | Am-243 | 821.3020.61 | 19.995 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T2 | U-232 | 837.3020.90 | 19.763 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T3 | Pu-242 | 846.3020.88 | 19.997 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T4 | Po-209 | 851.3020.87 | 16.014 | DPM/ml | 05/13/08 | 1 | ml | AW015 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | AM-241 | 816.2382.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-234 | 644.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-235 | 644.3020.52 | 0.948 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-238 | 644.3020.52 | 20.596 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S3 | Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S4 | Pb-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 1 | ml | AW015 |
| S4 | Po-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 1 | ml | AW015 |



**Supersedes:** 5/15/08 13:28

# Radiochemistry Prep Worksheet

**Paragon Analytics**

**Prep Batch: PL080513-1**

**Prep Procedure:** Po210

## Prep Batch Not Validated!!!

**Reviewed By:** **Review Date:**

**Non-Routine Pre-Treatment? Y / N** **Batch:** _____ **Re-Prep? Y / N** **Batch:** _____ **Prep QASS / NCR? Y / N** _____

**Prep SOP:** PAI 711 **Rev:** 7
**Prep SOP:** NONE
**Matrix Class:** solid

**Prep Analyst:** Tambrae Elhart TE
**Prep Date:** 5/13/2008
**Prep Dept:** AP

**Balance:** 27
**Balance:**

- 9m aliquot - after initial ICP

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Alq g | Fin Alq g | Prep Basis | Total Digestate Vol(ml) | Digestate Vol Taken(ml) | Decay Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0804083-1 | SMP | | 0.4585 | 0.463915 | As Received | 100 | 99 | | T1,T2,T3,T4 | |
| 2 | 1 | 0804083-2 | SMP | | 0.5008 | 0.594792 | As Received | 100 | 99 | | T1,T2,T3,T4 | |
| 3 | 1 | PL080513-1 | MB | | 0.52965 | 0.524354 | As Received | 100 | 99 | | T1,T2,T3,T4 | |
| 4 | 1 | PL080513-1 | LCS | | 0.52965 | 0.524354 | As Received | 100 | 99 | | S1,S2,S3,S4,T1,T2,T3,T4 | |
| 5 | 1 | PL080513-1 | LCSD | | 0.52965 | 0.524354 | As Received | 100 | 99 | | S1,S2,S3,S4,T1,T2,T3,T4 | |

Comments

**Spiked By:** Tambrae Elhart **Date:** 5/13/2008

**Witnessed By:** Jeffrey T. Lee **Date:** 5/13/2008

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | Am-243 | 832.3020.78 | 20.035 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T2 | U-232 | 837.3020.90 | 19.763 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T3 | Pu-242 | 846.3020.88 | 19.997 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T4 | Po-209 | 851.3020.87 | 16.014 | DPM/ml | 05/13/08 | 1 | ml | AW015 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | AM-241 | 616.2362.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-234 | 644.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-235 | 644.3020.52 | 0.948 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-238 | 644.3020.52 | 20.596 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S3 | Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S4 | Pb-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 1 | ml | AW015 |
| S4 | Po-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 1 | ml | AW015 |



**Supersedes:** 5/13/08 8:55

# Radiochemistry Prep Worksheet

**Paragon Analytics**

**Prep Batch: PL080518-1**

**Prep Procedure:** Po210, Am, Pu, U, Sr **Prep Batch Not Validated!!!** **Reviewed By:** **Review Date:**

Non-Routine Pre-Treatment? Y / N Batch: _____ Re-Prep? Y / N Batch: _____ Prep QASS / NCR? Y / N _____

Prep SOP: PAI 711 Rev: 7
Prep SOP: NONE
Matrix Class: solid

Prep Analyst: Tambrae Elhart TE
Prep Date: 5/13/2008
Prep Dept: AP

Balance:
Balance:

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Aiq g | Fin Aiq g | Prep Basis | Decay Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0804083-1 | SMP | | 0.5 | 0.5 | As Received | 5/15/08 0900 | T1,T2,T3,T4, T5 | .4585 |
| 2 | 1 | 0804083-2 | SMP | | 0.5 | 0.5 | As Received | | T1,T2,T3,T4, | .6008 |
| 3 | 1 | PL080513-1 | MB | | 0.5 | 0.5 | As Received | | T1,T2,T3,T4, | |
| 4 | 1 | PL080513-1 | LCS | | 0.5 | 0.5 | As Received | | S1,S2,S3,S4,T1,T2,T3,T4 S5,T5 | |
| 5 | 1 | PL080513-1 | LCSD | | 0.5 | 0.5 | As Received | | S1,S2,S3,S4,T1,T2,T3,T4 S5,T5 | |

Comments

Spiked By: TE Date: 5/13/08
Witnessed By: JJL Date: 5/13/08

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | Am-243 | ~~832.3020.78~~ 821.3020.61 | 20.035 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T2 | U-232 | 837.3020.90 | 19.763 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T3 | Pu-242 | 846.3020.88 | 19.997 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T4 | Po-209 | 851.3020.87 | 16.014 | DPM/ml | 05/13/08 | 1 | ml | AW015 |

T5 Sr carrier 247960 .5mL AW013

| | Exp |
|---|---|
| T1 | 2/10/09 |
| T2 | 1/13/09 |
| T3 | 12/3/08 |
| T4 | 12/5/08 |
| T5 | 8/3/08 |

**Spiked Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | AM-241 | 816.2382.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-234 | 644.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-235 | 644.3020.52 | 0.948 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-238 | 644.3020.52 | 20.596 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S3 | Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S4 | Pb-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 1 | ml | AW015 |
| **S4** | **Po-210** | **823.3020.41** | **47.234** | **DPM/ml** | **05/13/08** | **1** | **ml** | **AW015** |

S5 Sr-90 600.3020.82 ~57 dpm/mL .5mL AW013

| | Exp |
|---|---|
| S1 | 10/8/08 |
| S2 | 1/13/09 |
| S3 | 10/11/08 |
| S4 | 7/14/08 |
| S5 | 8/3/08 |

# SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TE

ANALYSIS DATE: 5/13/08 METHOD: Prep

| WORK ORDER | SAMPLE ID | SAMPLE CONDITION | | |
|---|---|---|---|---|
| | | Dry/Wet | TEXTURE | Remarks |
| 0804083 | 1 | dry | Dust | As Rec'd |
| " | 2 | " | " | " |

TE 5/13/08

PARAGON ANALYTICS
Radiochemistry Data Package

Section 8

# STANDARDS

Prepare a working level dilution of Pb-210 of approx. 50dpm/mL. Dilute RSO #823 to 1L in 1M $HNO_3$. (Lot# 061860)

Bal 12

1) Determine density of 1.0M $HNO_3$
Mass of empty 100mL class A flask: 64.1197g
Mass of flask + 100mL 1.0M $HNO_3$: 167.0040g
Net mass of 1.0M $HNO_3$: 102.8843g

D = 1.0288g/mL

2) Transfer approx. 1.13g of standard to Nalgene bottle (1L)
Mass of bottle w/out lid: 74.7598g
mass of bottle + standard: 75.9347g
Net mass of standard: 1.1749g

Bal 12

3) Dilute to 1000mL w/ 1.0M $HNO_3$
mass of bottle + standard + 1.0M $HNO_3$: 1141.0
mass of bottle: 74.7598g
net mass of std: 1066.24g

bal 12

4) Final Activity

$$\frac{(3.831\times10^4\,dps)\left(\frac{60\,dpm}{dps}\right)(1.1749g)(1.0288g/mL)}{(52.10846g)(1066.24g)} = 50.007\,dpm/mL$$

RG 11/3/06

Stnd ID: 823.3020.41

Description: Pb-210
Expiration: 8/10/2007
Activity: 50.00 dpm/mL

2s Uncertainty: 1.65 dpm/mL
Ref. Date: 7/13/2006
Ref Time: N/A
Prep Date: 8/4/2006 Prep by: AB
Matrix/Comp. 1.0M HNO3
Half Life (y): 2.23E+01

RG 11/3/06

| Reverification Log | | |
|---|---|---|
| Analysis Date | Initials | Expiration Date |
| 7/14/2007 | RG | 7/14/2008 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

RG 11/3/06

RG 11/3/06

Continued on Page

Read and Understood By

Amanda Barbae 8/4/06 Renee Gallegos 11/3/06

ANALYTICS
An Isotope Products Laboratories Company

RSO# 823
Rec'd 7/17/06 KAA

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

# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

73351-307

Pb-210 50 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master liquid radionuclide solution source. The master source was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

| | |
|---|---|
| ISOTOPE: | Pb-210 |
| ACTIVITY (dps): | 3.831 E4 |
| HALF-LIFE: | 22.3 years |
| CALIBRATION DATE: | July 13, 2006 12:00 EST |
| RELATIVE EXPANDED UNCERTAINTY (k=2): | 3.3% |

Impurities: γ-impurities <0.1%
α-impurities (other than decay products) <0.01%

52.10846 grams 1M $HNO_3$ solution.

P O NUMBER 71239 6-13-06, Item 1

SOURCE PREPARED BY: M Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: 7-13-06

Prepare a Working dilution of Po-209 from Primary dilution 851.3020.86 of approximately 20 dpm/g.

1) Use density of 2M HCl from page 86
$\rho = 1.0322$ g/ml

2) Transfer ½ of Std to 1 L Nalgene bal 12
Mass of Nalgene (No lid) 73.6812 g
Mass of Nalgene + Std 87.7360 g
Net Mass of Std Transferred 14.0548 g

3) Dilute with 2M HCl to final Vol bal. 12
Mass of Nalgene (from above) 73.6812 g
Mass of Nalgene, Std, and diluent 810.7 - bal. #26
Net Mass of Standard: 737.0188 g

4) Final activity Calculation:

JDD 12/13/07

$$\frac{895.743 \frac{dpm}{g} \cdot 14.0548\,g \cdot 1.0322\,g/ml}{737.0188\,g} = 20.001 \frac{dpm}{ml}$$ JDD 12/13/07

17.632 dpm/ml

MC 1/14/08

Stnd ID: 851.3020.87

Description: Po-209
Expiration: 12/5/2008
Activity: 17.63 dpm/mL

2s Uncertainty: 0.07 dpm/mL
Ref. Date: 3/15/1994
Ref Time: 0.417
Prep Date: 11/13/2007 Prep by: JD
Matrix/Comp. 2 M HCl
Half Life (y): 1.02E+02

MC 1/14/08

MC 1/14/08

| Reverification Log | | |
|---|---|---|
| Analysis Date | Initials | Expiration Date |
| | | |
| | | |
| | | |
| | | |
| | | |

MC 1/14/08

Continued on Page

Signed JDD 12/13/07 Date 12/13/07

Read and Understood By Signed Date 1/14/08

Prepare a Primary Dilution of Po-209 RSO# 851 of approximately 1000 dpm/g
JDD 11/13/07

1) Prepare 2 M HCl. 170 ml HCl and 830 ml DI water lot # 068438.

2) Determine density of 2 M HCl — bal. 12

| | |
|---|---|
| Mass of 100 ml Vol. flask | 66.4344 g |
| Mass of flask + 100 ml 2M HCl | 169.6538 g |
| Net Mass of 2 M HCl | 103.2194 g |

$\rho$ = 1.0322 g/ml

3) Transfer contents of vial to 40 ml voa vial — bal. 12

| | |
|---|---|
| Mass of Voa Vial (w/o lid) | 21.4814 g |
| Mass of Vial + Standard | 26.4704 g |
| Net Mass of standard Transferred | 4.989 g |

4) Dilute with 2 M HCl — bal. 12

| | |
|---|---|
| Mass of vial, Std, and diluent | 50.0271 g |
| Mass of vial (from above) | 21.4814 g |
| Net Mass of std | 28.5457 g |

~~50.0271 g~~ JDD 11/13/07

5) Final Activity Calculation:

JDD 12/13/07

$$\frac{(500\ Bq)\cdot\left(\frac{60\ secs}{1\ min}\right)\cdot(4.989\ g)}{(28.5457\ g)\cdot(5.16\ g)} = 1016.119\ \frac{dpm}{g}$$

$$\frac{\left(85.42\ \frac{Bq}{g}\right)\cdot\left(\frac{60\ secs}{1\ min}\right)(4.989\ g)}{(28.5457\ g)} = 895.743\ \frac{dpm}{g}$$

Continued on Page

Read and Understood By

| | | | |
|---|---|---|---|
| Signed | JDD 12/13/07 11/13/07 Date | Signed | 1/14/08 Date |

# National Institute of Standards & Technology

# Certificate

Ram # 851

## Standard Reference Material 4326
## Polonium-209 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive Polonium-209 chloride and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of alpha-particle counting instruments and for the monitoring of radiochemical procedures.

**Radiological Hazard**: The SRM ampoule contains Polonium-209 with a total activity of approximately 500Bq. Polonium-209 decays by alpha-particle emission. None of the alpha particles escape from the SRM ampoule. During the decay process X-rays and gamma rays with energies from approximately 10 keV to 900 keV are also emitted. Most of these photons escape from the SRM ampoule but their intensities are so small that they do not represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. The SRM should be used only by persons qualified to handle radioactive material.

**Chemical Hazard**: The SRM ampoule contains hydrochloric acid with a concentration of 2 moles per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

**Storage and Handling**: The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous for at least five (5) years after receipt. Refer to reference [5] for details on the long-term stability of polonium solution standards. The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported, it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of both the radioactivity and the strong acid.

**Preparation**: This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by R. Collé of the Radioactivity Group, and

## Liquid-Scintillation Counting Warning

Polonium-209 decays primarily by alpha-particle emission. One of the principal alpha-particle transition feeds a low-energy, **delayed**, isomeric state in the lead-205 daughter. Liquid scintillation measurements of polonium-209 activity can include some of the activity of this isomeric state. Refer to reference [6] for further information about the effect of this isomeric transition on routine liquid-scintillation counting of polonium-209.

## Recommended Procedure for Opening the SRM Ampoule

1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.

2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.

PROPERTIES OF SRM 4326

**Certified values**

| | |
|---|---|
| **Radionuclide** | **Polonium-209** |
| **Reference time** | **1200 EST, 15 March 1994** |
| **Massic alpha-particle-emission rate of the solution** [b]* | **85.42 $s^{-1} \cdot g^{-1}$** (Polonium-209 only) [c] |
| **Relative expanded uncertainty ($k$=2)** | **0.42%** [d] |
| **Solution mass** | **(5.160 ± 0.003) g** [e] |
| **Solution density** | **(1.031 ± 0.004) $g \cdot mL^{-1}$ at 22 °C** [e] |

Uncertified values

| Physical Properties: | |
|---|---|
| Source description | Liquid in flame-sealed NIST borosilicate-glass ampoule |

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

| Input Quantity $x_i$, the source of uncertainty (and individual uncertainty components where appropriate) | Method Used To Evaluate $u(x_i)$, the standard uncertainty of $x_i$ (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods | Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [i] | Relative Sensitivity Factor, $\lvert\partial y/\partial x_i\rvert \cdot (x_i/y)$ [j] | Relative Uncertainty Of Output Quantity, $u_i(y)/y$, (%) [k] |
|---|---|---|---|---|
| Massic liquid scintillation count rate, corrected for background and decay | Standard deviation for repeated measurements. Six degrees of freedom. (A) | 0.06 | 1.0 | 0.06 |
| Background variability | Multiple comparisons (A) [7] | 0.20 | 0.02 [m] | 0.004 |
| Liquid-scintillator quench corrections | Multiple comparisons (A) [7] | 0.12 | 1.0 | 0.12 |
| Liquid-scintillation-cocktail stability | Multiple comparisons (A) [7] | 0.7 | 0.007 | 0.005 |
| Gravimetric measurements | Estimated (B) | 0.05 | 1.0 | 0.05 |
| Half-life of Po-208<br>Half-life of Po-209 | Standard uncertainty of the half life (A) | 0.07 [n]<br>4.9 [n] | 0.0003 [p]<br>0.004 [p] | 0.00002<br>0.02 |
| Extrapolation of alpha-particle-count-rate-versus-energy to zero energy | Estimated (B) [7] | 0.06 | 1.0 | 0.06 |
| Live time [q] | Estimated (B) [7] | 0.04 | 1.0 | 0.04 |
| Alpha-particle detection efficiency of scintillator | Estimated (B) [7] | 0.10 | 1.0 | 0.10 |
| Correction for non-alpha-particle-decay modes | Estimated (B) [7] | 0.06 | 1.0 | 0.06 |
| Alpha-particle-emitting impurities | Estimated (B) [r]<br>Limit of detection [s] | 8.1<br>100 | 0.001<br>0.0006 | 0.01<br>0.06 |
| Photon-emitting impurities | Limit of detection (B) [s] | 100 | 0.0002 | 0.02 |

| | |
|---|---|
| Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%) | 0.21 |
| Coverage Factor, $k$ | x 2 |
| Relative Expanded Uncertainty of the Output Quantity, $U/y$, (%) | 0.42 |



*Notes and references are on pages 5 and 6.

NOTES

[a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.

| Distance from Ampoule (cm): | 1 | 30 | 100 |
|---|---|---|---|
| Approximate Dose Rate (μSv/h): | < 0.1 | - | - |

[b] **Massic alpha-particle-emission rate** is the preferred name for the quantity alpha-particle-emission rate divided by the total mass of the sample. **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].

[c] The polonium-209 massic activity of the solution is 85.83 $Bq \cdot g^{-1}$, assuming an alpha-particle branching ratio of $(0.9952 \pm 0.0004)\ s^{-1} \cdot Bq^{-1}$ [h].

[d] The reported value, $y$, of massic alpha-particle emission rate (alpha-particle emission rate per unit mass) at the reference time was not measured directly but was derived [illegible]

[k] Relative component of combined standard uncertainty of output quantity $y$, rounded to two significant figures or less. The relative component of combined standard uncertainty of $y$ is given by $u_r(y)/y \equiv |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_r(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.

[m] $|\partial y/\partial x_i| \cdot (x_i/y)$ = (average background count rate)/(average net sample count rate)

[n] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of $\lambda$ (i.e., of the half life). The relative standard uncertainty of $t$ is negligible.

[p] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$

[q] The live time is determined by counting the pulses from a gated crystal-controlled oscillator.

[r] The standard uncertainty the detected impurity. $|\partial y/\partial x_i| \cdot (x_i/y)$ = {(response per Bq of

PARAGON ANALYTICS

# Alpha Spectroscopy

# Quality Control Data

# Weekly Background, Energy, and Efficiency Calibrations

# Calibration Data Summary

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Prep SOP:** PAI 711
**Analytical SOP:** PAI 714

**Reported on:** Friday, May 16, 2008
9:06:21 AM

| Lab Sample ID<br>Spectrum<br>Analysis Date | QC Type | Batch ID<br>Analysis Run | Test Name | Detector Id | Eff Spectrum<br>Bkg Spectrum<br>Egy Spectrum | Eff Date<br>Bkg Date<br>Egy Date | **RESULTS**<br>%Efficiency<br>Bkg CPM<br>Energy keV | FLAGS<br>Efficiency<br>Background<br>Energy | **LCL**<br>%Efficiency<br>Bkg CPM<br>Energy keV | **LWL**<br>%Efficiency<br>Bkg CPM<br>Energy keV | **UWL**<br>%Efficiency<br>Bkg CPM<br>Energy keV | **UCL**<br>%Efficiency<br>Bkg CPM<br>Energy keV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SMP | PL080513-1 | Po210 | 1 | C08051401 | 5/14/2008 | 28.84 | Pass | 27.36 | 27.84 | 29.76 | 30.24 |
| Spectrum #1 | | PL080513-1A | | | B08051401 | 5/14/2008 | 0.0170 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/15/2008 | | | | | C08051401 | 5/14/2008 | 5547.7 | Pass | 5497.7 | 5507.7 | 5587.7 | 5597.7 |
| 0804083-2 | SMP | PL080513-1 | Po210 | 2 | C08051402 | 5/14/2008 | 30.95 | Pass | 29.81 | 30.33 | 32.43 | 32.95 |
| Spectrum #1 | | PL080513-1A | | | B08051402 | 5/14/2008 | 0.0150 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/15/2008 | | | | | C08051402 | 5/14/2008 | 5555.7 | Pass | 5503.6 | 5513.6 | 5593.6 | 5603.6 |
| PL080513-1 | MB | PL080513-1 | Po210 | 4 | C08051404 | 5/14/2008 | 30.59 | Pass | 28.67 | 29.17 | 31.19 | 31.69 |
| Spectrum #1 | | PL080513-1A | | | B08051404 | 5/14/2008 | 0.0220 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/15/2008 | | | | | C08051404 | 5/14/2008 | 5555.8 | Pass | 5505.7 | 5515.7 | 5595.7 | 5605.7 |
| PL080513-1 | LCS | PL080513-1 | Po210 | 5 | C08051405 | 5/14/2008 | 30.74 | Pass | 29.29 | 29.80 | 31.86 | 32.37 |
| Spectrum #1 | | PL080513-1A | | | B08051405 | 5/14/2008 | 0.0130 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/15/2008 | | | | | C08051405 | 5/14/2008 | 5536.0 | Pass | 5494.9 | 5504.9 | 5584.9 | 5594.9 |
| PL080513-1 | LCSD | PL080513-1 | Po210 | 6 | C08051406 | 5/14/2008 | 30.52 | Pass | 28.86 | 29.37 | 31.39 | 31.90 |
| Spectrum #1 | | PL080513-1A | | | B08051406 | 5/14/2008 | 0.0360 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/15/2008 | | | | | C08051406 | 5/14/2008 | 5537.5 | Pass | 5487.5 | 5497.5 | 5577.5 | 5587.5 |

**Data Package ID:** *PL0804083-1*

| Abbreviations: | | | | |
|---|---|---|---|---|
| | Eff - Efficiency | Bkg - Background | LCL - Lower Control Limit | UWL - Upper Warning Limit |
| | Egy - Energy | CPM - Counts per Minute | LWL - Lower Warning Limit | UCL - Upper Control Limit |

CI - The Analysis Date exceeds the Calibration Date by more than 7 days.

# Alpha Spec Calibration Source Re-Certification

R:\INST/ALPHASPEC\CLCRT0607.XLS

**Primary Certified Source**

Source PA ID 190 was recalibrated by Isotope Products Laboratories on 6/1/2007 and received by PA on 6/6/2007

| | |
|---|---|
| Source ID: | 92MIX223027; PA ID 190 (Labled #9) |
| Total Activity: | 3780.66 dpm |
| Ref. Date: | 6/1/07 |
| Count Date: | 6/8/07 |

| | | | |
|---|---|---|---|
| U-234 Activity: | 79.16% | = | 2994.78 dpm (decay corrected) |
| U-235 Activity: | 1.74% | = | 65.93 dpm (decay corrected) |
| Am-241 Activity: | 19.09% | = | 719.92 dpm (decay corrected) |
| Combined Activity: | | | 3780.64 dpm (decay corrected) |

**Detector 9 Efficiency Determination**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | count dur (s) | Combined cpm | Known dpm | Detector efficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX223027 | 190 | 97-19-103-09 | 6/8/07 | 7202 | 30313 | 686 | 2100 | 1091.46 | 3780.64 | 28.87% |

**Sources 1 through 8 activity determination**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | count dur (s) | Detector Efficiency | Am-241 dpm | U-234 dpm | U-235 dpm | Combined dpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:24:12AM 6/11/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO 190 (source 9)
Description:

Analysis Date: 6/11/2007 8:23:31AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

### Acquisition

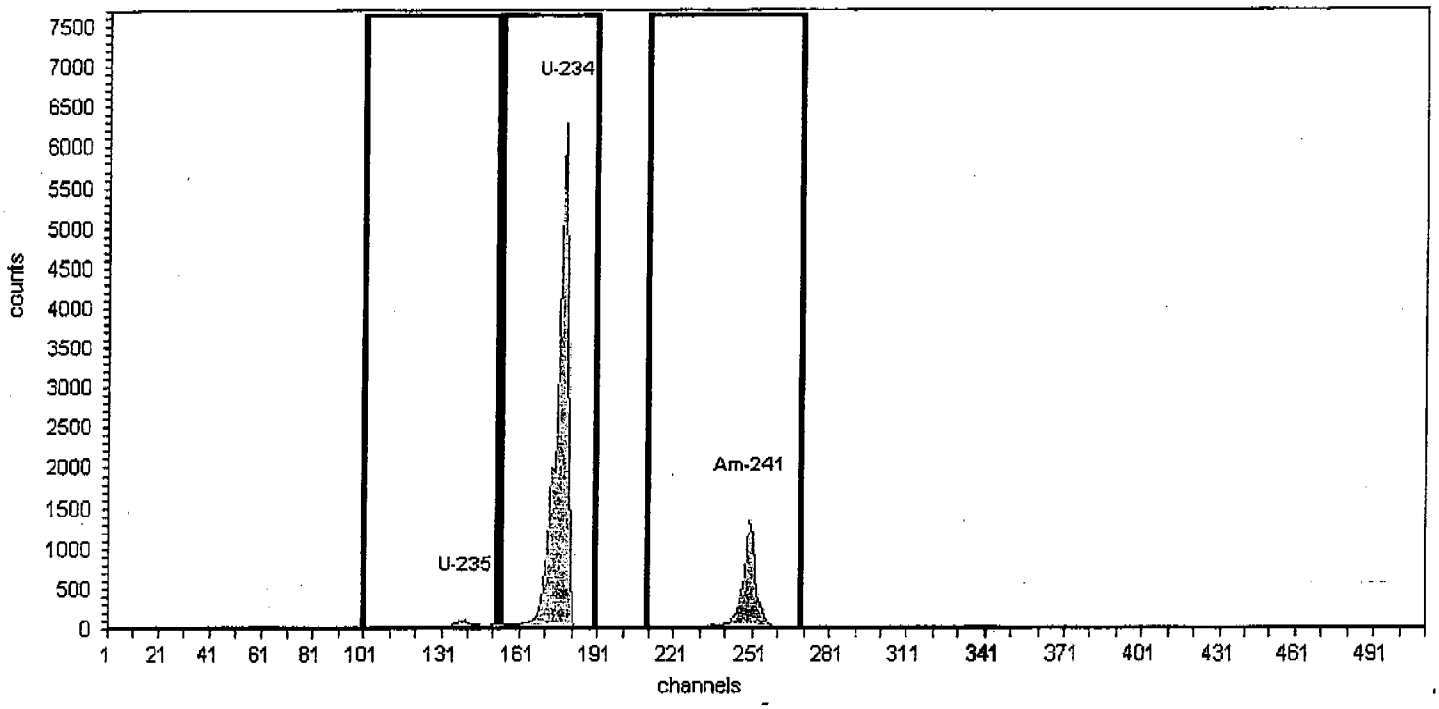
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 6:45:14AM

Live Time: 35.00 min.
Real Time: 35.01 min.

Efficiency Calibration Name: RSO 190 (source 9)

Energy Calibration Equation:
Gain = 9.9003 keV / Ch
Offset = 3,011.38 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.87% +/- 0.30% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 686.00 | 19.60 |
| U-234 | 178 | 4.78 | 153 | 190 | 30,313.00 | 866.09 |
| Am-241 | 250 | 5.49 | 210 | 270 | 7,202.00 | 205.77 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:55:35AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO182
Description:

Analysis Date: 6/8/2007 8:20:44AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A1 RSO#182
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:24PM

### Acquisition

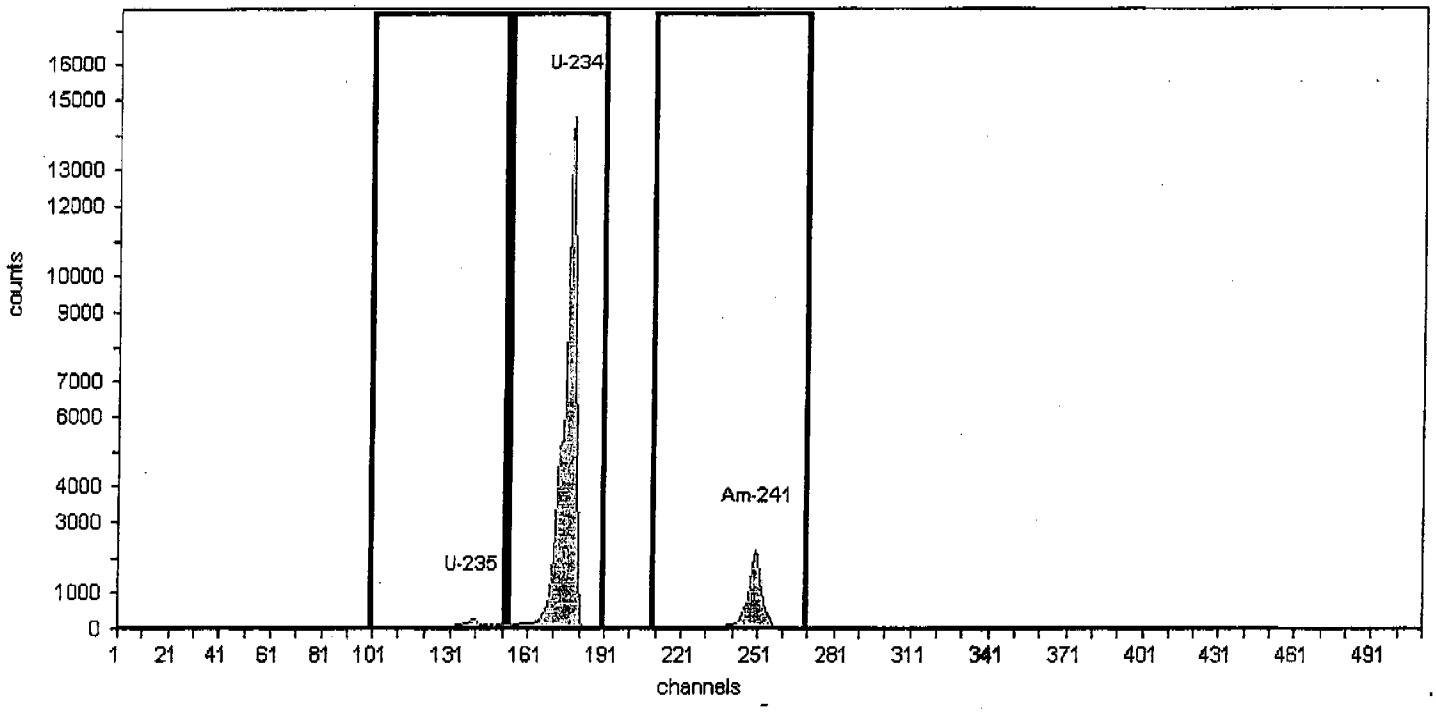
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 7:29:34AM

Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO182

Energy Calibration Equation:
Gain = 9.8224 keV / Ch
Offset = 3,029.39 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.20% +/- 0.20% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,739.00 | 49.69 |
| U-234 | 178 | 4.78 | 153 | 190 | 76,469.00 | 2,184.83 |
| Am-241 | 250 | 5.49 | 210 | 270 | 12,708.00 | 363.09 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
9:01:19AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO183
Description:

Analysis Date: 6/8/2007 9:01:07AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A2 RSO#183
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:00PM

### Acquisition

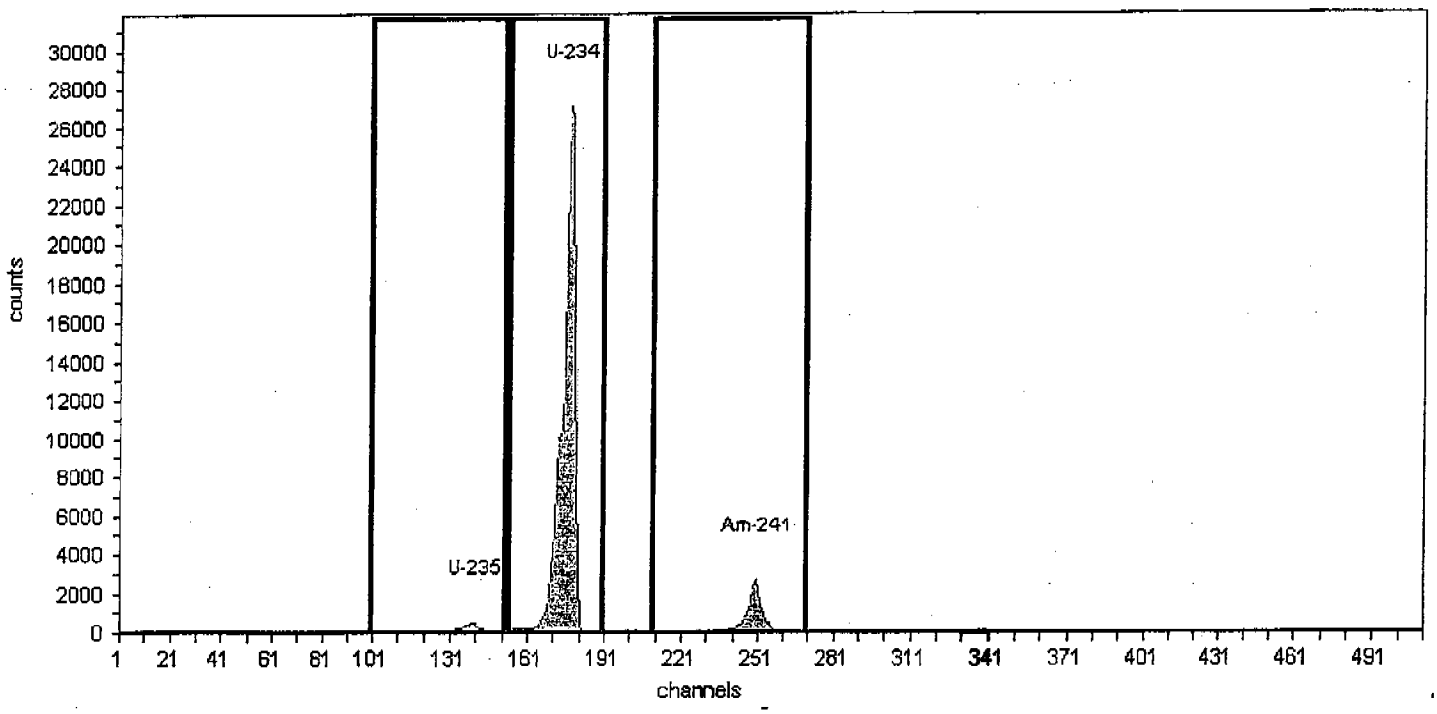
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 8:21:55AM

Live Time: 35.00 min.
Real Time: 35.05 min.

Efficiency Calibration Name: RSO183

Energy Calibration Equation:
Gain = 9.8810 keV / Ch
Offset = 3,018.33 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.98% +/- 0.15% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 3,048.00 | 87.09 |
| U-234 | 177 | 4.78 | 153 | 190 | 144,735.00 | 4,135.29 |
| Am-241 | 250 | 5.49 | 210 | 270 | 14,855.00 | 424.43 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 23

9:55:46AM 6/8/2007

### Calibration

Energy Calibration: RSO184
Description:

Analysis Date: 6/8/2007 9:55:40AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A3 RSO#184
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:00PM

### Acquisition

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 9:01:44AM

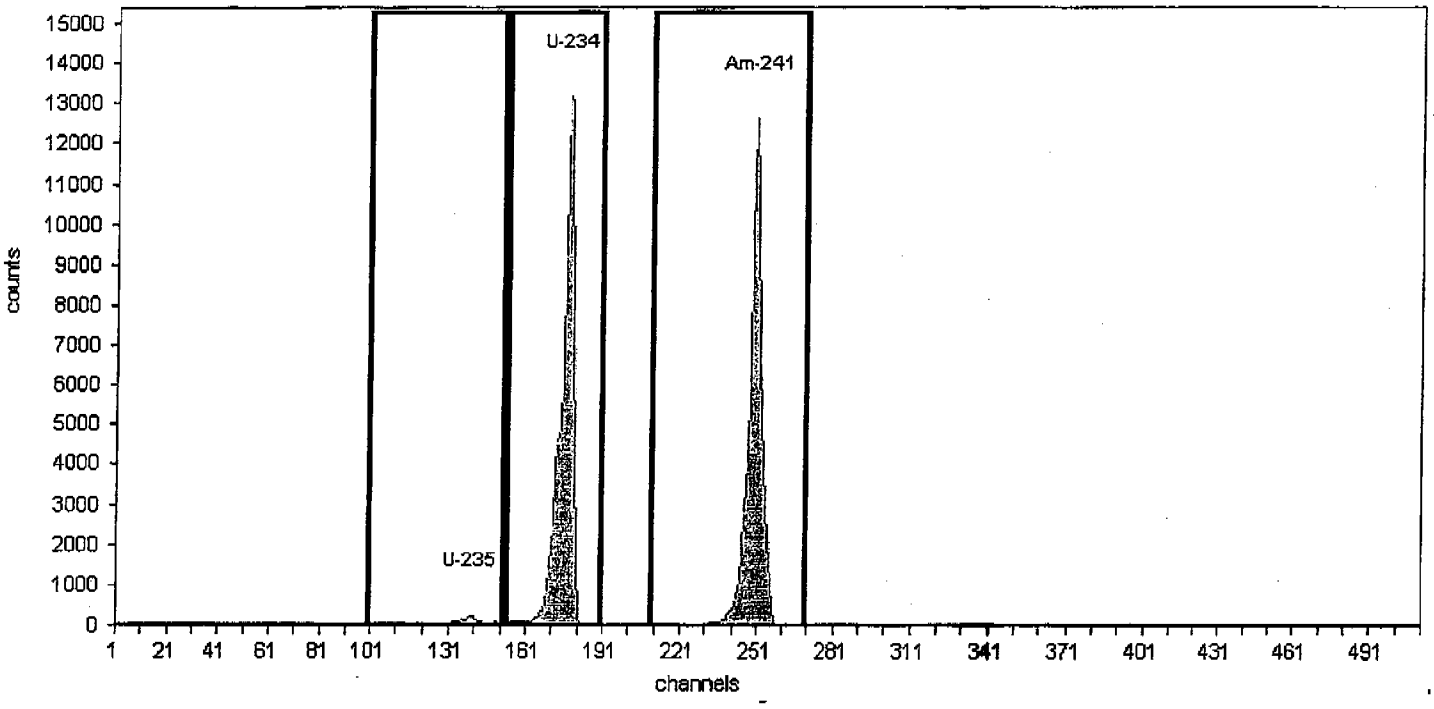
Live Time: 35.00 min.
Real Time: 35.04 min.

Efficiency Calibration Name: RSO184

Energy Calibration Equation:
Gain = 9.8047 keV / Ch

Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.14% +/- 0.16% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,458.00 | 41.66 |
| U-234 | 177 | 4.78 | 153 | 190 | 69,896.00 | 1,997.03 |
| Am-241 | 250 | 5.49 | 210 | 270 | 67,825.00 | 1,937.86 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
10:40:41AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO185
Description:

Analysis Date: 6/8/2007 10:40:28AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A4 RSO#185
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

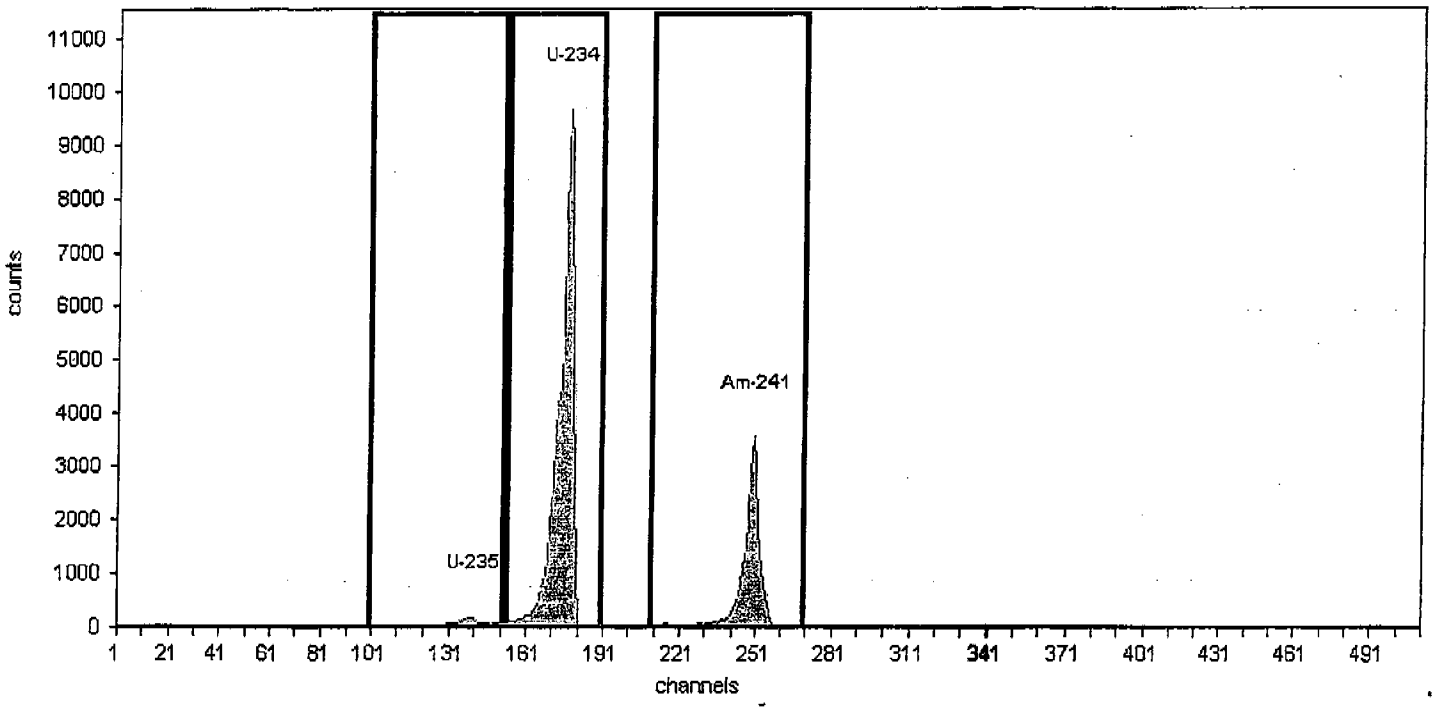
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 9:56:22AM

Live Time: 35.00 min.
Real Time: 35.02 min.

Efficiency Calibration Name: RSO185

Energy Calibration Equation:
Gain = 9.8810 keV / Ch
Offset = 3,018.33 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.41% +/- 0.20% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 1,483.00 | 42.37 |
| U-234 | 177 | 4.78 | 153 | 190 | 59,231.00 | 1,692.31 |
| Am-241 | 250 | 5.49 | 210 | 270 | 21,522.00 | 614.91 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
11:17:39AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO186
Description:

Analysis Date: 6/8/2007 11:17:32AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A5 RSO#186
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 10:41:40AM

Live Time: 35.00 min.
Real Time: 35.06 min.

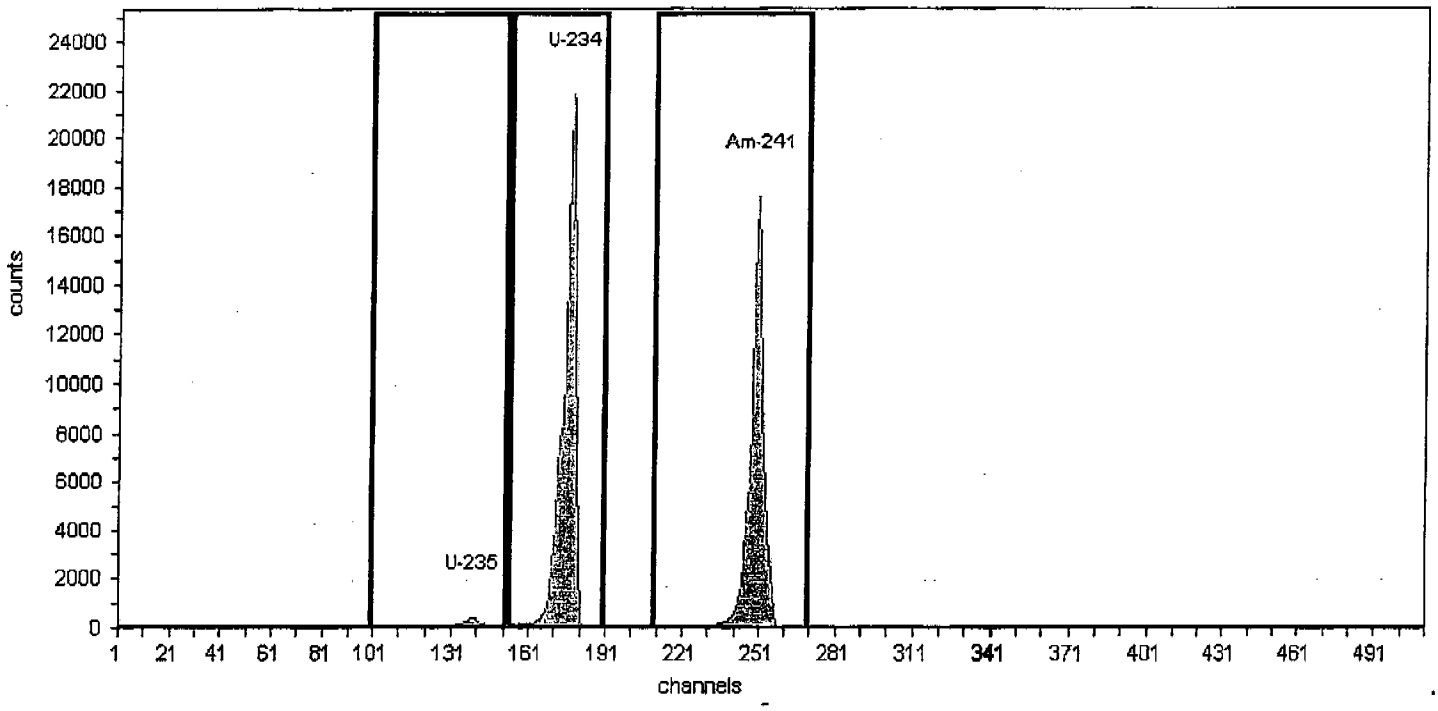
Efficiency Calibration Name: RSO186

Energy Calibration Equation:
Gain = 9.8047 keV / Ch

Offset = 3,036.00 keV

Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.13% +/- 0.13% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 2,472.00 | 70.63 |
| U-234 | 177 | 4.78 | 153 | 190 | 117,668.00 | 3,361.94 |
| Am-241 | 250 | 5.49 | 210 | 270 | 96,147.00 | 2,747.06 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
11:53:54AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO187
Description:

Analysis Date: 6/8/2007 11:53:46AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A6 RSO#187
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

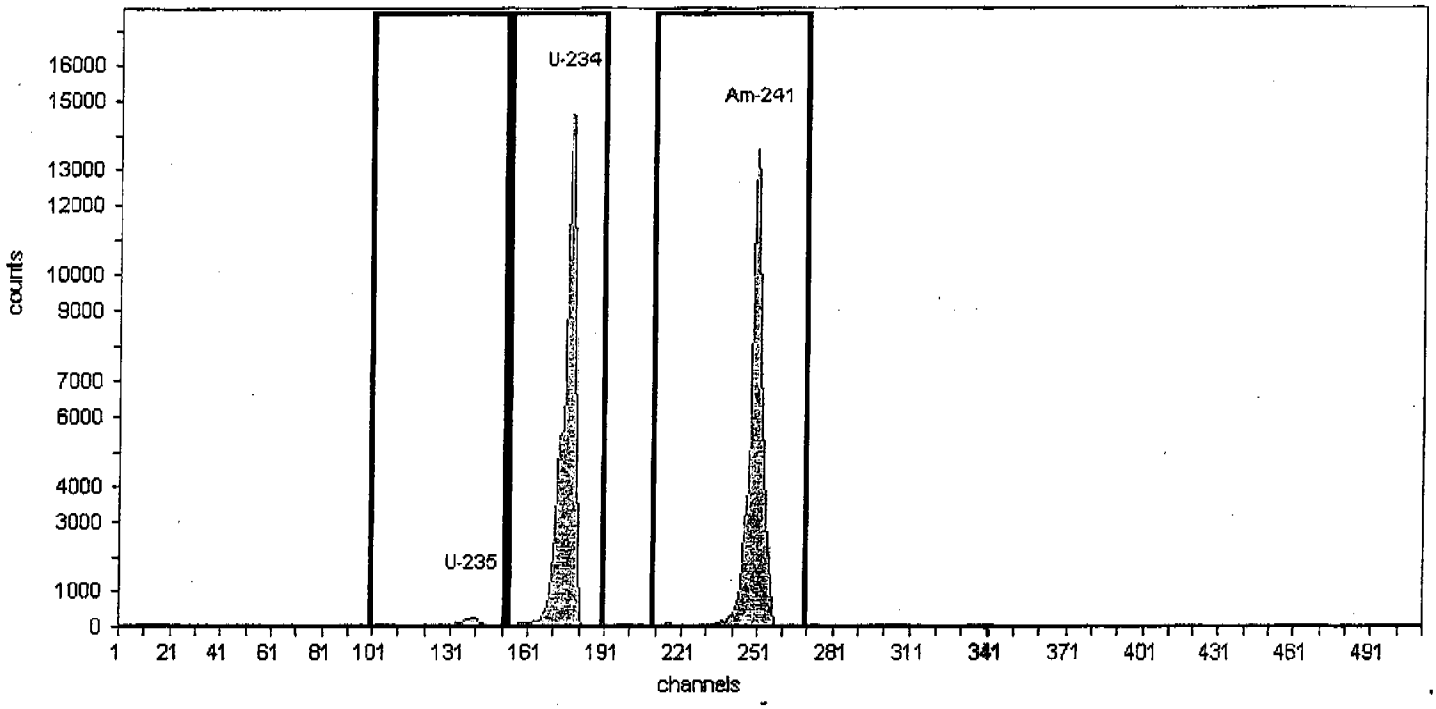
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 11:18:09AM

Live Time: 35.00 min.
Real Time: 35.05 min.

Efficiency Calibration Name: RSO187

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 28.66% +/- 0.15% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,643.00 | 46.94 |
| U-234 | 177 | 4.78 | 153 | 190 | 78,846.00 | 2,252.74 |
| Am-241 | 250 | 5.49 | 210 | 270 | 73,793.00 | 2,108.37 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:34:50PM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO188
Description:

Analysis Date: 6/8/2007 12:34:43PM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A7 RSO#188
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 11:54:29AM

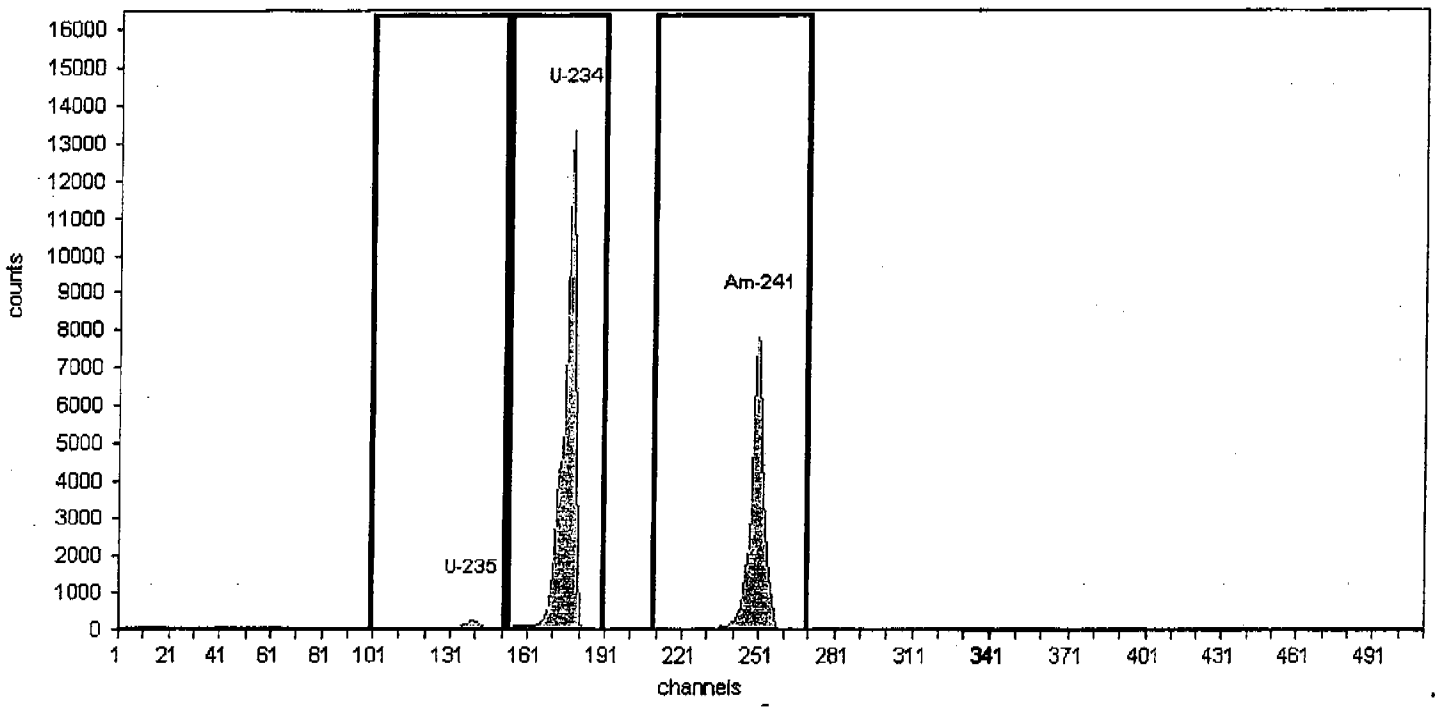
Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO188

Energy Calibration Equation:
Gain = 9.8224 keV / Ch

Offset = 3,029.39 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.21% +/- 0.18% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,369.00 | 39.11 |
| U-234 | 178 | 4.78 | 153 | 190 | 66,752.00 | 1,907.20 |
| Am-241 | 250 | 5.49 | 210 | 270 | 42,962.00 | 1,227.49 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 23

1:11:17PM 6/8/2007

***Calibration***

Energy Calibration: RSO189
Description:

Analysis Date: 6/8/2007 1:11:09PM
Calibration Type: Energy And Efficiency

***Source Info***

Certificate ID: A8 RSO#189
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

***Acquisition***

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 12:35:13PM

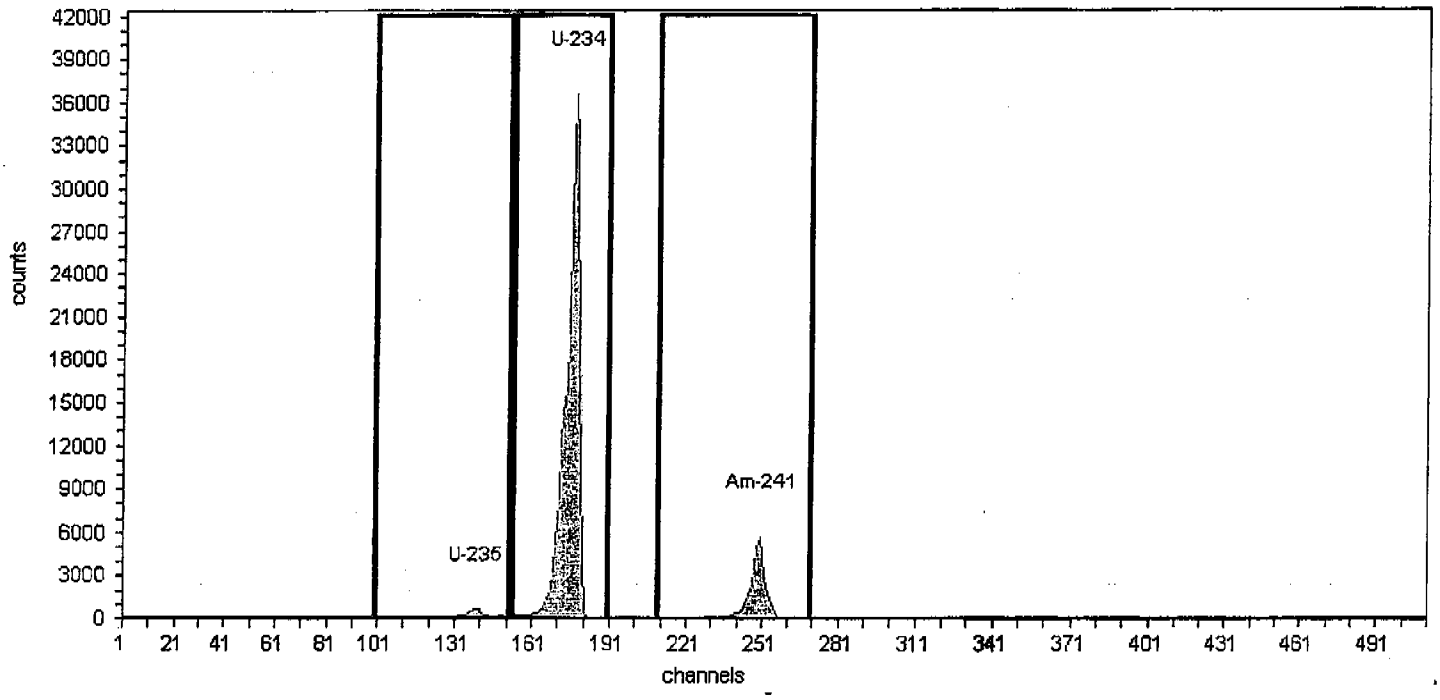
Live Time: 35.00 min.
Real Time: 35.07 min.

Efficiency Calibration Name: RSO189

Energy Calibration Equation:
Gain = 9.8047 keV / Ch

Offset = 3,036.00 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.15% +/- 0.12% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

***Nuclide Activity Summary***

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 4,335.00 | 123.86 |
| U-234 | 177 | 4.78 | 153 | 190 | 204,218.00 | 5,834.80 |
| Am-241 | 250 | 5.49 | 210 | 270 | 32,537.00 | 929.63 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:30:24AM 6/11/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO190
Description:

Analysis Date: 6/11/2007 8:30:16AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

### Acquisition

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 1:11:41PM

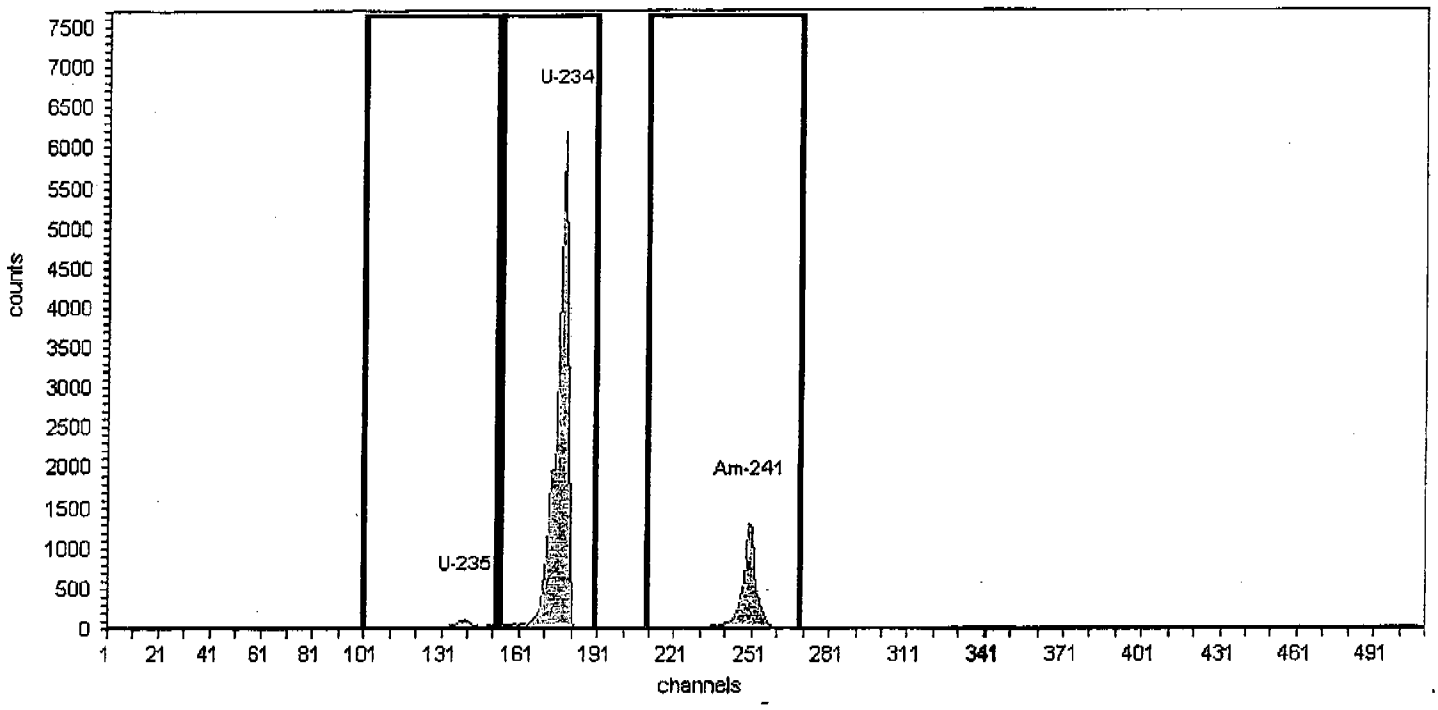
Live Time: 35.00 min.
Real Time: 35.01 min.

Efficiency Calibration Name: RSO190

Energy Calibration Equation:
Gain = 9.9003 keV / Ch

Offset = 3,011.38 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.67% +/- 0.30% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 730.00 | 20.86 |
| U-234 | 178 | 4.78 | 153 | 190 | 30,147.00 | 861.34 |
| Am-241 | 250 | 5.49 | 210 | 270 | 7,083.00 | 202.37 |

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α1
reverified 6/8/07
expires 6/8/08
PAI 187
recalibrate 4-15-03

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203026 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 3.354 | nCi | (124.1 Bq) | Am-241: | 0.5793 | nCi | (21.43 Bq) |
| U-235: | 0.06566 | nCi | (2.429 Bq) | Total Activity: | 3.999 | nCi | (148.0 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.7% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4483 α/min in 2π on 11 Apr 03.

Daniel James Van Dalsem
**Quality Control**

15-Apr-03
**Date Signed**

IPL Ref. No.: 987-7

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α2

reverified 6/6/07
expires 6/8/08
PAI 183
recalibrated 4-15-03

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203028 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 6.467 | nCi | (239.3 Bq) | Am-241: | 0.6366 | nCi | (23.55 Bq) |
| U-235: | 0.1135 | nCi | (4.200 Bq) | Total Activity: | 7.217 | nCi | (267.1 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.7% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source

24937 Avenue Tibbitts

reverified 6/8/07

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α4 reverified 6/8/07
expires 6/8/08
GW 6/22/07
PAI ID 00185
rec'd from recalibrator
3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Apr-03 12:00 PST |

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

A5 reverified 6/8/07 expires 6/8/08
PAI ID 00186
recalibration received 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Apr-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203025 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 5.486 | nCi | (203.0 Bq) | Am-241: | 3.958 | nCi | (146.4 Bq) |
| U-235: | 0.09221 | nCi | (3.412 Bq) | Total Activity: | 9.536 | nCi | (352.8 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.8% |
| B. Type B (systematic) uncertainty: | ± 3.1% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.2% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 10690 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
**Quality Control**

19-Mar-03
**Date Signed**

IPL Ref. No.: 987-2

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α6 reverified 6/8/01 expires 6/8/08
BAID 00187
recd from recalibrate 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Apr-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203022 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | |
|---|---|---|---|---|---|
| U-234: | 3.592 nCi | (132.9 Bq) | Am-241: | 3.279 nCi | (121.3 Bq) |
| U-235: | 0.08556 nCi | (3.166 Bq) | Total Activity: | 6.957 nCi | (257.4 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.8% |
| B. Type B (systematic) uncertainty: | ± 3.1% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.2% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 7799 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
**Quality Control**

19-Mar-03
**Date Signed**

IPL Ref. No.: 987-2

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α 7

reverified 6/8/07
expires 6/8/08
6/22/07
PAID 188
recd for recalibration 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Apr-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203023 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 2.895 | nCi | (107.1 Bq) | Am-241: | 1.953 | nCi | (72.26 Bq) |
| U-235: | 0.02502 | nCi | (0.9257 Bq) | Total Activity: | 4.873 | nCi | (180.3 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.8% |
| B. Type B (systematic) uncertainty: | ± 3.1% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.2% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 5463 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
**Quality Control**

19-Mar-03
**Date Signed**

IPL Ref. No.: 987-2

Isotope Products
24937 Avenue Tibbitts
Valencia, California 91355

28

reverified 6/8/07
expires 6/8/08

Eckert & Ziegler
24937 Avenue Tibbitts
Valencia, California 91355

RSO # 190

# Paragon Analytics

## Radiochemistry Case Narrative
## Isotopic Plutonium

---

## Los Alamos National Laboratory SMO

08-939

PA WO 0804083

1. This report consists of the analytical results and supporting documentation for two solid samples received by Paragon on 04/09/08.
2. These samples were prepared according to procedures PA SOP773R10, PA SOP778R12 and PA SOP777R9. Modifications were made to the method as described on QASS 328377 and 357740.
3. The samples were analyzed for the presence of isotopic plutonium according to procedure PA SOP714R11. The analyses were completed on 05/29/08.
4. The isotopic analysis results for these samples are reported on an 'as received' basis in units of pCi/gram.
5. Pu-240 is indistinguishable from Pu-239. In this report, any plutonium in this region of interest will be reported as Pu-239/240.
6. Due to insufficient sample volume, a laboratory control sample duplicate (LCSD) was prepared in lieu of a prep batch duplicate. Please refer to QASS 328377.
7. The associated method blank has a chemical yield below the 30% lower control limit at 29.8%. Spectral quality is adequate for accurate quantification. The results are submitted without further qualification. This sample is flagged with an "Y2" qualifier on the final reports. Please refer to NCR #10678.
8. The samples were prepared at a reduced aliquot of 0.5g. Consequently, the requested MDC of 0.02 pCi/gram for Pu-238 and Pu-239/240 for sample 0804083-2 and the associated method blank was not achieved following a maximum count time of 1000 minutes. These samples are identified with an "M" qualifier on the final reports.
9. No further anomalous situations were encountered during the preparation or analysis of these samples. All remaining quality control criteria were met.

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

Linda Arend
Radiochemistry Primary Reviewer

06/04/08
Date

Radiochemistry Final Data Review

6/4/08
Date

1

PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

# CHAIN OF CUSTODY

# Paragon Analytics

## Sample Number(s) Cross-Reference Table

**Paragon OrderNum:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939
**Client PO Number:** 33204-001-06 F3

| Client Sample Number | Lab Sample Number | COC Number | Matrix | Date Collected | Time Collected |
|---|---|---|---|---|---|
| SFB08-08-11838 | 0804083-1 | | SOLID | 08-Feb-08 | |
| SFB08-08-11839 | 0804083-2 | | SOLID | 08-Feb-08 | |

0804083



Tuesday, April 08, 2008

**LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 08-939C**

**REQUEST NUMBER: 08-939**

# LOS ALAMOS

**NATIONAL LABORATORY**

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 5/8/2008

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS:

| | SAMPLE ID | CTNR | CTNR DESC | ORDER | PRESERV | MATRIX |
|---|---|---|---|---|---|---|
| 1 | SFB08-08-11838 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |
| 2 | SFB08-08-11839 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |

| Relinquished By: | | Date | Time | Received By: | | Date | Time |
|---|---|---|---|---|---|---|---|
| [illegible] | | 4/8/08 | 1400 | Cheryl Trimble | Cheryl Trimble | 4-9-08 | 0930 |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |

**Received for DISPOSAL By:** **Date** **Time** **Remarks:**

Printed Name Signature

REQUEST NUMBER: 08-939

These Samples are on:

LANL Request Number:08-939

Per Agreement Number:1-800-443-1511

Project Cost Code: WEPR13110300

/2008

| NR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|
| | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |
| | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |
| | SFB08-08-11838 | S | 2/8/2008 | #1 White Rock at NM oversight office area | sent to Paragon |

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:PO-210 | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |

**Final Page of REQUEST NUMBER 08-939**

7

CONDITION OF SAMPLE UPON RECEIPT FORM **Paragon Analytics**

Client: LANL Workorder No: 0804083

Project Manager: LS Initials: CT Date: 4-9-08

| | | | |
|---|---|---|---|
| 1. Does this project require any **special handling** in addition to standard Paragon procedures? | | YES | (NO) |
| 2. Are custody **seals** on **shipping containers** intact? | NONE | (YES) | NO |
| 3. Are Custody seals on **sample containers** intact? | **NONE** | (YES) | NO |
| 4. Is there a **COC (Chain-of-Custody) present** or other representative documents? | | (YES) | NO |
| 5. Are the **COC and bottle labels complete and legible**? | | (YES) | NO |

ORIGIN ID: SAFA (505) 665-9968
JOYLENE VALDEZ
LOS ALAMOS NATL LAB
TA00 BLDG 1237 DPU 03

LOS ALAMOS, NM 87545
UNITED STATES US

Ship Date: 08APR08
ActWgt: 31.0 LB MAN
System#: 0014176/CAFE2355
Account: S *********

0804083

LANCE STEERE
PARAGON
225 COMMERCE

16

(800) 443-1511
FedEx
Express

FORT COLLINS, CO 80524

2

E

f: 6b010amr1a01401hco

CLS#501107/22/23

6

Delivery Address
Barcode

BILL SENDER

PRIORITY OVERNIGHT

WED
Deliver By:
09APR08

# 7209 7844 0486

Form
0201

DEN
AA

0524 -CO-US

XH FTCA

2

PARAGON ANALYTICS
Radiochemistry Data Package

Section 2

# SAMPLE RESULTS SUMMARY

# Isotopic Plutonium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Page:** 1 of 1
**Reported on:** Wednesday, June 04, 2008 10:01:00 AM

| Lab Sample ID | Client Sample ID | Sample Type | Nuclide | Result +/- 1 s TPU | MDC | Units | Matrix | Prep Batch | Date Analyzed | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SFB08-08-11838 | Sample | Pu-238 | 0.021 +/- 0.017 | 0.019 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | |
| 0804083-1 | SFB08-08-11838 | Sample | Pu-239/240 | 0.028 +/- 0.017 | 0.019 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | |
| 0804083-2 | SFB08-08-11839 | Sample | Pu-238 | 0 +/- 0.014 | 0.058 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | U,M |
| 0804083-2 | SFB08-08-11839 | Sample | Pu-239/240 | 0.024 +/- 0.015 | 0.045 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | U,M |

**Comments:**

**Data Package ID:** *PU0804083-1*

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
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)

BDL - Below Detection Limit

3

PARAGON ANALYTICS
Radiochemistry Data Package

Section 3

# QC RESULTS SUMMARY

# Isotopic Plutonium By Alpha Spectroscopy

## PAI 714 Rev 11

## Method Blank Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** AS080513-2MB

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 29-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2B
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13981-16-3 | Pu-238 | -0.009 +/- 0.023 | 0.086 | 0.02 | Y2,U,M |
| 10-12-8 | Pu-239/240 | 0 +/- 0.023 | 0.068 | 0.02 | Y2,U,M |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Pu-242 | 4.252 | 1.27 | pCi/g | 29.8 | 30 - 110 % | Y2 |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Data Package ID:** *PU0804083-1*

# Isotopic Plutonium By Alpha Spectroscopy

## PAI 714 Rev 11

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** AS080513-2LCS

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2B
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 10-12-8 | Pu-239/240 | 4.48 +/- 0.42 | 0.02 | 4.45 | 101 | 82 - 118 | P |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Pu-242 | 4.252 | 1.61 | pCi/g | 38.0 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

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

Abbreviations:

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

**Data Package ID:** *PU0804083-1*

# Isotopic Plutonium By Alpha Spectroscopy

## PAI 714 Rev 11

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** AS080513-2LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2B
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 10-12-8 | Pu-239/240 | 4.55 +/- 0.41 | 0.07 | 4.45 | 102 | 82 - 118 | P,M3 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Pu-242 | 4.252 | 1.93 | pCi/g | 45.5 | 30 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

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

Abbreviations:

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

**Data Package ID:** *PU0804083-1*

# Isotopic Plutonium By Alpha Spectroscopy

## PAI 714 Rev 11

## Duplicate Sample Results (DER)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:**
**Lab ID:** AS080513-2LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2B
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Analyte | Sample Result +/- 1s TPU | Duplicate Result +/- 1s TPU | DER | Control Limit | Lab Qualifiers |
|---|---|---|---|---|---|---|
| 10-12-8 | Pu-239/240 | 4.48 +/- 0.42 | 4.55 +/- 0.41 | 0.06 | 2.13 | P,M3 |

**Comments:**

**Duplicate Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13
LT - Result is less than Request MDC, greater than sample specific MDC
M - Requested MDC not met.
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
L - LCS Recovery below lower control limit.
H - LCS Recovery above upper control limit.
P - LCS, Matrix Spike Recovery within control limits.
N - Matrix Spike Recovery outside control limits

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
DER - Duplicate Error Ratio (see PAI SOP 715)
BDL - Below Detection Limit
NR - Not Reported

**Data Package ID:** *PU0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

4

Section 4

# INDIVIDUAL SAMPLE RESULTS

# Isotopic Plutonium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Sample Matrix:** SOLID

# Isotopic Plutonium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2B
**Count Time:** 1000 minutes
**Report Basis:** As Received

**Final Aliquot:** 0.595 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 13981-16-3 | Pu-238 | 0 +/- 0.014 | 0.058 | 0.02 | U,M |
| 10-12-8 | Pu-239/240 | 0.024 +/- 0.015 | 0.045 | 0.02 | U,M |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Pu-242 | 3.748 | 1.84 | pCi/g | 49.2 | 30 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

**Data Package ID:** *PU0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

5

Section 5

# RAW DATA

# scopy Raw Data Report

**Reported on:** Friday, May 30, 2008
1:35:08 PM

| Count Date/Time | Net Cnts Bkg Cnts | BaseEff Bkg(min) | CntDur(min) Yield | Activity +/- 1 s TPU | MDC DecLev | ReportUnits ReportBasis | DER RPD | %Spk. Recov Flags |
|---|---|---|---|---|---|---|---|---|
| 5/28/2008 | 3.000 | 31.94% | 1000 | 0.021 | 0.019 | pCi/g | NA | |
| 6:01 PM | 0.000 | 1000 | 44.0% | 0.017 | NA | As Received | NA | |
| 5/28/2008 | 4.000 | 31.94% | 1000 | 0.028 | 0.019 | pCi/g | NA | |
| 6:01 PM | 0.000 | 1000 | 44.0% | 0.017 | NA | As Received | NA | |
| 5/28/2008 | 696.000 | 31.94% | 1000 | 2.16 | 0.03 | pCi/g | NA | |
| 6:01 PM | 2.000 | 1000 | 44.0% | 0.18 | NA | As Received | NA | |
| 5/28/2008 | 0.000 | 32.12% | 1000 | 0 | 0.058 | pCi/g | NA | |
| 6:00 PM | 4.000 | 1000 | 49.2% | 0.014 | NA | As Received | NA | U,M |
| 5/28/2008 | 5.000 | 32.12% | 1000 | 0.024 | 0.045 | pCi/g | NA | |
| 6:00 PM | 2.000 | 1000 | 49.2% | 0.015 | NA | As Received | NA | U,M |
| 5/28/2008 | 782.000 | 32.12% | 1000 | 1.84 | 0.02 | pCi/g | NA | |
| 6:00 PM | 1.000 | 1000 | 49.2% | 0.15 | NA | As Received | NA | |
| 5/29/2008 | -1.000 | 31.10% | 1000 | -0.009 | 0.086 | pCi/g | NA | |
| 2:37 PM | 2.000 | 1000 | 29.8% | 0.023 | NA | As Received | NA | Y2,U,M |
| 5/29/2008 | 0.000 | 31.10% | 1000 | 0 | 0.068 | pCi/g | NA | |
| 2:37 PM | 1.000 | 1000 | 29.8% | 0.023 | NA | As Received | NA | Y2,U,M |
| 5/29/2008 | 458.000 | 31.10% | 1000 | 1.27 | 0.03 | pCi/g | NA | |
| 2:37 PM | 2.000 | 1000 | 29.8% | 0.11 | NA | As Received | NA | Y2 |
| 5/28/2008 | 628.000 | 31.73% | 1000 | 4.48 | 0.02 | pCi/g | NA | 101 |
| 6:00 PM | 0.000 | 1000 | 38.0% | 0.42 | NA | As Received | NA | P |
| 5/28/2008 | 596.000 | 31.73% | 1000 | 1.61 | 0.01 | pCi/g | NA | |
| 6:00 PM | 0.000 | 1000 | 38.0% | 0.14 | NA | As Received | NA | |

## Notes:

1) The Tracer results are not yield corrected (i.e. activity measured not activity added).

2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

## Abbreviations:

TR- Tracer TA - Target Analyte

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

uested MDC.

# Isotopic Plutonium By Alpha Spectroscopy Raw Data Report

**Laboratory Name:** Paragon Analytics

**PAI Work Order:** 0804083

**Prep SOP:** PAI 778

**Analytical SOP:** PAI 714

**Reported on:** Friday, May 30, 2008 1:35:08 PM

| Sample ID<br>QC Type | Nuclide<br>Type | Sample<br>Date/Time | Prep Batch<br>QCBatchID | Ingrowth Date<br>/Time | Decay<br>Date/Time | Matrix<br>%Moist. | Samp Alq<br>Analy Alq | Inst ID<br>Det ID | AnRunID<br>File Name | Count<br>Date/Time | Net Cnts<br>Bkg Cnts | BaseEff<br>Bkg(min) | CntDur(min)<br>Yield | Activity +/-<br>1 s TPU | MDC<br>DecLev | ReportUnits<br>ReportBasis | DER<br>RPD | %Spk. Recov<br>Flags |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS080513-2 | Pu-239/240 | 5/13/2008 | AS080513-2 | NA | NA | SOLID | 0.53 g | AlphaSpec2 | AS080513-2B | 5/28/2008 | 737.000 | 30.58% | 1000 | 4.55 | 0.07 | pCi/g | 0.06 | 102 |
| LCSD | Trg. Analyte | 9:46:35 AM | AS080513-2-1 | NA | NA | NA | 0.524 g | 52 | Spectrum #1 | 6:01 PM | 3.000 | 1000 | 45.5% | 0.41 | NA | As Received | NA | P,M3 |
| AS080513-2 | Pu-242 | 5/13/2008 | AS080513-2 | NA | NA | SOLID | 0.53 g | AlphaSpec2 | AS080513-2B | 5/28/2008 | 688.000 | 30.58% | 1000 | 1.93 | 0.01 | pCi/g | NA | |
| LCSD | Tracer | 9:46:35 AM | AS080513-2-1 | NA | NA | NA | 0.524 g | 52 | Spectrum #1 | 6:01 PM | 0.000 | 1000 | 45.5% | 0.16 | NA | As Received | NA | |

**Comments:**

**Data Package ID:** *PU0804083-1*

**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

+ - Duplicate RPD not within limits.

LT - Result is less than Request MDC, greater than sample specific MDC

* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.

\# - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

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

NC - Not Calculated for duplicate results less than 5 times MDC

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

**Notes:**

1) The Tracer results are not yield corrected (i.e. activity measured not activity added).

2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

**Abbreviations:**

TR- Tracer TA - Target Analyte

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 0804083-1
Spectrum #1 Analysis #1

Sample Size : 0.45

### Acquisition

Detector: 8
Batch Name: PAS080513-2_A
Nuclide Library: iso-Pu
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Iso-Pu

Acquisition Start Date: 5/28/2008 6:01:03PM
Live Time: 1,000.00 min.
Real Time: 1,001.49 min.
Dead Time: 0.15 %

### Calibration

Bkgd Info: Sample: B08052708; Det: 8; Spectrum #1; May-27-2008 16:51

Calibration Date: 5/27/2008 3:56:46PM

Efficiency Calibration: C08052708

Efficiency: 31.94% +/- 0.13% TPU(2 sigma)

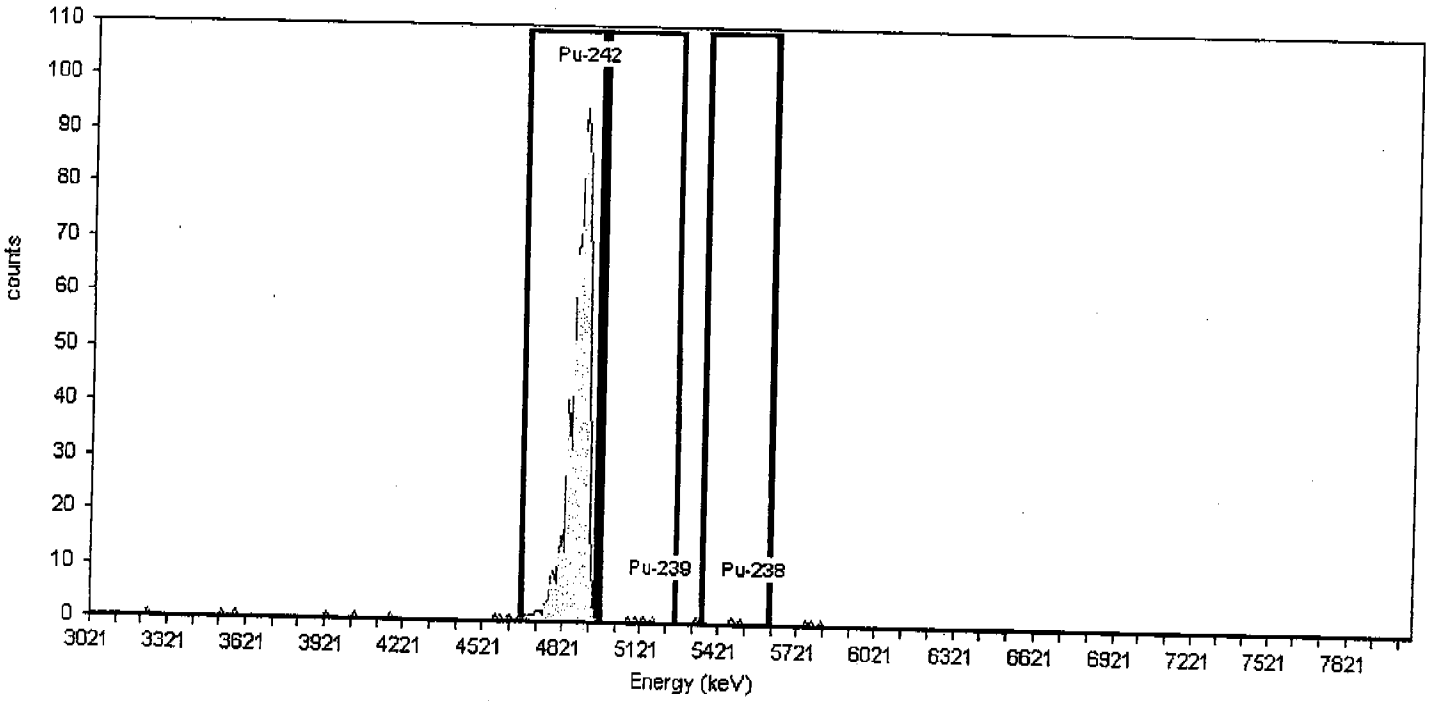
Energy Calibration: C08052708

Energy Cal: Gain = 9.9003 keV / Ch
Offset = 3,011.38 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 846.3020.88
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Pu-242
Tracer Recovery: 43.37%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-242 | 4892.4 | 4664.7 | 4951.8 | 63.4 | 100.5 | 698.00 | 2.00 | 696.00 | 2.2E+000 | 1.7E-001 | 2.4E-002 | 6.7E-002 |
| Pu-239 | 5199.3 | 4961.7 | 5258.7 | 82.5 | 100.0 | 4.00 | 0.00 | 4.00 | 2.9E-002 | 3.3E-002 | 0.0E+000 | 2.0E-002 |
| Pu-238 | 5555.8 | 5357.7 | 5615.2 | 21.4 | 100.0 | 3.00 | 0.00 | 3.00 | 2.2E-002 | 2.9E-002 | 0.0E+000 | 2.0E-002 |

Reviewed By: GB

Print Date: 5/29/2008 11:01:53AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 0804083-2
Spectrum #1 Analysis #1

Sample Size : 0.59

### Acquisition

Detector: 49
Batch Name: PAS080513-2_A
Nuclide Library: iso-Pu
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Iso-Pu

Acquisition Start Date: 5/28/2008 6:00:58PM
Live Time: 1,000.00 min.
Real Time: 1,000.02 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08052749; Det: 49; Spectrum #1; May-27-2008 16:50

Calibration Date: 5/27/2008 4:29:21PM

Efficiency Calibration: C08052749

Efficiency: 32.12% +/- 0.21% TPU(2 sigma)

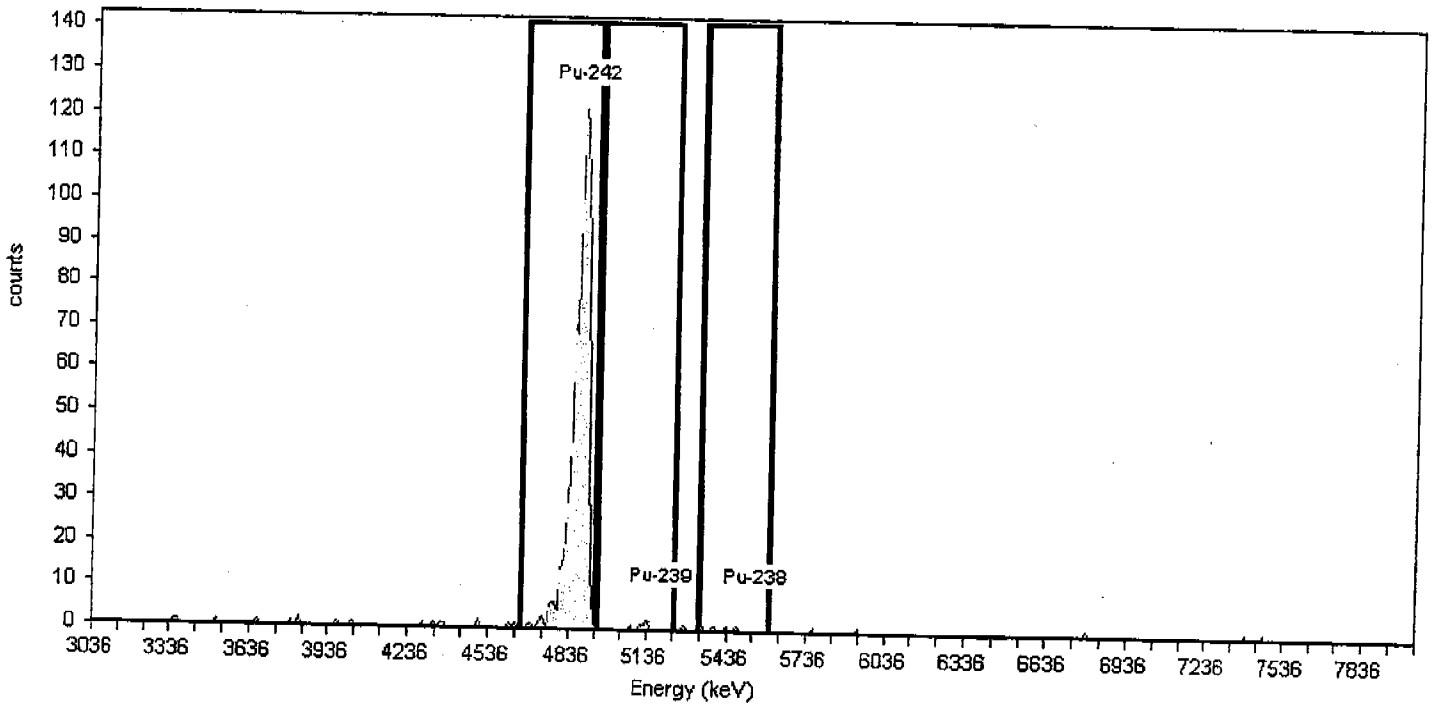
Energy Calibration: C08052749

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,026.20 keV
Quadratic = 0.0000 keV / Ch²

### Tracer

Tracer Name: 846.3020.88
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Pu-242
Tracer Recovery: 48.46%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-242 | 4889.1 | 4653.8 | 4938.1 | 55.4 | 100.5 | 783.00 | 1.00 | 782.00 | 1.8E+000 | 1.3E-001 | 1.1E-002 | 3.6E-002 |
| Pu-239 | 5193.0 | 4947.9 | 5242.1 | 30.4 | 100.0 | 7.00 | 2.00 | 5.00 | 2.4E-002 | 2.9E-002 | 1.6E-002 | 4.5E-002 |
| Pu-238 | 5546.0 | 5340.1 | 5595.0 | 16.2 | 100.0 | 4.00 | 4.00 | 0.00 | 0.0E+000 | 2.8E-002 | 2.3E-002 | 5.9E-002 |

Reviewed By: GB

Print Date: 5/29/2008 11:00:55AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS080513-2MB
Spectrum #1 Analysis #1

Sample Size : 0.53

### Acquisition

Detector: 33
Batch Name: PAS080513-2_B
Nuclide Library: iso-Pu
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: iso-Pu

Acquisition Start Date: 5/29/2008 2:37:53PM
Live Time: 1,000.00 min.
Real Time: 1,000.02 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08052733; Det: 33; Spectrum #1; May-27-2008 17:12

Calibration Date: 5/27/2008 2:51:02PM

Efficiency Calibration: C08052733A

Efficiency: 31.10% +/- 0.20% TPU(2 sigma)

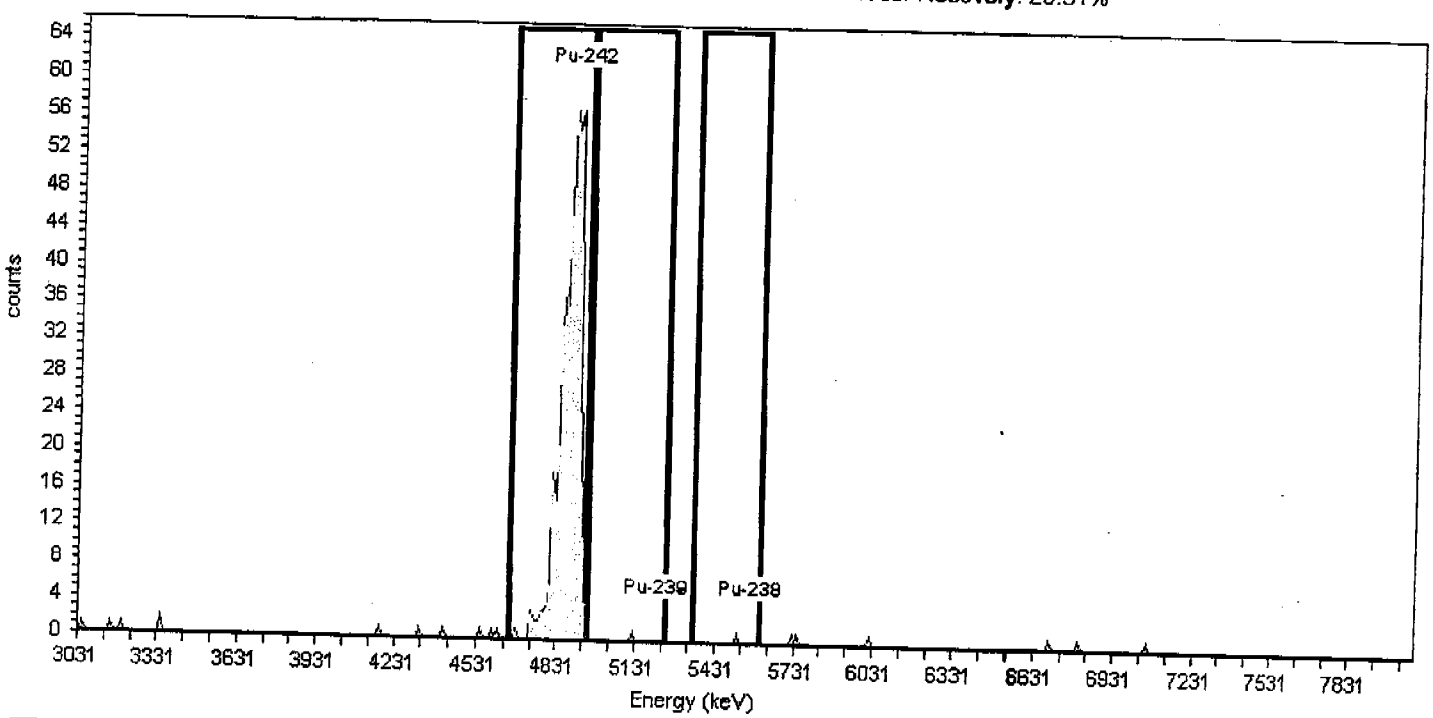
Energy Calibration: C08052733A

Energy Cal: Gain = 9.9003 keV / Ch
Offset = 3,021.28 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 846.3020.88
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Pu-242
Tracer Recovery: 29.31%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-242 | 4902.3 | 4654.8 | 4941.9 | 86.7 | 100.5 | 460.00 | 2.00 | 458.00 | 1.2E+000 | 1.2E-001 | 3.1E-002 | 8.6E-002 |
| Pu-239 | 5209.2 | 4951.8 | 5248.8 | 24.2 | 100.0 | 1.00 | | | | | | |

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS080513-2LCS
Spectrum #1 Analysis #1

Sample Size : 0.52

### Acquisition

Detector: 51
Batch Name: PAS080513-2_A
Nuclide Library: iso-Pu
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Iso-Pu

Acquisition Start Date: 5/28/2008 6:00:59PM
Live Time: 1,000.00 min.
Real Time: 1,000.02 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08052751; Det: 51; Spectrum #1; May-27-2008 16:50

Calibration Date: 5/27/2008 4:29:59PM

Efficiency Calibration: C08052751

Efficiency: 31.73% +/- 0.16% TPU(2 sigma)

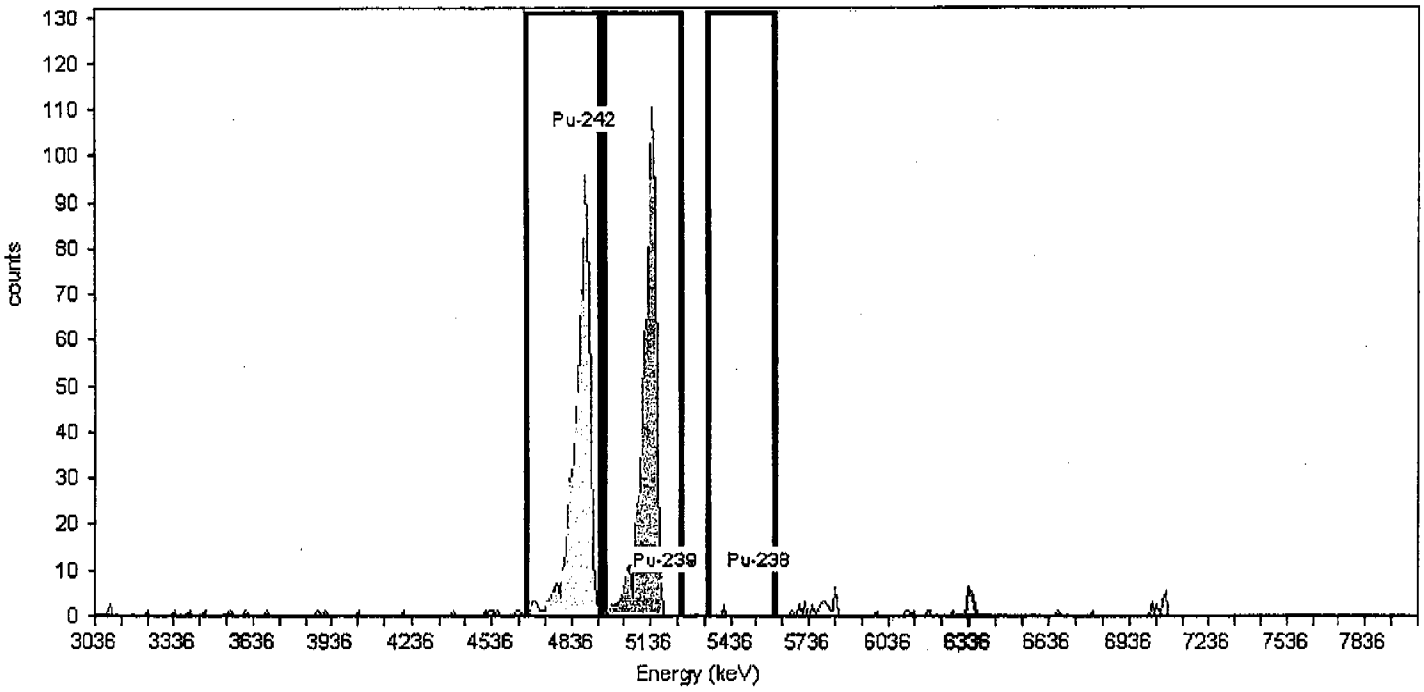
Energy Calibration: C08052751

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,026.20 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 846.3020.88
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Pu-242
Tracer Recovery: 37.39%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-242 | 4889.1 | 4663.6 | 4947.9 | 56.4 | 100.5 | 596.00 | 0.00 | 596.00 | 1.6E+000 | 1.3E-001 | 0.0E+000 | 2.0E-002 |
| Pu-239 | 5193.0 | 4957.7 | 5251.9 | 47.8 | 100.0 | 628.00 | 0.00 | 628.00 | 4.6E+000 | 6.9E-001 | 0.0E+000 | 2.0E-002 |
| Pu-238 | 5546.0 | 5349.9 | 5604.8 | 24.0 | 100.0 | 2.00 | 4.00 | -2.00 | -1.4E-002 | 3.6E-002 | 3.4E-002 | 8.7E-002 |

Reviewed By: GB

Print Date: 5/29/2008 11:02:10AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS080513-2LCSD
Spectrum #1 Analysis #1

Sample Size : 0.52

### Acquisition

Detector: 52
Batch Name: PAS080513-2_A
Nuclide Library: iso-Pu
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Iso-Pu

Acquisition Start Date: 5/28/2008 6:01:00PM
Live Time: 1,000.00 min.
Real Time: 1,000.02 min.
Dead Time: 0.00 %

### Calibration

Bkgd Info: Sample: B08052752; Det: 52; Spectrum #1; May-27-2008 16:50

Calibration Date: 5/27/2008 4:30:26PM

Efficiency Calibration: C08052752

Efficiency: 30.58% +/- 0.21% TPU(2 sigma)

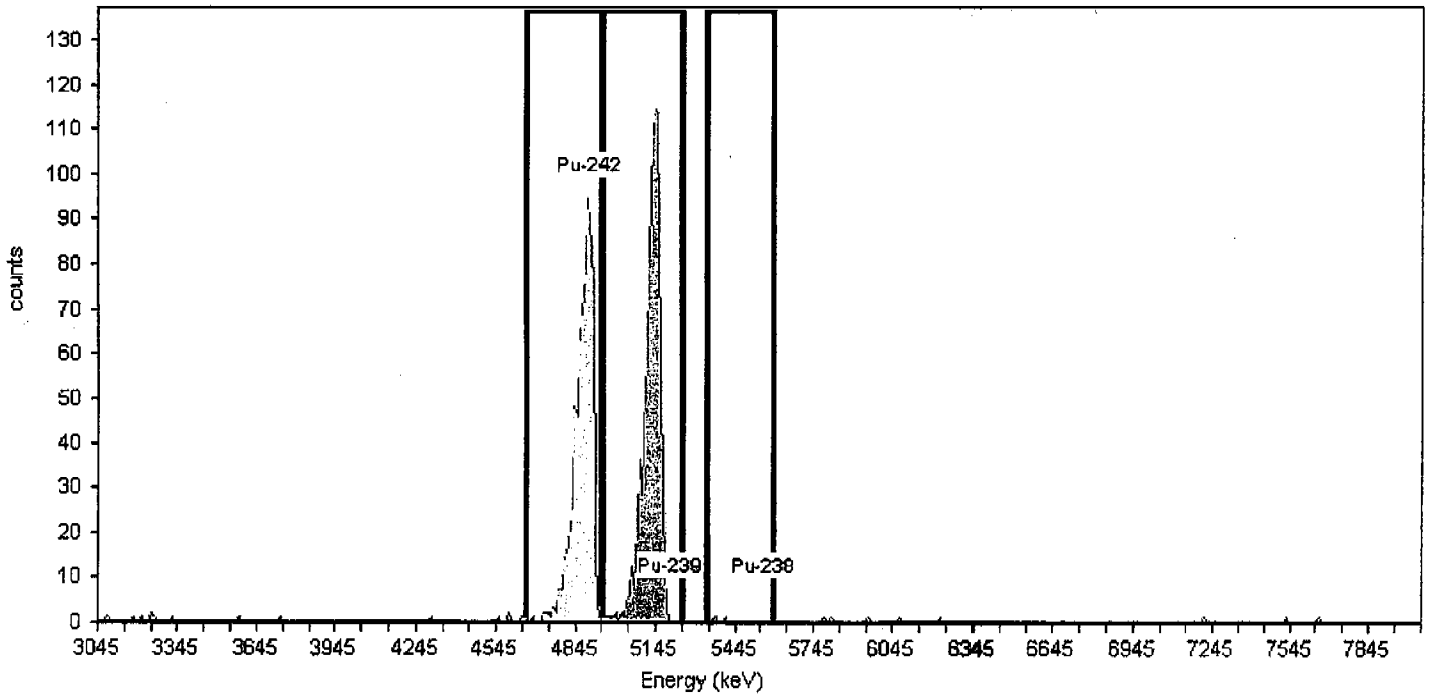
Energy Calibration: C08052752

Energy Cal: Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch$^2$

### Tracer

Tracer Name: 846.3020.88
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Pu-242
Tracer Recovery: 44.78%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-242 | 4898.9 | 4653.8 | 4938.1 | 71.0 | 100.5 | 688.00 | 0.00 | 688.00 | 1.9E+000 | 1.5E-001 | 0.0E+000 | 1.7E-002 |
| Pu-239 | 5202.9 | 4947.9 | 5242.1 | 51.3 | 100.0 | 740.00 | 3.00 | 737.00 | 4.6E+000 | 6.8E-001 | 2.5E-002 | 6.8E-002 |
| Pu-238 | 5555.8 | 5340.1 | 5595.0 | 62.9 | 100.0 | 2.00 | 1.00 | 1.00 | 6.3E-003 | 2.2E-002 | 1.5E-002 | 4.6E-002 |

Reviewed By: GB

Print Date: 5/29/2008 11:02:25AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

ORM 746r8.xls (10/2/07)

# Paragon Analytics

**366009** Alpha Spectrometer Instrument Run Log

Date: 5/28/08

| Detector | Batch ID | Sample ID | Iso/Matrix | Duration | Initial |
|---|---|---|---|---|---|
| 18 | TAS080519-1_D | 0805115-4P | Th/w | 1000 | GB |
| 19 | ↓ | AS080519-1MB | ↓ | ↓ | ↓ |
| 21 | UAS080519-2_B | 0805115-14 | U/w | 1000 | GB |
| 22 | UAS080516-1_D | 0805122-1 | U/s | 1000 | GB |
| 23 | ↓ | ↓ -2 | ↓ | ↓ | ↓ |
| 24 | UAS080522-4_C | 0805155-19 | U/w | 1000 | GB |
| 25 | ↓ | AS080522-4LCSD | ↓ | ↓ | ↓ |
| 26 | UAS080522-8_A | 0805155-1 | U/w | 1000 | GB |
| 27 | ↓ | ↓ -2 | ↓ | ↓ | ↓ |
| 28 | | -3 | | | |
| 29 | | -4 | | | |
| 30 | | -5 | | | |
| 31 | | -6 | | | |
| 32 | | -7 | | | |
| 57 | | -8 | | | |
| 58 | | -9 | | | |
| 59 | | -10 | | | |
| 60 | | ↓ -11 | | | |
| 61 | | AS080522-8MB | | | |
| 62 | | ↓ -8LCS | | | |
| 63 | | ↓ -8LCSD | ↓ | ↓ | ↓ |
| 64 | UAS080513-2_A | 0804083-1 | U/s | 1000 | GB |
| 1 | AAS080513-2_A | 0804083-1 | Am/s | 1000 | GB |
| 2 | ↓ | ↓ -2 | ↓ | ↓ | ↓ |

| Detector | Batch ID | Sample ID | Iso/Matrix | Duration | Initial |
|---|---|---|---|---|---|
| 4 | AAS080513-2_A | AS080513-2MB | Am/s | 1000 | GB |
| 5 | ↓ | ↓ -2LCS | ↓ | ↓ | ↓ |
| 6 | ↓ | ↓ -2LCSD | ↓ | ↓ | ↓ |
| 8 | PAS080513-2_A | 0804083-1 | Pu/s | 1000 | GB |
| 49 | ↓ | ↓ -2 | ↓ | ↓ | ↓ |
| 50 | ↓ | AS080513-2MB | ↓ | ↓ | ↓ |
| 51 | ↓ | ↓ -2LCS | ↓ | ↓ | ↓ |
| 52 | ↓ | ↓ -2LCSD | ↓ | ↓ | ↓ |
| 53 | PAS080516-4_C | 0805122-14 | Pu/w | 1160 | GB |
| 54 | ↓ | ↓ -14D | ↓ | ↓ | ↓ |
| ~~55~~ 33 | ↓ | ↓ -19 | ↓ | ↓ | ↓ |
| 34 | ↓ | AS080516-4MB | ↓ | ↓ | ↓ |
| 35 | ↓ | ↓ -4LCS | ↓ | ↓ | ↓ |
| 36 | ↓ | ↓ -4LCSD | ↓ | ↓ | ↓ |
| 37 | PAS080523-2_A | 0805113-5 | Pu/w | 1000 | GB |
| 39 | ↓ | ↓ -10 | ↓ | ↓ | ↓ |
| 40 | ↓ | 0805121-5 | ↓ | ↓ | ↓ |
| 42 | ↓ | ↓ -10 | ↓ | ↓ | ↓ |
| 43 | ↓ | 0805139-5 | ↓ | ↓ | ↓ |
| 45 | ↓ | AS080523-2MB | ↓ | ↓ | ↓ |
| 46 | ↓ | ↓ -2LCS | ↓ | ↓ | ↓ |
| 47 | ↓ | ↓ -2LCSD | ↓ | ↓ | ↓ |
| | | | | GB 5/29/08 | |

GB 5/28/08

Notes:

366009

Reviewed by: GB

Date: 5/29/08

Date: 5/29/08

| | Sample ID | Iso/Matrix | Duration | Initial |
|---|---|---|---|---|
| E | 0805139-5 | Am/W | 660 | DJ |
| B | AS080522-7MB | Th/W | 360 | DJ |
| | -7LCS | | | |
| | -7LCSD | | | |
| A | 0805155-12 | Th/W | 360 | DJ |
| | -13 | | | |
| | -14 | | | |
| | -15 | | | |
| A | 0805144-5 | Np/W | 1000 | DJ |
| | -5SYS | | | |
| | 0805173-5 | | | |
| | -5SYS | | | |
| | -10 | | | |
| | -10SYS | | | |
| | -15 | | | |
| | -15SYS | | | |
| | 0805195-5 | | | |
| | -5SYS | | | |
| | AS080527-1SYS | | | |
| | -1MB | | | |
| | -1LCS | | | |
| | -1LCSD | | | |
| | AS080516-5MB | Am/S | 660 | DJ |
| | -5LCS | | | |

Reviewed by: GB

Date: 5/30/08

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

6

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0804083
TEST Am, Pu, U, Sr, Po
METHOD Prep
SOP/REV (PREP) Various
SOP/REV (ANAL) _____

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

The following applies to samples 0804083 –1 and –2: 1C 5/13/08

1. The entire sample of ~0.5g was used for the sequential prep of Am-241, Pu-ISO, U-ISO, Po-210, and Sr-90 analysis. Actual weights are noted on the benchsheets.
2. Due to limited sample volume, an LCS-D was prepped to meet QC requirements.
3. The samples were aliquotted into 220ml polypropylene cups, spiked and traced, and digested per SOP 773/10 sect. 8.3.5 to 8.3.8
4. To convert to an HCl system, 10ml concentrated HCl was added to the digested samples and allowed to dry.
5. The samples were brought up in a 1M HCl solution to ~75ml. The samples were removed from the steambath after ~15 minutes and allowed to cool. 1C 5/13/08
6. Due to the presence of small particles in the sample solutions, the samples were filtered through Whatman 41 filter paper into a new 220ml polypropylene cup and brought up to 100ml with 1N HCl. 1C 5/13/08
7. A 1.0 ml Sr initial ICP aliquot was taken from all samples, and the final aliquot for the Actinides' benchsheets was adjusted accordingly using the following calculation:

$$\text{Final aliquot(g)} = \frac{\text{Initial aliquot(g)} * \text{Remaining Digestate after ICP(ml)}}{\text{Total Digestate Volume (ml)}}$$

7. The samples were analyzed for Po-210 per SOP 711/7 8.1.8.
8. After electroplating Po-210 onto the silver disks, the sample solutions containing the remaining analytes are submitted to the Ra-Sr lab for Sr-90 analysis.

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0804083
TEST Am, Pu, U
METHOD Prep
SOP/REV (PREP) 778/12
SOP/REV (ANAL)

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

TE 5/27/08

While running the Sr column, all the effluent was collected in a centrifuge bottle for Am, Pu, and U analyses. To this centrifuge bottle, ~100mL DI water, 2mL Fe carrier, and ~50ml $NH_4OH$ was added to form a ferric hydroxide precipitate. The samples were centrifuged at 3500 rpm for 12 minutes. At this time, it was noted that a ferric hydroxide plug was present for only the MB, LCS, and LCS-dup. No precipitate/plug formed for samples 0804083-1 and –2. Another 2ml of Fe carrier and ~25ml of $NH_4OH$ was added to samples –1 and –2. However, there was still no presence of precipitate. Therefore, the sample solution in the centrifuge bottles was poured into a clean empty beaker. Water was added to dilute the solution. Conc. HCl was added to acidify the solution. After the solution was dried down completely on a hotplate, ~50ml $HNO_3$ was added to the beaker and dried down. Another 10ml of $HNO_3$ was added to the beaker and diluted to ~1000ml with DI water. 50ml $NH_4OH$ was added to the beaker. At this time, a ferric hydroxide precipitate did form. The samples were poured into centrifuge bottles and centrifuged to form the ferric hydroxide plug. The supernatant was discarded. Further prep proceeded per SOP 778/12.

TE 5/27/08

TE 5/27/08

Note: The same procedure that was performed on the samples was also performed on all QC.

TE 5/27/08

~~TE 5/27/08~~

TECHNICIAN/ANALYST T Elliott DATE 5/27/08

DEPARTMENT MANAGER Crystal Shaeffer DATE 5/27/08

357740

FORM 302r6.doc (4/22/04)

NCR #: 10678

# PARAGON ANALYTICS

225 Commerce Drive ◆ Fort Collins, CO 80524 ◆ (800) 443-1511 ◆ (970) 490-1511 ◆ FAX (970) 490-1522

## CONTROLLED
## NON-CONFORMANCE REPORT

### Non-Conformance

**Initiated By:** Emily M. Bitler on 5/30/2008

**Event Type:** Lab QC Criteria Not Met -- Chemical Yield

**Event Explanation:** The chemical yield for the method blank is below the 30% lower control limit at 29.8%. All other quality control criteria were met for this batch.

**Action To Prevent Reccurence:** meets random marginal exceedance criteria

### Corrective Action

**Corrective Action:** Document in Narrative
**Department Manager Approval:** Mike B. Clemmer
**Approval Date:** 6/3/2008
**Corrective Action Comments:** Insuff sample for reprep.

**Workorders Affected**

| Workorder -- Procedure | | Approved By | Approval Date |
|---|---|---|---|
| 0804083 -- PulSO | Mike McNaughton; Keith Greene was contacted on 6/2/2008 | Lance R. Steere | 6/2/2008 |

### Associated Batches

The samples were originally associated with the following Batch(es):

AS080513-2B prepared on 5/29/2008

All rework was completed in the following Batch(es):

**Not Applicable**

### NCR Approval

**Project Manager Approval:** LRS on 6/2/2008
**Department Manager Approval:** Mike B. Clemmer on 6/3/2008
**QA Manager Approval:** Deb Scheib on 6/3/2008

PARAGON ANALYTICS
Radiochemistry Data Package

Section 7

# LABORATORY BENCH SHEETS

7

Prep Batch: AS080513-2

QASS / NCR? (Y) N 10678

Notes

A

GB 5/30/08

B to confirm results

GB 5/30/08

| e | Aliquot | Units | Pipet ID |
|---|---|---|---|
| 3 | 0.25 | ml | AW016 |
| 3 | 0.25 | ml | AW016 |
| 3 | 0.25 | ml | AW016 |
| 3 | 0.25 | ml | AW016 |
| 3 | 0.25 | ml | AW016 |

upersedes: NA

# Radiochemistry Prep Worksheet

Prep Batch: AS080513-2

PulSO

Reviewed By: tde 1DE

Review Date: 5/27/2008

Int? (Y) / N Batch: See QASS Re-Prep? Y / (N) Batch: NA Prep QASS / NCR? (Y) / N 328377, 357740

ev: 12

Prep Analyst: Tambrae Elhart TE

Prep Date: 5/13/2008

Prep Dept: AP

Balance: 27

Balance:

| C pe | Dish No. | Init Aliq g | Fin Aliq g | Prep Basis | Total Digestate Vol(ml) | Digestate Vol Taken(ml) | Micro Init | Micro Date | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| MP | | 0.4585 | 0.463915 | As Received | 100 | 99 | TE | 5/27/08 | T1,T2,T3 | |
| MP | | 0.6008 | 0.594792 | As Received | 100 | 99 | | | T1,T2,T3 | |
| B | | 0.52965 | 0.524354 | As Received | 100 | 99 | | | T1,T2,T3 | |
| CS | | 0.52965 | 0.524354 | As Received | 100 | 99 | | | S1,S2,S3,T1,T2,T3 | TE 5/27/08 |
| SD | | 0.52965 | 0.524354 | As Received | 100 | 99 | | | S1,S2,S3,T1,T2,T3 | |

rmed on all samples.

t Date: 5/13/2008

Date: 5/13/2008

er/Carrier Solution Information

| | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|
| 1 | 19.995 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| 0 | 19.763 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| B | 19.997 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |

Spike Solution Information

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | AM-241 | 616.2382.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-234 | 644.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-235 | 644.3020.52 | 0.946 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-238 | 644.3020.52 | 20.596 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S3 | Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |

# Radiochemistry Prep Worksheet

**Paragon Analytics**

**Prep Batch: PL080513-1**

**Prep Procedure:** Po210, Am, Pu, U, Sr **Prep Batch Not Validated!!!** **Reviewed By:** **Review Date:**

**Non-Routine Pre-Treatment? Y / N** **Batch:** _____ **Re-Prep? Y / N** **Batch:** _____ **Prep QASS / NCR? Y / N** _____

**Prep SOP:** PAI 711 **Rev:** 7
**Prep SOP:** NONE
**Matrix Class:** solid

**Prep Analyst:** Tambrae Elhart TE
**Prep Date:** 5/13/2008
**Prep Dept:** AP

**Balance:**
**Balance:**

| Samp Num | Prep Num | LabID | QC Type | Dish No. | Init Alq g | Fin Alq g | Prep Basis | Decay Date/Time | Standards | Prep Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0804083-1 | SMP | | 0.5 | 0.5 | As Received | | T1,T2,T3,T4, T5 | .4585 |
| 2 | 1 | 0804083-2 | SMP | | 0.5 | 0.5 | As Received | | T1,T2,T3,T4 | .6008 |
| 3 | 1 | PL080513-1 | MB | | 0.5 | 0.5 | As Received | | T1,T2,T3,T4 | |
| 4 | 1 | PL080513-1 | LCS | | 0.5 | 0.5 | As Received | | S1,S2,S3,S4,T1,T2,T3,T4 S5, T5 | |
| 5 | 1 | PL080513-1 | LCSD | | 0.5 | 0.5 | As Received | | S1,S2,S3,S4,T1,T2,T3,T4 S5, T5 | |

Comments

**Spiked By:** TE **Date:**
**Witnessed By:** JJL **Date:** 5/13/08

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | Am-243 | ~~832.3020.78~~ 821.3020.61 TE 5/13/08 | 20.035 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T2 | U-232 | 837.3020.90 | 19.763 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T3 | Pu-242 | 846.3020.88 | 19.997 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T4 | Po-209 | 851.3020.87 | 16.014 | DPM/ml | 05/13/08 | 1 | ml | AW015 |

T5 Sr carrier 247960 .5mL AW013

| | |
|---|---|
| T1 | 2/10/09 |
| T2 | 1/13/09 |
| T3 | 12/3/08 |
| T4 | 12/5/08 |
| T5 | 8/3/08 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | AM-241 | 818.2382.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-234 | 844.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-235 | 844.3020.52 | 0.948 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-238 | 844.3020.52 | 20.596 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S3 | Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| **S4** | **Pb-210** | **823.3020.41** | **47.234** | **DPM/ml** | **05/13/08** | **1** | **ml** | **AW015** |
| S4 | Po-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 1 | ml | AW015 |

S5 Sr-90 600.3020.82 ~57 dpm/mL .5mL AW013

Exp

| | |
|---|---|
| S1 | 10/8/08 |
| S2 | 1/13/09 |
| S3 | 10/11/08 |
| S4 | 7/14/08 |
| S5 | 8/3/08 |

# SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TC

ANALYSIS DATE: 5/13/08 METHOD: Prep

| WORK ORDER | SAMPLE ID | SAMPLE CONDITION | | |
|---|---|---|---|---|
| | | Dry/Wet | TEXTURE | Remarks |
| 0804083 | 1 | dry | Dust | As Rec'd |
| | 2 | | | |

TC 5/13/08

PARAGON ANALYTICS
Radiochemistry Data Package

Section 8

Prepare a working dilution of approximately 20 dpm/ml from RSO # 846

1) Calculate Density of 3 M $HNO_3$ Diluent bal. 12
Mass of 100 ml vol. flask. 66.4359 g
Mass of flask and 100 ml 3M $HNO_3$ 175.7312 g
Mass of 100 ml 3M $HNO_3$ : 109.2953
$\rho$ = 1.093 g/ml

2) Transfer Ampule #846 to 500 ml Nalgene bal. 12
Mass of Nalgene (No lid) 46.8610 g
Mass of Ampule, Std, 50 ml beaker 38.5810 g
Mass of empty Ampule, + 50 ml beaker 33.1178 g
[illegible] 5.4632 g

National Institute of Standards & Technology

## Recommended Procedure for Opening the SRM Ampoule

1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.

2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.

3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.

4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.

5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.

6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.

7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.

8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.

9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.



*Notes and references are on pages 5 to 7.

PROPERTIES OF SRM 4334H

**Certified values**

| | |
|---|---|
| **Radionuclide** | **Plutonium-242** |
| **Reference time** | **1200 EST, 07 June 1994 [b]*** |
| **Massic activity of the solution** [c] | **26.31 $Bq \cdot g^{-1}$** |
| **Relative expanded uncertainty ($k$=2)** | **0.72%** [d] [e] |
| [illegible] | **(1.105 ± 0.002) $g \cdot mL^{-1}$ at 20.8C** [f] |

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d] [e]*

| Input Quantity $x_i$, the source of uncertainty (and individual uncertainty components where appropriate) | Method Used To Evaluate $u(x_i)$, the standard uncertainty of $x_i$ (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods | Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [k] | Relative Sensitivity Factor, $\lvert\partial y/\partial x_i\rvert \cdot (x_i/y)$ [m] | Relative Uncertainty Of Output Quantity, $u_i(y)/y$, (%) [n] |
|---|---|---|---|---|
| Massic alpha-particle emission rate, corrected for background and decay | Standard deviation of the mean for 80 sets of $4\pi\alpha$ liquid-scintillation measurements (A) | 0.05 | 1.0 | 0.05 |
| Half life of Pu-242 | Standard uncertainty of the half life (A) | 0.32 [p] | 0.00001 [q] | 0.000003 |
| Decay-scheme data | Standard uncertainty of the probability of decay by alpha-particle emission (A) | 0.001 | 1.0 | 0.001 |
| Extrapolation of alpha-particle-count-rate-versus-energy to zero energy | Estimated (B) | 0.25 | 1.0 | 0.25 |
| Gravimetric measurements | Estimated (B) | 0.10 | 1.0 | 0.10 |
| Live time [r] | Estimated (B) | 0.10 | 1.0 | 0.10 |
| Alpha-particle detection efficiency of scintillators | Estimated (B) | 0.15 | 1.0 | 0.15 |
| Alpha-particle-emitting impurities | Limit of detection (B) [s] | 100. | 0.001 | 0.10 |
| Photon-emitting impurities | Limit of detection (B) [s] | 100. | 0.001 | 0.10 |
| Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%) | | | | 0.36 |
| Coverage Factor, $k$ | | | | x 2 |
| Relative Expanded Uncertainty of the Output Quantity, $U/y$, (%) | | | | 0.72 |



*Notes and references are on pages 5 to 7.

RELATIVE ACTIVITIES OF RADIONUCLIDIC IMPURITIES AT THE REFERENCE TIME [b]

| Radionuclide | Half-Life (years) [j] [5] | Relative Activity As Determined By | |
|---|---|---|---|
| | | LLNL | NIST |
| Plutonium-242 | 373 500 ± 1100 | 1.000 000 | 1.000 000 |
| Plutonium-241 | 14.35 ± 0.10 | -- | 0.0035 ± 0.0004 [t] |
| Plutonium-240 | 6 564 ± 11 | $^{239}Pu + ^{240}Pu$ <0.000 001 [u] | $^{239}Pu + ^{240}Pu$ 0.000 020 ± 0.000 021 [v] |
| Plutonium-239 | 24 110 ± 30 | | |
| Plutonium-238 | 87.7 ± 0.1 | $^{238}Pu + ^{241}Am$ <0.000 016 [u] | 0.000 009 ± 0.000 016 [v] |
| Americium-241 | 432.2 ± 0.7 | | 0.000 000 assumed [t] |

NOTES

[a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.

| Distance from Ampoule (cm): | 1 | 30 | 100 |
|---|---|---|---|
| Approximate Dose Rate (μSv/h): | <0.1 | - | - |

[b] The plutonium-242 master solution was chemically purified at 1200 EST, 07 June 1994.

[c] **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].

[d] The reported value, $y$, of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \ldots x_n)$, where $f$ is a mathematical function derived from the assumed model of the measurement process. The value, $x_i$, used for each input quantity $i$ has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in $y$, $u_i(y) \equiv |\partial y/\partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of $y$. The **combined standard uncertainty** of $y$, $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty. The combined standard uncertainty is multiplied by a **coverage factor** of $k = 2$ to obtain $U$, the **expanded uncertainty** of $y$.

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

[e] The value of each component of combined standard uncertainty, and hence the value of the expanded uncertainty itself, is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the massic response is approximately 50%) and for uncertainties evaluated by other methods (which could easily be over estimated or under estimated by substantial amounts). The unknown value of the expanded uncertainty is believed to lie in the interval $U/2$ to $2U$ (i.e., within a factor of 2 of the estimated value).

[f] The stated uncertainty is two times the standard uncertainty.

[g] Estimated limits of detection for alpha-particle-emitting impurities, expressed as massic alpha-particle emission rates (numbers of alpha particles per second per gram), are:

[p] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of $\lambda$ (i.e., of the half life). The relative standard uncertainty of $t$ is negligible.

[q] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$

[r] The live time is determined by counting the pulses from a gated crystal-controlled oscillator.

[s] The standard uncertainty for each undetected impurity that might reasonably be expected to be

Prepare a working level dilution of Pu-239 at approximately 20 dpm/mL by diluting ampoule 819 in 18% $HNO_3$ (2.88M $HNO_3$)

① Determine the density of 2.88M $HNO_3$

Mass of empty 100mL class A volumetric flask: 68.5670 Bal 12

Mass of flask + 100mL 2.88M $HNO_3$: 177.9032

Net mass of 100mL 2.88M $HNO_3$: ~~109.365 g~~ 109.336 g RG 12/28/06

Lot # 063544

$\rho = 1.094\ g/mL$ RG 12/28/06

② Transfer contents of ampoule 819 to a 1L poly bottle

Mass of nalgene bottle w/o lid: 74.7623 g Bal 12

Mass of bottle + standard: 80.0108 g

Net mass of standard transferred: 5.2485 g

③ Dilute with 2.88M $HNO_3$

Mass of nalgene bottle w/o lid (above): 74.7623 g Bal 12

Mass of bottle, standard + 2.88M $HNO_3$: 720.0 g Bal 26

Net mass of standard + 2.88M $HNO_3$: 645.2377 g

④ Final Activity Calculation

$$\frac{(39.24\ Bq/g)(60\ dpm/Bq)(5.2485\ g)(1.094\ g/mL)}{645.2377\ g} = \cancel{20.95\ dpm/mL}$$

RG 12/28/06

RG 12/28/06 20.93 dpm/mL

RG 12/29/06

Stnd ID: 819.3020.51

Description: Pu-239

Expiration: 11/30/2007

Activity: 20.93 dpm/mL

2s Uncertainty: 0.14 dpm/mL

Ref. Date: 11/15/1999

Ref Time: N/A

Prep Date: 11/28/2006 Prep by: AB

| Reverification Log | | |
|---|---|---|
| Analysis Date | Initials | Expiration Date |
| 10/11/07 | MC | 10/11/08 |
| | | |
| | | |
| | | |

12/29/06

RSO # 819 Rec'd 7/3/06 JVB

# National Institute of Standards & Technology

# Certificate

## Standard Reference Material 4330B
## Plutonium-239 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive plutonium-239 nitrate and nitric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of alpha-particle counting instruments and for the monitoring of radiochemical procedures.

**Radiological Hazard:** The SRM ampoule contains plutonium-239 with a total activity of approximately 220 Bq. Plutonium-239 decays by alpha-particle emission. None of the alpha particles escape from the SRM ampoule. During the decay process X-rays and gamma rays with energies from 10 keV to 1 MeV are also emitted. Most of these photons escape from the SRM ampoule but their intensities are so small that they do not represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. The SRM should be used only by persons qualified to handle radioactive material.

**Chemical Hazard:** The SRM ampoule contains nitric acid ($HNO_3$) with a concentration of 3 moles per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

**Storage and Handling:** The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least December 2009.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of the radioactivity and because of the strong acid.

**Preparation:** This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, L.R. Karam, Group Leader. The overall technical direction and physical

## Recommended Procedure for Opening the SRM Ampoule

1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.

2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.

3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.

4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.

5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.

6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.

7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.

8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.

9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.



*Notes and references are on pages 5 and 6.

PROPERTIES OF SRM 4330B

**Certified values**

| | |
|---|---|
| **Radionuclide** | **Plutonium-239** |
| **Reference time** | **1200 EST, 15 November 1999** |
| **Massic activity of the solution [b]*** | **39.24 $Bq \cdot g^{-1}$** |
| **Relative expanded uncertainty ($k$=2)** | **0.68% [c] [d]** |
| **Solution density** | **(1.101 ± 0.002) $g \cdot mL^{-1}$ at 21.4 °C [e]** |

Uncertified values

| | |
|---|---|
| Physical Properties: | |
| Source description | Liquid in flame-sealed NIST borosilicate-glass ampoule |

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [c] [d]*

| Input Quantity $x_i$, | Method Used To Evaluate $u(x_i)$, | Relative | Relative | Relative |
|---|---|---|---|---|

## NOTES

[a] The Sievert is the SI unit for dose equivalent. See reference [1]. One $\mu$Sv is equal to 0.1 mrem.

| Distance from Ampoule (cm): | 1 | 30 | 100 |
|---|---|---|---|
| Approximate Dose Rate ($\mu$Sv/h): | <0.1 | - | - |

[b] **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].

[c] The reported value, $y$, of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \ldots x_n)$, where $f$ is a mathematical function derived from the assumed model of the measurement process.

The value, $x_i$, used for each input quantity $i$ has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in $y$, $u_i(y) \equiv |\partial y/\partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of $y$.

The **combined standard uncertainty** of $y$, $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.

The combined standard uncertainty is multiplied by a **coverage factor** of $k = 2$ to obtain $U$, the **expanded uncertainty** of $y$.

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

For further information on the expression of uncertainties, see references [2] and [3].

[d] The value of each component of combined standard uncertainty, and hence the value of the expanded uncertainty itself, is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the massic count rate is approximately 50%) and for uncertainties evaluated by other methods (which could easily be over estimated or under estimated by substantial amounts). The unknown value of the expanded uncertainty is believed to lie in the interval $U/2$ to $2U$ (i.e., within a factor of 2 of the estimated value).

[e] The stated uncertainty is two times the standard uncertainty.

[f] Estimated limits of detection for alpha-particle-emitting impurities are:
0.04 $s^{-1} \cdot g^{-1}$ for energies less than 4.9 MeV and
0.001 $s^{-1} \cdot g^{-1}$ for energies greater than 5.2 MeV.
From mass-spectrometric measurements performed by the supplier, the massic activities of other detected radionuclides (in $Bq \cdot g^{-1}$ at the reference time) are:
$^{240}$Pu: 0.002; $^{241}$Pu: ≈0.02; $^{242}$Pu: ≈0.000003; $^{241}$Am: ≈0.001
From the photon measurements below, we have $^{241}$Am: ≤0.0006

[g] Estimated limits of detection for photon-emitting impurities are:
0.000200 $s^{-1} \cdot g^{-1}$ for energies between 42.5 and 90 keV,
0.000080 $s^{-1} \cdot g^{-1}$ for energies between 102 and 125 keV,
0.000030 $s^{-1} \cdot g^{-1}$ for energies between 133 and 1456 keV, and
0.000008 $s^{-1} \cdot g^{-1}$ for energies between 1465 and 3500 keV,
provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of plutonium-239.

[h] The stated uncertainty is the standard uncertainty.

[i] Relative standard uncertainty of the input quantity $x_i$.

[j] The relative change in the output quantity $y$ divided by the relative change in the input quantity $x_i$. If $|\partial y/\partial x_i| \cdot (x_i/y) = 1.0$, then a 1% change in $x_i$ results in a 1% change in $y$. If $|\partial y/\partial x_i| \cdot (x_i/y) = 0.05$, then a 1% change in $x_i$ results in a 0.05% change in $y$.

[k] Relative component of combined standard uncertainty of output quantity $y$, rounded to two significant figures or less. The relative component of combined standard uncertainty of $y$ is given by $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.

[m] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of $\lambda$ (i.e., of the half life). The relative standard uncertainty of $t$ is negligible.

[n] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$

[p] The live time is determined by counting the pulses from a gated oscillator.

[q] Includes the uncertainty in the alpha-particle detection efficiency of the liquid-scintillation cocktail

PARAGON ANALYTICS
Radiochemistry Data Package

Section 9

# ADDITIONAL SUPPORTING DOCUMENTATION

9

# Alpha Spectroscopy

# Quality Control Data

# Weekly Background, Energy, and Efficiency Calibrations

# Calibration Data Summary

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Prep SOP:** PAI 778
**Analytical SOP:** PAI 714

**Reported on:** Friday, May 30, 2008
1:35:08 PM

| Lab Sample ID<br>Spectrum<br>Analysis Date | QC Type | Batch ID<br>Analysis Run | Test Name | Detector Id | Eff Spectrum<br>Bkg Spectrum<br>Egy Spectrum | Eff Date<br>Bkg Date<br>Egy Date | RESULTS<br>%Efficiency<br>Bkg CPM<br>Energy keV | FLAGS<br>Efficiency<br>Background<br>Energy | LCL<br>%Efficiency<br>Bkg CPM<br>Energy keV | LWL<br>%Efficiency<br>Bkg CPM<br>Energy keV | UWL<br>%Efficiency<br>Bkg CPM<br>Energy keV | UCL<br>%Efficiency<br>Bkg CPM<br>Energy keV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SMP | AS080513-2 | PulSO | 8 | C08052708 | 5/27/2008 | 31.94 | Pass | 30.12 | 30.65 | 32.77 | 33.30 |
| Spectrum #1 | | AS080513-2B | | | B08052708 | 5/27/2008 | 0.0140 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052708 | 5/27/2008 | 5545.9 | Pass | 5495.8 | 5505.8 | 5585.8 | 5595.8 |
| 0804083-2 | SMP | AS080513-2 | PulSO | 49 | C08052749 | 5/27/2008 | 32.12 | Pass | 30.41 | 30.94 | 33.08 | 33.61 |
| Spectrum #1 | | AS080513-2B | | | B08052749 | 5/27/2008 | 0.0270 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052749 | 5/27/2008 | 5536.2 | Pass | 5505.8 | 5515.8 | 5595.8 | 5605.8 |
| AS080513-2 | MB | AS080513-2 | PulSO | 33 | C08052733A | 5/27/2008 | 31.10 | Pass | 28.77 | 29.27 | 31.29 | 31.79 |
| Spectrum #1 | | AS080513-2B | | | B08052733 | 5/27/2008 | 0.0170 | Pass | 0.0000 | 0.0100 | 0.1000 | 0.1500 |
| 5/29/2008 | | | | | C08052733A | 5/27/2008 | 5555.8 | Pass | 5497.9 | 5507.9 | 5587.9 | 5597.9 |
| AS080513-2 | LCS | AS080513-2 | PulSO | 51 | C08052751 | 5/27/2008 | 31.73 | Pass | 30.14 | 30.67 | 32.79 | 33.32 |
| Spectrum #1 | | AS080513-2B | | | B08052751 | 5/27/2008 | 0.0760 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052751 | 5/27/2008 | 5536.2 | Pass | 5486.2 | 5496.2 | 5576.2 | 5586.2 |
| AS080513-2 | LCSD | AS080513-2 | PulSO | 52 | C08052752 | 5/27/2008 | 30.58 | Pass | 28.93 | 29.44 | 31.47 | 31.97 |
| Spectrum #1 | | AS080513-2B | | | B08052752 | 5/27/2008 | 0.0230 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052752 | 5/27/2008 | 5546.0 | Pass | 5496.0 | 5506.0 | 5586.0 | 5596.0 |

**Data Package ID:** *PU0804083-1*

| Abbreviations: | | | | |
|---|---|---|---|---|
| | Eff - Efficiency | Bkg - Background | LCL - Lower Control Limit | UWL - Upper Warning Limit |
| | Egy - Energy | CPM - Counts per Minute | LWL - Lower Warning Limit | UCL - Upper Control Limit |

CI - The Analysis Date exceeds the Calibration Date by more than 7 days.

# Alpha Spec Calibration Source Re-Certification

R:\INST/ALPHASPEC\CLCRT0607.XLS

**Primary Certified Source**

Source PA ID 190 was recalibrated by Isotope Products Laboratories on 6/1/2007 and received by PA on 6/6/2007

Source ID: 92MIX223027; PA ID 190 (Labled #9)
Total Activity: 3780.66 dpm
Ref. Date: 6/1/07
Count Date: 6/8/07

| | | | |
|---|---|---|---|
| U-234 Activity: | 79.16% | = | 2994.78 dpm (decay corrected) |
| U-235 Activity: | 1.74% | = | 65.93 dpm (decay corrected) |
| Am-241 Activity: | 19.09% | = | 719.92 dpm (decay corrected) |
| Combined Activity: | | | 3780.64 dpm (decay corrected) |

**Detector 9 Efficiency Determination**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | count dur (s) | Combined cpm | Known dpm | Detector efficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX223027 | 190 | 97-19-103-09 | 6/8/07 | 7202 | 30313 | 686 | 2100 | 1091.46 | 3780.64 | 28.87% |

**Sources 1 through 8 activity determination**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | count dur (s) | Detector Efficiency | Am-241 dpm | U-234 dpm | U-235 dpm | Combined dpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX2203026 | 182 | 97-19-103-01 | 6/8/07 | 12708 | 76469 | 1739 | 2100 | 28.87% | 1257.67 | 7567.91 | 172.10 | 8997.68 |
| 92MIX2203028 | 183 | 97-19-103-02 | 6/8/07 | 14855 | 144735 | 3046 | 2100 | 28.87% | 1470.15 | 14323.99 | 301.65 | 16095.79 |
| 92MIX2203024 | 184 | 97-19-103-03 | 6/8/07 | 67825 | 69896 | 1458 | 2100 | 28.87% | 6712.44 | 6917.40 | 144.29 | 13774.13 |
| 92MIX2203021 | 185 | 97-19-103-04 | 6/8/07 | 21522 | 59231 | 1483 | 2100 | 28.87% | 2129.97 | 5861.91 | 146.77 | 8138.65 |
| 92MIX2203025 | 186 | 97-19-103-05 | 6/8/07 | 96147 | 117668 | 2472 | 2100 | 28.87% | 9515.38 | 11645.25 | 244.65 | 21405.27 |
| 92MIX2203022 | 187 | 97-19-103-06 | 6/8/07 | 73793 | 78846 | 1643 | 2100 | 28.87% | 7303.07 | 7803.15 | 162.60 | 15268.82 |
| 92MIX2203023 | 188 | 97-19-103-07 | 6/8/07 | 42962 | 66752 | 1369 | 2100 | 28.87% | 4251.82 | 6606.24 | 135.49 | 10993.55 |
| 92MIX2203029 | 189 | 97-19-103-08 | 6/8/07 | 32537 | 204218 | 4335 | 2100 | 28.87% | 3220.09 | 20210.84 | 429.02 | 23859.96 |

**Detector 9 Efficiency Verification**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | Count dur (s) | Combined cpm | Known dpm | Detector efficiency | % difference from 1st count |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX223027 | 190 | 97-19-103-09 | 6/8/07 | 7083 | 30147 | 730 | 2100 | 1084.57 | 3780.64 | 28.69% | 0.63% |

**Sources 1 through 8 activity re-verification**

| Source Serial# | PA ID | Sequential # | Combined Obseved dpm | Combined Certified dpm* | Percent Difference % | Within 5% of Certified value Yes/No |
|---|---|---|---|---|---|---|
| 92MIX2203026 | 182 | 97-19-103-01 | 8997.68 | 8869.83 | 1.44% | Yes |
| 92MIX2203028 | 183 | 97-19-103-02 | 16095.79 | 16012.52 | 0.52% | Yes |
| 92MIX2203024 | 184 | 97-19-103-03 | 13774.13 | 13600.19 | 1.28% | Yes |
| 92MIX2203021 | 185 | 97-19-103-04 | 8138.65 | 8194.88 | -0.69% | Yes |
| 92MIX2203025 | 186 | 97-19-103-05 | 21405.27 | 21111.44 | 1.39% | Yes |
| 92MIX2203022 | 187 | 97-19-103-06 | 15268.82 | 15394.76 | -0.82% | Yes |
| 92MIX2203023 | 188 | 97-19-103-07 | 10993.55 | 10789.02 | 1.90% | Yes |
| 92MIX2203029 | 189 | 97-19-103-08 | 23859.95 | 23639.88 | 0.93% | Yes |

* Certificate values decay corrected to the count date

RG 06/22/07

**AlphaVision v5.3**

# Alpha-Spectroscopy Calibration Report

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

8:24:12AM 6/11/2007

Analyst: ORTEC

Detector: 23

## Calibration

Energy Calibration: RSO 190 (source 9)
Description:

Analysis Date: 6/11/2007 8:23:31AM
Calibration Type: Energy And Efficiency

## Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

## Acquisition

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 6:45:14AM

Energy Calibration Equation:
Gain = 9.9003 keV / Ch

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:55:35AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO182
Description:

Analysis Date: 6/8/2007 8:20:44AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A1 RSO#182
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:24PM

### Acquisition

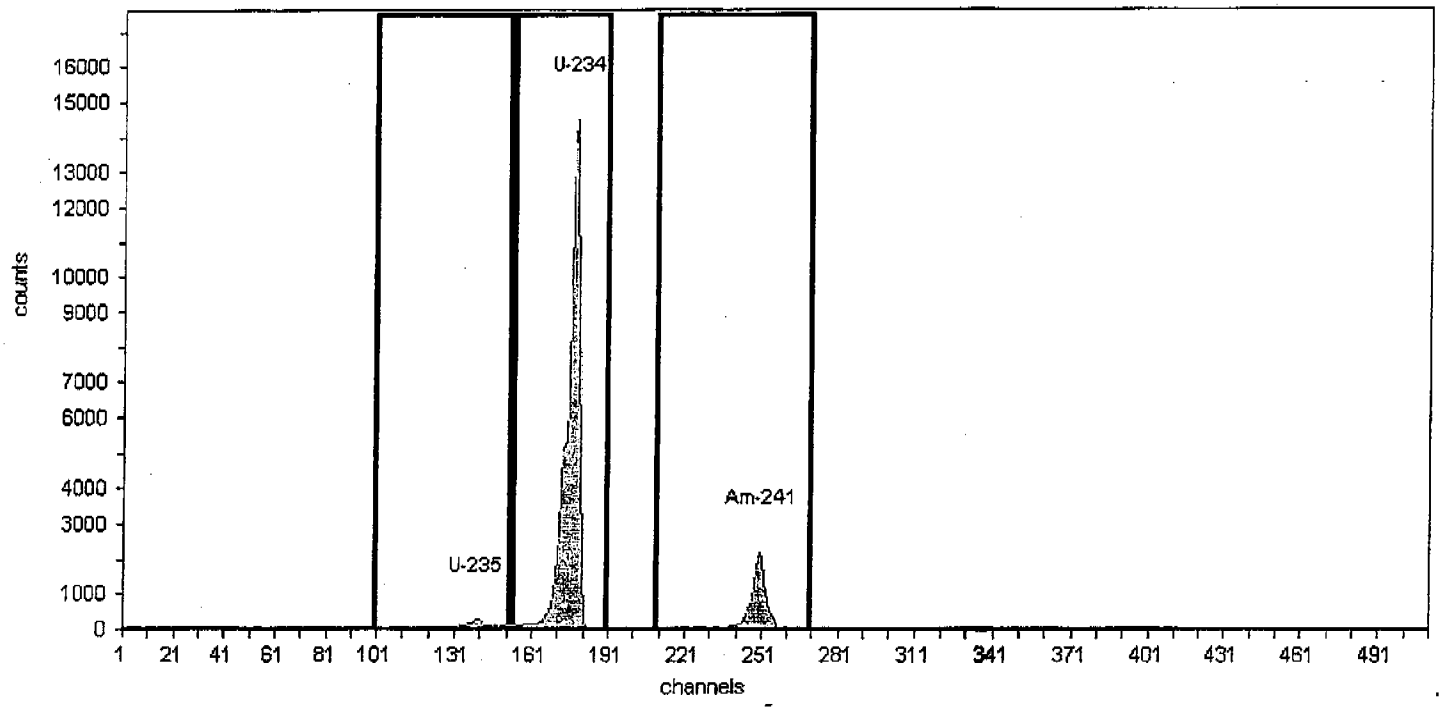
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 7:29:34AM

Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO182

Energy Calibration Equation:
Gain = 9.8224 keV / Ch
Offset = 3,029.39 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.20% +/- 0.20% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,739.00 | 49.69 |
| U-234 | 178 | 4.78 | 153 | 190 | 76,469.00 | 2,184.83 |
| Am-241 | 250 | 5.49 | 210 | 270 | 12,708.00 | 363.09 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
9:01:19AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO183
Description:

Analysis Date: 6/8/2007 9:01:07AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A2 RSO#183
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:00PM

### Acquisition

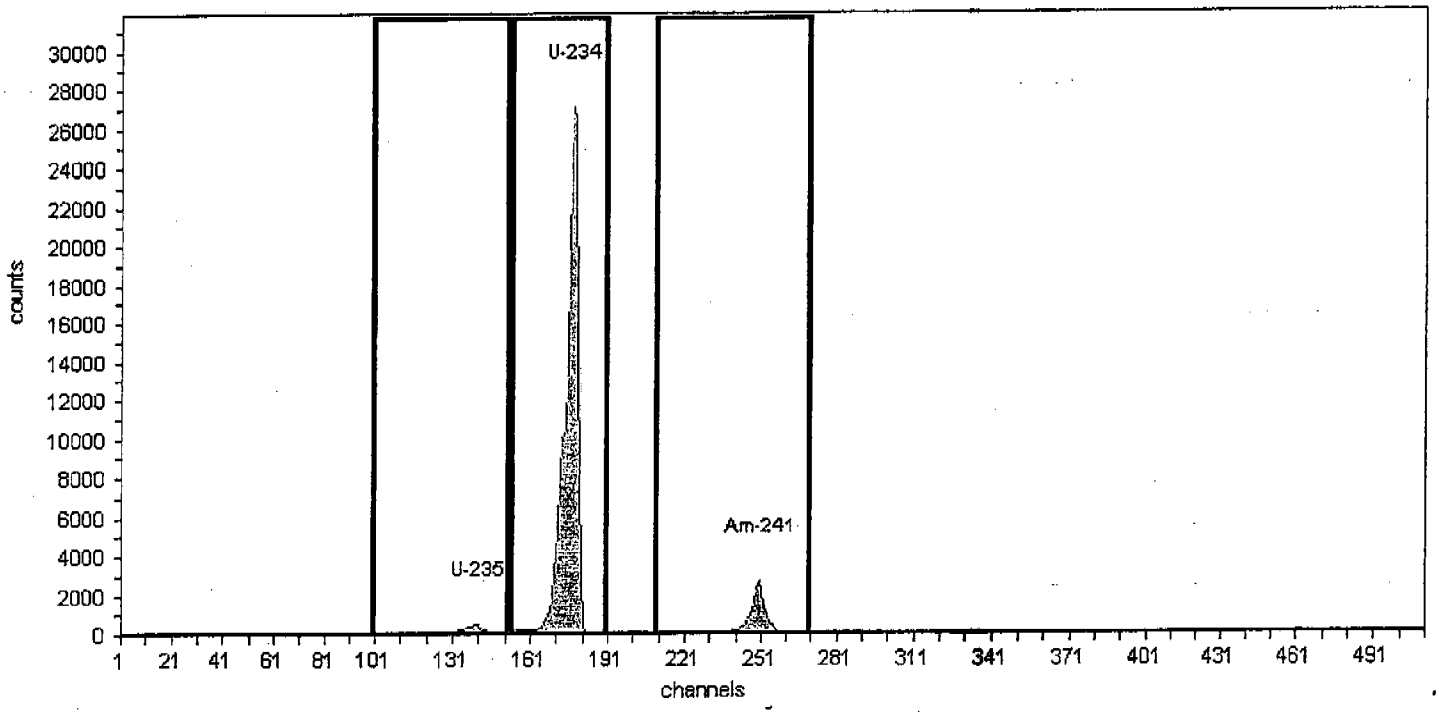
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 8:21:55AM

Live Time: 35.00 min.
Real Time: 35.05 min.

Efficiency Calibration Name: RSO183

Energy Calibration Equation:
Gain = 9.8810 keV / Ch
Offset = 3,018.33 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.98% +/- 0.15% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 3,048.00 | 87.09 |
| U-234 | 177 | 4.78 | 153 | 190 | 144,735.00 | 4,135.29 |
| Am-241 | 250 | 5.49 | 210 | 270 | 14,855.00 | 424.43 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 23

9:55:46AM 6/8/2007

***Calibration***

Energy Calibration: RSO184
Description:

Analysis Date: 6/8/2007 9:55:40AM
Calibration Type: Energy And Efficiency

***Source Info***

Certificate ID: A3 RSO#184
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:00PM

***Acquisition***

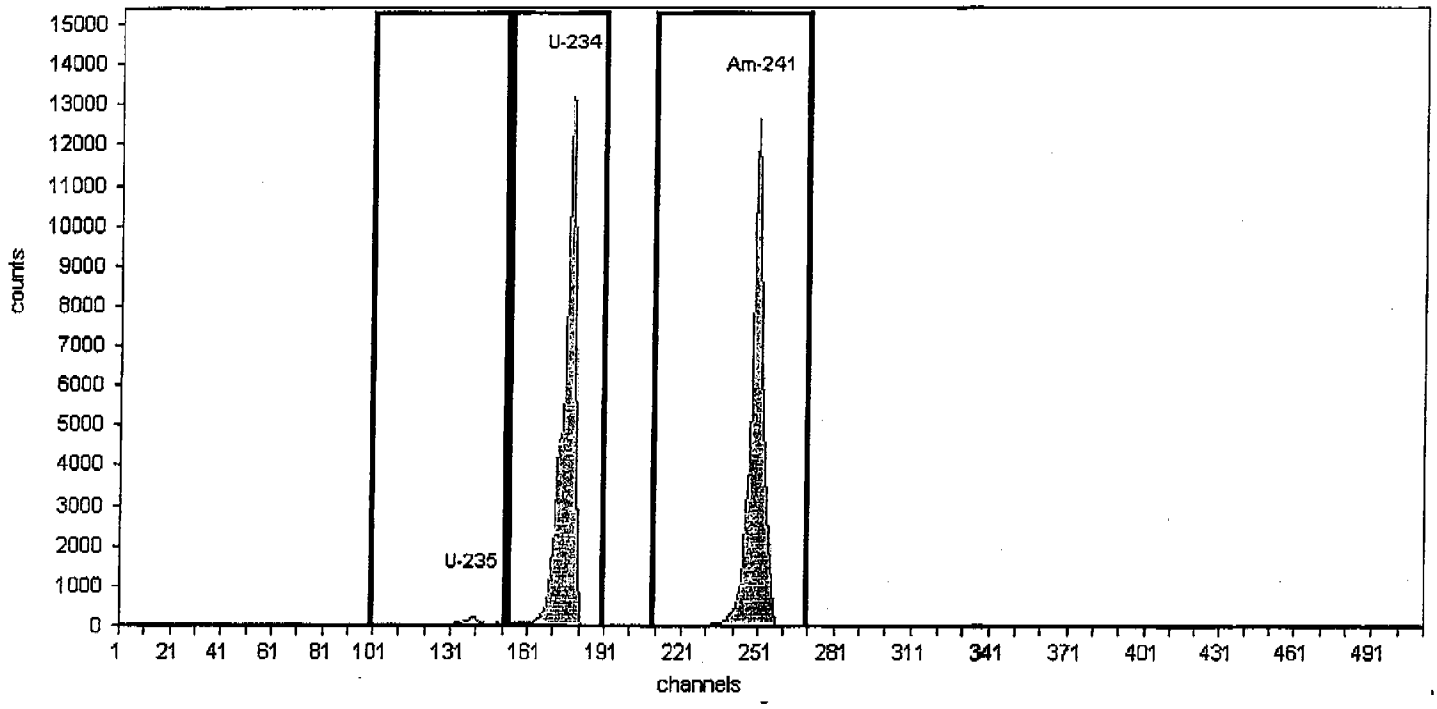
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 9:01:44AM

Live Time: 35.00 min.
Real Time: 35.04 min.

Efficiency Calibration Name: RSO184

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.14% +/- 0.16% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

***Nuclide Activity Summary***

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,458.00 | 41.66 |
| U-234 | 177 | 4.78 | 153 | 190 | 69,896.00 | 1,997.03 |
| Am-241 | 250 | 5.49 | 210 | 270 | 67,825.00 | 1,937.86 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
10:40:41AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO185
Description:

Analysis Date: 6/8/2007 10:40:28AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A4 RSO#185
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

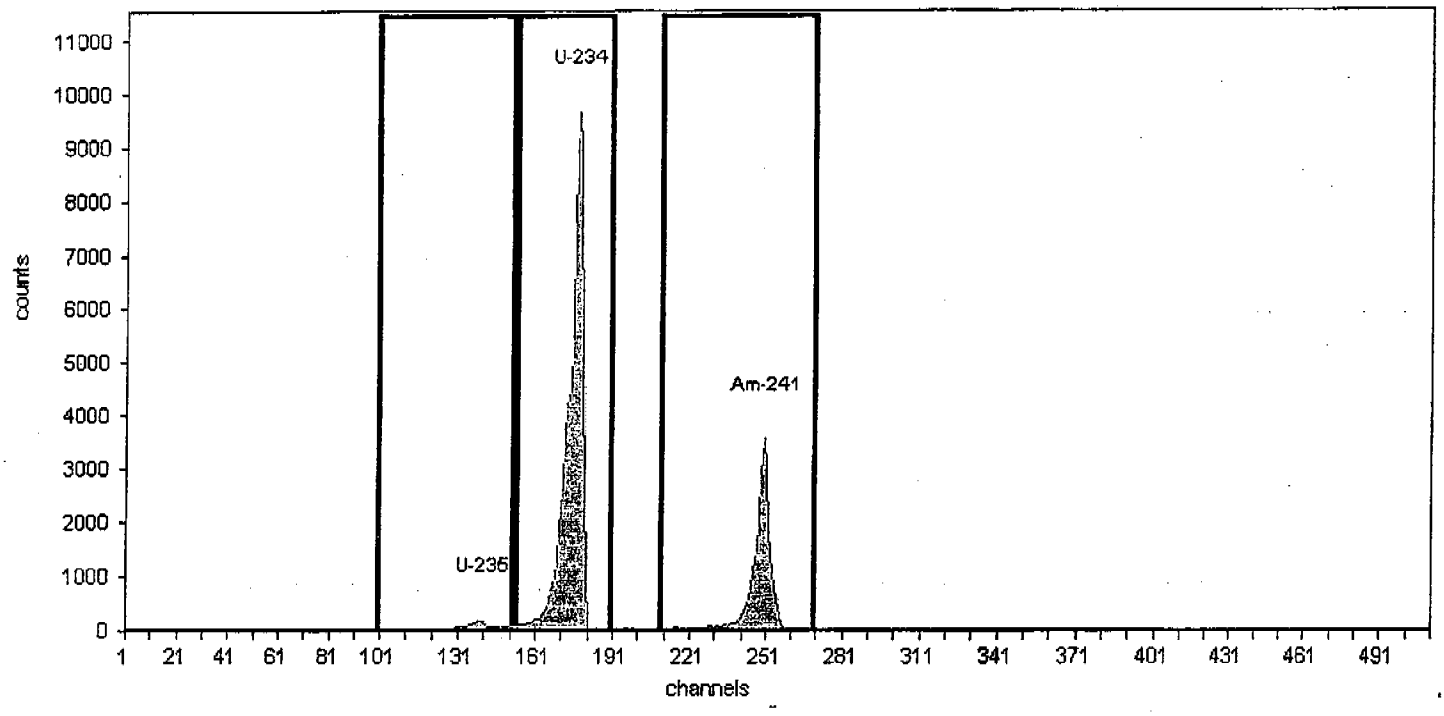
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 9:56:22AM

Live Time: 35.00 min.
Real Time: 35.02 min.

Efficiency Calibration Name: RSO185

Energy Calibration Equation:
Gain = 9.8810 keV / Ch
Offset = 3,018.33 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.41% +/- 0.20% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 1,483.00 | 42.37 |
| U-234 | 177 | 4.78 | 153 | 190 | 59,231.00 | 1,692.31 |
| Am-241 | 250 | 5.49 | 210 | 270 | 21,522.00 | 614.91 |

**AlphaVision v5.3**

Analyst: ORTEC

Detector: 23

## *Alpha-Spectroscopy Calibration Report*

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
11:17:39AM 6/8/2007

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
11:53:54AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO187
Description:

Analysis Date: 6/8/2007 11:53:46AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A6 RSO#187
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

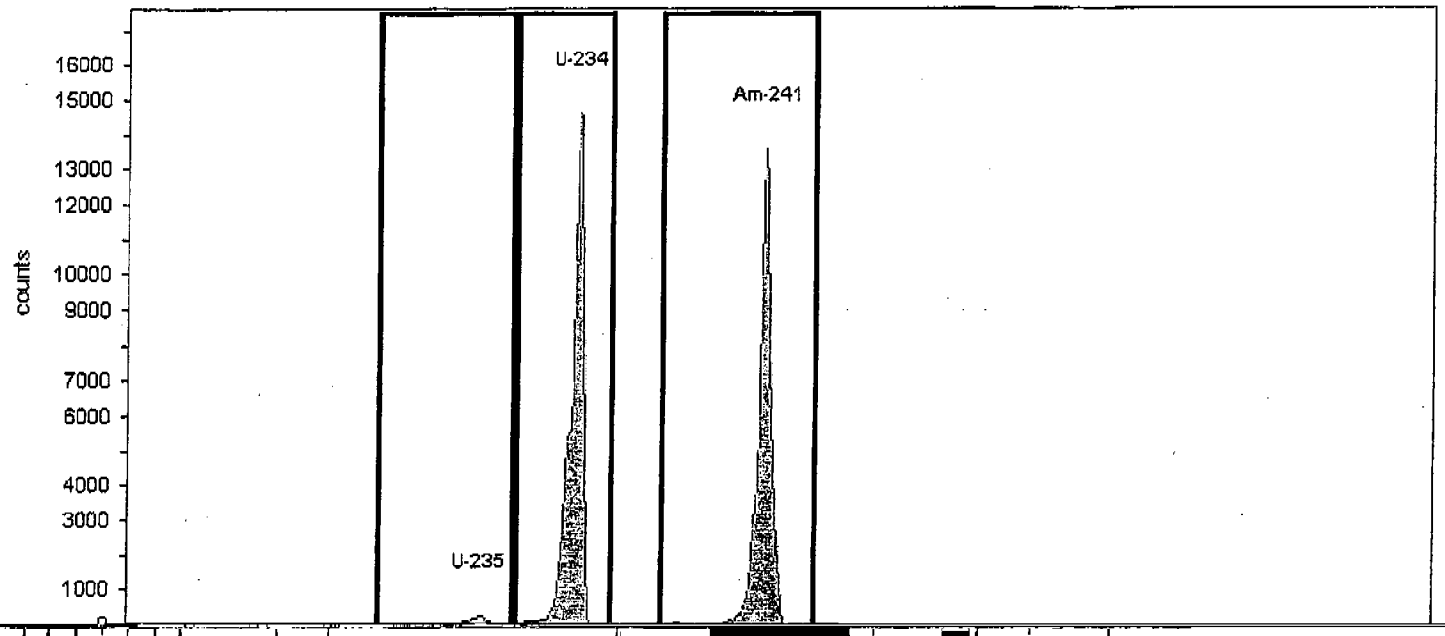
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 11:18:09AM

Live Time: 35.00 min.
Real Time: 35.05 min.

Efficiency Calibration Name: RSO187

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.66% +/- 0.15% TPU(2 sigma)



**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:34:50PM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO188
Description:

Analysis Date: 6/8/2007 12:34:43PM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A7 RSO#188
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

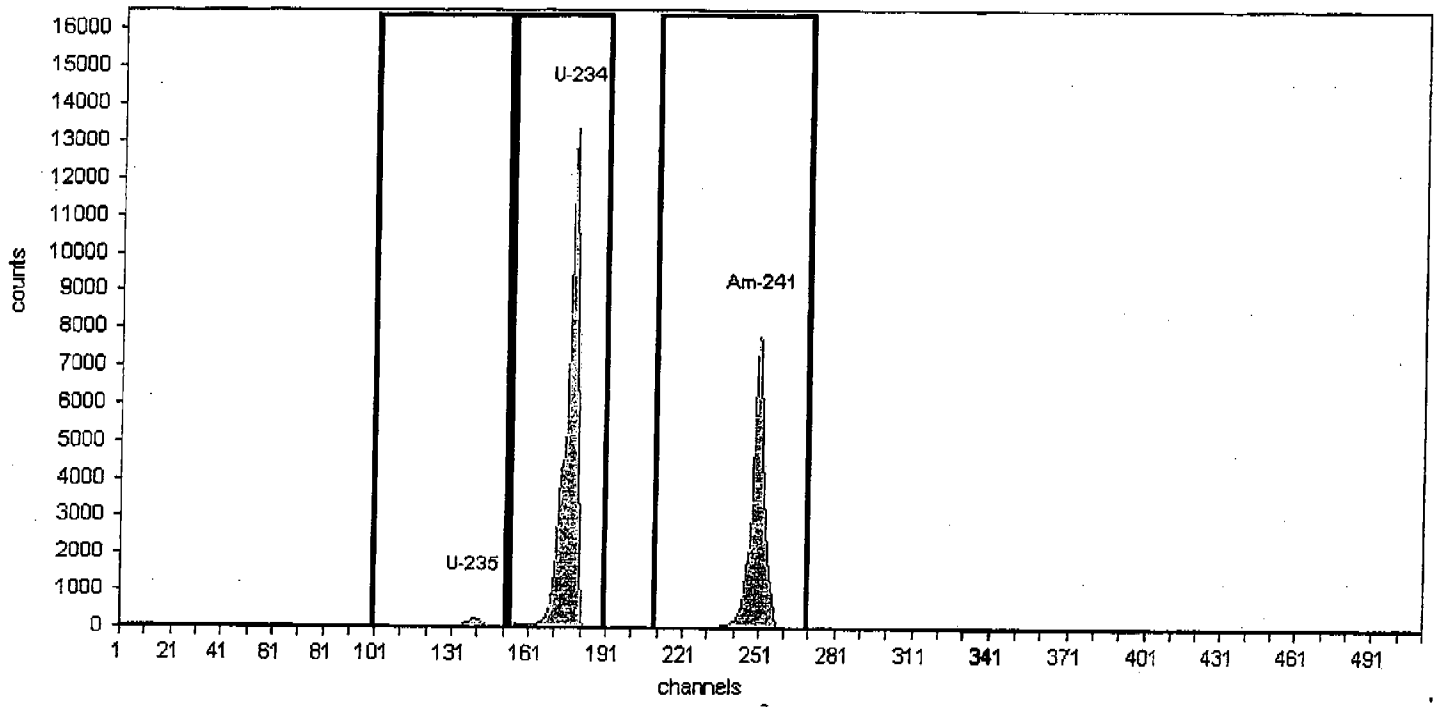
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 11:54:29AM

Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO188

Energy Calibration Equation:
Gain = 9.8224 keV / Ch
Offset = 3,029.39 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.21% +/- 0.18% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,369.00 | 39.11 |
| U-234 | 178 | 4.78 | 153 | 190 | 66,752.00 | 1,907.20 |
| Am-241 | 250 | 5.49 | 210 | 270 | 42,962.00 | 1,227.49 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: 23

1:11:17PM 6/8/2007

***Calibration***

Energy Calibration: RSO189
Description:

Analysis Date: 6/8/2007 1:11:09PM
Calibration Type: Energy And Efficiency

***Source Info***

Certificate ID: A8 RSO#189
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

***Acquisition***

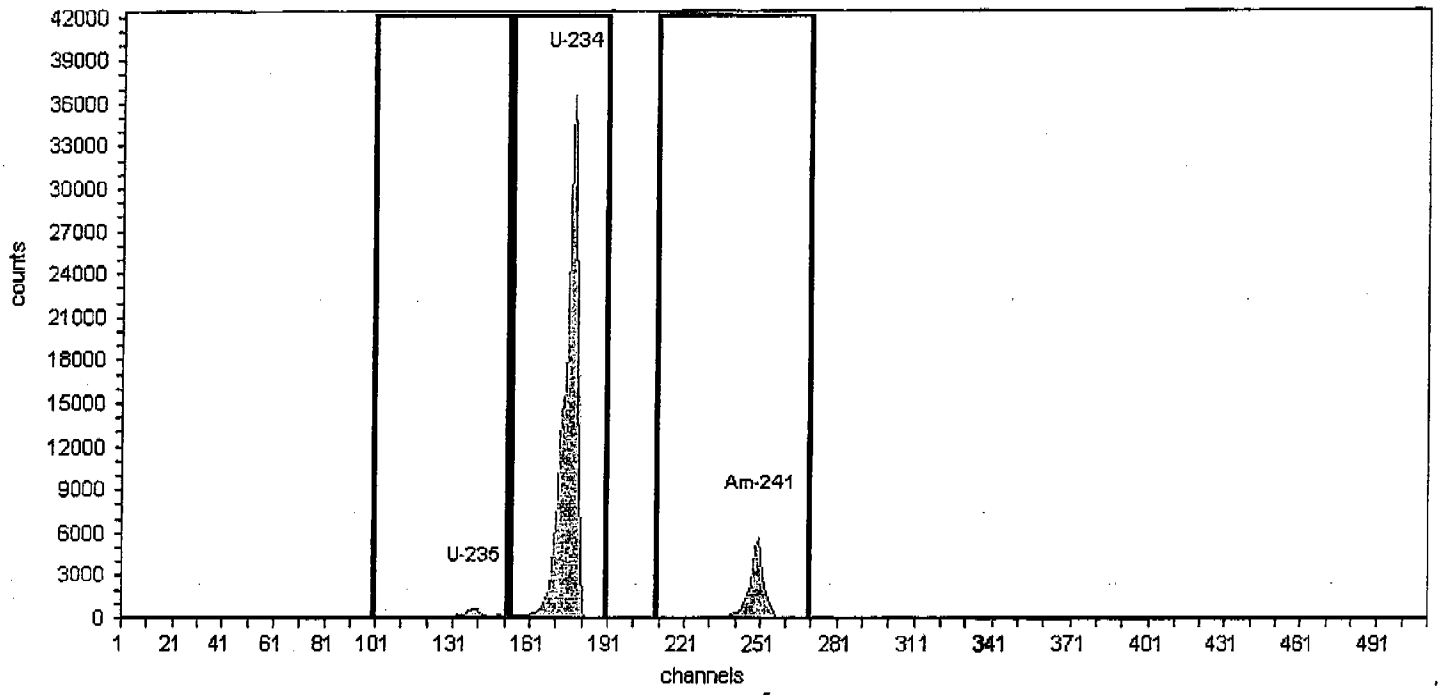
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 12:35:13PM

Live Time: 35.00 min.
Real Time: 35.07 min.

Efficiency Calibration Name: RSO189

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.15% +/- 0.12% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

***Nuclide Activity Summary***

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 4,335.00 | 123.86 |
| U-234 | 177 | 4.78 | 153 | 190 | 204,218.00 | 5,834.80 |
| Am-241 | 250 | 5.49 | 210 | 270 | 32,537.00 | 929.63 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:30:24AM 6/11/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO190
Description:

Analysis Date: 6/11/2007 8:30:16AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

### Acquisition

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 1:11:41PM

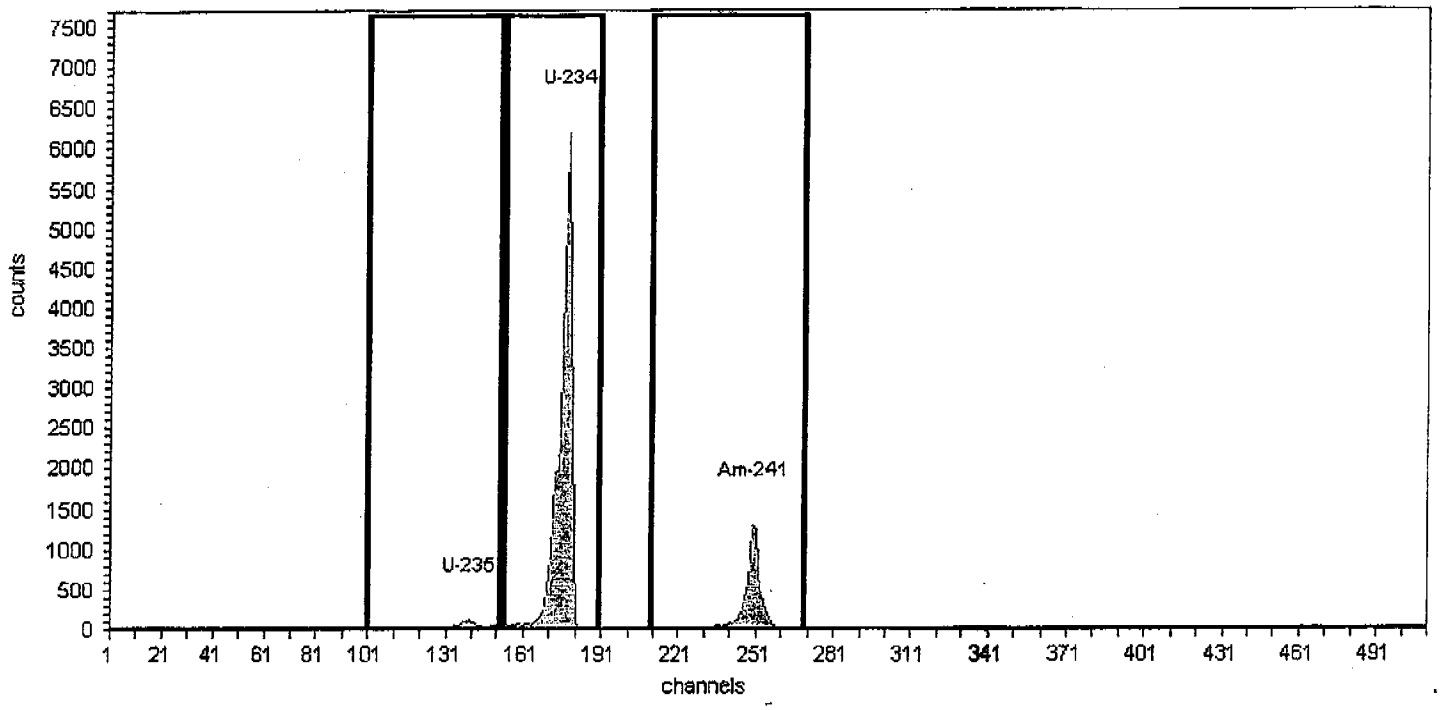
Live Time: 35.00 min.
Real Time: 35.01 min.

Efficiency Calibration Name: RSO190

Energy Calibration Equation:
Gain = 9.9003 keV / Ch

Offset = 3,011.38 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.67% +/- 0.30% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 730.00 | 20.86 |
| U-234 | 178 | 4.78 | 153 | 190 | 30,147.00 | 861.34 |
| Am-241 | 250 | 5.49 | 210 | 270 | 7,083.00 | 202.37 |

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α1
reverified 6/8/07
expires 6/8/08
PAT 187
recalibrate 4-15-03

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203026 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 3.354 | nCi | (124.1 Bq) | Am-241: | 0.5793 | nCi | (21.43 Bq) |
| U-235: | 0.06566 | nCi | (2.429 Bq) | Total Activity: | 3.999 | nCi | (148.0 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Mar 1998.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.7% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4483 α/min in 2π on 11 Apr 03.

Daniel James Van Dalsem
**Quality Control**

15-Apr-03
**Date Signed**

IPL Ref. No.: 987-7

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α2

reverified 6/6/07
expires 6/8/08
PAI 183
Recalibrated 4-15-03

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203028 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 6.467 | nCi | (239.3 Bq) | Am-241: | 0.6366 | nCi | (23.55 Bq) |
| U-235: | 0.1135 | nCi | (4.200 Bq) | Total Activity: | 7.217 | nCi | (267.1 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.7% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radio[illegible]

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α3 reverified 6/8/07
expires 6/8/08
PAT I.D 184
recalibrated 4-15-02

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203024 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 3.227 | nCi | (119.4 Bq) | Am-241: | 2.866 | nCi | (106.0 Bq) |
| U-235: | 0.05205 | nCi | (1.926 Bq) | Total Activity: | 6.145 | nCi | (227.3 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.6% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 6889 α/min in 2π on 11 Apr 03.

Daniel James Van Dalsem
**Quality Control**

15-Apr-03
**Date Signed**

IPL Ref. No.: 987-7

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α4 reverified 6/8/07 expires 6/8/08 EW 6/22/07
PAI ID 00185 recd from recalibration 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Apr-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203021 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 2.731 | nCi | (101.0 Bq) | Am-241: | 0.9325 | nCi | (34.50 Bq) |
| U-235: | 0.03416 | nCi | (1.264 Bq) | Total Activity: | 3.698 | nCi | (136.8 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.8% |
| B. Type B (systematic) uncertainty: | ± 3.1% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.2% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4145 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
**Quality Control**

19-Mar-03
**Date Signed**

IPL Ref. No.: 987-2

Isotope Products
Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661•309•1010
Fax 661•257•8303

A5

reverified 6/8/07
expires 6/8/08
PAI ID 00186
recalibration

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

L6 reverified 6/8/01 expires 6/8/08
BAID 60187
rec'd for recalibrate 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Apr-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203022 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 3.592 | nCi | (132.9 Bq) | Am-241: | 3.279 | nCi | (121.3 Bq) |
| U-235: | 0.08556 | nCi | (3.166 Bq) | Total Activity: | 6.957 | nCi | (257.4 Bq) |

**Physical description:**

A. Capsule type: Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit: Electrodeposited and diffusion bonded oxides

Isotope Products
Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α 7

reverified 6/18/07
expires 6/18/08
6/22/07
PAID 188
recd for recalibration
3-28-03

# CERTIFICATE OF CALIBRATION

Isotope Products
Laboratories

An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

28

revevified 6/8/07
expires 6/8/08
PAI, ID 189

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

RSO # 190
Rec'd 6/6/07 GW
Recertification 6/1/07

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

α 9

| | | | |
|---|---|---|---|
| **Radionuclide:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide:** | U-235 | **P.O. No.:** | 73179/R3768 |
| **Radio: 23** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half-life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Jun-07 12:00 PST |
| **Half-life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX223027 |
| **Half-life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| U-234: | 1.349 | **nCi,** | 49.91 | **Bq** | Am-241: | 0.3243 | **nCi,** | 12.00 | **Bq** |
| U-235: | 0.02970 | **nCi,** | 1.099 | **Bq** | Total Activity: | 1.703 | **nCi,** | 63.01 | **Bq** |

**Physical Description:**

A. Capsule type: Disk (47 mm OD x 0.76 mm THK)
B. Nature of active deposit: Electrodeposited and diffusion bonded oxide
C. Active diameter/volume: 19 mm
D. Backing: Stainless steel
E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in May 2001.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty: ± 0.9 %
B. Type B (systematic) uncertainty: ± 3.0 %
C. Uncertainty in aliquot weighing: ± 0.0 %
D. Total uncertainty at the 99% confidence level: ± 3.1 %

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 1909 α/min in 2π on 22-May-07

Quality Control

24 May 07
Date

IPL Ref. No.: 1143-19

# Paragon Analytics

## Radiochemistry Case Narrative

1

PARAGON ANALYTICS
Radiochemistry Data Package

Section 1

# CHAIN OF CUSTODY

# Paragon Analytics

## Sample Number(s) Cross-Reference Table

**Paragon OrderNum:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939
**Client PO Number:** 33204-001-06 F3

| Client Sample Number | Lab Sample Number | COC Number | Matrix | Date Collected | Time Collected |
|---|---|---|---|---|---|
| SFB08-08-11838 | 0804083-1 | | SOLID | 08-Feb-08 | |
| SFB08-08-11839 | 0804083-2 | | SOLID | 08-Feb-08 | |

0804083



Tuesday, April 08, 2008

**LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 08-939C**

**REQUEST NUMBER: 08-939**

## LOS ALAMOS

**NATIONAL LABORATORY**

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 5/8/2008

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS:

| | SAMPLE ID | CTNR | CTNR DESC | ORDER | PRESERV | MATRIX |
|---|---|---|---|---|---|---|
| 1 | SFB08-08-11838 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |
| 2 | SFB08-08-11839 | 1 | 500 ML POLY | AM-241+ISOPU+ISOU+SR90 | None | S |

| Relinquished By: | | Date | Time | Received By: | | Date | Time |
|---|---|---|---|---|---|---|---|
| [illegible] | | 4/8/08 | 1400 | Cheryl Trimble | Cheryl Trimble | 4-9-08 | 0930 |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |
| Printed Name | Signature | | | Printed Name | Signature | | |

**Received for DISPOSAL By:** **Date** **Time** **Remarks:**

Printed Name Signature

UEST NUMBER: 08-939

:08-939

r:1-800-443-1511

EPR13110300

| PLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|
| ite Rock at NM ght office area | sent to Paragon |
| st sample, White at NM oversight om | sent to Paragon |
| ite Rock at NM ght office area | sent to Paragon |
| st sample, White at NM oversight om | sent to Paragon |
| ite Rock at NM ght office area | sent to Paragon |

Tuesday, April 08, 2008

REQUEST NUMBER: 08-939

| PRIORITY | METHOD CODE | CNTNR | SAMPLE ID | SAMPLE MATRIX | DATE SAMPLED | SAMPLE COMMENTS | SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|
| | HASL-300:PO-210 | 1 | SFB08-08-11839 | S | 2/8/2008 | #2 dust sample, White Rock at NM oversight bathroom | sent to Paragon |

**Final Page of REQUEST NUMBER 08-939**

CONDITION OF SAMPLE UPON RECEIPT FORM **Paragon Analytics**

Client: LANL Workorder No: 0804083

Project Manager: LS Initials: CT Date: 4-9-08

| | | | |
|---|---|---|---|
| 1. Does this project require any **special handling** in addition to standard Paragon procedures? | | YES | (NO) |
| 2. Are custody **seals** on **shipping containers** intact? | NONE | (YES) | NO |
| 3. Are Custody seals on **sample containers** intact? | NONE | (YES) | NO |
| 4. Is there a **COC (Chain-of-Custody) present** or other representative documents? | | (YES) | NO |
| 5. Are the **COC and bottle labels complete and legible**? | | (YES) | NO |
| 6. Is the **COC in agreement** with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.) | | (YES) | NO |
| 7. Were **airbills / shipping documents** present and/or removable? | DROP OFF | (YES) | NO |
| 8. Are all aqueous **samples requiring preservation preserved correctly**? (excluding volatiles) | (N/A) | YES | NO |
| 9. Are all aqueous **non-preserved samples pH 4-9**? | (N/A) | YES | NO |
| 10. Is there **sufficient sample** for the requested analyses? | | (YES) | NO |
| 11. Were all samples placed in the **proper containers** for the requested analyses? | | (YES) | NO |
| 12. Are all samples within **holding times** for the requested analyses? | | (YES) | NO |
| 13. Were all sample containers received **intact**? (not broken or leaking, etc.) | | (YES) | NO |
| 14. Are all samples requiring no headspace (VOC, GRO, Rx CN/S, radon), headspace free? **Size of bubble**: ____ < green pea ____ > green pea | (N/A) | YES | NO |
| 15. 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.) | (N/A) | YES | NO |
| 16. Were the samples **shipped on ice**? | | (YES) | NO |
| 17. Were cooler temperatures measured at 0.1-6.0°C? **IR gun used*:** #2 (#4) | RAD ONLY | (YES) | NO |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cooler #: | 1 | | | | | | | |
| Temperature (°C): | 6° | | | | | | | |
| No. of custody seals on cooler: | 2 | | | | | | | |
| DOT Survey/ Acceptance Information — External µR/hr reading: | 16 | | | | | | | |
| Background µR/hr reading: | 13 | | | | | | | |

Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? (YES) / NO / NA (If no, see Form 008.)

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

Dust ~ 0.5 g each

Sequential analysis

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

**Project Manager Signature / Date:** [signature] 4/11/08

*IR Gun #2: Oakton, SN 29922500201-0066 *IR Gun #4: Oakton, SN 2372220101-0002

Form 201r20.xls (12/27/07)

ORIGIN ID: SAFA (505) 665-9966
JOYLENE VALDEZ
LOS ALAMOS NATL LAB.
TA00 BLDG 1237 DPU 03

LOS ALAMOS, NM 87545
UNITED STATES US

Ship Date: 08APR08
ActWgt: 31.0 LB MAN
System#: 0014176/CAFE2355
Account: S *********

0804083

(800) 443-1511
FedEx
Express

LANCE STEERE
PARAGON
225 COMMERCE

16

FORT COLLINS, CO 80524

2

f: 6b010amr1a01401hco

CL5858187/22/23

6K

Delivery Address
Barcode

BILL SENDER

PRIORITY OVERNIGHT

WED
Deliver By:
09APR08

TRK# 7209 7844 0486 Form 0201

DEN AA

0524 -CO-US XH FTCA

2

PARAGON ANALYTICS
Radiochemistry Data Package

Section 2

# SAMPLE RESULTS SUMMARY

# Isotopic Americium By Alpha Spectroscopy Sample Results Summary

**Client Name:** Los Alamos National Laboratory SMO
**Client Project Name:**
**Client Project Number:** 08-939

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Page:** 1 of 1
**Reported on:** Monday, June 02, 2008 12:08:29 PM

| Lab Sample ID | Client Sample ID | Sample Type | Nuclide | Result +/- 1 s TPU | MDC | Units | Matrix | Prep Batch | Date Analyzed | Flags |
|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SFB08-08-11838 | Sample | Am-241 | -0.005 +/- 0.013 | 0.050 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | U,M |
| 0804083-2 | SFB08-08-11839 | Sample | Am-241 | 0.034 +/- 0.012 | 0.011 | pCi/g | SOLID | AS080513-2 | 5/28/2008 | |

**Comments:**

**Data Package ID:** *AM0804083-1*

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
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)

BDL - Below Detection Limit

3

PARAGON ANALYTICS
Radiochemistry Data Package

Section 3

# QC RESULTS SUMMARY

# Isotopic Americium By Alpha Spectroscopy

PAI 714 Rev 11

Method Blank Results

# Isotopic Americium By Alpha Spectroscopy

## PAI 714 Rev 11

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** AS080513-2LCS

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2A
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 14596-10-2 | Am-241 | 4.09 +/- 0.37 | 0.06 | 4.22 | 97.0 | 79 - 118 | P,M3 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Am-243 | 4.251 | 2.12 | pCi/g | 49.8 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

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

Abbreviations:

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

**Data Package ID:** *AM0804083-1*

# Isotopic Americium By Alpha Spectroscopy

## PAI 714 Rev 11

## Laboratory Control Sample(s)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Lab ID:** AS080513-2LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2A
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Results +/- 1s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|---|---|---|---|---|---|---|---|
| 14596-10-2 | Am-241 | 4.66 +/- 0.41 | 0.07 | 4.22 | 111 | 79 - 118 | P,M3 |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Am-243 | 4.251 | 2.18 | pCi/g | 51.2 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

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

Abbreviations:

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

**Data Package ID:** *AM0804083-1*

# Isotopic Americium By Alpha Spectroscopy

## PAI 714 Rev 11

## Duplicate Sample Results (DER)

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:**
**Lab ID:** AS080513-2LCSD

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 13-May-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2A
**Count Time:** 1000 minutes

**Final Aliquot:** 0.524 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Analyte | Sample Result +/- 1s TPU | Duplicate Result +/- 1s TPU | DER | Control Limit | Lab Qualifiers |
|---|---|---|---|---|---|---|
| 14596-10-2 | Am-241 | 4.09 +/- 0.37 | 4.66 +/- 0.41 | 0.52 | 2.13 | P,M3 |

### Comments:

**Duplicate Qualifiers/Flags:**

U - Result is less than the sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13
LT - Result is less than Request MDC, greater than sample specific MDC
M - Requested MDC not met.
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
L - LCS Recovery below lower control limit.
H - LCS Recovery above upper control limit.
P - LCS, Matrix Spike Recovery within control limits.
N - Matrix Spike Recovery outside control limits

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
DER - Duplicate Error Ratio (see PAI SOP 715)
BDL - Below Detection Limit
NR - Not Reported

**Data Package ID:** *AM0804083-1*

PARAGON ANALYTICS
Radiochemistry Data Package

4

Section 4

# INDIVIDUAL SAMPLE RESULTS

# Isotopic Americium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11838
**Lab ID:** 0804083-1

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2A
**Count Time:** 1000 minutes
**Report Basis:** As Received

**Final Aliquot:** 0.454 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 14596-10-2 | Am-241 | -0.005 +/- 0.013 | 0.050 | 0.02 | U,M |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Am-243 | 4.911 | 3.13 | pCi/g | 63.8 | 30 - 110 % | |

### Comments:

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

**Data Package ID:** *AM0804083-1*

# Isotopic Americium By Alpha Spectroscopy

## PAI 714 Rev 11

## Sample Results

**Lab Name:** Paragon Analytics
**Work Order Number:** 0804083
**Client Name:** Los Alamos National Laboratory SMO
**ClientProject ID:** 08-939

**Field ID:** SFB08-08-11839
**Lab ID:** 0804083-2

**Analysis ReqCode:** ASP-A-003

**Sample Matrix:** SOLID
**Prep SOP:** PAI 778 Rev 12
**Date Collected:** 08-Feb-08
**Date Prepared:** 13-May-08
**Date Analyzed:** 28-May-08

**Prep Batch:** AS080513-2
**QCBatchID:** AS080513-2-1
**Run ID:** AS080513-2A
**Count Time:** 1000 minutes
**Report Basis:** As Received

**Final Aliquot:** 0.595 g
**Prep Basis:** As Received
**Moisture(%):** NA
**Result Units:** pCi/g
**File Name:** Spectrum #1

| CASNO | Target Nuclide | Result +/- 1 s TPU | MDC | Requested MDC | Lab Qualifier |
|---|---|---|---|---|---|
| 14596-10-2 | Am-241 | 0.034 +/- 0.012 | 0.011 | 0.02 | |

## Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|---|---|---|---|---|---|---|
| Am-243 | 3.748 | 2.17 | pCi/g | 57.8 | 30 - 110 % | |

**Comments:**

**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

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

Y2 - Chemical Yield outside default limits.

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

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

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

**Data Package ID:** *AM0804083-1*

PARAGON ANALYTICS

# RAW DATA

# rt

Thursday, May 29, 2008
12:15:30 PM

| vity +/- s TPU | MDC DecLev | ReportUnits ReportBasis | DER RPD | %Spk. Recov Flags |
|---|---|---|---|---|
| 005 | 0.050 | pCi/g | NA | |
| 013 | NA | As Received | NA | U,M |
| .13 | 0.03 | pCi/g | NA | |
| .25 | NA | As Received | NA | |
| 034 | 0.011 | pCi/g | NA | |
| 012 | NA | As Received | NA | |
| 17 | 0.03 | pCi/g | NA | |
| .17 | NA | As Received | NA | |
| 048 | 0.064 | pCi/g | NA | |
| 023 | NA | As Received | NA | U,M |
| 02 | 0.04 | pCi/g | NA | |
| 17 | NA | As Received | NA | |
| 09 | 0.06 | pCi/g | NA | 97.0 |
| 37 | NA | As Received | NA | P,M3 |
| 12 | 0.02 | pCi/g | NA | |
| 17 | NA | As Received | NA | |
| 66 | 0.07 | pCi/g | 0.52 | 111 |
| 41 | NA | As Received | NA | P,M3 |
| 18 | 0.04 | pCi/g | NA | |
| 18 | NA | As Received | NA | |

rrected (i.e. activity measured not activity added).
ie, 12:00 PM (Mountain) is used for decay correction.

(see PAI SOP 743)
tration (see PAI SOP 709)

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 0804083-1
Spectrum #1 Analysis #1

Sample Size : 0.45

### Acquisition

Detector: 1
Batch Name: AAS080513-2_A
Nuclide Library: Am-241
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Am-241

Acquisition Start Date: 5/28/2008 5:59:53PM
Live Time: 1,000.00 min.
Real Time: 1,001.49 min.
Dead Time: 0.15 %

### Calibration

Bkgd Info: Sample: B08052701; Det: 1; Spectrum #1; May-27-2008 16:51

Calibration Date: 5/27/2008 3:54:48PM

Efficiency Calibration: C08052701

Efficiency: 29.01% +/- 0.20% TPU(2 sigma)

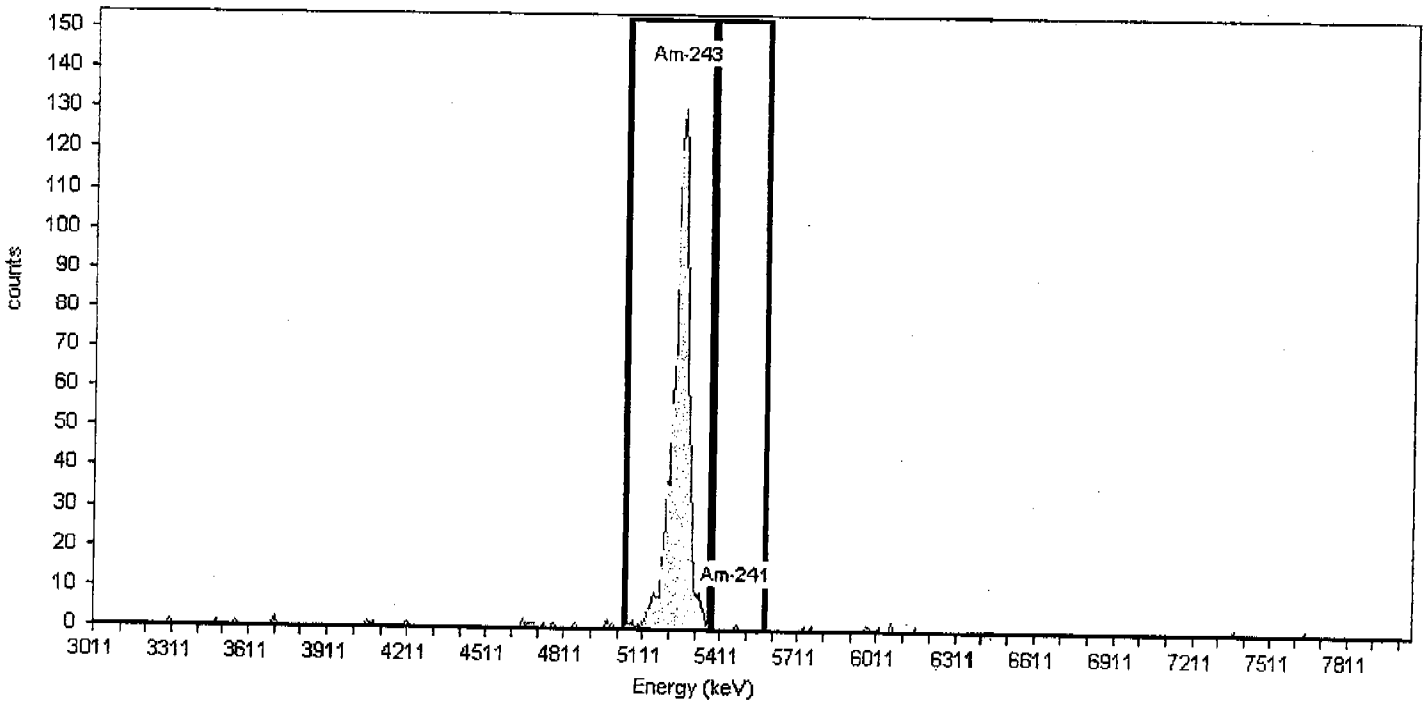
Energy Calibration: C08052701

Energy Cal: Gain = 9.9003 keV / Ch
Offset = 3,001.48 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 821.3020.61
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Am-243
Tracer Recovery: 63.25%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-243 | 5258.7 | 5040.9 | 5367.6 | 71.8 | 99.9 | 918.00 | 2.00 | 916.00 | 3.2E+000 | 2.1E-001 | 1.8E-002 | 5.1E-002 |
| Am-241 | 5466.6 | 5377.5 | 5585.5 | 24.2 | 100.0 | 1.00 | 2.00 | -1.00 | -5.5E-003 | 1.9E-002 | 1.8E-002 | 5.1E-002 |

Reviewed By: GB

Print Date: 5/29/2008 10:53:03AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: 0804083-2
Spectrum #1 Analysis #1

Sample Size : 0.59

### Acquisition

Detector: 2
Batch Name: AAS080513-2_A
Nuclide Library: Am-241
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Am-241

Acquisition Start Date: 5/28/2008 5:59:54PM
Live Time: 1,000.00 min.
Real Time: 1,001.49 min.
Dead Time: 0.15 %

### Calibration

Bkgd Info: Sample: B08052702; Det: 2; Spectrum #1; May-27-2008 16:51

Calibration Date: 5/27/2008 3:55:03PM

Efficiency Calibration: C08052702

Efficiency: 30.88% +/- 0.15% TPU(2 sigma)

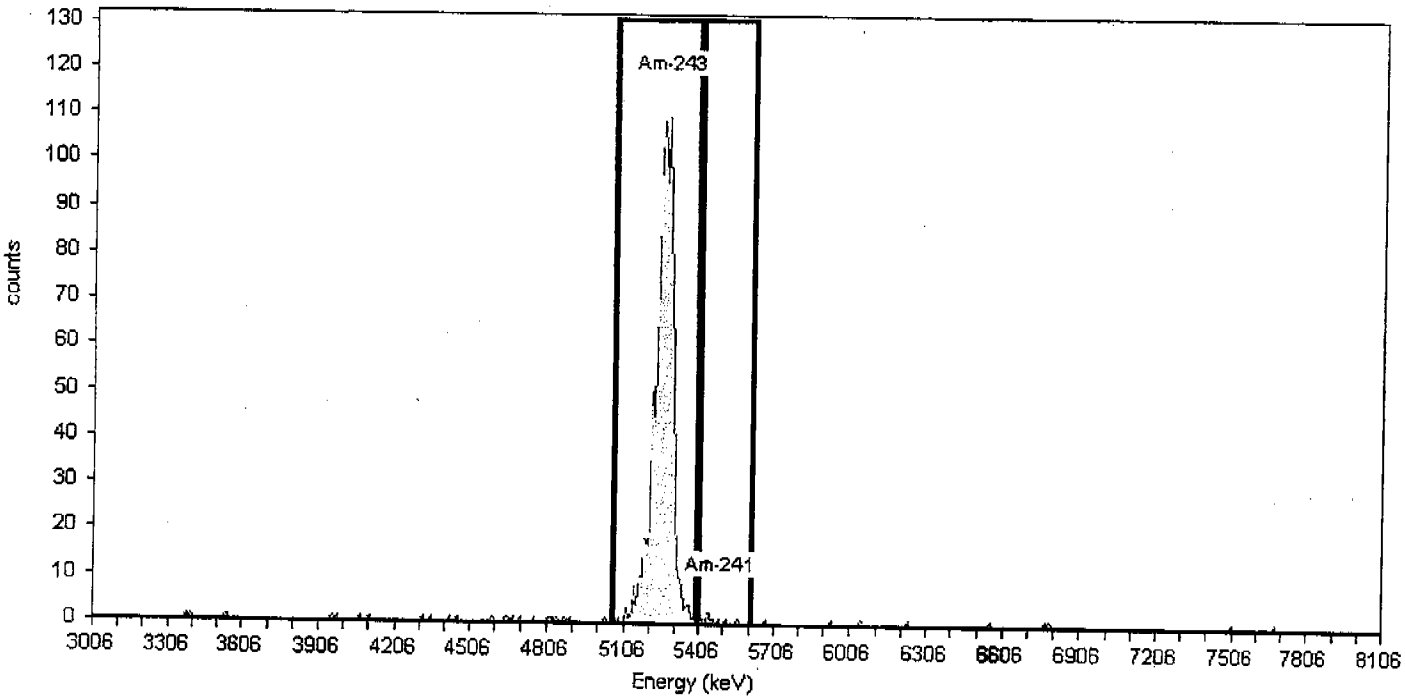
Energy Calibration: C08052702

Energy Cal: Gain = 9.9974 keV / Ch
Offset = 2,996.32 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 821.3020.61
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Am-243
Tracer Recovery: 57.35%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-243 | 5275.7 | 5065.8 | 5395.7 | 77.5 | 99.9 | 887.00 | 3.00 | 884.00 | 2.2E+000 | 1.5E-001 | 1.7E-002 | 4.6E-002 |
| Am-241 | 5485.7 | 5405.7 | 5615.6 | 23.4 | 100.0 | 8.00 | 0.00 | 8.00 | 3.4E-002 | 2.6E-002 | 0.0E+000 | 1.2E-002 |

Reviewed By: GB

Print Date: 5/29/2008 10:54:10AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS080513-2MB
Spectrum #1 Analysis #1

Sample Size : 0.52

### Acquisition

Detector: 4
Batch Name: AAS080513-2_A
Nuclide Library: Am-241
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Am-241

Acquisition Start Date: 5/28/2008 5:59:54PM
Live Time: 1,000.00 min.
Real Time: 1,001.49 min.
Dead Time: 0.15 %

### Calibration

Bkgd Info: Sample: B08052704; Det: 4; Spectrum #1; May-27-2008 16:51

Calibration Date: 5/27/2008 3:55:19PM

Efficiency Calibration: C08052704

Efficiency: 30.30% +/- 0.21% TPU(2 sigma)

Energy Calibration: C08052704

Energy Cal: Gain = 10.0776 keV / Ch
Offset = 2,977.80 keV
Quadratic = 0.0000 keV / $Ch^2$

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS080513-2LCS
Spectrum #1 Analysis #1

Sample Size : 0.52

### Acquisition

Detector: 5
Batch Name: AAS080513-2_A
Nuclide Library: Am-241
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Am-241

Acquisition Start Date: 5/28/2008 5:59:55PM
Live Time: 1,000.00 min.
Real Time: 1,001.49 min.
Dead Time: 0.15 %

### Calibration

Bkgd Info: Sample: B08052705; Det: 5; Spectrum #1; May-27-2008 16:51

Calibration Date: 5/27/2008 3:55:44PM

Efficiency Calibration: C08052705

Efficiency: 31.19% +/- 0.13% TPU(2 sigma)

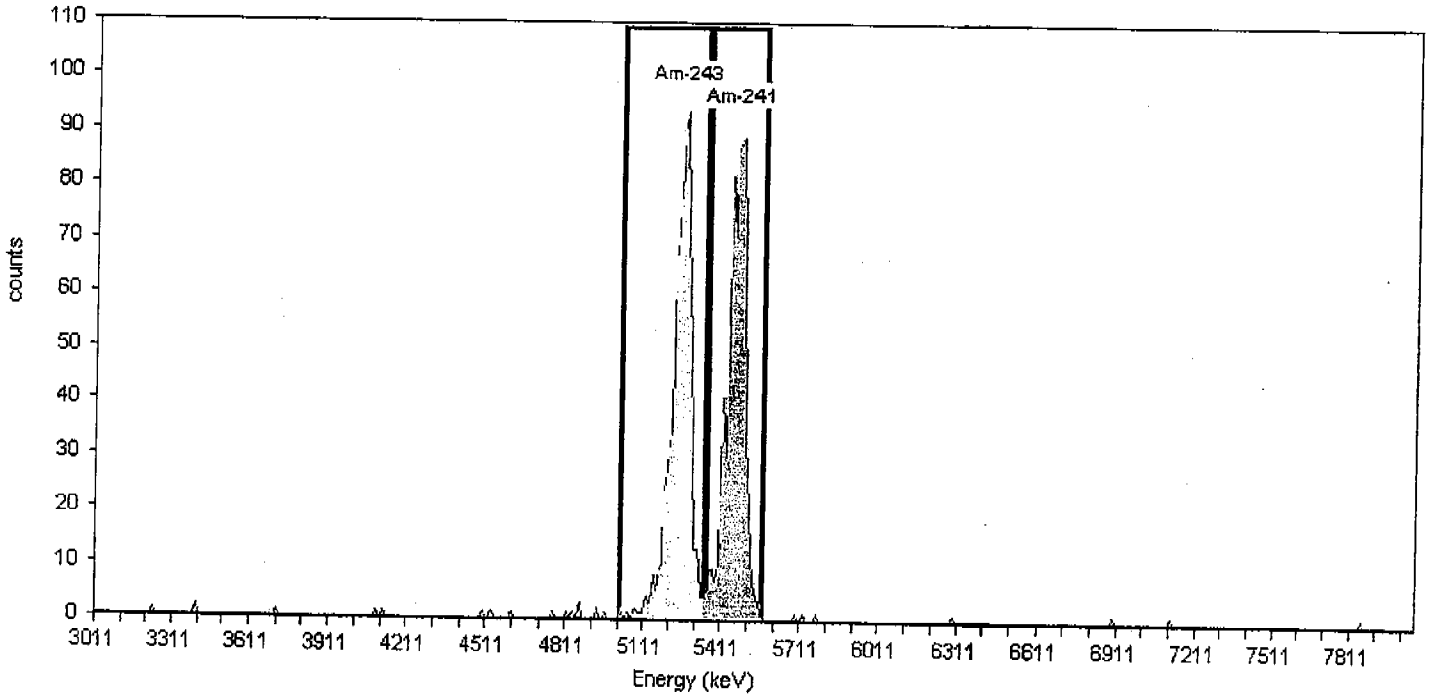
Energy Calibration: C08052705

Energy Cal: Gain = 9.9003 keV / Ch
Offset = 3,001.48 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 821.3020.61
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Am-243
Tracer Recovery: 49.46%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-243 | 5258.7 | 5021.1 | 5347.8 | 90.0 | 99.7 | 770.00 | 1.00 | 769.00 | 2.1E+000 | 1.5E-001 | 1.3E-002 | 4.1E-002 |
| Am-241 | 5466.6 | 5357.7 | 5565.7 | 68.7 | 100.0 | 743.00 | 3.00 | 740.00 | 4.1E+000 | 5.9E-001 | 2.2E-002 | 6.0E-002 |

Reviewed By: GB

Print Date: 5/29/2008 10:55:49AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

# Paragon Analytics

## Alpha-Spectroscopy Analysis Report

### Sample

Sample: AS080513-2LCSD
Spectrum #1 Analysis #1

Sample Size : 0.52

### Acquisition

Detector: 6
Batch Name: AAS080513-2_A
Nuclide Library: Am-241
Analysis Method: Absolute Interactive ROI Analysis
ROI Set: Am-241

Acquisition Start Date: 5/28/2008 5:59:56PM
Live Time: 1,000.00 min.
Real Time: 1,001.49 min.
Dead Time: 0.15 %

### Calibration

Bkgd Info: Sample: B08052706; Det: 6; Spectrum #1; May-27-2008 16:51

Calibration Date: 5/27/2008 3:56:04PM

Efficiency Calibration: C08052706

Efficiency: 30.49% +/- 0.15% TPU(2 sigma)

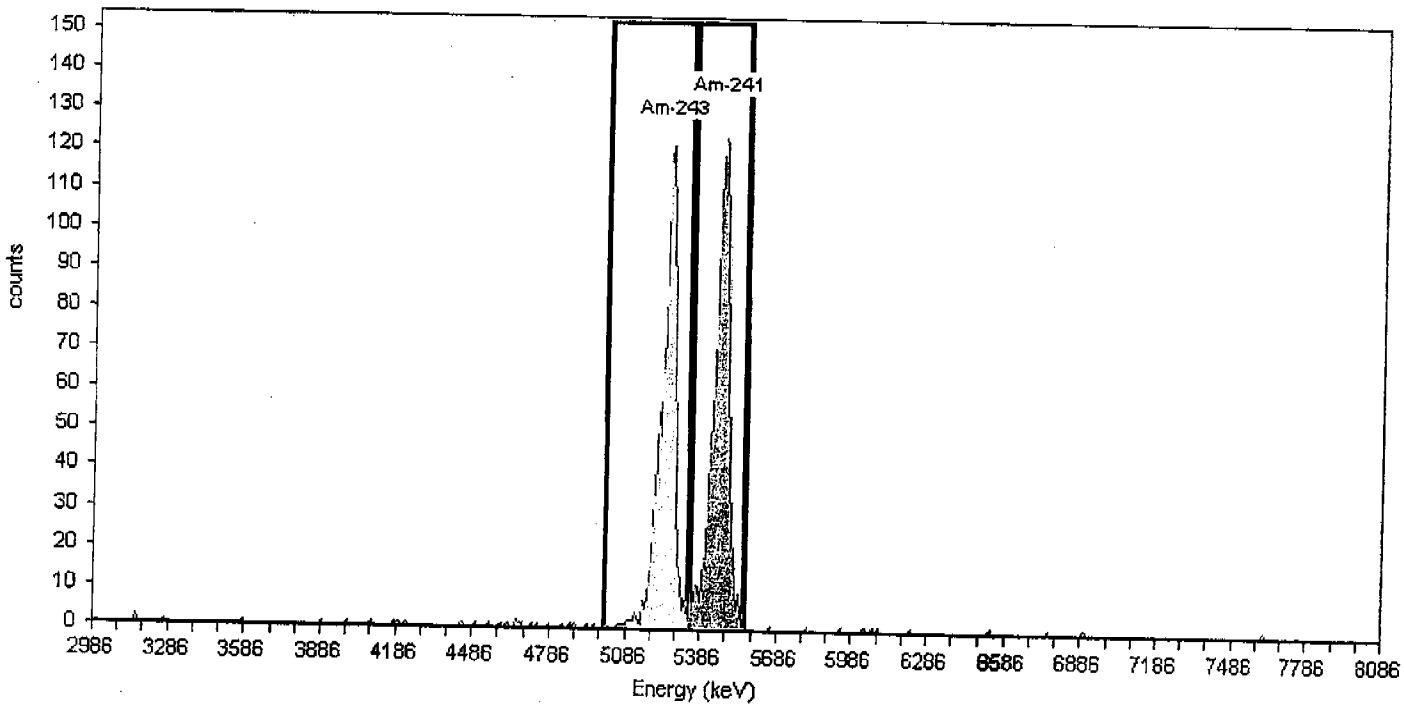
Energy Calibration: C08052706

Energy Cal: Gain = 9.9974 keV / Ch
Offset = 2,976.33 keV
Quadratic = 0.0000 keV / $Ch^2$

### Tracer

Tracer Name: 821.3020.61
Tracer Activity: 20.00 DPM/mL x (Vol.)0.25 mL = 5.00 DPM

Tracer Nuclide: Am-243
Tracer Recovery: 50.80%




### Nuclide Summary (ROI)

| Nuclide | Peak Energy keV | ROI Start keV | ROI End keV | FWHM keV | B.R. %. | Gross Counts | Bkgd Counts | Net Counts | Activity pCi/g | 2.00Sigma TPU pCi/g | Critical Level pCi/g | MDA pCi/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-243 | 5255.7 | 5005.8 | 5335.7 | 78.2 | 99.7 | 777.00 | 5.00 | 772.00 | 2.2E+000 | 1.6E-001 | 2.9E-002 | 7.3E-002 |
| Am-241 | 5465.7 | 5345.7 | 5555.7 | 55.1 | 100.0 | 851.00 | 4.00 | 847.00 | 4.7E+000 | 6.7E-001 | 2.6E-002 | 6.7E-002 |

Reviewed By: 9B

Print Date: 5/29/2008 10:57:02AM

AlphaVision v5.3
Custom Report Iteration: 08/09/07

*Analytics*

ter Instrument Run Log

Date: 5/28/06

| Detector | Batch ID | Sample ID | Iso/Matrix | Duration | Initial |
|---|---|---|---|---|---|
| 4 | AAS080513-2_A | AS080513-2MB | Am/s | 1000 | GB |
| 5 | ↓ | ↓ -2LCS | ↓ | ↓ | ↓ |
| 6 | | ↓ -2LCSD | | | |
| 8 | PAS080513-2_A | 0804083-1 | Pu/s | 1000 | GB |
| 49 | ↓ | ↓ -2 | ↓ | ↓ | ↓ |
| 50 | | AS080513-2MB | | | |
| 51 | | ↓ -2LCS | | | |
| 52 | | ↓ -2LCSD | | | |
| 53 | PAS080516-4_C | 0805122-14 | Pu/w | 1160 | GB |
| 54 | ↓ | ↓ -14D | ↓ | ↓ | ↓ |
| ~~55~~ | 33 | ↓ -19 | | | |
| 34 | | AS080516-4MB | | | |
| 35 | | ↓ -4LCS | | | |
| 36 | | ↓ -4LCSD | | | |
| 37 | PAS080523-2_A | 0805113-5 | Pu/w | 1000 | GB |
| 39 | ↓ | ↓ -10 | ↓ | ↓ | ↓ |
| 40 | | 0805121-5 | | | |
| 42 | | ↓ -10 | | | |
| 43 | | 0805139-5 | | | |
| 45 | | AS080523-2MB | | | |
| 46 | | ↓ -2LCS | | | |
| 47 | ↓ | ↓ -2LCSD | ↓ | ↓ | ↓ |
| | | | | GB 5/29/06 | |

Reviewed by: GB

Date: 7/27/06

PARAGON ANALYTICS
Radiochemistry Data Package

Section 6

# QUALITY ASSURANCE SUMMARY REPORTS

6

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0804083

TEST Am, Pu, U, Sr, Po

METHOD Prep

SOP/REV (PREP) Various

SOP/REV (ANAL) _____

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency,

*Paragon Analytics*

# QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0804083

PARAGON ANALYTICS
Radiochemistry Data Package

Section 7

# LABORATORY BENCH SHEETS

7

**Paragon Analytics**

# Radiochemistry Instrument Worksheet

**Prep Batch: AS080518-2**

**Prep Procedure:** Am241

Analytical QASS / NCR? Y (N) NA

| Prep Num | LabID | QC Type | Init Alq | Fin Alq | Units | Cnt 1 File | Cnt 1 Inst/Det | Cnt 1 Pos Chk By | Cnt 2 File | Cnt 2 Inst/Det | Cnt 2 Pos Chk By | Cnt 3 File | Cnt 3 Inst/Det | Cnt 3 Pos Chk By | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0804083-1 | SMP | 0.4585 | 0.453915 | g | _40831 | 1 | | _40831 | | | _40831 | | | |
| 1 | 0804083-2 | SMP | 0.6008 | 0.594792 | g | _40832 | 2 | | _40832 | | | _40832 | | | |
| 1 | AS080513-2 | MB | 0.52965 | 0.524354 | g | _5132B | 4 | | _5132B | | | _5132B | | | |
| 1 | AS080513-2 | LCS | 0.52965 | 0.524354 | g | _5132L | 5 | | _5132L | | | _5132L | | | |
| 1 | AS080513-2 | LCSD | 0.52965 | 0.524354 | g | _5132LD | 6 | | _5132LD | | | _5132LD AB 5/29/08 | | | AB 5/29/08 |

**Tracer/Carrier Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| T1 | Am-243 | 821.3020.61 | 19.995 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T2 | U-232 | 837.3020.90 | 19.763 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| T3 | Pu-242 | 846.3020.88 | 19.997 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |

**Spike Solution Information**

| Soln # | Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|---|
| S1 | AM-241 | 616.2382.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-234 | 644.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-235 | 644.3020.52 | 0.948 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S2 | U-238 | 644.3020.52 | 20.596 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| S3 | Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |

te: 5/27/2008
357740

y Prep Worksheet

Prep Batch: PL080513-1

Not Validated!!!

Reviewed By:

Review Date:

Y / N Batch: _____ Prep QASS / NCR? Y / N _____

Balance:

Balance:

| | Prep Notes |
|---|---|
| 4 ,TS | .4585 |
| 4 ,TS | .6008 |
| 1,T SS,TS | |
| 1,T SS,TS | |

Spike Solution Information

| Nuclide | SolnID | Prep Conc | Units | Prep Date | Aliquot | Units | Pipet ID |
|---|---|---|---|---|---|---|---|
| AM-241 | 616.2382.92 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| U-234 | 644.3020.52 | 19.838 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| U-235 | 644.3020.52 | 0.948 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| U-238 | 644.3020.52 | 20.596 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| Pu-239 | 819.3020.51 | 20.927 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| Pb-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 0.25 | ml | AW016 |
| Po-210 | 823.3020.41 | 47.234 | DPM/ml | 05/13/08 | 1 | ml | AW015 |
| Sr-90 | 600.3020.82 | ~57 dpm/mL | | | .5mL | | AW013 |

10/8/08
1/13/09
10/11/08
7/14/08
8/3/08

Analytics

on: 6.141A

Supersedes: NA

# SAMPLE CONDITION FORM (SOLIDS)

ANALYST: TC

ANALYSIS DATE: 5/13/08 METHOD: Prep

| WORK ORDER | SAMPLE ID | SAMPLE CONDITION | | |
|---|---|---|---|---|
| | | Dry/Wet | TEXTURE | Remarks |
| 0804083 | 1 | dry | Dust | As Rec'd |
| | 2 | | | |

TC 5/13/08

PARAGON ANALYTICS
Radiochemistry Data Package

Section 8

# STANDARDS TRACEABILITY DOCUMENTS

8

Prepare a working level dilution of Am-243 (RSO# 821) of ~20 dpm/mL using 1M $HNO_3$ (6% $HNO_3$).

AB 2/1/07

1. DETERMINE THE DENSITY OF ACID:

Balance ID

Acid type: 1M $HNO_3$ Lot# 063544 — 12

Mass of empty 100 mL Class A volumetric flask: 56.4421 g

Mass of flask with 100 mL acid: 159.4520 g

Net mass of acid: 103.0099 g

ρ= 1.0301 g/mL

2. TRANSFER STANDARD TO NALGENE BOTTLE:

Bottle size: 500mL

Mass of empty Nalgene without lid: 48.0209 g — 12

Mass of Nalgene and standard: 52.9124 g

Net mass of standard transferred: 4.8915 g

AB 2/1/07

AB 2/1/07

3. DILUTE WITH ACID

Mass of empty Nalgene w/o lid from above: 48.0209 g — 12

Mass of Nalgene, standard and acid: 595.83 g — 26

Net mass of standard and acid: 547.8091 g

4. FINAL ACTIVITY CALCULATION

$$\frac{(36.24\ Bq/g)\left(\frac{60\ dpm}{min}\right)(4.8915\ g)(1.0301\ g/mL)}{547.8091\ g} = \boxed{20.00\ dpm/mL}$$

AB 2/1/07

RG 2/23/07

Stnd ID: 821.3020.61

Description: Am-243

Expiration: 2/13/2008

Activity: 20.00 dpm/mL

2s Uncertainty: 0.17 dpm/mL

Ref. Date: 10/20/2005

Ref Time: N/A

Prep Date: 2/1/2007 Prep by: AB

Matrix/Comp. 1M HNO3

Half Life (y): 7.37E+03

RG 2/23/07

| Reverification Log | | |
|---|---|---|
| Analysis Date | Initials | Expiration Date |
| | | |
| | | |
| | | |
| | | |
| | | |

RG 2/23/07

RG 2/23/07

Continued on Page

Read and Understood By

A Barlow — Signed — 2/1/07 — Date

Renee Kellogg — Signed — 2/23/07 — Date

KSU # 821 Rec'd 4/13/06

# National Institute of Standards & Technology

# Certificate

## Standard Reference Material 4332D
## Americium-243 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive americium-243 nitrate and nitric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of alpha-particle counting instruments and for the monitoring of radiochemical procedures.

**Radiological Hazard**: The SRM ampoule contains americium-243 with a total activity of approximately 180Bq. Americium-243 decays by alpha-particle emission to neptunium-239, which decays by beta particle emission. None of the alpha or beta particles escape from the SRM ampoule. During the decay process X-rays and gamma rays with energies from approximately 14 keV to 700 keV are also emitted. Most of these

## Recommended Procedure for Opening the SRM Ampoule

1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.

2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.

3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.

4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.

5) Holding the ampoule upright, score the narrowest part of the neck around its entire circumference with a scribe or diamond pencil.

6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.

7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.

8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.

9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.



*Notes and references are on pages 5 and 6.

PROPERTIES OF SRM 4332D

**Certified values**

| | |
|---|---|
| **Radionuclide** | **Americium-243** |
| **Reference time** | **1200 EST, 20 October 2005 [b]** |
| **Massic activity of the solution** [c]* | **36.24 $Bq \cdot g^{-1}$** |
| **Relative expanded uncertainty ($k$=2)** | **0.86%** [d][e] |
| **Solution mass** | **(5.143 ± 0.002) g** [f] |
| **Solution density** | **(1.030 ± 0.002) $g \cdot mL^{-1}$ at 22.8 °C** [f] |

Uncertified values

| Physical Properties: | | |
|---|---|---|
| Source description | Liquid in flame-sealed NIST borosilicate-glass ampoule | |
| Ampoule specifications | Body outside diameter | (16.5 ± 0.5) mm |
| | Wall thickness | (0.60 ± 0.04) mm |
| | Barium content | Less than 2.5% |

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

| Input Quantity $x_i$, the source of uncertainty (and individual uncertainty components where appropriate) | Method Used To Evaluate $u(x_i)$, the standard uncertainty of $x_i$ (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods | Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [i] | Relative Sensitivity Factor, $\lvert\partial y/\partial x_i\rvert \cdot (x_i/y)$ [j] | Relative Uncertainty Of Output Quantity, $u_i(y)/y$, (%) [k] |
|---|---|---|---|---|
| Massic alpha-particle emission rate, corrected for background and decay | Standard deviation of the mean for 9 sets of "0.8π" α counter measurements (A) | 0.05 | 1.0 | 0.05 |
| Half-life of Am-243 | Standard uncertainty of the half life (A) | 0.54 [m] | 0.001 [n] | 0.0005 |
| Decay-scheme data | Standard uncertainty of the probability of decay by alpha-particle emission (A) | 0.01 | 1.0 | 0.01 |
| Extrapolation of alpha-particle-count-rate-versus-energy to zero energy | Estimated (B) | 0.25 | 1.0 | 0.25 |
| Gravimetric measurements | Estimated (B) | 0.05 | 1.0 | 0.05 |
| Live time [p] | Estimated (B) | 0.10 | 1.0 | 0.10 |
| Alpha-particle detection efficiency of scintillator | Estimated (B) | 0.20 | 1.0 | 0.20 |
| Geometry of "0.8π" α counter | Estimated (B) | 0.10 | 1.0 | 0.10 |
| Confirmatory measurements (long-term stability) | Estimated (B) | 0.20 | 1.0 | 0.21 |
| Alpha-particle-emitting impurities | Estimated (B) [q]<br>Limit of detection [r] | 13<br>100 | 0.0017<br>0.001 | 0.02<br>0.10 |
| Photon-emitting impurities | Limit of detection (B) [r] | 100 | 0.0001 | 0.01 |
| Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%) | | | | 0.43 |
| Coverage Factor, $k$ | | | | x 2 |
| Relative Expanded Uncertainty of the Output Quantity, $U/y$, (%) | | | | 0.86 |



*Notes and references are on pages 5 and 6.

NOTES

[a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.

| Distance from Ampoule (cm): | 1 | 30 | 100 |
|---|---|---|---|
| Approximate Dose Rate (μSv/h): | < 0.1 | - | - |

[b] The americium-243 master solution was chemically purified in 1978. The solution was calibrated in 1983 and in 1995 by primary methods, and was recalibrated with confirmatory measurements in 2005.

[c] **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].

[d] The reported value, $y$, of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \ldots x_n)$, where $f$ is a mathematical function derived from the assumed model of the measurement process. The value, $x_i$, used for each input quantity $i$ has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in $y$, $u_i(y) \equiv |\partial y/\partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of $y$. The **combined standard uncertainty** of $y$, $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty. The combined standard uncertainty is multiplied by a **coverage factor** of $k = 2$ to obtain $U$, the **expanded uncertainty** of $y$.

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

For further information on the expression of uncertainties, see references [2] and [3].

[e] The value of each component of combined standard uncertainty, and hence the value of the expanded uncertainty itself, is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the massic response is approximately 50%) and for uncertainties evaluated

[k] Relative component of combined standard uncertainty of output quantity $y$, rounded to two significant figures or less. The relative component of combined standard uncertainty of $y$ is given by $u_i(y)/y \equiv |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.

[m] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of $\lambda$ (i.e., of the half life). The relative standard uncertainty of $t$ is negligible.

[n] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$.

[p] The live time is determined by counting the pulses from a gated crystal-controlled oscillator.

[q] The standard uncertainty the detected impurity. $|\partial y/\partial x_i| \cdot (x_i/y)$ = {(response per Bq of impurity)/(response per Bq of americium-243)}·{(Bq of impurity)/(Bq of americium-243)}.

[r] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i)/x_i$ = 100%. $|\partial y/\partial x_i| \cdot (x_i/y)$ = {(response per Bq of impurity)/(response per Bq of americium-243)}·{(Bq of impurity)/(Bq of americium-243)}. Thus $u_i(y)/y$ is the relative change in $y$ if the impurity were present with a massic activity equal to the estimated limit of detection.

## REFERENCES


[1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from Global Engineering Documents, 12 Inverness Way East, Englewood, CO 80112, U.S.A. Telephone 1-800-854-7179.

[2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993 (corrected and reprinted, 1995). Available from Global Engineering Documents, 12 Inverness Way East, Englewood, CO 80112, U.S.A. Telephone 1-800-854-7179.

[3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.

[4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.

[5] Evaluated Nuclear Structure Data File (ENSDF), October 2005.

PROJECT Am-241 616.2382.92

Notebook No. _____

Continued From Page _____

Am-241 working level dilution

Prepare a working level dilution of Am-241 (616.2382.91) at 20 dpm/ml by diluting with 1M HCL (Lot 43045)

① Determine the density of 1M HCL (copied from previous page)

| | |
|---|---|
| mass of 100 ml class A volumetric flask | 67.5757 g (bal 12) |
| mass of flask and 1M HCL | 168.8580 g |
| net mass of 1M HCL | 101.2823 g |
| | ρ = 1.0128 g/ml |

② Transfer approx 0.5 g of 616.2382.91 to a 1L nalgene bottle

| | |
|---|---|
| mass of nalgene bottle without lid | 74.4779 g (bal 12) |
| mass of standard, vial, transfer pipet + 50 ml beaker before transfer | 94.1502 g |
| mass of standard, vial, transfer pipet + 50 ml beaker after transfer | 93.4751 g |
| net mass of standard transferred | 0.6751 g |

③ Dilute to final volume with 1M HCL

| | |
|---|---|
| mass of nalgene bottle without lid (from above) | 74.4779 g |
| mass of bottle, standard and 1M HCL | 1003.4 g (bal 26) |
| net mass of standard | 928.92 g |

RG 9/6/06

| Reverification Log | | |
|---|---|---|
| Analysis Date | Initials | Expiration Date |
| 8/11/06 | RG | 8/11/07 |
| 10/8/07 | MC | 10/8/08 |

④ final Activity calculation

SD 8/1/03 ~~27,168.64~~ ~~27,125.6~~ ~~27,206.49~~ MC 10/8/07 dpm/g) (0.6751 g) (1.0128 g/ml) / 928.92 g

20.02 dpm/ml MC 10/8/07 SD 8/1/03

~~19.97~~ ~~20.00~~

Stnd ID: 616.2382.92 SD 6/2/04

Description: Am-241 MC 11/1/07
Expiration: 5/27/05
Activity: ~~19.97~~ 20.02 dpm/mL
2s Uncertainty: 0.44 dpm/mL
Ref. Date: 4/18/02
Ref Time: N/A
Prep Date: 4/25/03 Prep by: CDM
Matrix/Comp. 1M HCl
Half Life (y): 4.32E+02

SD 6/2/04

Stnd ID: 616.2382.92 RG 5/13/05

Description: Am-241
Expiration: 4/30/06 MC 11/1/07
Activity: ~~19.97~~ 20.02 dpm/mL
2s Uncertainty: 0.44 dpm/mL
Ref. Date: 4/18/02
Ref Time: N/A
Prep Date: 4/25/03 Prep by: CDM
Matrix/Comp. 0.1M HCl
Half Life (y): 4.32E+02 RG 5/13/05

Stnd ID: 616.2382.92 RG 5/5/03

Description: Am-241 MC 11/1/07 ~~19.97~~ 20.02
Activity: ~~20.00~~ SD 8/1/03 dpm/ml
2s Uncertainty: 0.44 dpm/ml
Ref. Date: 4/18/02
Ref Time: na
Prep Date: 4/25/03 Prep by: CDM
Expiration: 4/29/04
Matrix/Comp. 0.1M HCl
Half Life (y): 4.32E+02

RG 5/5/03

MAY REQUIRE NCR FOR ICPT WORK

C Moncavage 4/25/03 Signed Date

Renee Gallegos RG 5/5/03 5/5/03 Signed Date

Am-241 intermediary dilution

Prepare an intermediate dilution of 616.2382.38 by diluting with 1M HCL (Lot 43015)

(1) Determine the density of 1M HCL

| | |
|---|---|
| mass of 100 ml Class A volumetric flask | 67.5757 g (bal) |
| mass of flask and 1M HCl | 168.8580 g |
| net mass of 1M HCL | 101.2823 |
| | ρ = 1.01228 g/ml |

(2) Transfer Am-241 (616.2382.38) to a 40 ml VOA vial

| | |
|---|---|
| mass of empty VOA vial without lid & 50 ml beaker | 54.0248 g (bal) |
| mass of standard, transfer pipet & 50 ml beaker (initial) | 95.0640 g |
| mass of standard, transfer pipet & 50 ml beaker after transfer) | ~~74~~ 75.0076 g (corrected) |
| net mass of standard transferred | 20.0564 g |

(3) Dilute to final volume with 1M HCL

| | |
|---|---|
| mass of empty VOA VIAL w/o lid & 50 ml beaker (from above) | 54.0248 g bal |
| mass of standard, 1M HCL, VOA vial & 50 ml beaker | 92.4609 g |
| net mass of standard | 38.4361 g |

(4) final activity calculation

$$\frac{\cancel{52,000}\ 52,128.96\ \text{dpm/g}}{38.4361\ \text{g}}(20.0564\ \text{g}) = \cancel{27,168.64}\ \text{dpm/g}$$

50 8/1/03

MC 11/1/07

27,201.49

Continued on Page

Read and Understood By

C Moncavage 4/25/03 Signed Date

Renee Valleroz 5/5/03 Signed Date

Am-241 primary dilution

prepare a primary dilution ( SOB 10/14/02
of RSO 6116 (NIST: ~~CRM~~ 14-02 SRS 163651-307) by diluting w/ 1M HCl

1) Determine the density of 1M HCl (Lot # 42223 ~~Lot# 42216~~)

| | | |
|---|---|---|
| mass of 100ml vol flask | 62.4712 g | (Bal 12) |
| mass of flask + 1M HCl | 163.8021 g | |
| Net mass of ~~stk~~ HCl RB 12/3/02 | 101.33090 g | |

2) Transfer contents of ampuli to 40 ml vol vial

PARAGON ANALYTICS
Radiochemistry Data Package

Section 9

# ADDITIONAL SUPPORTING DOCUMENTATION

9

# Alpha Spectroscopy

# Quality Control Data

# Weekly Background, Energy, and Efficiency Calibrations

# Calibration Data Summary

**Laboratory Name:** Paragon Analytics
**PAI Work Order:** 0804083

**Prep SOP:** PAI 778
**Analytical SOP:** PAI 714

**Reported on:** Thursday, May 29, 2008
12:15:30 PM

| Lab Sample ID<br>Spectrum<br>Analysis Date | QC Type | Batch ID<br>Analysis Run | Test Name | Detector Id | Eff Spectrum<br>Bkg Spectrum<br>Egy Spectrum | Eff Date<br>Bkg Date<br>Egy Date | RESULTS<br>%Efficiency<br>Bkg CPM<br>Energy keV | FLAGS<br>Efficiency<br>Background<br>Energy | LCL<br>%Efficiency<br>Bkg CPM<br>Energy keV | LWL<br>%Efficiency<br>Bkg CPM<br>Energy keV | UWL<br>%Efficiency<br>Bkg CPM<br>Energy keV | UCL<br>%Efficiency<br>Bkg CPM<br>Energy keV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0804083-1 | SMP | AS080513-2 | Am241 | 1 | C08052701 | 5/27/2008 | 29.01 | Pass | 27.36 | 27.84 | 29.76 | 30.24 |
| Spectrum #1 | | AS080513-2A | | | B08052701 | 5/27/2008 | 0.0180 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052701 | 5/27/2008 | 5536.0 | Pass | 5497.7 | 5507.7 | 5587.7 | 5597.7 |
| 0804083-2 | SMP | AS080513-2 | Am241 | 2 | C08052702 | 5/27/2008 | 30.88 | Pass | 29.81 | 30.33 | 32.43 | 32.95 |
| Spectrum #1 | | AS080513-2A | | | B08052702 | 5/27/2008 | 0.0140 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052702 | 5/27/2008 | 5555.7 | Pass | 5503.6 | 5513.6 | 5593.6 | 5603.6 |
| AS080513-2 | MB | AS080513-2 | Am241 | 4 | C08052704 | 5/27/2008 | 30.30 | Pass | 28.67 | 29.17 | 31.19 | 31.69 |
| Spectrum #1 | | AS080513-2A | | | B08052704 | 5/27/2008 | 0.0310 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052704 | 5/27/2008 | 5557.7 | Pass | 5505.7 | 5515.7 | 5595.7 | 5605.7 |
| AS080513-2 | LCS | AS080513-2 | Am241 | 5 | C08052705 | 5/27/2008 | 31.19 | Pass | 29.29 | 29.80 | 31.86 | 32.37 |
| Spectrum #1 | | AS080513-2A | | | B08052705 | 5/27/2008 | 0.0270 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052705 | 5/27/2008 | 5536.0 | Pass | 5494.9 | 5504.9 | 5584.9 | 5594.9 |
| AS080513-2 | LCSD | AS080513-2 | Am241 | 6 | C08052706 | 5/27/2008 | 30.49 | Pass | 28.86 | 29.37 | 31.39 | 31.90 |
| Spectrum #1 | | AS080513-2A | | | B08052706 | 5/27/2008 | 0.0260 | Pass | 0.0000 | 0.0102 | 0.1002 | 0.1500 |
| 5/28/2008 | | | | | C08052706 | 5/27/2008 | 5535.7 | Pass | 5487.5 | 5497.5 | 5577.5 | 5587.5 |

**Data Package ID:** *AM0804083-1*

Abbreviations:
Eff - Efficiency; Bkg - Background; LCL - Lower Control Limit; UWL - Upper Warning Limit
Egy - Energy; CPM - Counts per Minute; LWL - Lower Warning Limit; UCL - Upper Control Limit; CI - The Analysis Date exceeds the Calibration Date by more than 7 days.

# Alpha Spec Calibration Source Re-Certification

R:\INST/ALPHASPEC\CLCRT0607.XLS

**Primary Certified Source**

Source PA ID 190 was recalibrated by Isotope Products Laboratories on 6/1/2007 and received by PA on 6/6/2007

| | | | |
|---|---|---|---|
| Source ID: | 92MIX223027; PA ID 190 (Labled #9) | | |
| Total Activity: | 3780.66 dpm | | |
| Ref. Date: | 6/1/07 | | |
| Count Date: | 6/8/07 | | |
| U-234 Activity: | 79.16% | = | 2994.78 dpm (decay corrected) |
| U-235 Activity: | 1.74% | = | 65.93 dpm (decay corrected) |
| Am-241 Activity: | 19.09% | = | 719.92 dpm (decay corrected) |
| Combined Activity: | | | 3780.64 dpm (decay corrected) |

**Detector 9 Efficiency Determination**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | count dur (s) | Combined cpm | Known dpm | Detector efficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX223027 | 190 | 97-19-103-09 | 6/8/07 | 7202 | 30313 | 686 | 2100 | 1091.46 | 3780.64 | 28.87% |

**Sources 1 through 8 activity determination**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | count dur (s) | Detector Efficiency | Am-241 dpm | U-234 dpm | U-235 dpm | Combined dpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX2203026 | 182 | 97-19-103-01 | 6/8/07 | 12708 | 76469 | 1739 | 2100 | 28.87% | 1257.67 | 7567.91 | 172.10 | 8997.68 |
| 92MIX2203028 | 183 | 97-19-103-02 | 6/8/07 | 14855 | 144735 | 3046 | 2100 | 28.87% | 1470.15 | 14323.99 | 301.65 | 16095.79 |
| 92MIX2203024 | 184 | 97-19-103-03 | 6/8/07 | 67825 | 69896 | 1458 | 2100 | 28.87% | 6712.44 | 6917.40 | 144.29 | 13774.13 |
| 92MIX2203021 | 185 | 97-19-103-04 | 6/8/07 | 21522 | 59231 | 1483 | 2100 | 28.87% | 2129.97 | 5861.91 | 146.77 | 8138.65 |
| 92MIX2203025 | 186 | 97-19-103-05 | 6/8/07 | 96147 | 117668 | 2472 | 2100 | 28.87% | 9515.38 | 11645.25 | 244.65 | 21405.27 |
| 92MIX2203022 | 187 | 97-19-103-06 | 6/8/07 | 73793 | 78846 | 1643 | 2100 | 28.87% | 7303.07 | 7803.15 | 162.60 | 15268.82 |
| 92MIX2203023 | 188 | 97-19-103-07 | 6/8/07 | 42962 | 66752 | 1369 | 2100 | 28.87% | 4251.82 | 6606.24 | 135.49 | 10993.55 |
| 92MIX2203029 | 189 | 97-19-103-08 | 6/8/07 | 32537 | 204218 | 4335 | 2100 | 28.87% | 3220.09 | 20210.84 | 429.02 | 23859.95 |

**Detector 9 Efficiency Verification**

| Source Serial# | PA ID | Sequential # | Count Date | Am-241 net cts | U-234 net cts | U-235 net cts | Count dur (s) | Combined cpm | Known dpm | Detector efficiency | % difference from 1st count |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 92MIX223027 | 190 | 97-19-103-09 | 6/8/07 | 7083 | 30147 | 730 | 2100 | 1084.57 | 3780.64 | 28.69% | 0.63% |

**Sources 1 through 8 activity re-verification**

| Source Serial# | PA ID | Sequential # | Combined Obseved dpm | Combined Certified dpm* | Percent Difference % | Within 5% of Certified value Yes/No |
|---|---|---|---|---|---|---|
| 92MIX2203026 | 182 | 97-19-103-01 | 8997.68 | 8869.83 | 1.44% | Yes |
| 92MIX2203028 | 183 | 97-19-103-02 | 16095.79 | 16012.52 | 0.52% | Yes |
| 92MIX2203024 | 184 | 97-19-103-03 | 13774.13 | 13600.19 | 1.28% | Yes |
| 92MIX2203021 | 185 | 97-19-103-04 | 8138.65 | 8194.88 | -0.69% | Yes |
| 92MIX2203025 | 186 | 97-19-103-05 | 21405.27 | 21111.44 | 1.39% | Yes |
| 92MIX2203022 | 187 | 97-19-103-06 | 15268.82 | 15394.76 | -0.82% | Yes |
| 92MIX2203023 | 188 | 97-19-103-07 | 10993.55 | 10789.02 | 1.90% | Yes |
| 92MIX2203029 | 189 | 97-19-103-08 | 23859.95 | 23639.86 | 0.93% | Yes |

* Certificate values decay corrected to the count date

RG 6/22/07

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:55:35AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO182
Description:

Analysis Date: 6/8/2007 8:20:44AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A1 RSO#182
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:24PM

### Acquisition

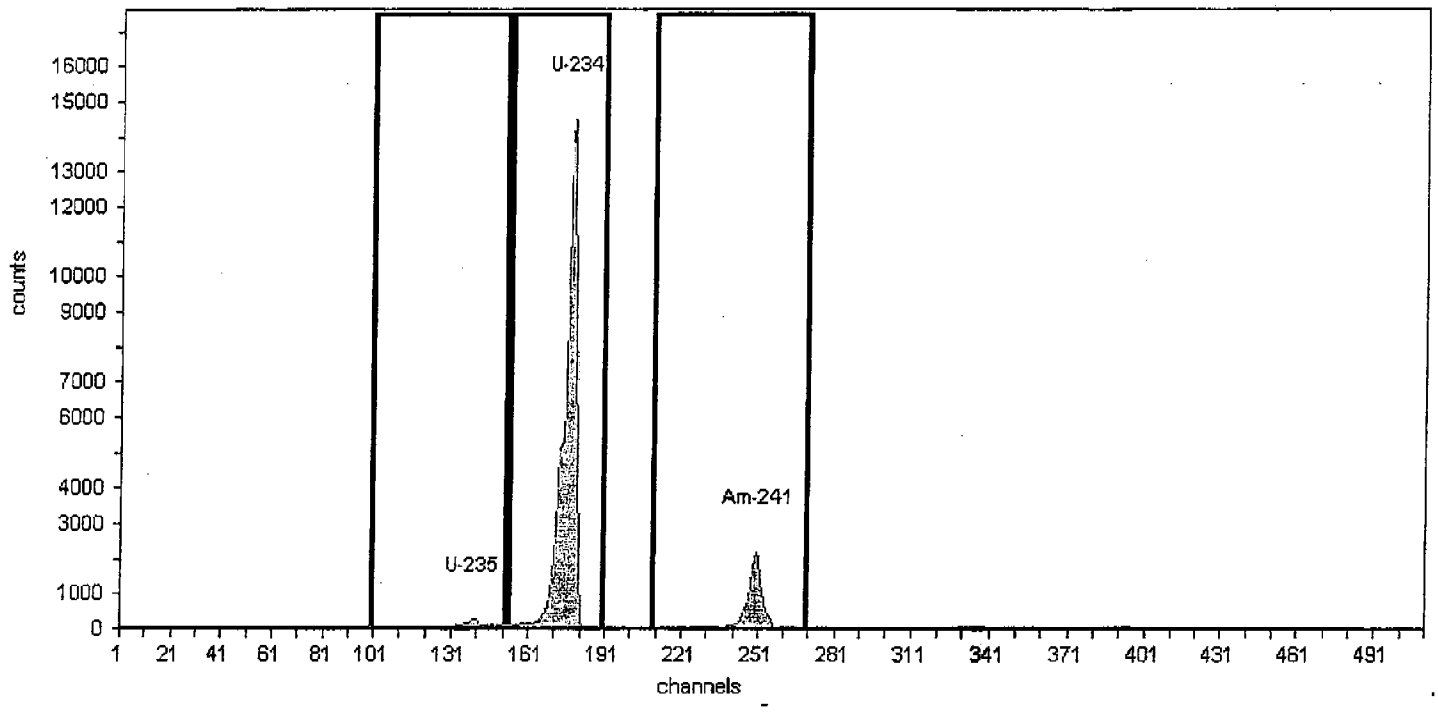
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 7:29:34AM

Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO182

Energy Calibration Equation:
Gain = 9.8224 keV / Ch
Offset = 3,029.39 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.20% +/- 0.20% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,739.00 | 49.69 |
| U-234 | 178 | 4.78 | 153 | 190 | 76,469.00 | 2,184.83 |
| Am-241 | 250 | 5.49 | 210 | 270 | 12,708.00 | 363.09 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
9:01:19AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO183
Description:

Analysis Date: 6/8/2007 9:01:07AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A2 RSO#183
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:00PM

### Acquisition

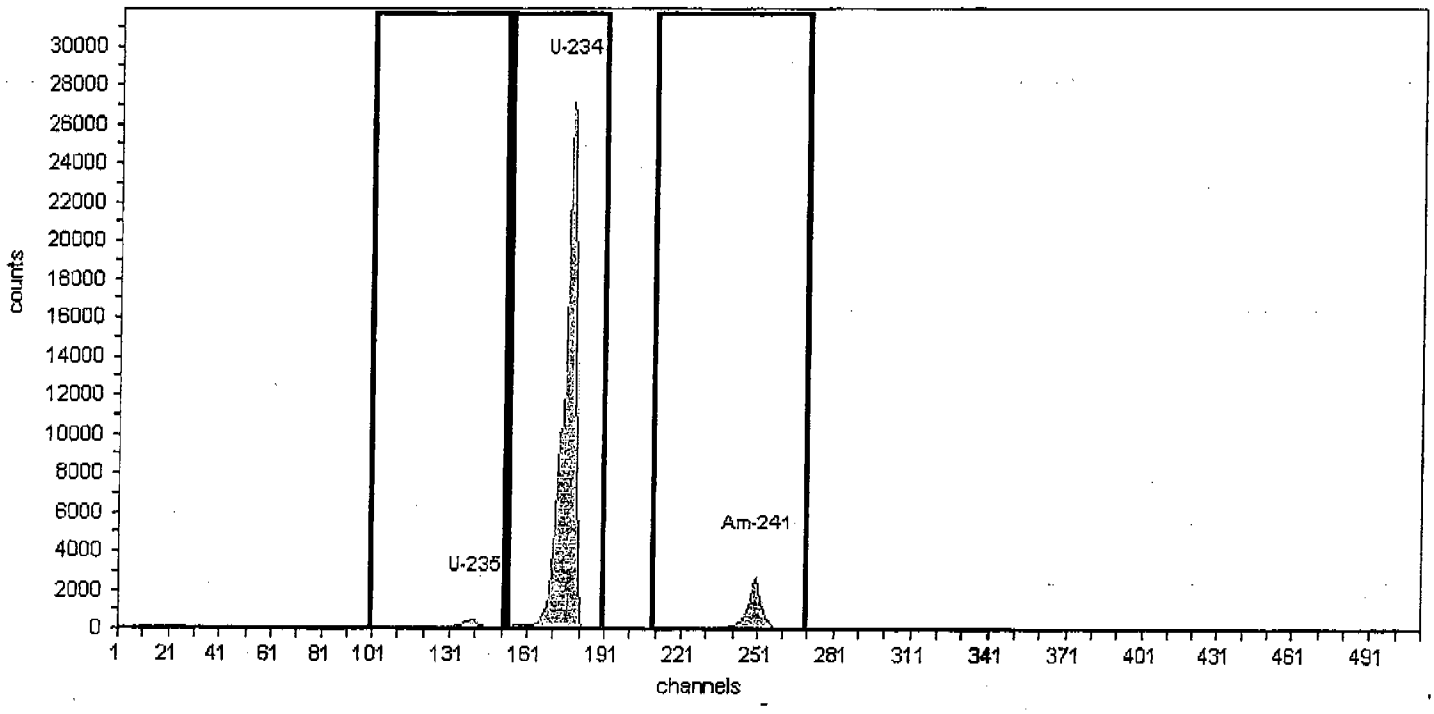
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 8:21:55AM

Live Time: 35.00 min.
Real Time: 35.05 min.

Efficiency Calibration Name: RSO183

Energy Calibration Equation:
Gain = 9.8810 keV / Ch
Offset = 3,018.33 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.98% +/- 0.15% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 3,048.00 | 87.09 |
| U-234 | 177 | 4.78 | 153 | 190 | 144,735.00 | 4,135.29 |
| Am-241 | 250 | 5.49 | 210 | 270 | 14,855.00 | 424.43 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
9:55:46AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO184
Description:

Analysis Date: 6/8/2007 9:55:40AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A3 RSO#184
Prepared by: IPL
Description:

Certification Date: 5/1/2003 12:00:00PM

### Acquisition

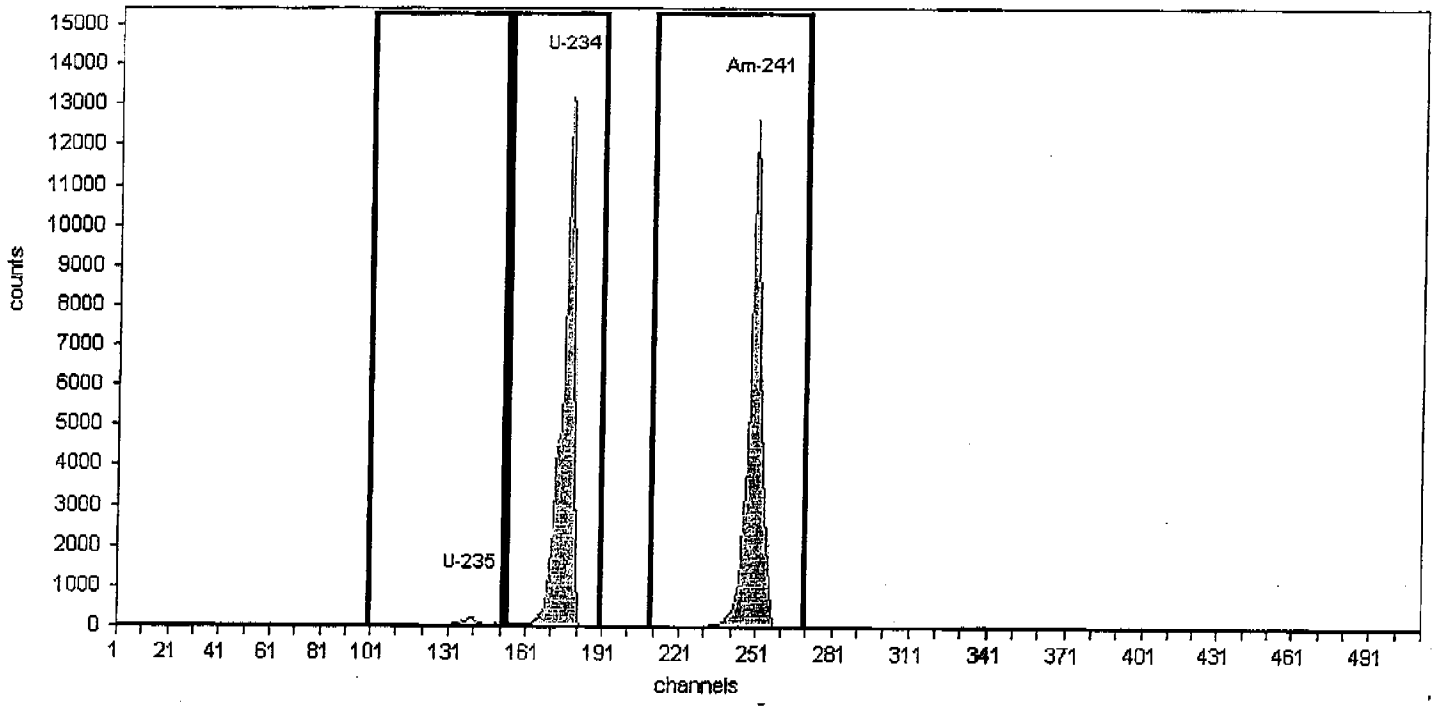
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 9:01:44AM

Live Time: 35.00 min.
Real Time: 35.04 min.

Efficiency Calibration Name: RSO184

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 29.14% +/- 0.16% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,458.00 | 41.66 |
| U-234 | 177 | 4.78 | 153 | 190 | 69,896.00 | 1,997.03 |
| Am-241 | 250 | 5.49 | 210 | 270 | 67,825.00 | 1,937.86 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
10:40:41AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO185
Description:

Analysis Date: 6/8/2007 10:40:28AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A4 RSO#185
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

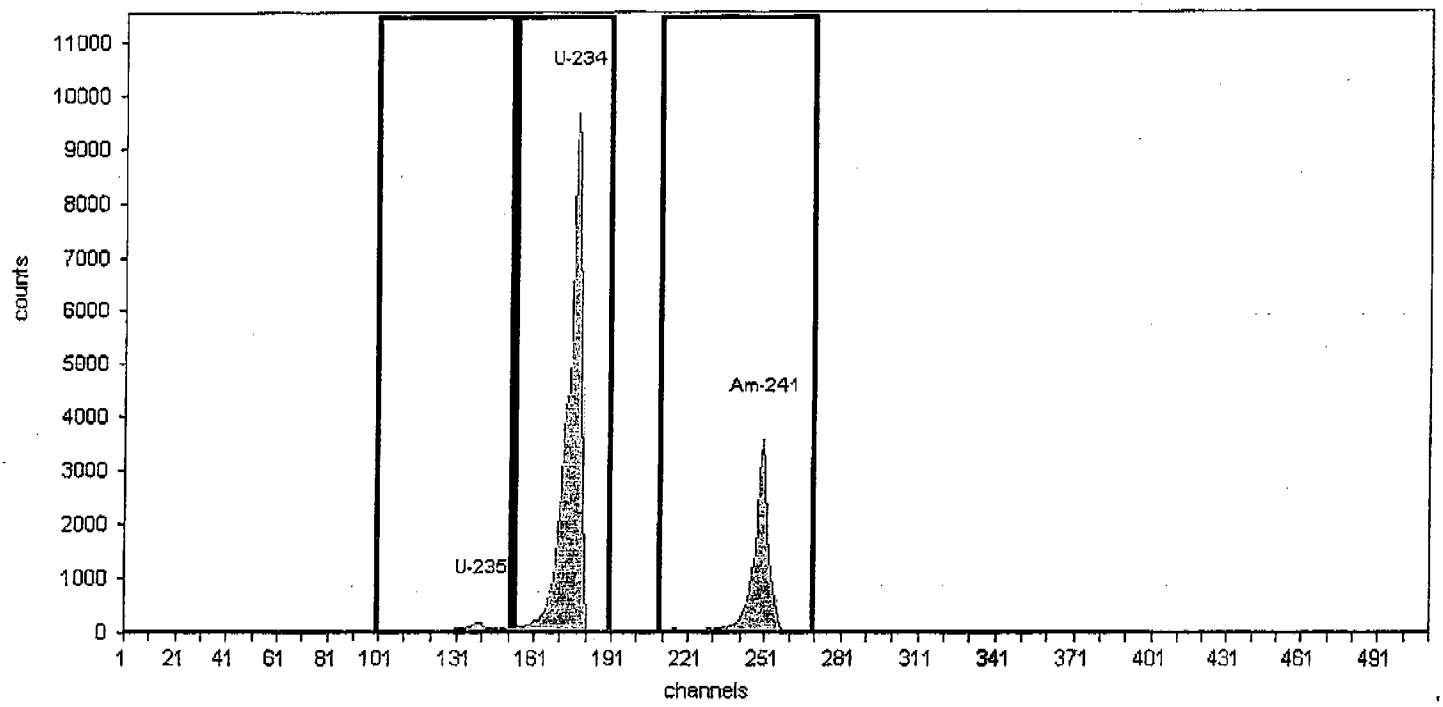
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 9:56:22AM

Live Time: 35.00 min.
Real Time: 35.02 min.

Efficiency Calibration Name: RSO185

Energy Calibration Equation:
Gain = 9.8810 keV / Ch
Offset = 3,018.33 keV
Quadratic = 0.0000 keV / $Ch^2$

Efficiency: 28.41% +/- 0.20% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 1,483.00 | 42.37 |
| U-234 | 177 | 4.78 | 153 | 190 | 59,231.00 | 1,692.31 |
| Am-241 | 250 | 5.49 | 210 | 270 | 21,522.00 | 614.91 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
11:17:39AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO186
Description:

Analysis Date: 6/8/2007 11:17:32AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A5 RSO#186
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

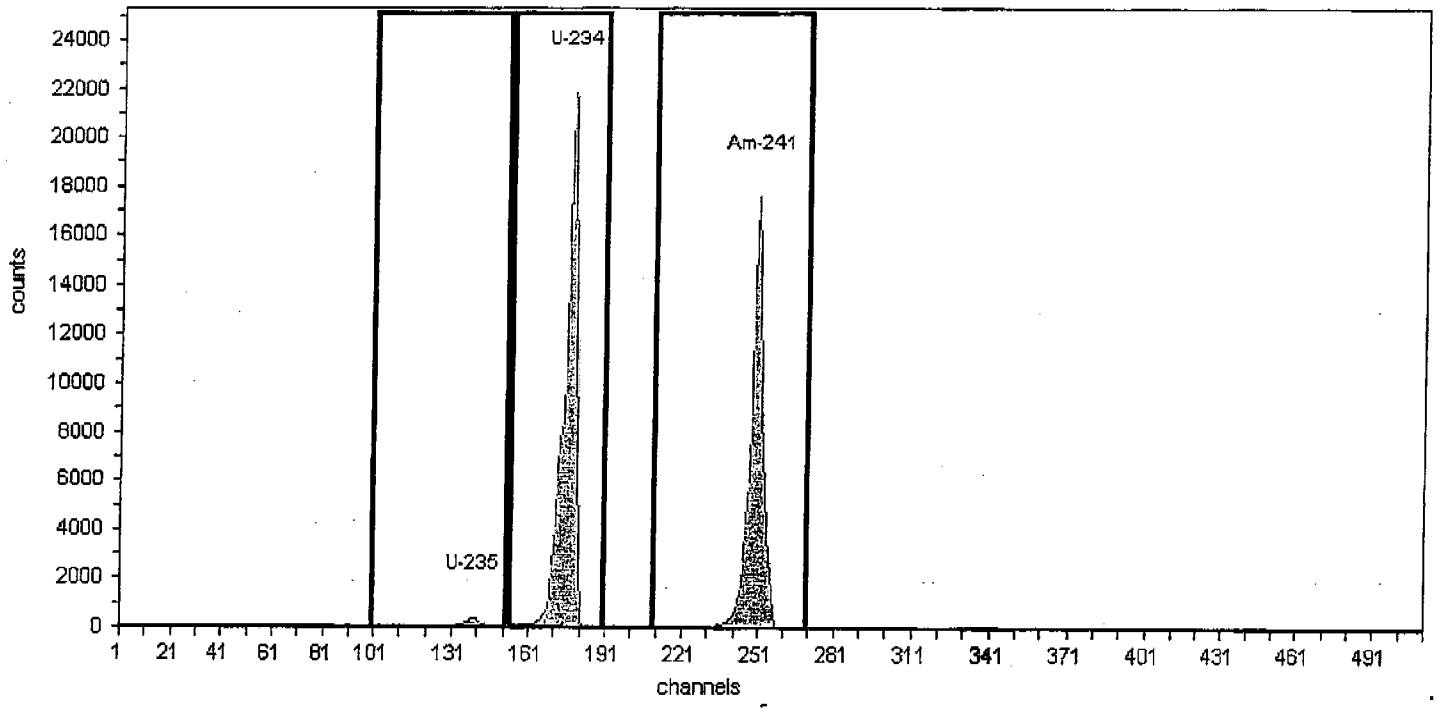
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 10:41:40AM

Live Time: 35.00 min.
Real Time: 35.06 min.

Efficiency Calibration Name: RSO186

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.13% +/- 0.13% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 2,472.00 | 70.63 |
| U-234 | 177 | 4.78 | 153 | 190 | 117,668.00 | 3,361.94 |
| Am-241 | 250 | 5.49 | 210 | 270 | 96,147.00 | 2,747.06 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
11:53:54AM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO187
Description:

Analysis Date: 6/8/2007 11:53:46AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A6 RSO#187
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

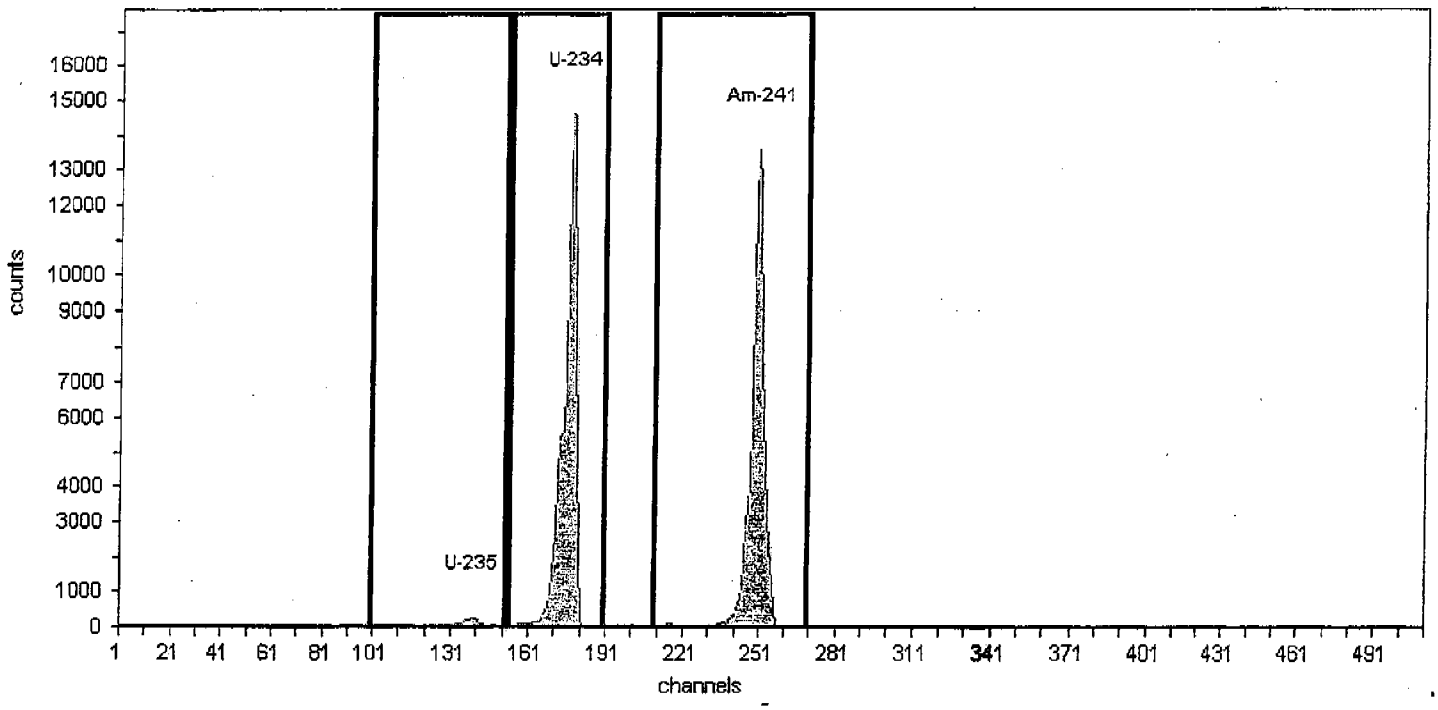
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 11:18:09AM

Live Time: 35.00 min.
Real Time: 35.05 min.

Efficiency Calibration Name: RSO187

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 28.66% +/- 0.15% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,643.00 | 46.94 |
| U-234 | 177 | 4.78 | 153 | 190 | 78,846.00 | 2,252.74 |
| Am-241 | 250 | 5.49 | 210 | 270 | 73,793.00 | 2,108.37 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:34:50PM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO188
Description:

Analysis Date: 6/8/2007 12:34:43PM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A7 RSO#188
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 11:54:29AM

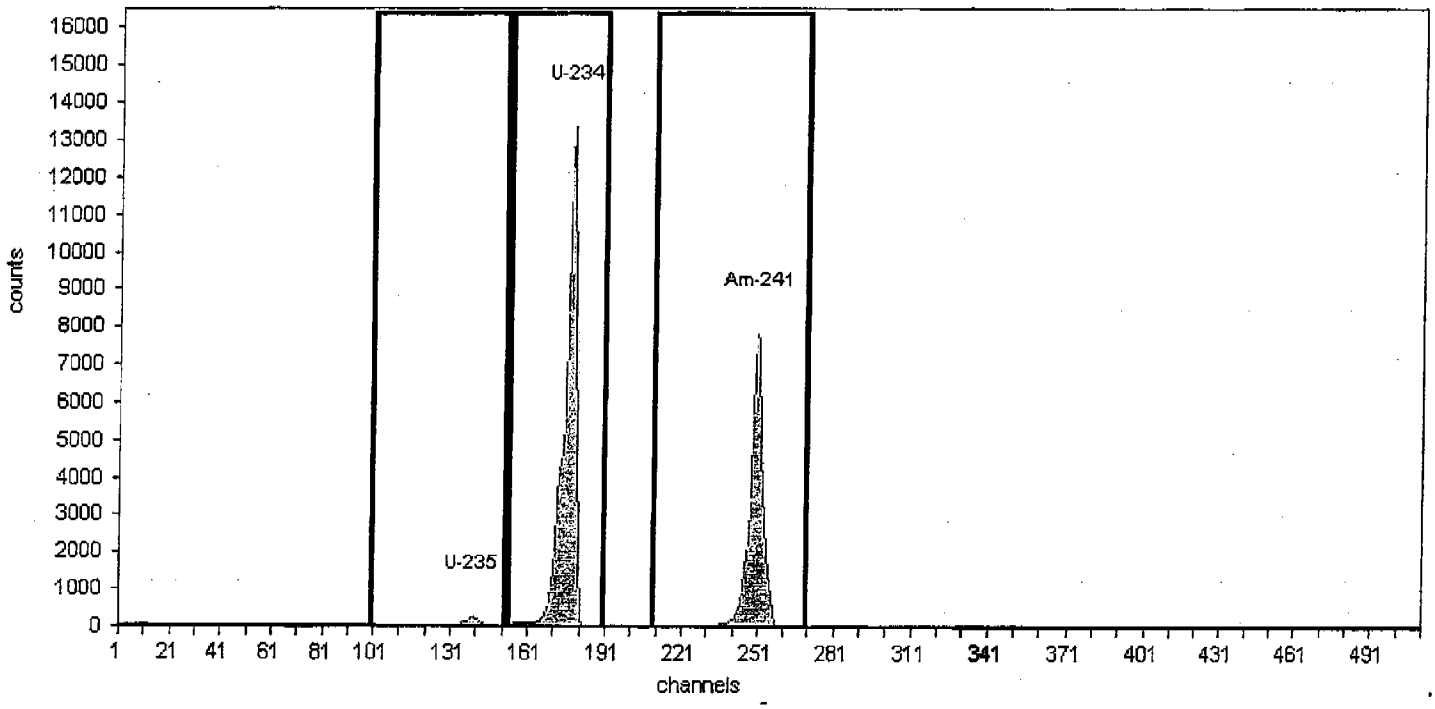
Live Time: 35.00 min.
Real Time: 35.03 min.

Efficiency Calibration Name: RSO188

Energy Calibration Equation:
Gain = 9.8224 keV / Ch

Offset = 3,029.39 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.21% +/- 0.18% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 1,369.00 | 39.11 |
| U-234 | 178 | 4.78 | 153 | 190 | 66,752.00 | 1,907.20 |
| Am-241 | 250 | 5.49 | 210 | 270 | 42,962.00 | 1,227.49 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
1:11:17PM 6/8/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO189
Description:

Analysis Date: 6/8/2007 1:11:09PM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A8 RSO#189
Prepared by: IPL
Description:

Certification Date: 4/1/2003 12:00:00PM

### Acquisition

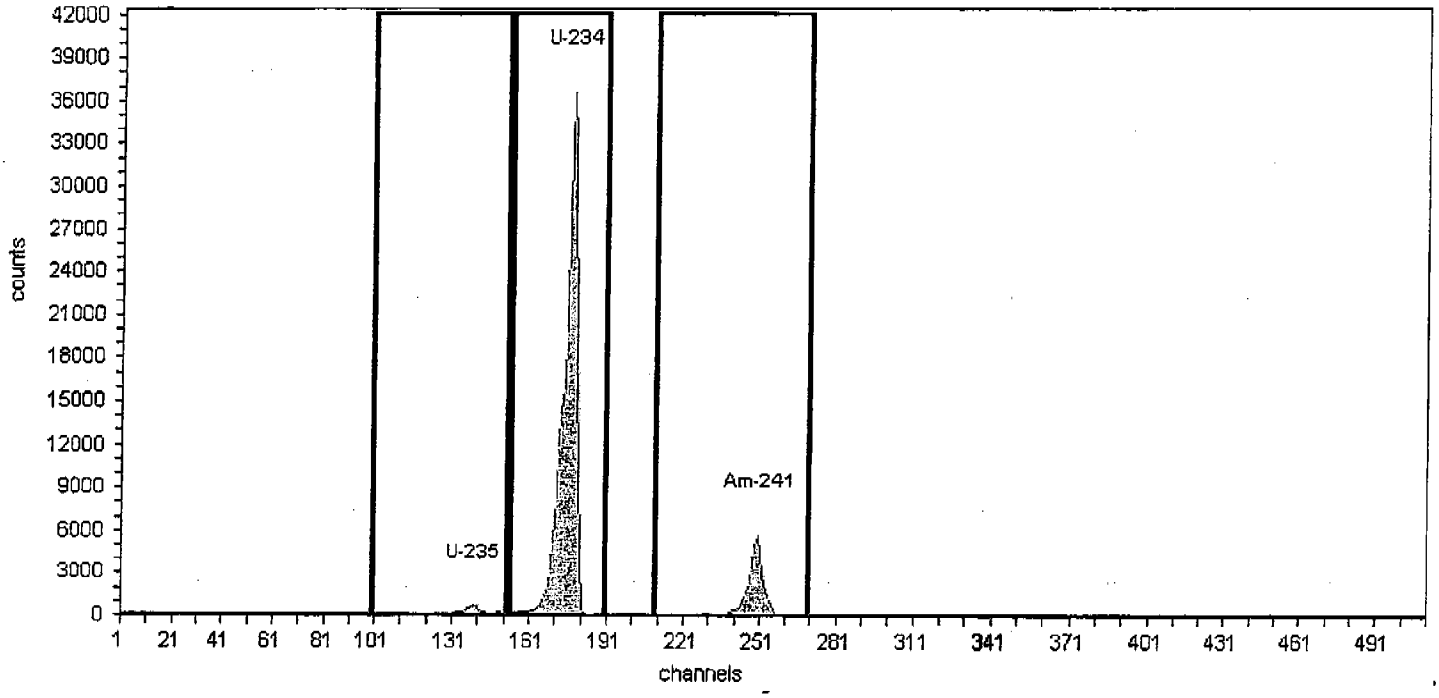
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 12:35:13PM

Live Time: 35.00 min.
Real Time: 35.07 min.

Efficiency Calibration Name: RSO189

Energy Calibration Equation:
Gain = 9.8047 keV / Ch
Offset = 3,036.00 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 29.15% +/- 0.12% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 139 | 4.40 | 100 | 152 | 4,335.00 | 123.86 |
| U-234 | 177 | 4.78 | 153 | 190 | 204,218.00 | 5,834.80 |
| Am-241 | 250 | 5.49 | 210 | 270 | 32,537.00 | 929.63 |

**AlphaVision v5.3** **Alpha-Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:30:24AM 6/11/2007

Analyst: ORTEC
Detector: 23

### Calibration

Energy Calibration: RSO190
Description:

Analysis Date: 6/11/2007 8:30:16AM
Calibration Type: Energy And Efficiency

### Source Info

Certificate ID: A9 RSO#190
Prepared by: IPL
Description:

Certification Date: 6/1/2007 12:00:00PM

### Acquisition

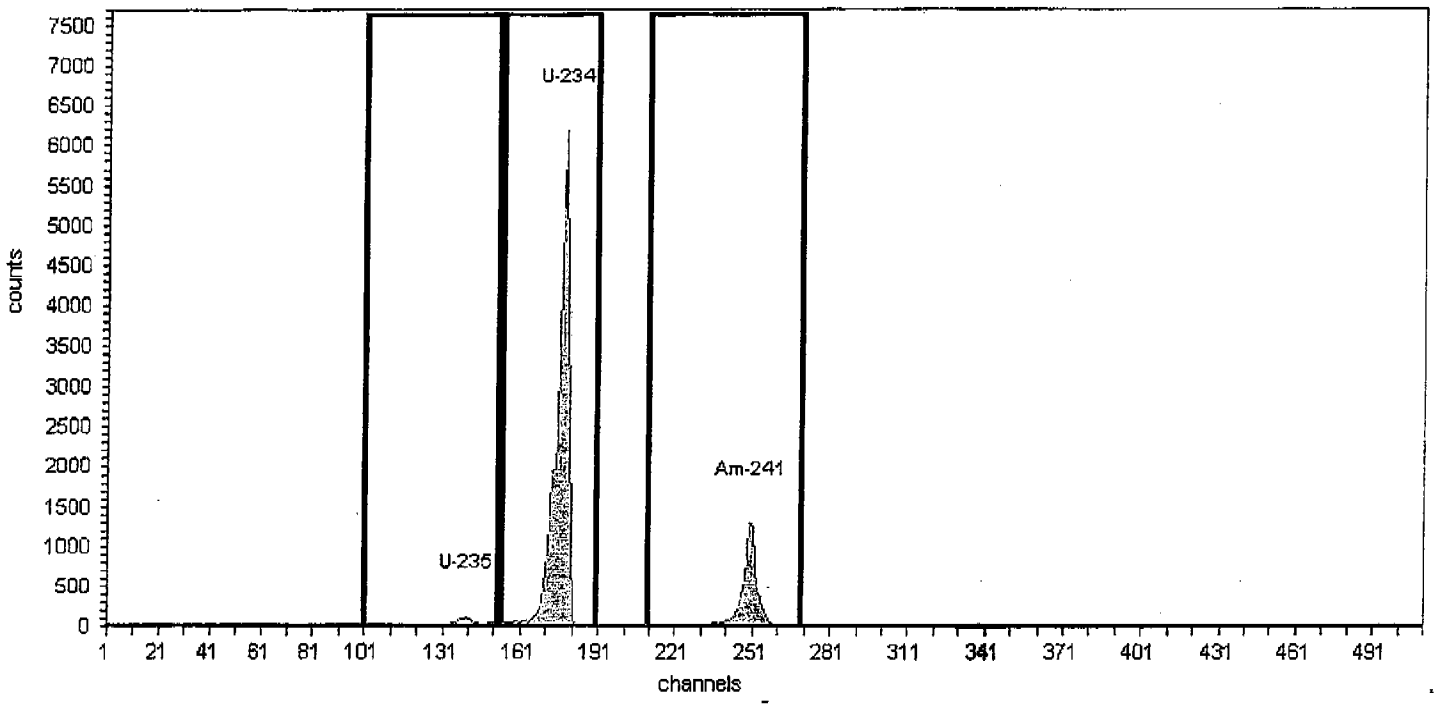
Detector: 23 , SN:
Acquisition Start Date: 6/8/2007 1:11:41PM

Live Time: 35.00 min.
Real Time: 35.01 min.

Efficiency Calibration Name: RSO190

Energy Calibration Equation:
Gain = 9.9003 keV / Ch
Offset = 3,011.38 keV
Quadratic = 0.0000 keV / Ch$^2$

Efficiency: 28.67% +/- 0.30% TPU(2 sigma)




Method: Interactive ROI
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

### Nuclide Activity Summary

| Nuclide | Peak Channel | Peak Energy MeV | ROI Start Channel | ROI End Channel | Gross Counts | Net Count Rate (cpm) |
|---|---|---|---|---|---|---|
| U-235 | 140 | 4.40 | 100 | 152 | 730.00 | 20.86 |
| U-234 | 178 | 4.78 | 153 | 190 | 30,147.00 | 861.34 |
| Am-241 | 250 | 5.49 | 210 | 270 | 7,083.00 | 202.37 |

Isotope Products
Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α1
reverified 6/8/07
expires 6/8/08
PA I 187
recalibrate 4-15-07

[22] reverified 10/10/07

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α3 reverified 6/8/07
expires 6/8/08
PAT I.D 184
recalibrated 4-15-08

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW040203/R2193 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-May-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203024 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 3.227 | nCi | (119.4 Bq) | Am-241: | 2.866 | nCi | (106.0 Bq) |
| U-235: | 0.05205 | nCi | (1.926 Bq) | Total Activity: | 6.145 | nCi | (227.3 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.6% |
| B. Type B (systematic) uncertainty: | ± 3.0% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.1% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 6889 α/min in 2π on 11 Apr 03.

Daniel James Van Dalsem
**Quality Control**

15-Apr-03
**Date Signed**

IPL Ref. No.: 987-7

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α4 reverified 6/8/07
expires 6/8/08
gw 6/22/07
PAI ID 00185
rec'd from recalibration
3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

**Radionuclide A:** U-234
**Radionuclide B:** U-235
**Radionuclide C:** Am-241
**Half Life (U-234):** (2.454 ± 0.006)E+05 years
**Half Life (U-235):** (7.037 ± 0.011)E+08 years
**Half Life (Am-241):** 432.17 ± 0.66 years

**Customer:** PARAGON ANALYTICS, INC.
**P.O. No.:** EW030603/R2155
**Catalog No.:** MISC-STD
**Reference Date:** 1-Apr-03 12:00 PST
**Source No.:** 92MIX2203021

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 2.731 | nCi | (101.0 Bq) | Am-241: | 0.9325 | nCi | (34.50 Bq) |
| U-235: | 0.03416 | nCi | (1.264 Bq) | Total Activity: | 3.698 | nCi | (136.8 Bq) |

**Physical description:**

A. Capsule type: Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit: Electrodeposited and diffusion bonded oxides
C. Active Diameter: 19 mm
D. Backing: Stainless steel
E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty: ± 0.8%
B. Type B (systematic) uncertainty: ± 3.1%
C. Uncertainty in aliquot weighing: ± 0.0%
D. Total uncertainty at the 99% confidence level: ± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 4145 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
**Quality Control**

19-Mar-03
**Date Signed**

IPL Ref. No.: 987-2

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α5 reverified 6/8/07 expires 6/8/08
PAI ID 00186
recalibration received 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

| | | | |
|---|---|---|---|
| **Radionuclide A:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide B:** | U-235 | **P.O. No.:** | EW030603/R2155 |
| **Radionuclide C:** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half Life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Apr-03 12:00 PST |
| **Half Life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX2203025 |
| **Half Life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 5.486 | nCi | (203.0 Bq) | Am-241: | 3.958 | nCi | (146.4 Bq) |
| U-235: | 0.09221 | nCi | (3.412 Bq) | Total Activity: | 9.536 | nCi | (352.8 Bq) |

**Physical description:**

| | |
|---|---|
| A. Capsule type: | Disk (22 mm OD X 0.79 mm THK) |
| B. Nature of active deposit: | Electrodeposited and diffusion bonded oxides |
| C. Active Diameter: | 19 mm |
| D. Backing: | Stainless steel |
| E. Cover: | None |

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

| | |
|---|---|
| A. Type A (random) uncertainty: | ± 0.8% |
| B. Type B (systematic) uncertainty: | ± 3.1% |
| C. Uncertainty in aliquot weighing: | ± 0.0% |
| D. Total uncertainty at the 99% confidence level: | ± 3.2% |

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 10690 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
**Quality Control**

19-Mar-03
**Date Signed**

IPL Ref. No.: 987-2

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

α 7

reverified 6/18/07
expires 6/18/08
6/22/07
PAID 188
recd for recalibration 3-28-03

# CERTIFICATE OF CALIBRATION
# ALPHA STANDARD SOURCE

**Radionuclide A:** U-234
**Radionuclide B:** U-235
**Radionuclide C:** Am-241
**Half Life (U-234):** (2.454 ± 0.006)E+05 years
**Half Life (U-235):** (7.037 ± 0.011)E+08 years
**Half Life (Am-241):** 432.17 ± 0.66 years

**Customer:** PARAGON ANALYTICS, INC.
**P.O. No.:** EW030603/R2155
**Catalog No.:** MISC-STD
**Reference Date:** 1-Apr-03 12:00 PST
**Source No.:** 92MIX2203023

**Contained Radioactivity:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| U-234: | 2.895 | nCi | (107.1 Bq) | Am-241: | 1.953 | nCi | (72.26 Bq) |
| U-235: | 0.02502 | nCi | (0.9257 Bq) | Total Activity: | 4.873 | nCi | (180.3 Bq) |

**Physical description:**

A. Capsule type: Disk (22 mm OD X 0.79 mm THK)
B. Nature of active deposit: Electrodeposited and diffusion bonded oxides
C. Active Diameter: 19 mm
D. Backing: Stainless steel
E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in Aug 1992.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty: ± 0.8%
B. Type B (systematic) uncertainty: ± 3.1%
C. Uncertainty in aliquot weighing: ± 0.0%
D. Total uncertainty at the 99% confidence level: ± 3.2%

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 5463 α/min in 2π on 18 Mar 03.

Daniel James Van Dalsem
**Quality Control**

19-Mar-03
**Date Signed**

IPL Ref. No.: 987-2

Isotope Products
Laboratories

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661•309•1010

28

reverified 6/8/07
expires 6/8/08
RAI.ID 189

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

RSO # 190
Rec'd 6/6/07 GW
Recertification 6/1/07

# CERTIFICATE OF CALIBRATION
# MIXED ALPHA STANDARD SOURCE

α 9

| | | | |
|---|---|---|---|
| **Radionuclide:** | U-234 | **Customer:** | PARAGON ANALYTICS, INC. |
| **Radionuclide:** | U-235 | **P.O. No.:** | 73179/R3768 |
| **Radio: 23** | Am-241 | **Catalog No.:** | MISC-STD |
| **Half-life (U-234):** | (2.454 ± 0.006)E+05 years | **Reference Date:** | 1-Jun-07 12:00 PST |
| **Half-life (U-235):** | (7.037 ± 0.011)E+08 years | **Source No.:** | 92MIX223027 |
| **Half-life (Am-241):** | 432.17 ± 0.66 years | | |

**Contained Radioactivity:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| U-234: | 1.349 | **nCi,** | 49.91 | **Bq** | Am-241: | 0.3243 | **nCi,** | 12.00 | **Bq** |
| U-235: | 0.02970 | **nCi,** | 1.099 | **Bq** | Total Activity: | 1.703 | **nCi,** | 63.01 | **Bq** |

**Physical Description:**

A. Capsule type: Disk (47 mm OD x 0.76 mm THK)
B. Nature of active deposit: Electrodeposited and diffusion bonded oxide
C. Active diameter/volume: 19 mm
D. Backing: Stainless steel
E. Cover: None

**Radioimpurities:** Not determined

**Method of Calibration:**

This source was assayed using a windowless internal gas flow proportional counter for total alpha activity. Individual nuclide ratios were taken from those determined in May 2001.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty: ± 0.9 %
B. Type B (systematic) uncertainty: ± 3.0 %
C. Uncertainty in aliquot weighing: ± 0.0 %
D. Total uncertainty at the 99% confidence level: ± 3.1 %

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a total alpha surface emission rate of 1909 α/min in 2π on 22-May-07

Quality Control

24 May 07
Date

IPL Ref. No.: 1143-19