

ANALYTICAL REPORT

Job Number: 160-17842-1

Job Description: Hill AFB and Cabrera - Hill AFB WR111

For:

EA Engineering, Science, and Technology
7995 E. Prentice Ave, Suite 206E
Greenwood Village, CO 80111
Attention: Pamela J Moss



Approved for release.
Jessica H DeHerrera
Project Manager I
7/13/2016 5:18 PM

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07/13/2016

The test results in this report relate only to the samples in this report and meet all requirements of NELAP, with any exceptions noted. Pursuant to NELAP, this report shall not be reproduced except in full, without the written approval of the laboratory. All questions regarding this report should be directed to the TestAmerica Denver Project Manager.

The Lab Certification ID# is 4025.

Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.

TestAmerica Laboratories, Inc.

TestAmerica St. Louis 13715 Rider Trail North, Earth City, MO 63045
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Definitions/Glossary

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

CASE NARRATIVE
Client: EA Engineering, Science, and Technology
Project: Hill AFB and Cabrera - Hill AFB WR111
Report Number: 160-17842-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 06/17/2016; the samples arrived in good condition. The temperature of the cooler at receipt was 18.0° C. Thermal preservation is not required for the requested analyses. Corrective action is deemed unnecessary.

Custody seals were not present on the cooler at time of sample receipt. The cooler was received taped shut and the cooler did not appear to be tampered with. The client was notified on 6/20/16.

RADIUM-226 & OTHER GAMMA EMITTERS (GS)

Sample WR111-REF-018-SS-P-00 (160-17842-1) was analyzed for Radium-226 & Other Gamma Emitters (GS) in accordance with EPA 901.1. The samples were leached on 06/17/2016, prepared on 06/21/2016 and analyzed on 07/12/2016.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

DRY AND GRIND

Sample WR111-REF-018-SS-P-00 (160-17842-1) was analyzed for Dry and Grind in accordance with Dry and Grind. The samples were leached on 06/17/2016, prepared on 06/22/2016 and analyzed on 07/08/2016.

Thorium-230 was detected in method blank MB 160-257496/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged "J". However, because the result concentration was less than ½ the reporting limit, no corrective action was necessary.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Detection Summary

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Client Sample ID: WR111-REF-018-SS-P-00

Lab Sample ID: 160-17842-1

 No Detections.

This Detection Summary does not include radiochemical test results.

TestAmerica St. Louis

Client Sample Results

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Client Sample ID: WR111-REF-018-SS-P-00

Lab Sample ID: 160-17842-1

Date Collected: 06/15/16 13:10

Matrix: Solid

Date Received: 06/17/16 10:50

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2 σ +/-)	Total Uncert. (2 σ +/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.49		0.269	0.310	0.500	0.243	pCi/g	06/21/16 13:11	07/12/16 12:20	1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2 σ +/-)	Total Uncert. (2 σ +/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	1.78		0.219	0.265	0.100	0.0370	pCi/g	06/22/16 10:40	07/08/16 12:38	1
Thorium-232	1.64		0.209	0.251	0.100	0.0200	pCi/g	06/22/16 10:40	07/08/16 12:38	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	64.0		30 - 110					06/22/16 10:40	07/08/16 12:38	1

Tracer/Carrier Summary

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)						
Lab Sample ID	Client Sample ID	Th-229 (30-110)						
160-17842-1	WR111-REF-018-SS-P-00	64.0						
LCS 160-257496/2-A	Lab Control Sample	80.5						
MB 160-257496/1-A	Method Blank	89.2						
Tracer/Carrier Legend								
Th-229 = Thorium-229								

QC Sample Results

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Method: 901.1 - Radium-226 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-257318/1-A

Matrix: Solid

Analysis Batch: 260174

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 257318

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.009406	U	0.0172	0.0173	0.500	0.284	pCi/g	06/21/16 13:11	07/12/16 10:01	1

Lab Sample ID: LCS 160-257318/2-A

Matrix: Solid

Analysis Batch: 260175

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 257318

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.1	99.51		10.4		1.13	pCi/g	102	87 - 116
Cesium-137	29.6	29.46		3.14		0.226	pCi/g	100	87 - 120
Cobalt-60	16.9	16.65		1.72		0.0983	pCi/g	98	87 - 115

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-257496/1-A

Matrix: Solid

Analysis Batch: 260076

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 257496

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-230	0.06090		0.0366	0.0369	0.100	0.0289	pCi/g	06/22/16 10:40	07/11/16 19:29	1
Thorium-232	-0.001174	U	0.00319	0.00319	0.100	0.0253	pCi/g	06/22/16 10:40	07/11/16 19:29	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	89.2		30 - 110					06/22/16 10:40	07/11/16 19:29	1

Lab Sample ID: LCS 160-257496/2-A

Matrix: Solid

Analysis Batch: 259861

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 257496

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	LOQ	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	28.50		2.63	0.100	0.0315	pCi/g	116	81 - 118
Tracer	LCS %Yield	LCS Qualifier	Limits						
Thorium-229	80.5		30 - 110						

QC Association Summary

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Rad

Leach Batch: 256923

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17842-1	WR111-REF-018-SS-P-00	Total/NA	Solid	Dry and Grind	

Prep Batch: 257318

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17842-1	WR111-REF-018-SS-P-00	Total/NA	Solid	Fill_Geo-21	256923
LCS 160-257318/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-257318/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	

Prep Batch: 257496

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17842-1	WR111-REF-018-SS-P-00	Total/NA	Solid	ExtChrom	256923
LCS 160-257496/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-257496/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Lab Chronicle

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Client Sample ID: WR111-REF-018-SS-P-00

Lab Sample ID: 160-17842-1

Date Collected: 06/15/16 13:10

Matrix: Solid

Date Received: 06/17/16 10:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			256923	06/17/16 15:02	DRO	TAL SL
Total/NA	Prep	Fill_Geo-21			257318	06/21/16 13:11	R1S	TAL SL
Total/NA	Analysis	901.1		1	260176	07/12/16 12:20	RTM	TAL SL
Total/NA	Leach	Dry and Grind			256923	06/17/16 15:02	DRO	TAL SL
Total/NA	Prep	ExtChrom			257496	06/22/16 10:40	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	259885	07/08/16 12:38	ALD	TAL SL

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Certification Summary

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Laboratory: TestAmerica St. Louis

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska	State Program	10	MO00054	06-30-17
California	State Program	9	2886	03-31-18
Connecticut	State Program	1	PH-0241	03-31-17
Florida	NELAP	4	E87689	06-30-17
Illinois	NELAP	5	003757	11-30-16
Iowa	State Program	7	373	12-01-16
Kansas	NELAP	7	E-10236	07-31-16 *
Kentucky (DW)	State Program	4	90125	12-31-16
L-A-B	DoD ELAP		L2305	04-06-19
Louisiana	NELAP	6	04080	06-30-17
Louisiana (DW)	NELAP	6	LA160008	12-31-16
Maryland	State Program	3	310	09-30-16 *
Missouri	State Program	7	780	06-30-17
Nevada	State Program	9	MO000542016-1	07-31-16 *
New Jersey	NELAP	2	MO002	06-30-17
New York	NELAP	2	11616	03-31-17
North Dakota	State Program	8	R207	06-30-16 *
NRC	NRC		24-24817-01	12-31-22
Oklahoma	State Program	6	9997	08-31-16 *
Pennsylvania	NELAP	3	68-00540	02-28-17 *
South Carolina	State Program	4	85002001	06-30-16 *
Texas	NELAP	6	T104704193-15-9	07-31-16 *
USDA	Federal		P330-07-00122	01-09-17
Utah	NELAP	8	MO000542015-7	07-31-16 *
Virginia	NELAP	3	460230	06-14-17
Washington	State Program	10	C592	08-30-16 *
West Virginia DEP	State Program	3	381	08-31-16 *

Laboratory: TestAmerica Denver

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-17
Utah	NELAP	8	CO00026	07-31-16

* Certification renewal pending - certification considered valid.

TestAmerica St. Louis

Method Summary

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Method	Method Description	Protocol	Laboratory
901.1	Radium-226 & Other Gamma Emitters (GS)	EPA	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

- DOE = U.S. Department of Energy
- EPA = US Environmental Protection Agency

Laboratory References:

- TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: EA Engineering, Science, and Technology
Project/Site: Hill AFB and Cabrera - Hill AFB WR111

TestAmerica Job ID: 160-17842-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-17842-1	WR111-REF-018-SS-P-00	Solid	06/15/16 13:10	06/17/16 10:50

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-17842-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
82232-334_00001	06/03/60	Eckert & Ziegler, Lot 82232-334			(Purchased Reagent)		Americium-241	7.281 Bq
							Pu-239	7.137 Bq
							Thorium-230	7.63 Bq
82233-334_00001	06/03/60	Eckert & Zigler, Lot 82233-334			(Purchased Reagent)		Americium-241	5.114 Bq
							Pu-239	6.064 Bq
							Thorium-230	4.95 Bq
82234-334_00001	06/02/60	Eckert & Zigler, Lot 82234-334			(Purchased Reagent)		Americium-241	5.652 Bq
							Pu-239	5.936 Bq
							Thorium-230	5.685 Bq
82237-334_00003						Pulser		
						U		
82242-334_00001						Pulser		
						U		
82245-334_00001	06/09/60	Eckert & Ziegler, Lot 82245-334			(Purchased Reagent)		Americium-241	5.528 Bq
							Pu-239	5.437 Bq
							Thorium-230	6.727 Bq
Source E_00001	04/01/59	02/23/11	water, Lot 79670-334	1.0205 g	Gamma Ampuole_00001	1.0205 g	Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq
							Sn-113	7626.6 Bq
							Y-88	12712 Bq
.Gamma Ampuole_00001	04/07/59	Analytics, Lot 79670-334			(Purchased Reagent)		Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq
							Co-57	2951.3 Bq
							Cobalt-60	6200.2 Bq
							Hg-203	9699.6 Bq
							Sn-113	7626.6 Bq
							Y-88	12712 Bq
Source G_00001	01/01/61	01/01/11	water, Lot 83725-334	10 mL	Gamma Ampuole_00003	1.8639 g	Americium-241	1693.09 Bq
							Cd-109	24592.1 Bq
							Ce-139	816.481 Bq
							Cesium-137	681.815 Bq
							Co-57	532.386 Bq
							Cobalt-60	1120.87 Bq
							Hg-203	1766.08 Bq
							Sn-113	1445.98 Bq
							Y-88	2359.21 Bq
.Gamma Ampuole_00003	01/19/61	Analytics, Lot 83725-334			(Purchased Reagent)		Americium-241	9083.6 Bq
							Cd-109	131939 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-17842-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Ce-139	4380.5 Bq
							Cesium-137	3658 Bq
							Co-57	2856.3 Bq
							Cobalt-60	6013.6 Bq
							Hg-203	9475.2 Bq
							Sn-113	7757.8 Bq
							Y-88	12657.4 Bq
Source H_00002	01/01/51	01/01/12	wataer, Lot 83725-334	10 mL	Gamma Ampuole_00003	2.1184 g	Americium-241	1924.27 Bq
							Cd-109	27950 Bq
							Ce-139	927.965 Bq
							Cesium-137	774.911 Bq
							Co-57	605.079 Bq
							Cobalt-60	1273.92 Bq
							Hg-203	2007.23 Bq
							Sn-113	1643.41 Bq
.Gamma Ampuole_00003	01/19/61		Analytics, Lot 83725-334		(Purchased Reagent)		Y-88	2681.34 Bq
							Americium-241	9083.6 Bq
							Cd-109	131939 Bq
							Ce-139	4380.5 Bq
							Cesium-137	3658 Bq
							Co-57	2856.3 Bq
							Cobalt-60	6013.6 Bq
							Hg-203	9475.2 Bq
Th-229_00020	08/05/16	07/16/15	0.1M HNO3, Lot n/a	500 mL	Th-229_00017	15 mL	Sn-113	7757.8 Bq
							Y-88	12657.4 Bq
							At-217	67.2296 dpm/mL
							Thorium-229	67.2296 dpm/mL
							At-217	2240.99 dpm/mL
							Thorium-229	2240.99 dpm/mL
							At-217	740.127 Bq/g
							Thorium-229	740.127 Bq/g
.Th-229_00017	08/05/16	08/20/14	0.1M HNO3, Lot n/a	100 mL	Th-229_00016	5.0464 g	Pb-210	22.1 pCi/g
							Radium-226	25.4 pCi/g
							Thorium-230	24.5 pCi/g
							U-234	6.2 pCi/g
							U-238	6 pCi/g
							Americium-241	219 dpm/g
							Cesium-137	82.3 dpm/g
							Cobalt-60	136 dpm/g
..Th-229_00016	08/06/64		Analytics, Lot 97790		(Purchased Reagent)		Ce-139	546 Bq
							Cesium-137	465 Bq
							Pb-210	22.1 pCi/g
							Radium-226	25.4 pCi/g
							Thorium-230	24.5 pCi/g
							U-234	6.2 pCi/g
							U-238	6 pCi/g
							Americium-241	1164 Bq
TRM-2_00001	03/20/50		DOE, Lot TRM-2		(Purchased Reagent)		Cd-109	16063 Bq
							Ce-139	546 Bq
							Cesium-137	465 Bq
							Pb-210	22.1 pCi/g
							Radium-226	25.4 pCi/g
							Thorium-230	24.5 pCi/g
							U-234	6.2 pCi/g
							U-238	6 pCi/g
Tuna Can LCS_00005	10/29/16		Analytics, Lot 74139-334		(Purchased Reagent)		Americium-241	1164 Bq
							Cd-109	16063 Bq
							Ce-139	546 Bq
							Cesium-137	465 Bq
							Pb-210	22.1 pCi/g
							Radium-226	25.4 pCi/g
							Thorium-230	24.5 pCi/g
							U-234	6.2 pCi/g
Tuna Can_00002	02/03/15		Eckert & Ziegler, Lot 81427-334		(Purchased Reagent)		U-238	6 pCi/g
							Americium-241	1164 Bq
							Cd-109	16063 Bq
							Ce-139	546 Bq
							Cesium-137	465 Bq
							Pb-210	22.1 pCi/g
							Radium-226	25.4 pCi/g
							Thorium-230	24.5 pCi/g

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-17842-1

SDG No.: _____

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Co-57	357 Bq
							Cobalt-60	742 Bq
							Hg-203	1208 Bq
							Pb-210	15186 Bq
							Sn-113	943 Bq
							Y-88	1571 Bq
Tuna Can_00003	02/09/17	Eckert & Ziegler, Lot 90099			(Purchased Reagent)		Americium-241	1164 Bq
							Cd-109	16373 Bq
							Ce-139	549 Bq
							Cesium-137	467 Bq
							Co-57	362 Bq
							Cobalt-60	735 Bq
							Hg-203	1171 Bq
							Pb-210	14936 Bq
							Sn-113	967 Bq
Tuna Can_00006	03/01/16	Eckert & Ziegler, Lot 83814-334			(Purchased Reagent)		Y-88	1590 Bq
							Americium-241	1195 Bq
							Cd-109	16353 Bq
							Ce-139	543 Bq
							Cesium-137	453 Bq
							Co-57	354 Bq
							Cobalt-60	745 Bq
							Hg-203	1175 Bq
							Pb-210	14606 Bq
							Sn-113	961 Bq
							Y-88	1568 Bq

Reagent

82232-334_00001

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

82232-334

24.1 mm Diameter x 0.65 mm Thick Stainless Steel Disk

Customer: Test America/St. Louis
P.O. No.: 2355182, Item 1

This standard radionuclide source was prepared by electrodeposition onto a stainless steel disk. Total alpha activity was determined with a ZnS scintillation detector. Radionuclide activities and impurities were calculated from the total activity and the fraction of activity for each radionuclide determined by alpha spectroscopy. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Reference Date: 3-Jun-2010 12:00 PM EST

Isotope	Activity (Bq)	Energy Range (keV)	Half-Life, years	Uncertainty* Type (%)		
				u_A	u_B	U
Th-230	7.630E+00	4420-4800	7.540E+04	0.7	1.1	2.6
Pu-239	7.137E+00	4950-5240	2.410E+04	0.7	1.1	2.6
Am-241	7.281E+00	5280-5600	4.326E+02	0.7	1.1	2.6
Total Activity	2.210E+01	3000-8000		0.4	1.1	2.3

***Uncertainty:** U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

(Certificate continued on reverse side)



Comments:

Diameter of active area: 19 mm. Disk mounted on customer supplied disk 31.8 mm diameter x 0.45 mm thick stainless steel disk.

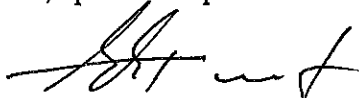
CAUTION: Active material deposited on the unmarked surface. Handle carefully to prevent scratching or damaging the active surface of this source (i.e., use Teflon coated forceps). Store in the container provided when not in use.

Source Calibrated by:



A. Chen, Spectroscopist

QA Approved:



E. A. Taskaev, QA Manager Alternate

Date: 06-24-2010



Reagent

82233-334_00001

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

82233-334

24.1 mm Diameter x 0.65 mm Thick Stainless Steel Disk

Customer: Test America/St. Louis
P.O. No.: 2355182, Item 1

This standard radionuclide source was prepared by electrodeposition onto a stainless steel disk. Total alpha activity was determined with a ZnS scintillation detector. Radionuclide activities and impurities were calculated from the total activity and the fraction of activity for each radionuclide determined by alpha spectroscopy. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Reference Date: 3-Jun-2010 12:00 PM EST

Isotope	Activity (Bq)	Energy Range (keV)	Half-Life, years	Uncertainty* Type (%)		
				u _A	u _B	U
Th-230	4.950E+00	4420-4800	7.540E+04	0.8	1.1	2.7
Pu-239	6.064E+00	4950-5240	2.410E+04	0.7	1.1	2.6
Am-241	5.114E+00	5280-5600	4.326E+02	0.8	1.1	2.7
Total Activity	1.616E+01	3000-8000		0.1	1.1	2.2

***Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

(Certificate continued on reverse side)

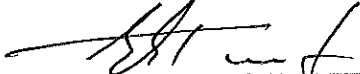


Comments:

Diameter of active area: 19 mm. Disk mounted on customer supplied disk 31.8 mm diameter x 0.45 mm thick stainless steel disk.

CAUTION: Active material deposited on the unmarked surface. Handle carefully to prevent scratching or damaging the active surface of this source (i.e., use Teflon coated forceps). Store in the container provided when not in use.

Source Calibrated by: 
A. Chen, Spectroscopist

QA Approved: 
E. A. Taskaev, QA Manager Alternate

Date: 06-24-2010



Reagent

82234-334_00001

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

82234-334

24.1 mm Diameter x 0.65 mm Thick Stainless Steel Disk

Customer: Test America/St. Louis

P.O. No.: 2355182, Item 1

This standard radionuclide source was prepared by electrodeposition onto a stainless steel disk. Total alpha activity was determined with a ZnS scintillation detector. Radionuclide activities and impurities were calculated from the total activity and the fraction of activity for each radionuclide determined by alpha spectroscopy. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Reference Date: 2-Jun-2010 12:00 PM EST

Isotope	Activity (Bq)	Energy Range (keV)	Half-Life, years	Uncertainty* Type (%)		
				u _A	u _B	U
Th-230	5.685E+00	4420-4800	7.540E+04	0.9	1.1	2.8
Pu-239	5.936E+00	4950-5240	2.410E+04	0.9	1.1	2.8
Am-241	5.652E+00	5280-5600	4.326E+02	0.9	1.1	2.8
Total Activity	1.732E+01	3000-8000		0.5	1.1	2.4

***Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

(Certificate continued on reverse side)



Comments:

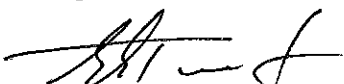
Diameter of active area: 19 mm. Disk mounted on customer supplied disk 31.8 mm diameter x 0.45 mm thick stainless steel disk.

CAUTION: Active material deposited on the unmarked surface. Handle carefully to prevent scratching or damaging the active surface of this source (i.e., use Teflon coated forceps). Store in the container provided when not in use.

Source Calibrated by:


A. Chen, Spectroscopist

QA Approved:


E. A. Taskaev, QA Manager Alternate

Date: 06-24-2010



Reagent

82237-334_00003

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

82237-334

24.1 mm Diameter x 0.65 mm Thick Stainless Steel Disk

Customer: Test America/St. Louis
P.O. No.: 2355182, Item 1

This standard radionuclide source was prepared by electrodeposition onto a stainless steel disk. Total alpha activity was determined with a ZnS scintillation detector. Radionuclide activities and impurities were calculated from the total activity and the fraction of activity for each radionuclide determined by alpha spectroscopy. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Reference Date: 1-Jun-2010 12:00 PM EST

Isotope	Activity (Bq)	Energy Range (keV)	Half-Life, years	Uncertainty* Type (%)		
				u _A	u _B	U
Th-230	5.856E+00	4420-4800	7.540E+04	1.0	1.1	3.0
Pu-239	6.424E+00	4950-5240	2.410E+04	0.9	1.1	2.8
Am-241	5.608E+00	5280-5600	4.326E+02	1.0	1.1	3.0
Total Activity	1.793E+01	3000-8000		0.6	1.1	2.5

***Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

(Certificate continued on reverse side)



Comments:

Diameter of active area: 19 mm. Disk mounted on customer supplied disk 31.8 mm diameter x 0.45 mm thick stainless steel disk.

CAUTION: Active material deposited on the unmarked surface. Handle carefully to prevent scratching or damaging the active surface of this source (i.e., use Teflon coated forceps). Store in the container provided when not in use.

Source Calibrated by: 
A. Chen, Spectroscopist

QA Approved: 
E. A. Taskaev, QA Manager Alternate

Date: 06-24-2010



Reagent

82242-334_00001

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

82242-334

24.1 mm Diameter x 0.65 mm Thick Stainless Steel Disk

Customer: Test America/St. Louis

P.O. No.: 2355182, Item 1

This standard radionuclide source was prepared by electrodeposition onto a stainless steel disk. Total alpha activity was determined with a ZnS scintillation detector. Radionuclide activities and impurities were calculated from the total activity and the fraction of activity for each radionuclide determined by alpha spectroscopy. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Reference Date: 8-Jun-2010 12:00 PM EST

Isotope	Activity (Bq)	Energy Range (keV)	Half-Life, years	Uncertainty* Type (%)		
				u_A	u_B	U
Th-230	6.583E+00	4420-4800	7.540E+04	0.9	1.1	2.8
Pu-239	6.414E+00	4950-5240	2.410E+04	0.9	1.1	2.8
Am-241	7.145E+00	5280-5600	4.326E+02	0.9	1.1	2.8
Total Activity	2.018E+01	3000-8000		0.6	1.1	2.5

*Uncertainty: U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

(Certificate continued on reverse side)



Comments:

Diameter of active area: 19 mm. Disk mounted on customer supplied disk 31.8 mm diameter x 0.45 mm thick stainless steel disk.

CAUTION: Active material deposited on the unmarked surface. Handle carefully to prevent scratching or damaging the active surface of this source (i.e., use Teflon coated forceps). Store in the container provided when not in use.

Source Calibrated by:


A. Chen, Spectroscopist

QA Approved:


E. A. Taskaev, QA Manager Alternate

Date: 06-24-2010



Reagent

82245-334_00001

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

82245-334

24.1 mm Diameter x 0.65 mm Thick Stainless Steel Disk

Customer: Test America/St. Louis
P.O. No.: 2355182, Item 1

This standard radionuclide source was prepared by electrodeposition onto a stainless steel disk. Total alpha activity was determined with a ZnS scintillation detector. Radionuclide activities and impurities were calculated from the total activity and the fraction of activity for each radionuclide determined by alpha spectroscopy. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Reference Date: 9-Jun-2010 12:00 PM EST

Isotope	Activity (Bq)	Energy Range (keV)	Half-Life, years	Uncertainty* Type (%)		
				u_A	u_B	U
Th-230	6.727E+00	4420-4800	7.540E+04	1.0	1.1	3.0
Pu-239	5.437E+00	4950-5240	2.410E+04	1.1	1.1	3.1
Am-241	5.528E+00	5280-5600	4.326E+02	1.1	1.1	3.1
Total Activity	1.773E+01	3000-8000		0.8	1.1	2.7

*Uncertainty: U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

(Certificate continued on reverse side)



Comments:

Diameter of active area: 19 mm. Disk mounted on customer supplied disk 31.8 mm diameter x 0.45 mm thick stainless steel disk.

CAUTION: Active material deposited on the unmarked surface. Handle carefully to prevent scratching or damaging the active surface of this source (i.e., use Teflon coated forceps). Store in the container provided when not in use.

Source Calibrated by:


A. Chen, Spectroscopist

QA Approved:


E. A. Taskaev, QA Manager Alternate

Date: 06-24-2010



Reagent

Gamma Ampuole_00001



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

79670-334

5 mL Liquid in Flame Sealed Vial

Customer: TestAmerica St. Louis

P.O. No.: 2303925, Item 1

Calibration Date: 01-Apr-2009 12:00 EST **Grams of Master Source:** 0.028371

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

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					u_A	u_B	U	
Am-241	59.5	157860	—	3.390E+03	0.1	0.9	1.8	4 π LS
Cd-109	88.0	462.60	1.691E+05	4.798E+03	0.4	1.7	3.5	HPGe
Co-57	122.1	271.79	8.904E+04	2.526E+03	0.5	1.3	2.8	HPGe
Ce-139	165.9	137.6	1.256E+05	3.563E+03	0.4	1.1	2.3	HPGe
Hg-203	279.2	46.61	2.788E+05	7.910E+03	0.3	1.1	2.3	HPGe
Sn-113	391.7	115.1	1.725E+05	4.894E+03	0.5	1.1	2.4	HPGe
Cs-137	661.7	10983	1.120E+05	3.178E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	106.6	4.205E+05	1.193E+04	0.8	1.1	2.7	HPGe
Co-60	1173.2	1925.4	2.184E+05	6.196E+03	0.7	1.1	2.6	HPGe
Cd-60	1332.5	1925.4	2.185E+05	6.199E+03	0.7	1.1	2.6	HPGe
Y-88	1836.1	106.6	4.444E+05	1.261E+04	0.7	1.1	2.6	HPGe

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

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

Comments:

5.31740 grams 4M HCl solution with approximately 30 microg/g each of Cd, Co, Ce, Hg, Sn, Cs, and Y carriers.

This standard will expire one year after the calibration date.

Source Prepared by: W. Mao for
W. Mao, Radiochemist

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

Date: 5-13-09

End of Certificate

Reagent

Gamma Ampuole_00003

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

83725-334

5 mL Liquid in Flame Sealed Vial

Customer: Test America St. Louis/Earth City, MO

P.O. No.: 2397508, Item 1

Reference Date: 01-Jan-2011 12:00 PM EST **Grams of Master Source:** 0.028066

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty, %			Calibration Method
					u _A	u _B	U	
Am-241	59.5	1.580E+05	—	3.261E+03	0.1	0.9	1.8	4π LS
Cd-109	88.0	4.626E+02	1.697E+05	4.763E+03	0.8	1.7	3.8	HPGe
Co-57	122.1	2.718E+02	8.711E+04	2.445E+03	0.5	1.3	2.8	HPGe
Ce-139	165.9	1.376E+02	1.247E+05	3.500E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	4.661E+01	2.753E+05	7.727E+03	0.4	1.1	2.3	HPGe
Sn-113	391.7	1.151E+02	1.769E+05	4.965E+03	0.5	1.1	2.4	HPGe
Cs-137	661.7	1.098E+04	1.109E+05	3.113E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	1.066E+02	4.224E+05	1.186E+04	0.5	1.1	2.4	HPGe
Co-60	1173.2	1.925E+03	2.142E+05	6.012E+03	0.6	1.1	2.5	HPGe
Co-60	1332.5	1.925E+03	2.143E+05	6.015E+03	0.6	1.1	2.5	HPGe
Y-88	1836.1	1.066E+02	4.472E+05	1.255E+04	0.5	1.1	2.4	HPGe

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

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

(Certificate continued on reverse side)



Comments:

5.30203 grams 4M HCl solution with approximately 30 µg/g each of Cd, Co, Ce, Hg, Sn, Cs, and Y carriers.

This standard will expire one year after the reference date.

Source Prepared by: M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved: J. D. McCorvey
J. D. McCorvey, QA Manager Alternate

Date: 13 JAN 11



Reagent

Source E_00001



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

79670-334

5 mL Liquid in Flame Sealed Vial

Customer: TestAmerica St. Louis

P.O. No.: 2303925, Item 1

Calibration Date: 01-Apr-2009 12:00 EST **Grams of Master Source:** 0.028371

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

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					u_A	u_B	U	
Am-241	59.5	157860	—	3.390E+03	0.1	0.9	1.8	4 π LS
Cd-109	88.0	462.60	1.691E+05	4.798E+03	0.4	1.7	3.5	HPGe
Co-57	122.1	271.79	8.904E+04	2.526E+03	0.5	1.3	2.8	HPGe
Ce-139	165.9	137.6	1.256E+05	3.563E+03	0.4	1.1	2.3	HPGe
Hg-203	279.2	46.61	2.788E+05	7.910E+03	0.3	1.1	2.3	HPGe
Sn-113	391.7	115.1	1.725E+05	4.894E+03	0.5	1.1	2.4	HPGe
Cs-137	661.7	10983	1.120E+05	3.178E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	106.6	4.205E+05	1.193E+04	0.8	1.1	2.7	HPGe
Co-60	1173.2	1925.4	2.184E+05	6.196E+03	0.7	1.1	2.6	HPGe
Cq-60	1332.5	1925.4	2.185E+05	6.199E+03	0.7	1.1	2.6	HPGe
Y-88	1836.1	106.6	4.444E+05	1.261E+04	0.7	1.1	2.6	HPGe

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

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

Comments:

5.31740 grams 4M HCl solution with approximately 30 microg/g each of Cd, Co, Ce, Hg, Sn, Cs, and Y carriers.

This standard will expire one year after the calibration date.

Source Prepared by: W. Mao for
W. Mao, Radiochemist

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

Date: 5-13-09

End of Certificate

Reagent

Source G_00001



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

79670-334

5 mL Liquid in Flame Sealed Vial

Customer: TestAmerica St. Louis

P.O. No.: 2303925, Item 1

Calibration Date: 01-Apr-2009 12:00 EST **Grams of Master Source:** 0.028371

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

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					u_A	u_B	U	
Am-241	59.5	157860	—	3.390E+03	0.1	0.9	1.8	4 π LS
Cd-109	88.0	462.60	1.691E+05	4.798E+03	0.4	1.7	3.5	HPGe
Co-57	122.1	271.79	8.904E+04	2.526E+03	0.5	1.3	2.8	HPGe
Ce-139	165.9	137.6	1.256E+05	3.563E+03	0.4	1.1	2.3	HPGe
Hg-203	279.2	46.61	2.788E+05	7.910E+03	0.3	1.1	2.3	HPGe
Sn-113	391.7	115.1	1.725E+05	4.894E+03	0.5	1.1	2.4	HPGe
Cs-137	661.7	10983	1.120E+05	3.178E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	106.6	4.205E+05	1.193E+04	0.8	1.1	2.7	HPGe
Co-60	1173.2	1925.4	2.184E+05	6.196E+03	0.7	1.1	2.6	HPGe
Cd-60	1332.5	1925.4	2.185E+05	6.199E+03	0.7	1.1	2.6	HPGe
Y-88	1836.1	106.6	4.444E+05	1.261E+04	0.7	1.1	2.6	HPGe

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

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

Comments:

5.31740 grams 4M HCl solution with approximately 30 microg/g each of Cd, Co, Ce, Hg, Sn, Cs, and Y carriers.

This standard will expire one year after the calibration date.

Source Prepared by: W. Mao for
W. Mao, Radiochemist

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

Date: 5-13-09

End of Certificate

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

83725-334

5 mL Liquid in Flame Sealed Vial

Customer: Test America St. Louis/Earth City, MO

P.O. No.: 2397508, Item 1

Reference Date: 01-Jan-2011 12:00 PM EST **Grams of Master Source:** 0.028066

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty, %			Calibration Method
					u _A	u _B	U	
Am-241	59.5	1.580E+05	—	3.261E+03	0.1	0.9	1.8	4π LS
Cd-109	88.0	4.626E+02	1.697E+05	4.763E+03	0.8	1.7	3.8	HPGe
Co-57	122.1	2.718E+02	8.711E+04	2.445E+03	0.5	1.3	2.8	HPGe
Ce-139	165.9	1.376E+02	1.247E+05	3.500E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	4.661E+01	2.753E+05	7.727E+03	0.4	1.1	2.3	HPGe
Sn-113	391.7	1.151E+02	1.769E+05	4.965E+03	0.5	1.1	2.4	HPGe
Cs-137	661.7	1.098E+04	1.109E+05	3.113E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	1.066E+02	4.224E+05	1.186E+04	0.5	1.1	2.4	HPGe
Co-60	1173.2	1.925E+03	2.142E+05	6.012E+03	0.6	1.1	2.5	HPGe
Co-60	1332.5	1.925E+03	2.143E+05	6.015E+03	0.6	1.1	2.5	HPGe
Y-88	1836.1	1.066E+02	4.472E+05	1.255E+04	0.5	1.1	2.4	HPGe

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

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

(Certificate continued on reverse side)



Comments:

5.30203 grams 4M HCl solution with approximately 30 µg/g each of Cd, Co, Ce, Hg, Sn, Cs, and Y carriers.

This standard will expire one year after the reference date.

Source Prepared by: M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved: J. D. McCorvey
J. D. McCorvey, QA Manager Alternate

Date: 13 JAN 11



Reagent

Source H_00002

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

83725-334

5 mL Liquid in Flame Sealed Vial

Customer: Test America St. Louis/Earth City, MO

P.O. No.: 2397508, Item 1

Reference Date: 01-Jan-2011 12:00 PM EST **Grams of Master Source:** 0.028066

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty, %			Calibration Method
					u _A	u _B	U	
Am-241	59.5	1.580E+05	—	3.261E+03	0.1	0.9	1.8	4π LS
Cd-109	88.0	4.626E+02	1.697E+05	4.763E+03	0.8	1.7	3.8	HPGe
Co-57	122.1	2.718E+02	8.711E+04	2.445E+03	0.5	1.3	2.8	HPGe
Ce-139	165.9	1.376E+02	1.247E+05	3.500E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	4.661E+01	2.753E+05	7.727E+03	0.4	1.1	2.3	HPGe
Sn-113	391.7	1.151E+02	1.769E+05	4.965E+03	0.5	1.1	2.4	HPGe
Cs-137	661.7	1.098E+04	1.109E+05	3.113E+03	0.7	1.2	2.8	HPGe
Y-88	898.0	1.066E+02	4.224E+05	1.186E+04	0.5	1.1	2.4	HPGe
Co-60	1173.2	1.925E+03	2.142E+05	6.012E+03	0.6	1.1	2.5	HPGe
Co-60	1332.5	1.925E+03	2.143E+05	6.015E+03	0.6	1.1	2.5	HPGe
Y-88	1836.1	1.066E+02	4.472E+05	1.255E+04	0.5	1.1	2.4	HPGe

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

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

(Certificate continued on reverse side)



Comments:

5.30203 grams 4M HCl solution with approximately 30 µg/g each of Cd, Co, Ce, Hg, Sn, Cs, and Y carriers.

This standard will expire one year after the reference date.

Source Prepared by: M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved: J. D. McCorvey
J. D. McCorvey, QA Manager Alternate

Date: 13 JAN 11



Reagent

Th-229_00016

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

97790

Th-229 5 mL Liquid in Flame Sealed Vial

Customer: TestAmerica - St. Louis
P.O. No.: 2573570, Item 1 **Product Code:** 8229



430569
ID: Th-229_00016
Exp:08/06/14 Pripd:SCB Opm:08/20/14
Th-229 Ampoule

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide calibration and purity were checked by germanium gamma-ray spectrometry, liquid scintillation counting, and/or alpha spectrometry, as applicable. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 2, July 2007, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty* , %			Reference Date (12:00 PM EST)
			u_A	u_B	U	
Th-229	2.681E+06	3.761E+03	0.5	1.5	3.1	08/06/2014

***Uncertainty:** U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: α -impurities: Th-228 2.83E-01 Bq, Th-230 2.33E+01 Bq, Th-232 1.51E0 Bq; γ -impurities (other than decay products) <0.1%.
5.08156 g 0.5M HNO₃ solution. Carrier free.

Source Prepared by: _____

Z. Dimitrova, Radiochemist

QC Approved: _____

A. Chen, Spectroscopist

Date: 06 AUG 14





U.S. DEPARTMENT OF COMMERCE
National Institute of Standards & Technology
Gaithersburg, MD 20899

Certificate of Participation

Eckert & Ziegler Analytics
Atlanta, Georgia

is a participant for the period January 1, 2014, through December 31, 2014, in a radioactivity measurements assurance program conducted by the National Institute of Standards and Technology, in cooperation with NRMAT Incorporated. Continued participation is evidenced by dated Reports of Traceability issued for particular radionuclides, which indicate the deviation of the participant's reported value from that measured by the National Institute of Standards and Technology. The significance of these Reports is addressed below.*

For the Director,

A handwritten signature in black ink, appearing to read "Michael P. Unterweger".

Michael P. Unterweger, Leader
Radioactivity Group
Physical Measurement Laboratory

*As guidance for the proper use of Reports of Traceability, it should be emphasized that the National Institute of Standards and Technology is concerned only with fostering good measurements capability and consistency with the national measurements system. The assurance of the proper application of that capability to the ultimate consumer products is the responsibility of each manufacturer of these products and of the Federal regulatory agencies.

A continuing traceability program in radioactivity demonstrates, to the degree established by the periodic assays of calibrated radioactivity samples, a continuing competence to maintain the methods and standards necessary for accurate measurement. Such a program cannot, however, endorse each and every measurement nor the final product, any more than a spot check can vouch for every unchecked item. Care should be taken, therefore, not to imply such endorsement. The proper use of this Report is governed by section 200.114 of Title 15 of the Code of Federal Regulations. These regulations may be met if Reports are quoted only in their entirety. Excerpts out of context may be misleading.

Recommended Procedure for Opening the Flame Sealed Vial

- 1) If the solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the standard.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood.
- 3) Shake the vial to wet the entire inside surface of the vial. Return the vial to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the vial. If necessary, gently tap the neck to speed the process.
- 5) The Wheaton vials we use are pre-scored.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the vial upright and wrap with soft tissue, such as Chem Wipes, around the tip of the vial and secure with tape (see picture). Snap off the top of the vial by pressing the pre-scored part of the neck away towards you while pulling the tip of the vial away from you.
- 8) Transfer the solution from the vial using a pycnometer or pipet with a dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused solution in a flame sealed glass vial, if possible, to minimize the evaporation loss.

Reagent

Th-229_00020

St. Louis Radiological Standard Reverification Form

Standard ID Number: Th-229_00020
True Value = 66.223 DPM/L or g
Date Analyzed: 8/5/2015

Radionuclide: Th-229

	Replicates	
#1	<u>66.657</u>	DPM/L or g
#2	<u>65.249</u>	DPM/L or g
#3	<u>68.757</u>	DPM/L or g

Mean = 66.88767

1 sigma = 1.765339

1.96 sigma = 3.460064

True Value minus 5% = 62.91185

(True Value - 5%)

True Value plus 5% = 69.53415

(True Value + 5%)

Accuracy:

Mean value within 5% of Certified (True) Value? Yes (Acceptance Criteria)

Precision:

1.96 sigma Value Within 10% of Mean Value? Yes (Acceptance Criteria)

Standard Reverification Acceptable?

Yes

Note: Criteria for reverification of radiological standards is taken from the DOE QSAS and LANL Statements of Work

Reviewed By/Date: Rachel T. Mueller 8/11/2015

SOP Reference: STL-QA-0002, Current Revision

Sample Name: Verification 1
Sample Type: Sample

Sample Collection Date:

Batch Name: Th-229_00020
AnalysisID: 650912

Tracer Name: Th-230_00025
Tracer Activity: 44.56 DPM/mL x (Vol.)0.30 mL = 13.37 DPM
Tracer Ref. Date: 8/8/2013 12:00:04PM

Sample

Spectrum #1 Analysis #1
Sample Volume : 0.1000mL
Aliquot: N/A Aliquot Fraction: N/A

Batch

Analyst: 60040

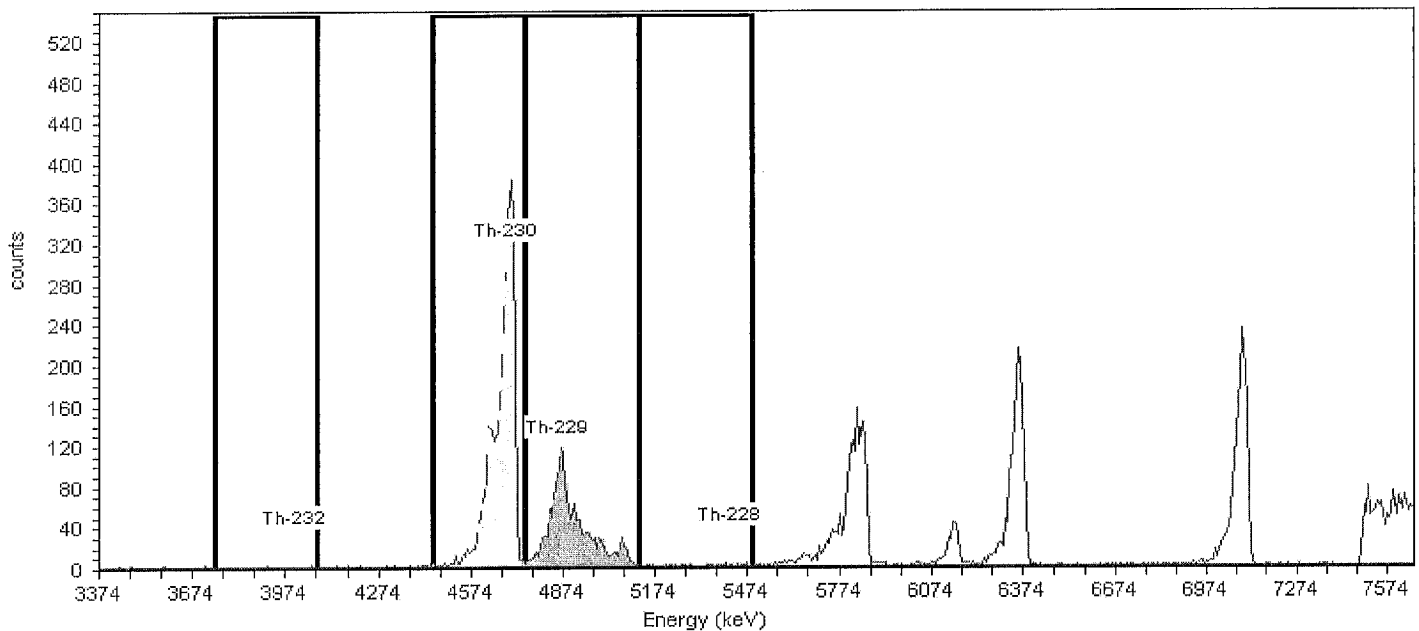
Tracer

Tracer Nuclide: Th-230
Tracer Recovery: 99.76%

Acquisition

Detector: AV115
Serial Number: 49-037E4
Acquisition Start Date: 8/5/2015 12:04:12PM
Live Time: 960.00 min.
Real Time: 960.02 min.
Background Date: 7/17/2015 12:56:42PM
Background Info: Sample: ICB;AV115; Det: AV115; Spectrum #1;
Jul-17-2015 12:56

Calibration Name: IC-9817;AV115-20150603
Calibration Date: 6/4/2015 1:31:22AM
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Energy Cal: Quadratic = 0.0000 keV / Ch²
Efficiency: 25.44% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th-230_Tracer
Decay Correction: 8/5/2015 12:01:32PM
MDA Constants: $K\alpha = 1.65$, $K\beta = 1.65$

Nuclide Library: Thorium
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	Peak Expected keV	Peak Diff keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity	Units
Th-232	3999.0	4,010.0	-11.0	3743.0	4072.0	10.7	100.2	2	3.4586	-1.46	-0.060	DPM/mL
Th-230	4688.0	4,687.5	0.5	4448.3	4746.6	31.9	99.7	3250	2.0000	3248.00	133.370	DPM/mL
Th-229	4848.0	4,845.3	2.7	4746.6	5119.5	75.3	99.8	1624	3.0000	1621.00	66.657	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	11.0	99.8	28	3.0000	25.15	1.035	DPM/mL

Sample Name: Verification 2
SampleType: Sample

Sample Collection Date:

Batch Name: Th-229_00020
AnalysisID: 650913

Tracer Name: Th-230_00025
Tracer Activity: 44.56 DPM/mL x (Vol.)0.30 mL = 13.37 DPM
Tracer Ref. Date: 8/8/2013 12:00:04PM

Sample

Spectrum #1 Analysis #1
Sample Volume : 0.1000mL
Aliquot: N/A Aliquot Fraction: N/A

Batch

Analyst: 60040

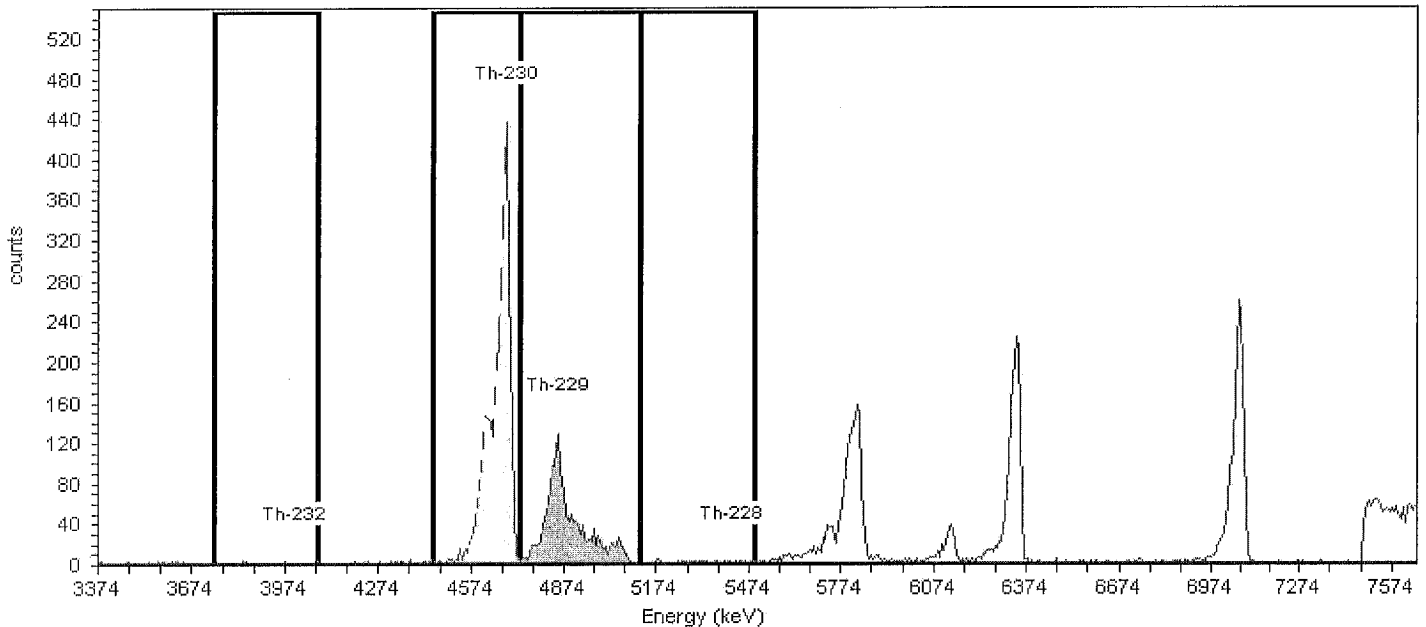
Tracer

Tracer Nuclide: Th-230
Tracer Recovery: 102.76%

Acquisition

Detector: AV116
Serial Number: 49-034G1
Acquisition Start Date: 8/5/2015 12:04:13PM
Live Time: 960.00 min.
Real Time: 960.02 min.
Background Date: 7/17/2015 12:56:44PM
Background Info: Sample: ICB;AV116; Det: AV116; Spectrum #1;
Jul-17-2015 12:56

Calibration Name: IC-9884;AV116-20150603
Calibration Date: 6/4/2015 1:31:31AM
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Energy Cal: Quadratic = 0.0000 keV / Ch²
Efficiency: 24.86% +/- 0.36% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th-230_Tracer
Decay Correction: 8/5/2015 12:01:32PM
MDA Constants: $K\alpha = 1.65$, $K\beta = 1.65$

Nuclide Library: Thorium
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	Peak Expected keV	Peak Diff keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity	Units
Th-232	3999.0	4,010.0	-11.0	3743.0	4072.0	44.6	100.2	4	1.0000	2.54	0.103	DPM/mL
Th-230	4688.0	4,687.5	0.5	4448.3	4731.7	40.1	99.7	3272	3.0000	3269.00	137.388	DPM/mL
Th-229	4848.0	4,845.3	2.7	4731.7	5119.5	69.1	99.8	1599	2.0000	1597.00	65.249	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	.3	99.8	24	4.0000	19.94	0.815	DPM/mL

Sample Name: Verification 3

SampleType: Sample

Sample Collection Date:

Batch Name: Th-229_00020

AnalysisID: 650914

Tracer Name: Th-230_00025

Tracer Activity: 44.56 DPM/mL x (Vol.)0.30 mL = 13.37 DPM

Tracer Ref. Date: 8/8/2013 12:00:04PM

Sample

Spectrum #1 Analysis #1
Sample Volume : 0.1000mL
Aliquot: N/A Aliquot Fraction: N/A

Batch

Analyst: 60040

Tracer

Tracer Nuclide: Th-230
Tracer Recovery: 99.73%

Acquisition

Detector: AV117

Serial Number: 49-037X4

Acquisition Start Date: 8/5/2015 12:04:18PM

Live Time: 960.00 min.

Real Time: 960.02 min.

Background Date: 7/19/2015 5:26:41PM

Background Info: Sample: ICB;AV117; Det: AV117; Spectrum #1;

Jul-19-2015 17:26

Calibration Name: IC-9885;AV117-20150603

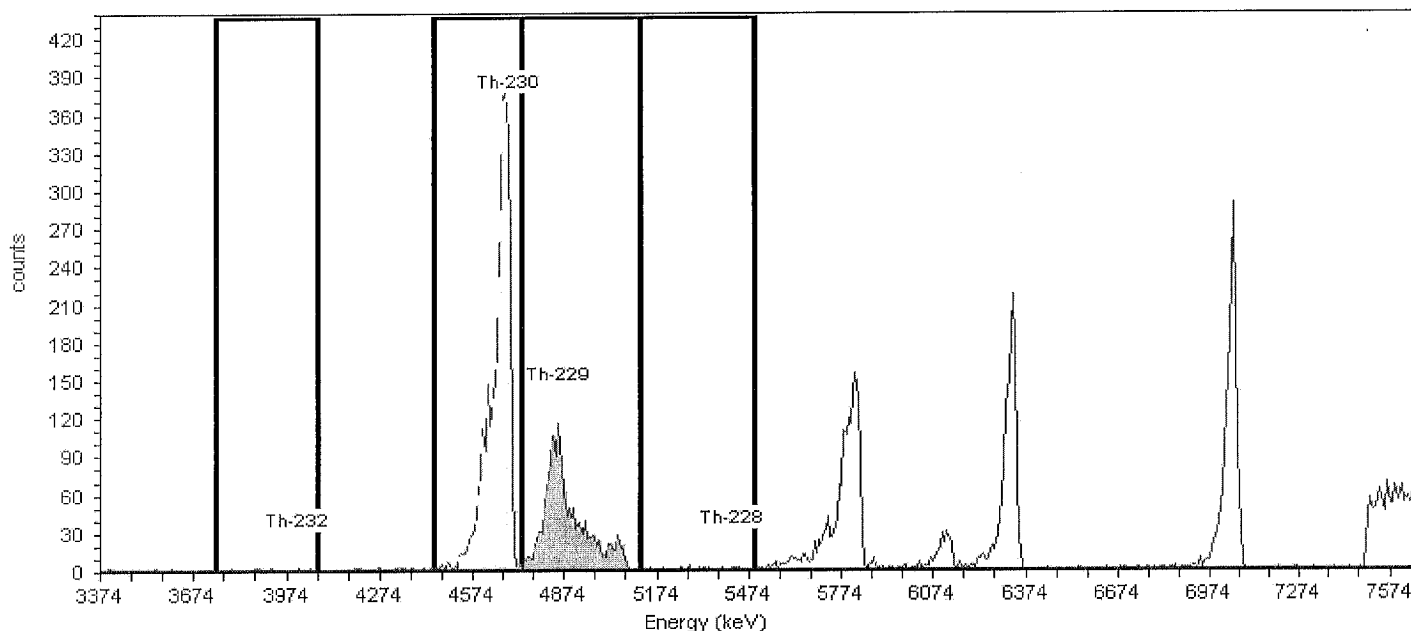
Calibration Date: 6/4/2015 1:31:41AM

Gain = 7.4575 keV / Ch

Energy Cal: Offset = 3,366.95 keV

Quadratic = 0.0000 keV / Ch²

Efficiency: 24.89% +/- 0.37% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th-230_Tracer

Decay Correction: 8/5/2015 12:01:32PM

MDA Constants: $K\alpha = 1.65$, $K\beta = 1.65$

Nuclide Library: Thorium

MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	Peak Expected keV	Peak Diff keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity	Units
Th-232	3999.0	4,010.0	-11.0	3743.0	4072.0	10.2	100.2	7	1.0000	6.00	0.251	DPM/mL
Th-230	4688.0	4,687.5	0.5	4448.3	4731.7	46.3	99.7	3176	0.0000	3176.00	133.339	DPM/mL
Th-229	4848.0	4,845.3	2.7	4731.7	5119.5	78.5	99.8	1635	0.0000	1635.00	68.757	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	258.3	99.8	16	2.0866	14.09	0.593	DPM/mL

Th-229
Actinide Prep

Tracer
Verification

Batch No.:

Balance ID:

Note: The section below is not used, marked the N/A box and initial & date next to the N/A.
If Mark N/A Box, the repair is not added to the sample's then
initial and date next to the N/A

No.	Sample Number	Aliquot (g / mL)	Crucible ID	Dilution
1	ver 1	0.1	115	
2	12	I	116	
3	13		117	
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Tracer	<input type="checkbox"/> N/A	Initials / Date
Isotope:	Th-229	
Std Sol'n No.:	Th-229-00025	
Vol (mL):	0.3	
Ref Activity (dpm/mL):		
Act Ref Date:		

Samples Spiked and Traced By:
Sub 8/3/15
Initials / Date

Verification Signature & Date:
NW 8-3-15
Initials / Date

LCS Standard	<input type="checkbox"/> N/A	Initials / Date
Isotope:	Th-229-0002	Sub 8/3/15
Std Sol'n ID.:	Th-229-00020	
Vol (mL):	0.1	Ready to
Ref Activity (dpm/mL):	67.229	
Act Ref Date:	08-06-14	6/23 4pm

SOP's applied in preparing these samples. Mark box to left for all that apply:

<input type="checkbox"/> ST-RC-0003 Rev.	<input type="checkbox"/> ST-RC-0040 Rev.	<input type="checkbox"/> ST-RC-0110 Rev.
<input type="checkbox"/> ST-RC-0004 Rev.	<input type="checkbox"/> ST-RC-0041 Rev.	<input type="checkbox"/> ST-RC-0120 Rev.
<input type="checkbox"/> ST-RC-0014 Rev.	<input type="checkbox"/> ST-RC-0050 Rev.	<input type="checkbox"/> ST-RC-0232 Rev.
<input type="checkbox"/> ST-RC-0020 Rev.	<input type="checkbox"/> ST-RC-0090 Rev.	<input type="checkbox"/> ST-RC-0238 Rev.
<input type="checkbox"/> ST-RC-0021 Rev.	<input type="checkbox"/> ST-RC-0100 Rev.	<input type="checkbox"/> ST-RC-0240 Rev.
		<input type="checkbox"/> ST-RC-0241 Rev.
		<input type="checkbox"/> ST-RC-0242 Rev.
		<input type="checkbox"/> ST-RC-5016 Rev.
		<input type="checkbox"/>
		<input type="checkbox"/>

Count Time	Matrix
Long Count <input type="checkbox"/>	Soil <input type="checkbox"/>
Short Count <input type="checkbox"/>	H ₂ O <input type="checkbox"/>

Isotope(s)			
<input type="checkbox"/> αβ	<input type="checkbox"/> Iso Pu	<input type="checkbox"/> Tc-99	<input type="checkbox"/> Iso Cm
<input type="checkbox"/> Iso Am	<input type="checkbox"/> Ra	<input type="checkbox"/> Iso Th	<input type="checkbox"/> Pu-241
<input type="checkbox"/> KPA	<input type="checkbox"/> Sr	<input checked="" type="checkbox"/>	<input type="checkbox"/> Th-229
<input type="checkbox"/> Np	<input type="checkbox"/> TAR	<input type="checkbox"/> C-14	<input type="checkbox"/> Cl-36

Prepared By:

Reviewed by:

Date:

Date:

Page 1

\\slsvr01\RAD\MasterForms\RAD-0045
Rev(3)



Reagent ID: Th-229_00020

Description: Th-229 Tracer
No. of Bottles: 1
Storage Location: RAD Actinide STDs
Reagent Volume: 500.000 mL
Creation Date: 07/16/2015
Open Date:
Container(s): 684059
Comment:

Expiration Date: 12/24/2015
Laboratory: TestAmerica St. Louis
Prepared By: Bernsen, Sarah C
Solvent: 0.1M HNO3
Solvent Lot: n/a

Reagent Analyte Information

Analyte	Source ID	Source Exp. Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
At-217	Th-229_00017	08/06/2064	2240.98600	dpm/mL	67.22958	dpm/mL
Th-229	Th-229_00017	08/06/2064	2240.98600	dpm/mL	67.22958	dpm/mL

Source Reagents

Reagent	Description	Type	Expiration	Vendor	Vendor Lot #	Vendor Cat Lot #	Volume Used	Volume Units
Th-229_00017	Th-229 Parent		08/06/64				15.00000	mL

Reagent

TRM-2_00001

Perry, Doug E

From: Salmi, Douglas R
Sent: March 20, 2000 10:48 AM
To: Perry, Doug E; Puissant, Pamela M
Subject: FW: SRMs for radiochemistry LCSs

Pam, Doug
FYI

-----Original Message-----

From: Minter@aol.com [mailto:Minter@aol.com]
Sent: March 20, 2000 10:36 AM
To: drsalmi@sandia.gov
Cc: dbourne@doeal.gov; GLDechant@aol.com; crandallb@quanterra.com
Subject: SRMs for radiochemistry LCSs

Doug:

As we discussed by telephone, please send approximately 500 grams each of PEM-1, TRM-2, and NBHD to STL St. Louis. These are to be used by STL as laboratory control samples. As with our other laboratories, STL will be asked to provide summaries of the data obtained in quarterly progress reports. This is not to assess their proficiency, but rather to help us develop interlaboratory acceptance criteria. The known values (given below) for PEM and TRM are good because the samples are well characterized. The known values for NBHD result from a single analysis and hence should be taken as estimates. All the values below are in pCi/g.

PEM-1:

Parameter	Result	Std. Dev.
Pu-238	8.03	0.37
Pu-239	41.0	3.0
Am-241	32.5	1.1
Cs-137	73.5	0.9
U-234	5.99	0.2
U-235	0.27	0.04
U-238	18.1	0.5

TRM-2

Parameter	Result	Uncertainty
U-238	6.0	+/- 4.0
U-234	6.2	+/- 4.0
Th-230	24.5	+/- 0.6
Ra-226	25.4	+/- 0.9
Pb-210	22.1	+/- 1.2

NBHD

Parameter	Result	Uncertainty
Am-241	1.47	+/- 0.28
Ra-226	67.3	+/- 5.5
U-234	174	none available
U-235	8.7	"
U-238	212	"
Cs-137	52.1	+/- 4.6
Pb-210	78.3	+/- 2.4
Pu-239/40	4.7	+/- 0.63
Pu-238	0.3	+/- 0.11
Th-230	83.4	+/- 6.5

Reagent

Tuna Can LCS_00005

St. Louis Radiological Standard Reverification Form

Standard ID Number: Tuna Can LCS_00005 (776670)
True Value = 30.08 pCi/g
Date Analyzed: 10/25/2015

Radionuclide:
Gamma LCS Cs-137

	Replicates	
#1	<u>30</u>	pCi/g
#2	<u>29.42</u>	pCi/g
#3	<u>28.95</u>	pCi/g

Mean = 29.45667

1 sigma = 0.525959

1.96 sigma = 1.030881

True Value minus 5% = 28.576

(True Value - 5%)

True Value plus 5% = 31.584

(True Value + 5%)

Accuracy:

Mean value within 5% of Certified (True) Value?

Yes (Acceptance Criteria)

Precision:

1.96 sigma Value Within 10% of Mean Value?

Yes (Acceptance Criteria)

Standard Reverification Acceptable?

Yes

Note: Criteria for reverification of radiological standards is taken from the DOE QSAS and LANL Statements of Work

Reviewed By/Date: Jody Watson 10/29/15

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: Tuna Can LCS_00005 (776670)
True Value = 97.23 pCi/g
Date Analyzed: 10/25/2015

Radionuclide:
Gamma LCS Am-241

	Replicates	
#1	<u>96.82</u>	pCi/g
#2	<u>97.14</u>	pCi/g
#3	<u>97.26</u>	pCi/g

Mean = 97.07333

1 sigma = 0.22745

1.96 sigma = 0.445801

True Value minus 5% = 92.3685

(True Value - 5%)

True Value plus 5% = 102.0915

(True Value + 5%)

Accuracy:

Mean value within 5% of Certified (True) Value?

Yes (Acceptance Criteria)

Precision:

1.96 sigma Value Within 10% of Mean Value?

Yes (Acceptance Criteria)

Standard Reverification Acceptable?

Yes

Note: Criteria for reverification of radiological standards is taken from the DOE QSAS and LANL Statements of Work

Reviewed By/Date: Jody Watson 10/29/15

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: Tuna Can LCS_00005 (776670)
True Value = 18.6 pCi/g
Date Analyzed: 10/25/2015

Radionuclide:
Gamma LCS Co-60

	Replicates	
#1	<u>17.74</u>	pCi/g
#2	<u>18.7</u>	pCi/g
#3	<u>17.74</u>	pCi/g

Mean = 18.06

1 sigma = 0.554256

1.96 sigma = 1.086342

True Value minus 5% = 17.67
True Value plus 5% = 19.53

(True Value - 5%)

(True Value + 5%)

Accuracy:

Mean value within 5% of Certified (True) Value?

Yes (Acceptance Criteria)

Precision:

1.96 sigma Value Within 10% of Mean Value?

Yes (Acceptance Criteria)

Standard Reverification Acceptable?

Yes

Note: Criteria for reverification of radiological standards is taken from the DOE QSAS and LANL Statements of Work

Reviewed By/Date: Jody Watson 10/29/15

SOP Reference: STL-QA-0002, Current Revision

SampleID	WRKNO	Aliquot	Sigma	Instrument	Detector	CountDate	Time	CountDuration
LCS 160-217910~2-	LCS	341.90g	1.00	GammaVision	GV01	10 / 25 / 15	16:00	30
Analyte	Compnd#	Activity	TotalUnc	CountUnc	MDA	MLCC	Act/MDA	
AC-228	11136	6.771E-001pCi/g	2.800E-001	2.778E-001	1.003E+000	4.849E-001	0.68	
AG-108M	10982	-6.779E-003pCi/g	1.235E-002	1.235E-002	2.560E-001	1.249E-001	-0.03	
AG-110M	10973	8.663E-003pCi/g	1.112E-001	1.112E-001	3.788E-001	1.830E-001	0.02	
AM-241	10818	9.682E+001pCi/g	5.076E+000	7.243E-001	1.019E+000	5.045E-001	95.00	
BA-133	10469	1.494E-002pCi/g	8.071E-002	8.071E-002	2.729E-001	1.325E-001	0.05	
BA-140	10463	1.374E-001pCi/g	2.240E-001	2.238E-001	7.542E-001	3.638E-001	0.18	
BE-7	10435	0.000E+000pCi/g	3.925E-001	3.925E-001	2.266E+000	1.104E+000	0.00	
BI-207	10195	-2.705E-003pCi/g	5.167E-002	5.167E-002	1.770E-001	8.502E-002	-0.02	
BI-210M	10173	8.461E-002pCi/g	9.172E-002	9.158E-002	3.052E-001	1.486E-001	0.28	
BI-212	10160	5.691E-002pCi/g	6.570E-001	6.570E-001	2.266E+000	1.080E+000	0.03	
BI-214	10154	5.973E-001pCi/g	1.858E-001	1.832E-001	3.511E-001	1.678E-001	1.70	
CD-109	9254	9.357E+000pCi/g	3.288E+000	3.246E+000	3.163E+000	1.546E+000	2.96	
CD-113M	17462	-1.418E+002pCi/g	7.297E+002	7.296E+002	2.462E+003	1.198E+003	-0.06	
CE-139	9241	-3.471E-002pCi/g	4.795E-002	4.783E-002	1.596E-001	7.801E-002	-0.22	
CE-141	9235	1.101E-001pCi/g	6.681E-002	6.657E-002	2.193E-001	1.068E-001	0.50	
CE-144	9221	-1.962E-001pCi/g	3.271E-001	3.269E-001	1.092E+000	5.343E-001	-0.18	
CF-249	9215	-9.471E-002pCi/g	9.312E-002	9.299E-002	3.094E-001	1.508E-001	-0.31	
CF-251	13690	9.783E-002pCi/g	2.187E-001	2.185E-001	7.329E-001	3.576E-001	0.13	
CO-56	8704	-4.255E-002pCi/g	7.343E-002	7.340E-002	2.477E-001	1.193E-001	-0.17	
CO-57	13694	3.299E-002pCi/g	4.336E-002	4.333E-002	1.444E-001	7.069E-002	0.23	
CO-58	8698	-4.234E-003pCi/g	6.516E-002	6.516E-002	2.232E-001	1.072E-001	-0.02	
CO-60	8692	1.774E+001pCi/g	9.138E-001	2.049E-001	6.716E-002	2.728E-002	264.12	
CR-51	8604	3.076E-001pCi/g	4.401E-001	4.398E-001	1.475E+000	7.149E-001	0.21	
CS-134	8553	2.831E-002pCi/g	5.517E-002	5.515E-002	1.867E-001	8.973E-002	0.15	
CS-136	8546	-1.109E-001pCi/g	7.217E-002	7.189E-002	2.373E-001	1.142E-001	-0.47	
CS-137	8539	3.000E+001pCi/g	1.596E+000	3.338E-001	2.346E-001	1.129E-001	127.87	
EU-152	7145	2.877E-001pCi/g	2.421E-001	2.417E-001	6.269E-001	3.045E-001	0.46	
EU-154	7138	1.536E-001pCi/g	1.711E-001	1.709E-001	2.192E+000	1.058E+000	0.07	
EU-155	7131	4.023E-002pCi/g	1.795E-001	1.795E-001	6.019E-001	2.949E-001	0.07	
FE-59	7073	5.086E-002pCi/g	8.161E-002	8.157E-002	4.958E-001	2.382E-001	0.10	
GA-68	18005	-1.209E+000pCi/g	2.759E+000	2.758E+000	9.368E+000	4.493E+000	-0.13	
GD-153	6824	-3.997E-003pCi/g	1.316E-001	1.316E-001	4.420E-001	2.167E-001	-0.01	
HF-181	6495	9.445E-002pCi/g	6.542E-002	6.524E-002	2.322E-001	1.124E-001	0.41	
HG-203	6466	-3.305E-002pCi/g	5.989E-002	5.986E-002	2.006E-001	9.778E-002	-0.16	
I-131	6380	6.854E-002pCi/g	6.647E-002	6.638E-002	2.080E-001	1.010E-001	0.33	
IR-192	6303	-3.750E-002pCi/g	5.981E-002	5.977E-002	2.001E-001	9.748E-002	-0.19	
K-40	6148	-1.766E-002pCi/g	3.281E-001	3.281E-001	1.273E+000	5.734E-001	-0.01	
LA-140	6096	5.379E-002pCi/g	4.255E-002	4.246E-002	1.212E-001	5.304E-002	0.44	
MN-54	5382	3.726E-002pCi/g	6.608E-002	6.605E-002	2.235E-001	1.073E-001	0.17	
NA-22	5201	2.193E-002pCi/g	3.156E-002	3.154E-002	1.109E-001	4.933E-002	0.20	
NB-94	5160	-7.036E-002pCi/g	5.947E-002	5.936E-002	1.977E-001	9.485E-002	-0.36	
NB-95	5154	3.994E-002pCi/g	5.496E-002	5.493E-002	1.856E-001	8.861E-002	0.22	
ND-147	5083	-4.022E-002pCi/g	4.368E-001	4.368E-001	1.486E+000	7.183E-001	-0.03	
NP-237	4757	-4.170E-001pCi/g	3.829E-001	3.821E-001	1.266E+000	6.228E-001	-0.33	
NP-239	4751	-3.998E-004pCi/g	1.579E-001	1.579E-001	5.314E-001	2.601E-001	0.00	
PA-231	4541	1.362E+000pCi/g	8.851E-001	8.820E-001	4.992E+000	2.420E+000	0.27	
PA-233	4535	1.538E-001pCi/g	1.053E-001	1.050E-001	4.596E-001	2.236E-001	0.33	
PA-234	4528	-1.000E-001pCi/g	2.035E-001	2.034E-001	6.804E-001	3.330E-001	-0.15	
PA-234M	19453	-4.676E-001pCi/g	9.603E+000	9.603E+000	3.283E+001	1.580E+001	-0.01	
PB-210	4467	8.549E+002pCi/g	5.089E+001	8.359E+000	1.428E+001	7.079E+000	59.88	

PB-212	4454	3.866E-001pCi/g	1.254E-001	1.229E-001	3.210E-001	1.563E-001	1.20
PB-214	4448	3.785E-001pCi/g	1.361E-001	1.347E-001	4.828E-001	2.350E-001	0.78
PM-144	19585	4.119E-002pCi/g	3.554E-002	3.548E-002	1.884E-001	9.023E-002	0.22
PM-146	2464	3.014E-002pCi/g	1.161E-001	1.161E-001	5.435E-001	2.596E-001	0.06
RH-106	1882	-2.180E-001pCi/g	1.994E-001	1.991E-001	2.012E+000	9.694E-001	-0.11
RU-103	1828	0.000E+000pCi/g	5.216E-002	5.216E-002	2.468E-001	1.200E-001	0.00
SB-124	1784	4.494E-003pCi/g	5.524E-002	5.524E-002	1.889E-001	9.084E-002	0.02
SB-125	1777	2.356E-001pCi/g	2.342E-001	2.338E-001	7.180E-001	3.497E-001	0.33
SC-46	1739	9.344E-002pCi/g	5.627E-002	5.606E-002	2.546E-001	1.226E-001	0.37
SN-113	1570	-5.143E-002pCi/g	9.312E-002	9.309E-002	3.121E-001	1.520E-001	-0.16
SN-126	17459	5.835E-002pCi/g	5.783E-001	5.783E-001	1.938E+000	9.517E-001	0.03
TA-182	1301	1.840E-003pCi/g	2.175E-001	2.175E-001	7.482E-001	3.582E-001	0.00
TC-99M	17412	2.645E-002pCi/g	4.239E-002	4.236E-002	1.415E-001	6.920E-002	0.19
TH-227	1058	2.617E+000pCi/g	1.856E+000	1.850E+000	6.105E+000	3.024E+000	0.43
TH-229	1046	9.577E-002pCi/g	1.073E-001	1.070E-001	3.470E+000	1.699E+000	0.03
TH-234	1027	7.930E-002pCi/g	7.788E-002	7.777E-002	5.067E+000	2.489E+000	0.02
TL-208	929	1.848E-001pCi/g	8.785E-002	8.733E-002	2.310E-001	1.114E-001	0.80
U-235	281	8.439E-002pCi/g	1.008E-001	1.007E-001	9.972E-001	4.863E-001	0.08
Y-88	74	-2.520E-002pCi/g	8.904E-002	8.903E-002	3.017E-001	1.458E-001	-0.08
ZN-65	31	-9.888E-002pCi/g	1.701E-001	1.700E-001	5.742E-001	2.762E-001	-0.17
ZR-95	7	8.948E-002pCi/g	8.129E-002	8.116E-002	3.492E-001	1.669E-001	0.26

Laboratory Control Sample Information

Sample ID	WRKNO	Analyte	Activity	StdAdded	Recovery	ZFactor
LCS 160-217910~2-A	LCS 160-217910~2-A	CS-137	3.000E+001 pCi/g	3.008E+001	99.72%	-0.0379
		CO-60	1.774E+001 pCi/g	1.860E+001	95.37%	-0.6506
		AM-241	9.682E+001 pCi/g	9.723E+001	99.58%	-0.0565

Sample Duplicate Information

Sample ID	Dup Sample ID	Analyte	Samp Activity	Dup Activity	RPD	RER	DER	Flag	ZFactor
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Blanks Information

<u>SampleID</u>	<u>WRKNO</u>	<u>Analyte</u>	<u>Activity</u>	<u>UncTotal</u>	<u>ZFactor</u>
MB 160-217910~1-A	MB	AC-228	4.303E-002	4.671E-002	0.9214
MB 160-217910~1-A	MB	AG-108M	5.251E-003	5.684E-003	0.9238
MB 160-217910~1-A	MB	AG-110M	-1.714E-002	2.621E-002	-0.6542
MB 160-217910~1-A	MB	AM-241	-1.074E-002	2.656E-002	-0.4043
MB 160-217910~1-A	MB	BA-133	8.629E-003	1.742E-002	0.4954
MB 160-217910~1-A	MB	BA-140	1.558E-002	5.153E-002	0.3023
MB 160-217910~1-A	MB	BE-7	2.157E-003	9.785E-002	0.0220
MB 160-217910~1-A	MB	BI-207	1.116E-002	1.404E-002	0.7947
MB 160-217910~1-A	MB	BI-210M	1.161E-002	2.003E-002	0.5795
MB 160-217910~1-A	MB	BI-212	-6.519E-004	1.749E-001	-0.0037
MB 160-217910~1-A	MB	BI-214	-3.620E-002	1.629E-001	-0.2222
MB 160-217910~1-A	MB	CD-109	1.434E-001	1.674E-001	0.8566
MB 160-217910~1-A	MB	CD-113M	0.000E+000	1.045E+002	0.0000
MB 160-217910~1-A	MB	CE-139	1.578E-003	8.340E-003	0.1892
MB 160-217910~1-A	MB	CE-141	1.422E-002	1.284E-002	1.1075
MB 160-217910~1-A	MB	CE-144	4.109E-002	5.187E-002	0.7922
MB 160-217910~1-A	MB	CF-249	-5.027E-003	1.126E-002	-0.4467
MB 160-217910~1-A	MB	CF-251	4.859E-003	5.226E-002	0.0930
MB 160-217910~1-A	MB	CO-56	8.053E-003	1.466E-002	0.5492
MB 160-217910~1-A	MB	CO-57	0.000E+000	3.213E-003	0.0000
MB 160-217910~1-A	MB	CO-58	0.000E+000	1.250E-002	0.0000
MB 160-217910~1-A	MB	CO-60	-1.064E-002	2.053E-002	-0.5180
MB 160-217910~1-A	MB	CR-51	1.172E-001	6.390E-002	1.8350
MB 160-217910~1-A	MB	CS-134	9.570E-003	1.221E-002	0.7837
MB 160-217910~1-A	MB	CS-136	3.486E-003	1.564E-002	0.2228
MB 160-217910~1-A	MB	CS-137	9.350E-003	1.111E-002	0.8412
MB 160-217910~1-A	MB	EU-152	2.175E-002	4.360E-002	0.4989
MB 160-217910~1-A	MB	EU-154	4.973E-002	3.892E-002	1.2779
MB 160-217910~1-A	MB	EU-155	1.249E-002	1.540E-002	0.8106
MB 160-217910~1-A	MB	FE-59	1.620E-002	2.388E-002	0.6781
MB 160-217910~1-A	MB	GA-68	0.000E+000	1.259E-001	0.0000
MB 160-217910~1-A	MB	GD-153	-7.436E-003	2.145E-002	-0.3466
MB 160-217910~1-A	MB	HF-181	3.207E-003	4.689E-003	0.6839
MB 160-217910~1-A	MB	HG-203	-1.192E-003	1.116E-002	-0.1067
MB 160-217910~1-A	MB	I-131	2.131E-002	1.517E-002	1.4047
MB 160-217910~1-A	MB	IR-192	1.091E-003	6.973E-003	0.1565
MB 160-217910~1-A	MB	K-40	-4.508E-001	8.911E+000	-0.0506
MB 160-217910~1-A	MB	LA-140	0.000E+000	5.961E-003	0.0000
MB 160-217910~1-A	MB	MN-54	-1.135E-002	1.784E-002	-0.6362
MB 160-217910~1-A	MB	NA-22	0.000E+000	4.741E-003	0.0000
MB 160-217910~1-A	MB	NB-94	2.773E-004	1.092E-002	0.0254
MB 160-217910~1-A	MB	NB-95	7.816E-004	1.302E-002	0.0600
MB 160-217910~1-A	MB	ND-147	4.997E-002	8.625E-002	0.5794
MB 160-217910~1-A	MB	NP-237	1.411E-002	3.697E-002	0.3816
MB 160-217910~1-A	MB	NP-239	1.903E-002	2.441E-002	0.7798
MB 160-217910~1-A	MB	PA-231	5.945E-002	5.603E-002	1.0610
MB 160-217910~1-A	MB	PA-233	2.561E-002	2.422E-002	1.0574
MB 160-217910~1-A	MB	PA-234	2.390E-002	2.381E-002	1.0038
MB 160-217910~1-A	MB	PA-234M	-1.176E+000	2.117E+000	-0.5557
MB 160-217910~1-A	MB	PB-210	0.000E+000	1.332E-001	0.0000
MB 160-217910~1-A	MB	PB-212	0.000E+000	1.627E-002	0.0000
MB 160-217910~1-A	MB	PB-214	5.054E-002	1.994E-002	2.5345

MB 160-217910~1-A	MB	PM-144	7.657E-003	1.530E-002	0.5006
MB 160-217910~1-A	MB	PM-146	-3.061E-002	4.827E-002	-0.6342
MB 160-217910~1-A	MB	RA-226	-8.578E-002	2.376E-001	-0.3610
MB 160-217910~1-A	MB	RH-106	-3.627E-003	1.343E-001	-0.0270
MB 160-217910~1-A	MB	RU-103	-4.735E-003	1.118E-002	-0.4237
MB 160-217910~1-A	MB	SB-124	4.616E-003	1.522E-002	0.3032
MB 160-217910~1-A	MB	SB-125	1.047E-002	2.186E-002	0.4787
MB 160-217910~1-A	MB	SC-46	0.000E+000	7.139E-003	0.0000
MB 160-217910~1-A	MB	SN-113	6.694E-003	1.727E-002	0.3875
MB 160-217910~1-A	MB	SN-126	9.094E-003	7.322E-002	0.1242
MB 160-217910~1-A	MB	TA-182	9.043E-003	1.445E-002	0.6258
MB 160-217910~1-A	MB	TC-99M	-1.255E-003	8.033E-003	-0.1562
MB 160-217910~1-A	MB	TH-227	5.670E-003	1.499E-001	0.0378
MB 160-217910~1-A	MB	TH-229	-7.369E-002	1.885E-001	-0.3910
MB 160-217910~1-A	MB	TH-234	1.446E-002	1.018E-001	0.1420
MB 160-217910~1-A	MB	TL-208	1.346E-002	1.077E-002	1.2495
MB 160-217910~1-A	MB	U-235	7.507E-002	5.910E-002	1.2704
MB 160-217910~1-A	MB	Y-88	0.000E+000	3.838E-003	0.0000
MB 160-217910~1-A	MB	ZN-65	-1.025E-002	3.666E-002	-0.2797
MB 160-217910~1-A	MB	ZR-95	3.371E-003	1.189E-002	0.2836

SampID	WRKNO	Aliquot	Sigma	Instrument	Detector	CountDate	Time	CountDuration
LCS 160-218441~2-	LCS	341.90g	1.00	GammaVision	GV08	10 / 27 / 15	15:25	30
Analyte	Cmpnd#	Activity	TotalUnc	CountUnc	MDA	MLCC	Act/MDA	
AC-228	11136	7.359E-002pCi/g	1.183E-001	1.183E-001	1.351E+000	6.534E-001	0.05	
AG-108M	10982	-1.250E-001pCi/g	9.830E-002	9.810E-002	3.249E-001	1.586E-001	-0.38	
AG-110M	10973	-2.165E-001pCi/g	1.350E-001	1.346E-001	4.435E-001	2.131E-001	-0.49	
AM-241	10818	9.714E+001pCi/g	5.131E+000	9.547E-001	1.461E+000	7.246E-001	66.50	
BA-133	10469	-1.434E-001pCi/g	1.166E-001	1.163E-001	3.856E-001	1.880E-001	-0.37	
BA-140	10463	3.008E-001pCi/g	3.866E-001	3.863E-001	8.898E-001	4.279E-001	0.34	
BE-7	10435	1.764E-001pCi/g	8.364E-001	8.364E-001	2.818E+000	1.373E+000	0.06	
BI-207	10195	-3.983E-002pCi/g	7.303E-002	7.300E-002	2.465E-001	1.188E-001	-0.16	
BI-210M	10173	4.829E-002pCi/g	6.207E-002	6.201E-002	3.950E-001	1.928E-001	0.12	
BI-212	10160	1.191E+000pCi/g	9.269E-001	9.248E-001	3.076E+000	1.467E+000	0.39	
BI-214	10154	1.600E-001pCi/g	1.464E-001	1.462E-001	4.902E-001	2.351E-001	0.33	
CD-109	9254	2.361E+000pCi/g	4.441E+000	4.439E+000	4.063E+000	1.992E+000	0.58	
CD-113M	17462	-3.716E+001pCi/g	9.021E+002	9.021E+002	3.049E+003	1.485E+003	-0.01	
CE-139	9241	3.182E-002pCi/g	5.820E-002	5.812E-002	1.942E-001	9.506E-002	0.16	
CE-141	9235	4.980E-002pCi/g	8.364E-002	8.361E-002	2.795E-001	1.366E-001	0.18	
CE-144	9221	2.569E-002pCi/g	4.004E-001	4.004E-001	1.345E+000	6.591E-001	0.02	
CF-249	9215	5.942E-002pCi/g	1.163E-001	1.162E-001	3.177E-001	1.540E-001	0.19	
CF-251	13690	3.966E-001pCi/g	2.757E-001	2.735E-001	9.033E-001	4.415E-001	0.44	
CO-56	8704	8.557E-002pCi/g	8.063E-002	8.051E-002	2.695E-001	1.287E-001	0.32	
CO-57	13694	3.076E-002pCi/g	5.134E-002	5.131E-002	1.712E-001	8.393E-002	0.18	
CO-58	8698	1.346E-002pCi/g	8.405E-002	8.405E-002	2.875E-001	1.379E-001	0.05	
CO-60	8692	1.870E+001pCi/g	1.007E+000	3.639E-001	1.870E-001	8.459E-002	100.02	
CR-51	8604	-4.740E-001pCi/g	6.167E-001	6.162E-001	2.059E+000	1.002E+000	-0.23	
CS-134	8553	9.391E-002pCi/g	6.368E-002	6.349E-002	1.526E-001	7.164E-002	0.62	
CS-136	8546	3.304E-002pCi/g	3.799E-002	3.794E-002	3.085E-001	1.484E-001	0.11	
CS-137	8539	2.942E+001pCi/g	1.582E+000	3.998E-001	3.497E-001	1.691E-001	84.15	
EU-152	7145	1.912E-001pCi/g	2.554E-001	2.552E-001	8.302E-001	4.042E-001	0.23	
EU-154	7138	6.956E-002pCi/g	1.146E-001	1.146E-001	2.351E+000	1.125E+000	0.03	
EU-155	7131	2.888E-002pCi/g	2.199E-001	2.199E-001	7.370E-001	3.618E-001	0.04	
FE-59	7073	-1.833E-001pCi/g	1.818E-001	1.815E-001	6.083E-001	2.908E-001	-0.30	
GA-68	18005	4.764E+000pCi/g	2.454E+000	2.440E+000	7.914E+000	3.694E+000	0.60	
GD-153	6824	7.978E-002pCi/g	1.552E-001	1.551E-001	5.177E-001	2.540E-001	0.15	
HF-181	6495	2.335E-002pCi/g	1.043E-001	1.043E-001	3.518E-001	1.712E-001	0.07	
HG-203	6466	6.698E-003pCi/g	6.497E-002	6.497E-002	2.197E-001	1.068E-001	0.03	
I-131	6380	-1.610E-002pCi/g	8.500E-002	8.500E-002	2.866E-001	1.396E-001	-0.06	
IR-192	6303	1.018E-001pCi/g	9.042E-002	9.022E-002	2.283E-001	1.111E-001	0.45	
K-40	6148	1.623E-001pCi/g	3.950E-001	3.949E-001	1.502E+000	6.607E-001	0.11	
LA-140	6096	6.191E-003pCi/g	4.179E-002	4.179E-002	5.946E-002	1.880E-002	0.10	
MN-54	5382	1.822E-002pCi/g	9.095E-002	9.094E-002	3.102E-001	1.491E-001	0.06	
NA-22	5201	1.507E-002pCi/g	4.555E-002	4.554E-002	1.637E-001	7.329E-002	0.09	
NB-94	5160	6.019E-002pCi/g	3.912E-002	3.899E-002	2.572E-001	1.233E-001	0.23	
NB-95	5154	2.541E-002pCi/g	7.560E-002	7.559E-002	2.579E-001	1.234E-001	0.10	
ND-147	5083	4.071E-001pCi/g	4.877E-001	4.871E-001	1.636E+000	7.863E-001	0.25	
NP-237	4757	0.000E+000pCi/g	4.510E-001	4.510E-001	1.509E+000	7.430E-001	0.00	
NP-239	4751	-1.622E-002pCi/g	2.061E-001	2.061E-001	6.910E-001	3.393E-001	-0.02	
PA-231	4541	-2.797E-001pCi/g	6.016E-001	6.014E-001	7.388E+000	3.603E+000	-0.04	
PA-233	4535	1.354E-001pCi/g	2.200E-001	2.199E-001	5.917E-001	2.884E-001	0.23	
PA-234	4528	2.370E-002pCi/g	7.301E-002	7.300E-002	8.496E-001	4.166E-001	0.03	
PA-234M	19453	2.685E+000pCi/g	3.731E+000	3.729E+000	3.935E+001	1.884E+001	0.07	
PB-210	4467	8.385E+002pCi/g	5.067E+001	1.196E+001	2.132E+001	1.059E+001	39.34	

PB-212	4454	2.569E-001pCi/g	1.484E-001	1.475E-001	4.865E-001	2.382E-001	0.53
PB-214	4448	-1.187E-001pCi/g	2.062E-001	2.061E-001	4.941E-001	2.392E-001	-0.24
PM-144	19585	-1.104E-002pCi/g	1.584E-002	1.583E-002	2.412E-001	1.154E-001	-0.05
PM-146	2464	1.016E-001pCi/g	1.134E-001	1.133E-001	6.877E-001	3.278E-001	0.15
RH-106	1882	9.849E-001pCi/g	7.318E-001	7.301E-001	1.785E+000	8.453E-001	0.55
RU-103	1828	-7.826E-003pCi/g	8.182E-002	8.182E-002	2.777E-001	1.346E-001	-0.03
SB-124	1784	1.264E-001pCi/g	7.595E-002	7.567E-002	1.582E-001	7.445E-002	0.80
SB-125	1777	2.237E-001pCi/g	1.965E-001	1.962E-001	9.608E-001	4.688E-001	0.23
SC-46	1739	6.651E-002pCi/g	9.525E-002	9.519E-002	3.209E-001	1.541E-001	0.21
SN-113	1570	2.166E-002pCi/g	1.160E-001	1.160E-001	3.912E-001	1.906E-001	0.06
SN-126	17459	-6.991E+000pCi/g	1.044E+000	9.772E-001	3.085E+000	1.523E+000	-2.27
TA-182	1301	2.287E-001pCi/g	2.419E-001	2.416E-001	9.149E-001	4.354E-001	0.25
TC-99M	17412	-3.499E-002pCi/g	5.302E-002	5.298E-002	1.767E-001	8.659E-002	-0.20
TH-227	1058	-3.701E+001pCi/g	4.063E+000	3.522E+000	1.124E+001	5.589E+000	-3.29
TH-229	1046	-1.190E+000pCi/g	1.295E+000	1.291E+000	4.291E+000	2.104E+000	-0.28
TH-234	1027	-5.199E+001pCi/g	5.252E+000	4.493E+000	1.365E+001	6.775E+000	-3.81
TL-208	929	1.496E-001pCi/g	8.481E-002	8.445E-002	2.772E-001	1.334E-001	0.54
U-235	281	-6.184E-002pCi/g	1.918E+001	1.918E+001	1.442E+000	7.072E-001	-0.04
Y-88	74	-1.169E-001pCi/g	1.223E-001	1.221E-001	4.080E-001	1.972E-001	-0.29
ZN-65	31	-6.060E-002pCi/g	2.169E-001	2.169E-001	7.398E-001	3.548E-001	-0.08
ZR-95	7	1.074E-001pCi/g	1.365E-001	1.364E-001	4.600E-001	2.199E-001	0.23

Laboratory Control Sample Information

Sample ID	WRKNO	Analyte	Activity	StdAdded	Recovery	ZFactor
LCS 160-218441~2-A	LCS 160-218441~2-A	CS-137	2.942E+001 pCi/g	3.008E+001	97.82%	-0.2899
		CO-60	1.870E+001 pCi/g	1.859E+001	100.64%	0.0836
		AM-241	9.714E+001 pCi/g	9.723E+001	99.92%	-0.0112

Sample Duplicate Information

Sample ID	Dup Sample ID	Analyte	Samp Activity	Dup Activity	RPD	RER	DER	Flag	ZFactor
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Blanks Information

<u>SampleID</u>	<u>WRKNO</u>	<u>Analyte</u>	<u>Activity</u>	<u>UncTotal</u>	<u>ZFactor</u>
MB 160-218441~1-A	MB	AC-228	3.987E-002	4.560E-002	0.8743
MB 160-218441~1-A	MB	AG-108M	5.451E-003	8.527E-003	0.6393
MB 160-218441~1-A	MB	AG-110M	-1.473E-002	2.625E-002	-0.5612
MB 160-218441~1-A	MB	AM-241	-1.477E-002	2.928E-002	-0.5047
MB 160-218441~1-A	MB	BA-133	3.407E-003	1.959E-002	0.1740
MB 160-218441~1-A	MB	BA-140	6.525E-002	6.139E-002	1.0630
MB 160-218441~1-A	MB	BE-7	0.000E+000	6.035E-002	0.0000
MB 160-218441~1-A	MB	BI-207	8.121E-003	1.544E-002	0.5258
MB 160-218441~1-A	MB	BI-210M	1.934E-002	1.581E-002	1.2233
MB 160-218441~1-A	MB	BI-212	0.000E+000	1.856E-001	0.0000
MB 160-218441~1-A	MB	BI-214	-1.133E-002	5.880E-002	-0.1926
MB 160-218441~1-A	MB	CD-109	9.453E-002	2.288E-001	0.4132
MB 160-218441~1-A	MB	CD-113M	-1.366E+002	2.218E+002	-0.6159
MB 160-218441~1-A	MB	CE-139	-3.140E-003	9.986E-003	-0.3145
MB 160-218441~1-A	MB	CE-141	-6.169E-003	1.570E-002	-0.3929
MB 160-218441~1-A	MB	CE-144	4.904E-003	4.662E-002	0.1052
MB 160-218441~1-A	MB	CF-249	8.754E-003	1.572E-002	0.5569
MB 160-218441~1-A	MB	CF-251	-2.594E-002	5.279E-002	-0.4914
MB 160-218441~1-A	MB	CO-56	-6.736E-003	1.135E-002	-0.5936
MB 160-218441~1-A	MB	CO-57	4.406E-003	9.298E-003	0.4738
MB 160-218441~1-A	MB	CO-58	1.276E-002	1.914E-002	0.6662
MB 160-218441~1-A	MB	CO-60	-3.371E-003	2.082E-002	-0.1619
MB 160-218441~1-A	MB	CR-51	6.564E-002	1.182E-001	0.5552
MB 160-218441~1-A	MB	CS-134	-7.518E-004	1.083E-003	-0.6945
MB 160-218441~1-A	MB	CS-136	0.000E+000	5.399E-003	0.0000
MB 160-218441~1-A	MB	CS-137	1.650E-002	1.844E-002	0.8946
MB 160-218441~1-A	MB	EU-152	-8.619E-004	1.441E-003	-0.5979
MB 160-218441~1-A	MB	EU-154	1.149E-001	1.445E-001	0.7954
MB 160-218441~1-A	MB	EU-155	-2.026E-002	3.719E-002	-0.5447
MB 160-218441~1-A	MB	FE-59	9.255E-003	1.826E-002	0.5070
MB 160-218441~1-A	MB	GA-68	0.000E+000	1.430E-001	0.0000
MB 160-218441~1-A	MB	GD-153	-2.088E-002	3.165E-002	-0.6598
MB 160-218441~1-A	MB	HF-181	-1.476E-003	1.865E-003	-0.7914
MB 160-218441~1-A	MB	HG-203	1.656E-002	9.732E-003	1.7013
MB 160-218441~1-A	MB	I-131	6.142E-003	2.344E-002	0.2620
MB 160-218441~1-A	MB	IR-192	3.418E-003	1.317E-002	0.2595
MB 160-218441~1-A	MB	K-40	-6.451E-001	1.290E+001	-0.0500
MB 160-218441~1-A	MB	LA-140	2.528E-003	2.485E-002	0.1017
MB 160-218441~1-A	MB	MN-54	-2.351E-003	1.657E-002	-0.1419
MB 160-218441~1-A	MB	NA-22	0.000E+000	5.287E-003	0.0000
MB 160-218441~1-A	MB	NB-94	1.400E-003	7.442E-003	0.1881
MB 160-218441~1-A	MB	NB-95	-2.221E-003	1.672E-002	-0.1328
MB 160-218441~1-A	MB	ND-147	2.932E-002	2.819E-002	1.0401
MB 160-218441~1-A	MB	NP-237	-1.201E-002	7.433E-002	-0.1615
MB 160-218441~1-A	MB	NP-239	4.366E-002	2.736E-002	1.5962
MB 160-218441~1-A	MB	PA-231	3.079E-001	2.831E-001	1.0876
MB 160-218441~1-A	MB	PA-233	2.077E-002	3.041E-002	0.6831
MB 160-218441~1-A	MB	PA-234	5.537E-002	5.645E-002	0.9808
MB 160-218441~1-A	MB	PA-234M	-7.028E-001	1.816E+000	-0.3870
MB 160-218441~1-A	MB	PB-210	4.463E-001	4.306E-001	1.0364
MB 160-218441~1-A	MB	PB-212	4.711E-003	2.788E-002	0.1690
MB 160-218441~1-A	MB	PB-214	4.377E-002	3.189E-002	1.3727

MB 160-218441~1-A	MB	PM-144	9.554E-004	6.357E-003	0.1503
MB 160-218441~1-A	MB	PM-146	-3.544E-002	4.841E-002	-0.7319
MB 160-218441~1-A	MB	RH-106	4.655E-002	1.634E-001	0.2849
MB 160-218441~1-A	MB	RU-103	6.210E-003	1.531E-002	0.4057
MB 160-218441~1-A	MB	SB-124	-1.006E-002	1.857E-002	-0.5418
MB 160-218441~1-A	MB	SB-125	1.305E-003	4.143E-003	0.3151
MB 160-218441~1-A	MB	SC-46	-1.594E-004	1.758E-002	-0.0091
MB 160-218441~1-A	MB	SN-113	3.684E-002	1.998E-002	1.8437
MB 160-218441~1-A	MB	SN-126	2.933E-001	1.237E-001	2.3710
MB 160-218441~1-A	MB	TA-182	2.383E-002	4.528E-002	0.5262
MB 160-218441~1-A	MB	TC-99M	3.169E-003	8.389E-003	0.3778
MB 160-218441~1-A	MB	TH-227	2.179E-001	1.503E-001	1.4498
MB 160-218441~1-A	MB	TH-229	-9.602E-002	2.482E-001	-0.3868
MB 160-218441~1-A	MB	TH-234	-6.219E-001	8.472E-001	-0.7341
MB 160-218441~1-A	MB	TL-208	1.433E-002	2.289E-002	0.6260
MB 160-218441~1-A	MB	U-235	1.116E-001	8.413E-002	1.3268
MB 160-218441~1-A	MB	Y-88	0.000E+000	6.164E-003	0.0000
MB 160-218441~1-A	MB	ZN-65	0.000E+000	9.463E-003	0.0000
MB 160-218441~1-A	MB	ZR-95	-8.939E-004	1.210E-003	-0.7385

SampID	WRKNO	Aliquot	Sigma	Instrument	Detector	CountDate	Time	CountDuration
LCS 160-218442-2-	LCS	341.90g	1.00	GammaVision	GV09	10 / 27 / 15	14:09	30
Analyte	Cmpnd#	Activity	TotalUnc	CountUnc	MDA	MLCC	Act/MDA	
AC-228	11136	5.980E-001pCi/g	2.506E-001	2.488E-001	1.014E+000	4.923E-001	0.59	
AG-108M	10982	6.362E-006pCi/g	7.135E-002	7.135E-002	2.404E-001	1.175E-001	0.00	
AG-110M	10973	-4.015E-003pCi/g	1.009E-001	1.009E-001	3.435E-001	1.661E-001	-0.01	
AM-241	10818	9.726E+001pCi/g	5.101E+000	7.368E-001	1.053E+000	5.222E-001	92.32	
BA-133	10469	8.644E-004pCi/g	8.695E-002	8.695E-002	2.932E-001	1.432E-001	0.00	
BA-140	10463	2.814E-001pCi/g	2.308E-001	2.303E-001	7.647E-001	3.708E-001	0.37	
BE-7	10435	5.425E-001pCi/g	6.400E-001	6.394E-001	2.131E+000	1.041E+000	0.25	
BI-207	10195	-2.984E-002pCi/g	5.728E-002	5.726E-002	1.928E-001	9.338E-002	-0.15	
BI-210M	10173	2.463E-002pCi/g	9.686E-002	9.684E-002	3.249E-001	1.590E-001	0.08	
BI-212	10160	4.340E-001pCi/g	7.169E-001	7.165E-001	2.420E+000	1.163E+000	0.18	
BI-214	10154	8.273E-001pCi/g	1.845E-001	1.794E-001	3.533E-001	1.700E-001	2.34	
CD-109	9254	5.485E+000pCi/g	3.401E+000	3.387E+000	3.143E+000	1.540E+000	1.75	
CD-113M	17462	8.114E+000pCi/g	7.905E+002	7.905E+002	2.661E+003	1.302E+003	0.00	
CE-139	9241	-3.089E-002pCi/g	5.178E-002	5.170E-002	1.723E-001	8.460E-002	-0.18	
CE-141	9235	-3.579E-003pCi/g	6.317E-002	6.317E-002	2.129E-001	1.040E-001	-0.02	
CE-144	9221	1.068E-001pCi/g	3.278E-001	3.277E-001	1.096E+000	5.379E-001	0.10	
CF-249	9215	1.007E-001pCi/g	1.004E-001	1.002E-001	2.876E-001	1.404E-001	0.35	
CF-251	13690	-2.639E-001pCi/g	2.511E-001	2.500E-001	8.293E-001	4.069E-001	-0.32	
CO-56	8704	1.134E-001pCi/g	8.881E-002	8.861E-002	2.341E-001	1.131E-001	0.48	
CO-57	13694	5.717E-003pCi/g	4.406E-002	4.406E-002	1.476E-001	7.249E-002	0.04	
CO-58	8698	5.129E-002pCi/g	6.155E-002	6.150E-002	2.064E-001	9.935E-002	0.25	
CO-60	8692	1.774E+001pCi/g	9.122E-001	1.984E-001	9.851E-002	4.359E-002	180.05	
CR-51	8604	-2.572E-002pCi/g	5.332E-001	5.332E-001	1.795E+000	8.779E-001	-0.01	
CS-134	8553	5.920E-002pCi/g	4.059E-002	4.047E-002	2.764E-001	1.350E-001	0.21	
CS-136	8546	4.051E-002pCi/g	4.705E-002	4.700E-002	1.989E-001	9.561E-002	0.20	
CS-137	8539	2.895E+001pCi/g	1.537E+000	3.066E-001	2.184E-001	1.053E-001	132.57	
EU-152	7145	1.210E-001pCi/g	1.140E-001	1.138E-001	6.662E-001	3.254E-001	0.18	
EU-154	7138	1.536E-001pCi/g	2.903E-001	2.902E-001	2.035E+000	9.844E-001	0.08	
EU-155	7131	-2.215E-001pCi/g	1.885E-001	1.881E-001	6.227E-001	3.061E-001	-0.36	
FE-59	7073	-2.347E-001pCi/g	1.656E-001	1.651E-001	5.463E-001	2.646E-001	-0.43	
GA-68	18005	-1.959E+000pCi/g	2.934E+000	2.932E+000	9.861E+000	4.761E+000	-0.20	
GD-153	6824	1.074E-001pCi/g	5.604E-002	5.566E-002	4.253E-001	2.089E-001	0.25	
HF-181	6495	7.655E-003pCi/g	2.864E-002	2.863E-002	2.832E-001	1.384E-001	0.03	
HG-203	6466	-5.635E-002pCi/g	6.273E-002	6.264E-002	2.084E-001	1.020E-001	-0.27	
I-131	6380	7.130E-002pCi/g	8.246E-002	8.238E-002	2.211E-001	1.079E-001	0.32	
IR-192	6303	6.154E-002pCi/g	5.067E-002	5.054E-002	2.010E-001	9.829E-002	0.31	
K-40	6148	-1.447E-001pCi/g	7.481E-001	7.481E-001	1.284E+000	5.849E-001	-0.11	
LA-140	6096	1.563E-002pCi/g	2.812E-002	2.811E-002	1.016E-001	4.393E-002	0.15	
MN-54	5382	-2.832E-002pCi/g	6.926E-002	6.925E-002	2.341E-001	1.131E-001	-0.12	
NA-22	5201	-2.471E-002pCi/g	3.987E-002	3.985E-002	1.381E-001	6.356E-002	-0.18	
NB-94	5160	4.992E-002pCi/g	4.304E-002	4.296E-002	1.435E-001	6.826E-002	0.35	
NB-95	5154	-8.541E-002pCi/g	6.319E-002	6.303E-002	2.089E-001	1.008E-001	-0.41	
ND-147	5083	-5.970E-002pCi/g	4.393E-001	4.392E-001	1.487E+000	7.219E-001	-0.04	
NP-237	4757	-4.152E-001pCi/g	3.778E-001	3.771E-001	1.248E+000	6.152E-001	-0.33	
NP-239	4751	1.422E-001pCi/g	1.425E-001	1.422E-001	4.725E-001	2.313E-001	0.30	
PA-231	4541	7.897E-001pCi/g	5.588E-001	5.571E-001	6.014E+000	2.942E+000	0.13	
PA-233	4535	1.659E-001pCi/g	1.174E-001	1.170E-001	4.817E-001	2.355E-001	0.34	
PA-234	4528	7.379E-003pCi/g	1.848E-001	1.848E-001	6.212E-001	3.043E-001	0.01	
PA-234M	19453	-3.849E+000pCi/g	1.050E+001	1.050E+001	3.544E+001	1.718E+001	-0.11	
PB-210	4467	8.556E+002pCi/g	5.093E+001	8.354E+000	1.399E+001	6.939E+000	61.17	

PB-212	4454	4.747E-001pCi/g	1.198E-001	1.158E-001	2.884E-001	1.405E-001	1.65
PB-214	4448	2.527E-001pCi/g	1.397E-001	1.390E-001	4.865E-001	2.377E-001	0.52
PM-144	19585	5.467E-002pCi/g	5.088E-002	5.080E-002	1.697E-001	8.140E-002	0.32
PM-146	2464	-1.121E-001pCi/g	1.694E-001	1.693E-001	5.705E-001	2.747E-001	-0.20
RH-106	1882	2.453E-001pCi/g	5.500E-001	5.499E-001	1.858E+000	8.973E-001	0.13
RU-103	1828	3.179E-003pCi/g	6.795E-002	6.795E-002	2.296E-001	1.119E-001	0.01
SB-124	1784	6.871E-002pCi/g	5.491E-002	5.479E-002	1.820E-001	8.786E-002	0.38
SB-125	1777	7.725E-002pCi/g	1.204E-001	1.203E-001	7.192E-001	3.515E-001	0.11
SC-46	1739	6.865E-002pCi/g	3.773E-002	3.756E-002	2.744E-001	1.331E-001	0.25
SN-113	1570	-5.988E-002pCi/g	9.283E-002	9.278E-002	3.100E-001	1.515E-001	-0.19
SN-126	17459	4.728E-001pCi/g	6.187E-001	6.182E-001	2.053E+000	1.011E+000	0.23
TA-182	1301	2.190E-001pCi/g	1.744E-001	1.740E-001	6.078E-001	2.897E-001	0.36
TC-99M	17412	4.814E-002pCi/g	4.538E-002	4.530E-002	1.502E-001	7.375E-002	0.32
TH-227	1058	5.812E-001pCi/g	8.496E-001	8.490E-001	7.338E+000	3.643E+000	0.08
TH-229	1046	3.346E-001pCi/g	9.867E-001	9.864E-001	3.300E+000	1.619E+000	0.10
TH-234	1027	-3.012E+001pCi/g	2.825E+000	2.346E+000	7.161E+000	3.541E+000	-4.21
TL-208	929	1.402E-001pCi/g	7.085E-002	7.047E-002	2.180E-001	1.055E-001	0.64
U-235	281	1.225E-001pCi/g	2.509E-001	2.508E-001	1.165E+000	5.718E-001	0.11
Y-88	74	-5.977E-002pCi/g	8.913E-002	8.908E-002	2.987E-001	1.449E-001	-0.20
ZN-65	31	1.053E-001pCi/g	9.011E-002	8.995E-002	3.017E-001	1.411E-001	0.35
ZR-95	7	3.603E-002pCi/g	1.120E-001	1.120E-001	3.799E-001	1.833E-001	0.09

Laboratory Control Sample Information

Sample ID	WRKNO	Analyte	Activity	StdAdded	Recovery	ZFactor
LCS 160-218442~2-A	LCS 160-218442~2-A	CS-137	2.895E+001 pCi/g	3.008E+001	96.24%	-0.5100
		CO-60	1.774E+001 pCi/g	1.859E+001	95.42%	-0.6439
		AM-241	9.726E+001 pCi/g	9.723E+001	100.04%	0.0052

Sample Duplicate Information

Sample ID	Dup Sample ID	Analyte	Samp Activity	Dup Activity	RPD	RER	DER	Flag	ZFactor
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Blanks Information

<u>SampleID</u>	<u>WRKNO</u>	<u>Analyte</u>	<u>Activity</u>	<u>UncTotal</u>	<u>ZFactor</u>
MB 160-218442~1-A	MB	AC-228	4.629E-002	5.406E-002	0.8562
MB 160-218442~1-A	MB	AG-108M	5.830E-003	1.413E-002	0.4125
MB 160-218442~1-A	MB	AG-110M	1.867E-002	2.797E-002	0.6674
MB 160-218442~1-A	MB	AM-241	4.337E-002	3.562E-002	1.2178
MB 160-218442~1-A	MB	BA-133	3.213E-003	1.707E-002	0.1882
MB 160-218442~1-A	MB	BA-140	7.074E-002	6.022E-002	1.1747
MB 160-218442~1-A	MB	BE-7	2.063E-003	1.089E-001	0.0189
MB 160-218442~1-A	MB	BI-207	-8.550E-003	1.554E-002	-0.5500
MB 160-218442~1-A	MB	BI-210M	-5.240E-005	2.134E-002	-0.0025
MB 160-218442~1-A	MB	BI-212	1.891E-001	2.106E-001	0.8980
MB 160-218442~1-A	MB	BI-214	5.878E-002	4.257E-002	1.3807
MB 160-218442~1-A	MB	CD-109	-3.780E-002	2.773E-001	-0.1363
MB 160-218442~1-A	MB	CD-113M	-1.209E+002	2.006E+002	-0.6023
MB 160-218442~1-A	MB	CE-139	-2.638E-003	1.098E-002	-0.2403
MB 160-218442~1-A	MB	CE-141	0.000E+000	1.549E-002	0.0000
MB 160-218442~1-A	MB	CE-144	2.685E-004	7.314E-002	0.0037
MB 160-218442~1-A	MB	CF-249	1.313E-003	1.950E-002	0.0673
MB 160-218442~1-A	MB	CF-251	-3.857E-003	5.706E-002	-0.0676
MB 160-218442~1-A	MB	CO-56	1.232E-004	1.804E-004	0.6833
MB 160-218442~1-A	MB	CO-57	2.443E-003	8.085E-003	0.3022
MB 160-218442~1-A	MB	CO-58	-1.180E-003	2.037E-002	-0.0579
MB 160-218442~1-A	MB	CO-60	6.900E-003	9.579E-003	0.7203
MB 160-218442~1-A	MB	CR-51	1.599E-003	1.074E-001	0.0149
MB 160-218442~1-A	MB	CS-134	3.207E-002	2.395E-002	1.3391
MB 160-218442~1-A	MB	CS-136	5.803E-003	1.781E-002	0.3257
MB 160-218442~1-A	MB	CS-137	0.000E+000	1.138E-002	0.0000
MB 160-218442~1-A	MB	EU-152	-3.093E-005	4.932E-002	-0.0006
MB 160-218442~1-A	MB	EU-154	-1.070E-001	1.707E-001	-0.6272
MB 160-218442~1-A	MB	EU-155	2.380E-002	1.887E-002	1.2612
MB 160-218442~1-A	MB	FE-59	0.000E+000	8.903E-003	0.0000
MB 160-218442~1-A	MB	GA-68	0.000E+000	1.515E-001	0.0000
MB 160-218442~1-A	MB	GD-153	0.000E+000	1.067E-002	0.0000
MB 160-218442~1-A	MB	HF-181	1.261E-002	1.480E-002	0.8522
MB 160-218442~1-A	MB	HG-203	3.510E-003	1.144E-002	0.3067
MB 160-218442~1-A	MB	I-131	0.000E+000	6.680E-003	0.0000
MB 160-218442~1-A	MB	IR-192	1.578E-003	1.452E-002	0.1086
MB 160-218442~1-A	MB	K-40	-2.137E-001	7.006E-001	-0.3050
MB 160-218442~1-A	MB	LA-140	0.000E+000	7.055E-003	0.0000
MB 160-218442~1-A	MB	MN-54	0.000E+000	5.770E-003	0.0000
MB 160-218442~1-A	MB	NA-22	-2.879E-004	1.602E-002	-0.0180
MB 160-218442~1-A	MB	NB-94	1.568E-003	1.741E-002	0.0901
MB 160-218442~1-A	MB	NB-95	2.922E-003	1.554E-002	0.1880
MB 160-218442~1-A	MB	ND-147	7.112E-002	1.032E-001	0.6894
MB 160-218442~1-A	MB	NP-237	5.092E-003	7.332E-002	0.0695
MB 160-218442~1-A	MB	NP-239	1.565E-002	3.200E-002	0.4890
MB 160-218442~1-A	MB	PA-231	-1.854E-001	3.961E-001	-0.4681
MB 160-218442~1-A	MB	PA-233	7.432E-003	1.916E-002	0.3879
MB 160-218442~1-A	MB	PA-234	1.231E-002	3.411E-002	0.3608
MB 160-218442~1-A	MB	PA-234M	0.000E+000	7.911E-001	0.0000
MB 160-218442~1-A	MB	PB-210	3.880E-001	4.487E-001	0.8648
MB 160-218442~1-A	MB	PB-212	-2.440E-002	9.674E-002	-0.2522
MB 160-218442~1-A	MB	PB-214	-2.424E-002	8.010E-002	-0.3026

MB 160-218442~1-A	MB	PM-144	2.715E-003	1.733E-002	0.1567
MB 160-218442~1-A	MB	PM-146	1.519E-002	1.570E-002	0.9676
MB 160-218442~1-A	MB	RH-106	-2.995E-002	1.833E-001	-0.1634
MB 160-218442~1-A	MB	RU-103	-5.540E-003	1.385E-002	-0.4000
MB 160-218442~1-A	MB	SB-124	3.566E-003	1.681E-002	0.2121
MB 160-218442~1-A	MB	SB-125	-3.271E-002	4.871E-002	-0.6716
MB 160-218442~1-A	MB	SC-46	1.794E-002	1.459E-002	1.2302
MB 160-218442~1-A	MB	SN-113	5.033E-004	1.899E-002	0.0265
MB 160-218442~1-A	MB	SN-126	2.542E-002	1.062E-001	0.2393
MB 160-218442~1-A	MB	TA-182	5.091E-002	6.392E-002	0.7965
MB 160-218442~1-A	MB	TC-99M	4.412E-003	8.994E-003	0.4906
MB 160-218442~1-A	MB	TH-227	0.000E+000	6.308E-002	0.0000
MB 160-218442~1-A	MB	TH-229	1.425E-001	1.928E-001	0.7391
MB 160-218442~1-A	MB	TH-234	-5.703E-002	3.530E-001	-0.1616
MB 160-218442~1-A	MB	TL-208	-2.982E-003	2.496E-002	-0.1195
MB 160-218442~1-A	MB	U-235	-6.134E-003	8.135E-003	-0.7541
MB 160-218442~1-A	MB	Y-88	1.099E-002	2.017E-002	0.5449
MB 160-218442~1-A	MB	ZN-65	0.000E+000	1.005E-002	0.0000
MB 160-218442~1-A	MB	ZR-95	-1.630E-002	3.169E-002	-0.5142

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

74139-334

1.0 Liter Sand in 1 Liter Wide Mouth HDPE "S" Bottle

Customer: Severn Trent Laboratories/Earth City, MO

P.O. No.: 2169577, Item 1

Calibration Date: 01-Oct-2006 **12:00 EST** **Grams of Master Source:** 0.01652

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

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* cps/gram	This Source cps	Uncertainty , %			Calibration Method
					Type			
					u _A	u _B	U	
Pb-210	46.5	8145.9	————	3079.8	0.33	1.46	2.99	4π LS
Am-241	59.5	157860	————	2034.3	0.33	1.46	2.99	4π LS
Cd-109	88.0	462.60	189000	2933.5	0.57	1.70	3.59	HPGe
Co-57	122.1	271.79	94570	1467.8	0.34	1.30	2.69	HPGe
Ce-139	165.9	137.6	133800	2076.7	0.35	1.10	2.31	HPGe
Hg-203	279.2	46.61	295300	4583	0.40	1.10	2.34	HPGe
Sn-113	391.7	115.1	185600	2880.7	0.42	1.10	2.35	HPGe
Cs-137	661.7	10983	116700	1811.3	0.70	1.20	2.78	HPGe
Y-88	898.0	106.60	455400	7068	0.50	1.10	2.42	HPGe
Co-60	1173.2	1925.4	226900	3522	0.60	1.10	2.51	HPGe
Co-60	1332.5	1925.4	227000	3523	0.90	1.10	2.84	HPGe
Y-88	1836.1	106.6	481200	7469	0.90	1.10	2.84	HPGe

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

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

Comments:

1550 grams of sand. NOTE: Homogeneity was checked by the addition of Tc-99 tracer to the solution used to spike the sand. Ten 10-gram aliquots were removed after mixing and counted to measure the Tc-99. The standard deviation for the 10 measurements was 1.3% with a range of 4.8%. This demonstrates reasonable homogeneity for this source material down to a 10-gram aliquot.

This standard will expire one year after the calibration date.

Source Prepared by: M. I. Taskasva
M. I. Taskasva, Radiochemist

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

Date: 12-21-06

End of Certificate

Reagent

Tuna Can_00002

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

81427-334

1.0 Liter Sand in 1 Liter HDPE Silgan Jar

Customer: TestAmerica/St. Louis, MO

P.O. No.: 2339090, Item 1

Reference Date: 01-Jan-2010 12:00 PM EST **Grams of Master Source:** 0.017570

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					u _A	u _B	U	
Pb-210	46.5	8.120E+03	—	3.141E+03	0.1	2.1	4.1	4π LS
Am-241	59.5	1.580E+05	—	2.034E+03	0.1	1.7	3.5	4π LS
Cd-109	88.0	4.626E+02	1.606E+05	2.822E+03	0.4	2.3	4.7	HPGe
Co-57	122.1	2.718E+02	8.471E+04	1.488E+03	0.5	2.0	4.1	HPGe
Ce-139	165.9	1.376E+02	1.209E+05	2.124E+03	0.4	1.9	3.9	HPGe
Hg-203	279.2	4.661E+01	2.726E+05	4.790E+03	0.4	1.9	3.9	HPGe
Sn-113	391.7	1.151E+02	1.672E+05	2.938E+03	0.5	1.9	3.9	HPGe
Cs-137	661.7	1.098E+04	1.096E+05	1.926E+03	0.6	1.9	4.0	HPGe
Y-88	898.0	1.066E+02	4.077E+05	7.163E+03	0.4	1.9	3.9	HPGe
Co-60	1173.2	1.925E+03	2.055E+05	3.611E+03	0.5	1.9	3.9	HPGe
Co-60	1332.5	1.925E+03	2.056E+05	3.612E+03	0.7	1.9	4.0	HPGe
Y-88	1836.1	1.066E+02	4.308E+05	7.569E+03	0.5	1.9	3.9	HPGe

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

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

(Certificate continued on reverse side)



Comments:

1550 grams of sand.

This standard will expire one year after the reference date.

Source Prepared by: W. Mao
W. Mao, Radiochemist

QA Approved: J. D. McCorvey
J. D. McCorvey, QA Manager Alternate

Date: 2/1/10

Reagent

Tuna Can_00003



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

90099

1.0 Liter Sand in 1 Liter Wide Mouth HDPE Silgan Jar

Customer: TestAmerica St. Louis / Earth City, MO

P.O. No.: 2454150, Item 1

Reference Date: 01-Jan-2012 12:00 PM EST **Grams of Master Source:** 0.017180

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Additional radionuclides were added gravimetrically from solutions calibrated by gamma-ray spectrometry, ionization chamber, or liquid scintillation counting. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 2, July 2007, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source*	This Source γps	Uncertainty*, %			Calibration Method*
			γps/gram		Type	u _A	u _B		U
Pb-210	46.5	8.109E+03	————	3.094E+03	0.1	2.1	4.1	4π LS
Am-241	59.5	1.580E+05	————	2.037E+03	0.1	1.7	3.5	4π LS
Cd-109	88.0	4.626E+02	1.677E+05	2.881E+03	0.5	2.3	4.7	HPGe
Co-57	122.1	2.718E+02	8.795E+04	1.511E+03	0.4	2.0	4.1	HPGe
Ce-139	165.9	1.376E+02	1.245E+05	2.139E+03	0.4	1.9	3.9	HPGe
Hg-203	279.2	4.661E+01	2.707E+05	4.651E+03	0.3	1.9	3.8	HPGe
Sn-113	391.7	1.151E+02	1.755E+05	3.015E+03	0.4	1.9	3.9	HPGe
Cs-137	661.7	1.098E+04	1.128E+05	1.938E+03	0.7	1.9	4.0	HPGe
Y-88	898.0	1.066E+02	4.228E+05	7.264E+03	0.5	1.9	3.9	HPGe
Co-60	1173.2	1.925E+03	2.084E+05	3.580E+03	0.6	1.9	4.0	HPGe
Co-60	1332.5	1.925E+03	2.084E+05	3.581E+03	0.7	1.9	4.0	HPGe
Y-88	1836.1	1.066E+02	4.476E+05	7.690E+03	0.7	1.9	4.0	HPGe

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

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

(Certificate continued on reverse side)



Comments:

1550 grams of sand. Homogenous down to 10 grams aliquot.
This standard will expire one year after the reference date.

Source Prepared by: _____

Z. Dimitrova, Radiochemist

QA Approved: _____

J.D. McCorvey, Counting Room Manager

Date: _____

30 JAN 12



Reagent

Tuna Can_00006

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

83814-334

1.0 Liter Sand in 1 Liter Wide Mouth HDPE Silgan Jar

Customer: Test America St. Louis

P.O. No.: 2395112, Item 1

Reference Date: 01-Jan-2011 12:00 PM EST **Grams of Master Source:** 0.016927

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					Type	u_A	u_B	U
Pb-210	46.5	8.120E+03	—	3.021E+03	0.1	2.1	4.1	4π LS
Am-241	59.5	1.580E+05	—	2.090E+03	0.1	1.7	3.5	4π LS
Cd-109	88.0	4.626E+02	1.697E+05	2.873E+03	0.8	2.3	4.9	HPGe
Co-57	122.1	2.718E+02	8.711E+04	1.475E+03	0.5	2.0	4.1	HPGe
Ce-139	165.9	1.376E+02	1.247E+05	2.111E+03	0.5	1.9	3.9	HPGe
Hg-203	279.2	4.661E+01	2.753E+05	4.660E+03	0.4	1.9	3.9	HPGe
Sn-113	391.7	1.151E+02	1.769E+05	2.994E+03	0.5	1.9	3.9	HPGe
Cs-137	661.7	1.098E+04	1.109E+05	1.877E+03	0.7	1.9	4.0	HPGe
Y-88	898.0	1.066E+02	4.224E+05	7.150E+03	0.5	1.9	3.9	HPGe
Co-60	1173.2	1.925E+03	2.142E+05	3.626E+03	0.6	1.9	4.0	HPGe
Co-60	1332.5	1.925E+03	2.143E+05	3.627E+03	0.6	1.9	4.0	HPGe
Y-88	1836.1	1.066E+02	4.472E+05	7.570E+03	0.5	1.9	3.9	HPGe

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

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

(Certificate continued on reverse side)



Comments:

1550 grams of sand. Homogeneous down to 10 gram aliquot.
This standard will expire one year after the reference date.

Source Prepared by: _____

Z. Dimitrova
Z. Dimitrova, Radiochemist

QA Approved: _____

J. D. McCorvey
J. D. McCorvey, QA Manager Alternate

Date: _____

2/11/11



ALPHA SPECTROSCOPY

Method A-01-R Th

Isotopic Thorium (Alpha
Spectrometry) by Method A-01-R

Prep Batch: 257496

Preparation, Extraction
Chromatography Resin Actinide
Separation

Alpha Spectroscopy Analysis Detail Report

Prep Batch: 257496

Lab ID: MB 160-257496/1-A
Client ID:
Sigma: 2

Analyzed: 07/11/16 19:29
Detector: AV191
Dil Fac: 1

Decay Corrected: No
Yield Truncated: No
Ts: 400

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	0.06090	0.0366	0.0369		pCi/g	0.100	0.0289	260076	
Thorium-232	-0.001174	0.00319	0.00319	U	pCi/g	0.100	0.0253	260076	
Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	2.700	0.225	0.319		pCi/g	0.0254	3.03	89.2	30 - 110

Lab ID: LCS 160-257496/2-A
Client ID:
Sigma: 2

Analyzed: 07/08/16 12:38
Detector: AV148
Dil Fac: 1

Decay Corrected: No
Yield Truncated: No
Ts: 400

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	28.50	1.09	2.63		pCi/g	0.100	0.0315	259861	
Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	4.865	0.406	0.576		pCi/g	0.0555	6.05	80.5	30 - 110

Lab ID: 160-17842-1
Client ID: WR111-REF-018-SS-P-00
Sigma: 2

Analyzed: 07/08/16 12:38
Detector: AV175
Dil Fac: 1

Decay Corrected: No
Yield Truncated: No
Ts: 400

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch	
Thorium-230	1.78	0.219	0.265		pCi/g	0.100	0.0370	259885	
Thorium-232	1.64	0.209	0.251		pCi/g	0.100	0.0200	259885	
Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	1.94	0.183	0.245		pCi/g	0.0346	3.03	64.0	30 - 110

Quality Control Summary

Method Blank ID:	Analyte	Parent Result	Spike Added	MB Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
MB 160-257496/1-A	Thorium-230			0.06090		pCi/g							3.297107
MB 160-257496/1-A	Thorium-232			-0.001174	U	pCi/g							-.73545843
Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-257496/2-A	Thorium-230		24.5	28.50		pCi/g	116	81 - 118					2.3089291026

Glossary:
Ts = Count Duration, Sample

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-17842-1

SDG No.: _____

Batch Number: 257496 Batch Start Date: 06/22/16 10:40 Batch Analyst: Bernsen, Sarah CBatch Method: ExtChrom Batch End Date: 07/07/16 08:53

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00020	TRM-2 00001	AnalysisComment		
MB 160-257496/1		ExtChrom, A-01-R		1.0 g	0.1 mL				
LCS 160-257496/2		ExtChrom, A-01-R		0.5009 g	0.1 mL	0.5009 g	TRM		
160-17842-A-1-A	WR111-REF-018-SS -P-00	ExtChrom, A-01-R	T	0.9982 g	0.1 mL				

Batch Notes	
Balance ID	27050421
Analyst ID - Column	nmn
Column Date	7/5/16
Analyst ID - CoPrecipitation	nmn
CoPrecipitation Date	7/7/16
Pipette ID	rad097
Analyst ID - Reagent Drop Witness	rjs per nmn
Analyst ID - Reagent Drop	sek
SOP Number	st rc 0003 st rc 0004 st rc0100 st rc 0242

Basis	Basis Description
T	Total/NA

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

Sample Name: MB 160-257496/1-A Type: Blank
Spectrum #3 Analysis #1
: MB 160-257496/1-A
Sample Collection Date: 7/7/2016 8:51:00AM
Comment:

Sample

Sample Weight : 1.00 Sample Units: g
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch Name: 257496
AnalysisResultsID: 171019
Description:

Batch

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer Name: Th-229_00020
Tracer Activity: 67.23 DPM / mL x (Vol.) 0.10 mL = 6.72 DPM
Tracer Ref. Date: 8/6/2014 1:28:22PM

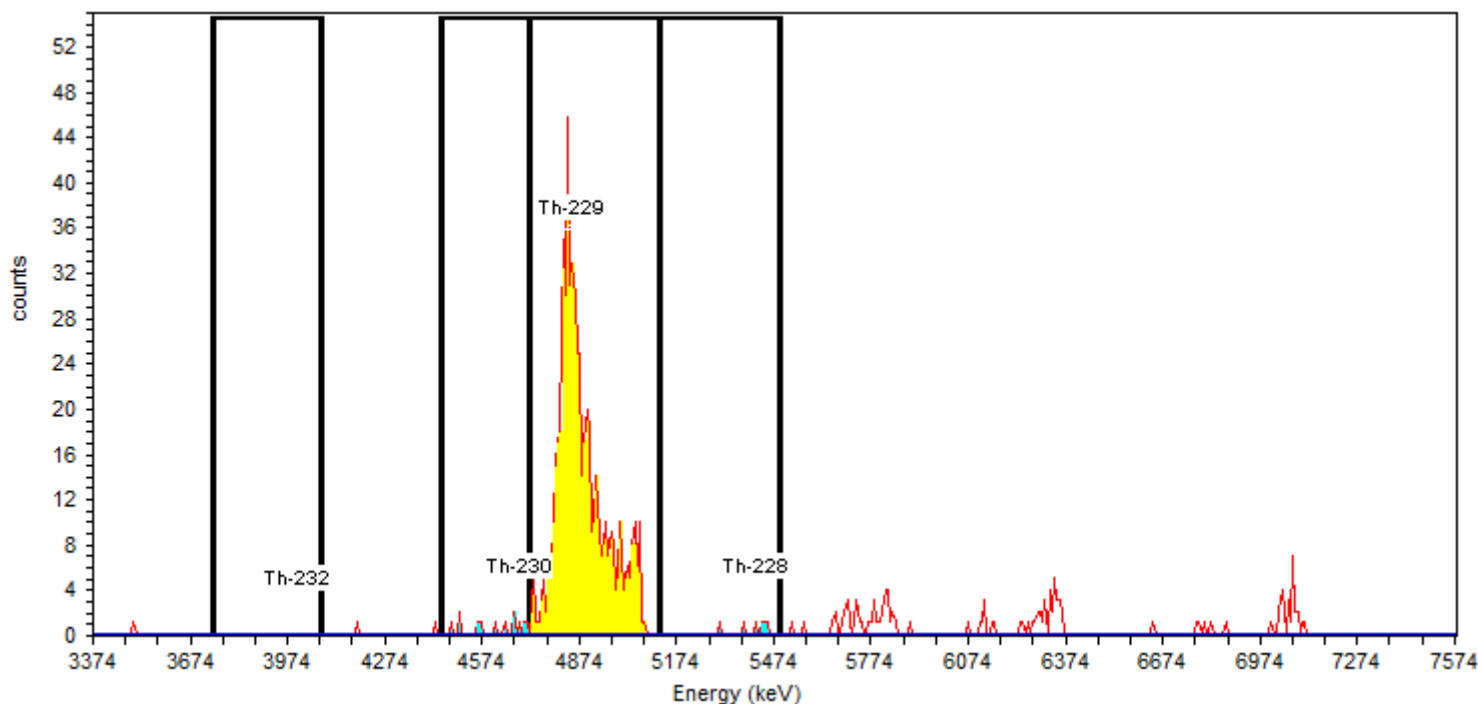
Tracer

Tracer Nuclide: Th-229
Tracer Recovery: 89.17%

Detector: AV191 SN: 50-112A2
Acquisition Start Date: 7/11/2016 7:29:20PM
Live Time: 400.00 min.
Real Time: 400.00 min.
Background Date: 6/26/2016 5:10:12PM
Bkgd Info: Sample: ICB;AV191; Det: AV191; Spectrum #4; 6/26/2016 5:10:12 PM

Acquisition

Energy Calibration: IC-8875;AV191-20151017
Efficiency Calibration:IC-8875;AV191-20151017
Calibration Date: 10/18/2015 3:55:04PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 24.22% +/- 0.34% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 7/7/2016 1:05:10PM
MDA Constants: $K\alpha = 1.64$, $K\beta = 1.64$

Nuclide Library: Thorium
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	Peak Expected keV	Peak Diff keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity Units
Th-232	3999.0	4,010.0	-11.0	3743.0	4072.0	.0	100.2	0	0.2256	-0.23	-1.174E-003 pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	9.8	99.7	12	0.4167	11.65	6.090E-002 pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	82.2	99.6	579	0.3900	578.67	2.700E+000 pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	17.0	99.8	6	7.0567	-1.06	-5.546E-003 pCi/g

Sample Name: LCS 160-257496/2-A Type: Control
Spectrum #2 Analysis #1
: LCS 160-257496/2-A
Sample Collection Date: 7/7/2016 8:51:00AM
Comment:

Sample

Sample Weight : 0.50 Sample Units: g
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch Name: 257496
AnalysisResultsID: 170795
Description:

Batch

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer Name: Th-229_00020
Tracer Activity: 67.23 DPM / mL x (Vol.) 0.10 mL = 6.72 DPM
Tracer Ref. Date: 8/6/2014 1:28:22PM

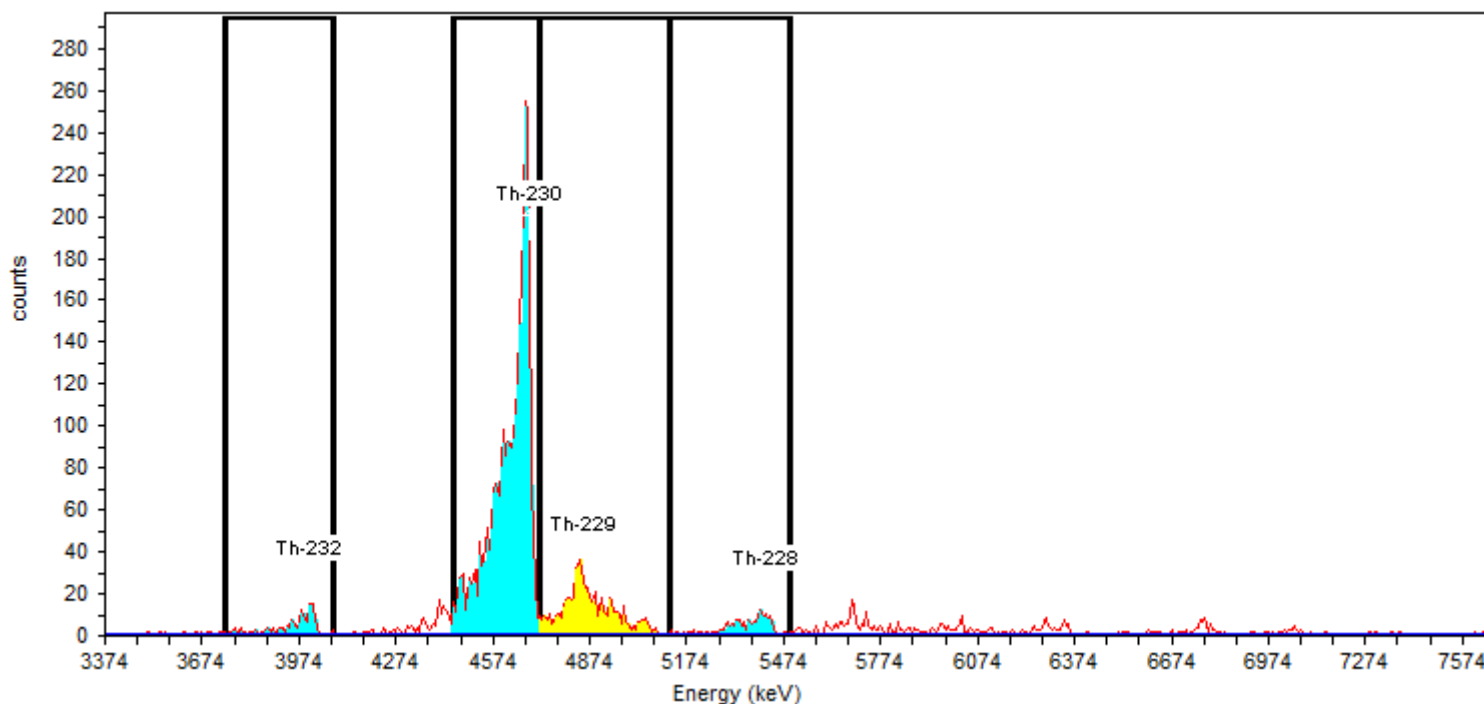
Tracer

Tracer Nuclide: Th-229
Tracer Recovery: 80.48%

Detector: AV148 SN: 50-05/R2
Acquisition Start Date: 7/8/2016 12:38:27PM
Live Time: 400.00 min.
Real Time: 400.00 min.
Background Date: 6/24/2016 4:15:34PM
Bkgd Info: Sample: ICB;AV148; Det: AV148; Spectrum #1; 6/24/2016
4:15:34 PM

Acquisition

Energy Calibration: IC-8874;AV148-20151016a
Efficiency Calibration:IC-8874;AV148-20151016a
Calibration Date: 10/16/2015 6:47:19PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.72% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 7/7/2016 1:05:09PM
MDA Constants: $K\alpha = 1.64$, $K\beta = 1.64$

Nuclide Library: Thorium
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	Peak Expected keV	Peak Diff keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity Units
Th-232	3999.0	4,010.0	-11.0	3743.0	4072.0	60.5	100.2	141	0.4167	140.24	1.463E+000 pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	25.4	99.7	2599	0.0000	2598.86	2.725E+001 pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	87.2	99.6	577	0.8333	576.10	4.866E+000 pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	124.1	99.8	153	5.4167	147.58	1.548E+000 pCi/g

Sample Name: LCS 160-257496/2-A Type: Control
Spectrum #2 Analysis #1
: LCS 160-257496/2-A
Sample Collection Date: 7/7/2016 8:51:00AM
Comment:

Sample

Sample Weight : 0.50 Sample Units: g
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch Name: 257496
AnalysisResultsID: 170820
Description:

Batch

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer Name: Th-229_00020
Tracer Activity: 67.23 DPM / mL x (Vol.) 0.10 mL = 6.72 DPM
Tracer Ref. Date: 8/6/2014 1:28:22PM

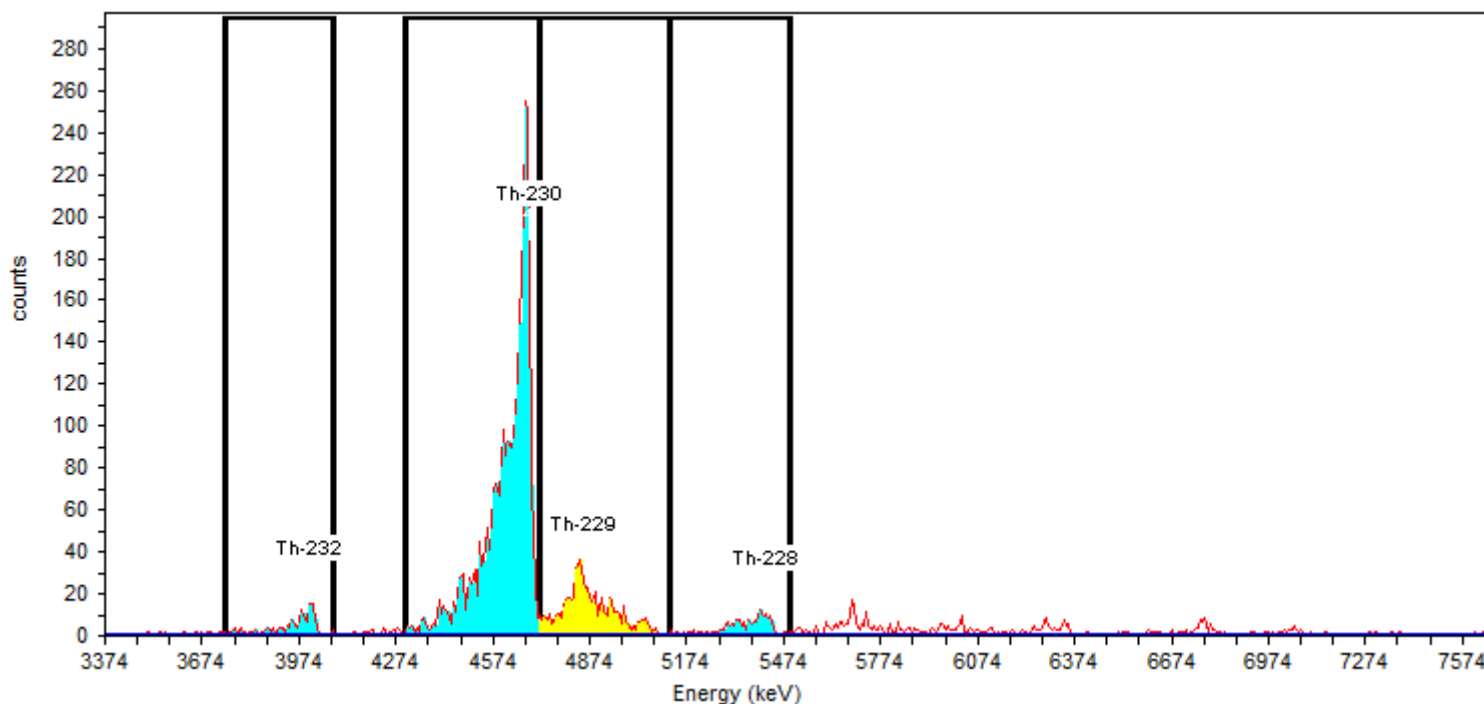
Tracer

Tracer Nuclide: Th-229
Tracer Recovery: 80.48%

Detector: AV148 SN: 50-05/R2
Acquisition Start Date: 7/8/2016 12:38:27PM
Live Time: 400.00 min.
Real Time: 400.00 min.
Background Date: 6/24/2016 4:15:34PM
Bkgd Info: Sample: ICB;AV148; Det: AV148; Spectrum #1; 6/24/2016
4:15:34 PM

Acquisition

Energy Calibration: IC-8874;AV148-20151016a
Efficiency Calibration: IC-8874;AV148-20151016a
Calibration Date: 10/16/2015 6:47:19PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.72% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute Interactive ROI Analysis
Decay Correction: 7/7/2016 1:05:09PM
MDA Constants: $K\alpha = 1.64$, $K\beta = 1.64$

Nuclide Library: Thorium
MDA Source: Background

Manual Integration for
tailing. 07/11/2016 ALD

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	Peak Expected keV	Peak Diff keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity	Units
Th-232	3999.0	4,010.0	-11.0	3743.0	4072.0	60.5	100.2	141	0.4167	140.24	1.463E+000	pCi/g
Th-230	4688.0	4,687.5	0.5	4299.1	4716.8	19.0	99.7	2718	0.0000	2718.00	2.850E+001	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	87.2	99.6	577	0.8333	576.10	4.866E+000	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	124.1	99.8	153	5.4167	147.58	1.548E+000	pCi/g

Sample Name: 160-17842-A-1-C Type: Sample
Spectrum #2 Analysis #1
: 160-17842-A-1-C
Sample Collection Date: 6/15/2016 1:10:00PM
Comment:

Sample

Sample Weight : 1.00 Sample Units: g
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch Name: 257496
AnalysisResultsID: 170793
Description:

Batch

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer Name: Th-229_00020
Tracer Activity: 67.23 DPM / mL x (Vol.) 0.10 mL = 6.72 DPM
Tracer Ref. Date: 8/6/2014 1:28:22PM

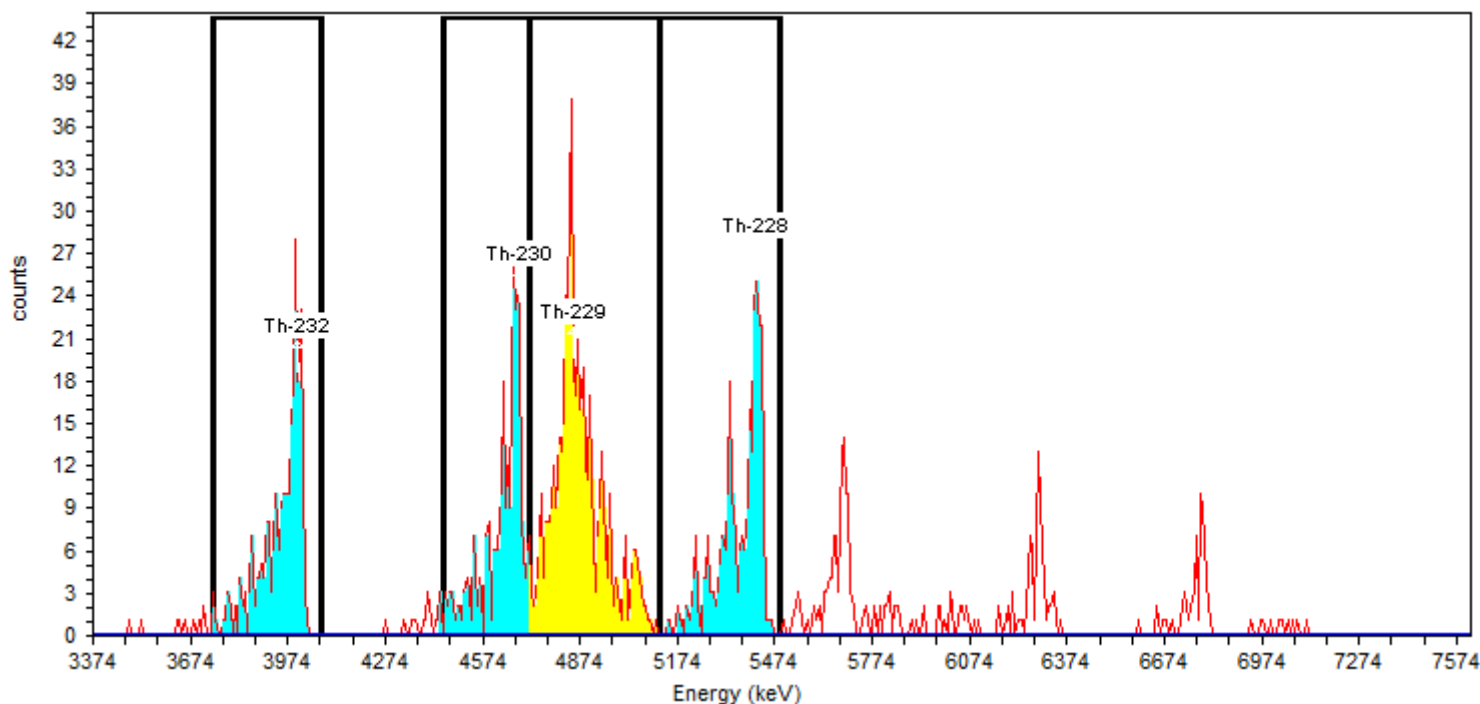
Tracer

Tracer Nuclide: Th-229
Tracer Recovery: 65.27%

Detector: AV175 SN: 50-117H1
Acquisition Start Date: 7/8/2016 12:38:29PM
Live Time: 400.00 min.
Real Time: 400.01 min.
Background Date: 6/24/2016 4:15:22PM
Bkgd Info: Sample: ICB;AV175; Det: AV175; Spectrum #1; 6/24/2016 4:15:22 PM

Acquisition

Energy Calibration: IC-7107;AV175-20151017
Efficiency Calibration:IC-7107;AV175-20151017
Calibration Date: 10/17/2015 6:01:46PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.38% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction:7/7/2016 1:05:09PM
MDA Constants: $K\alpha = 1.64$, $K\beta = 1.64$

Nuclide Library: Thorium
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	Peak Expected keV	Peak Diff keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity	Units
Th-232	3999.0	4,010.0	-11.0	3743.0	4072.0	58.5	100.2	246	0.0000	246.15	1.610E+000	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	27.2	99.7	258	0.4167	257.38	1.692E+000	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	90.5	99.6	463	1.6667	461.21	1.980E+000	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	53.5	99.8	278	5.4167	272.67	1.793E+000	pCi/g

Sample Name: 160-17842-A-1-C Type: Sample
Spectrum #2 Analysis #1
: 160-17842-A-1-C
Sample Collection Date: 6/15/2016 1:10:00PM
Comment:

Sample

Sample Weight : 1.00 Sample Units: g
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch Name: 257496
AnalysisResultsID: 170821
Description:

Batch

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer Name: Th-229_00020
Tracer Activity: 67.23 DPM / mL x (Vol.) 0.10 mL = 6.72 DPM
Tracer Ref. Date: 8/6/2014 1:28:22PM

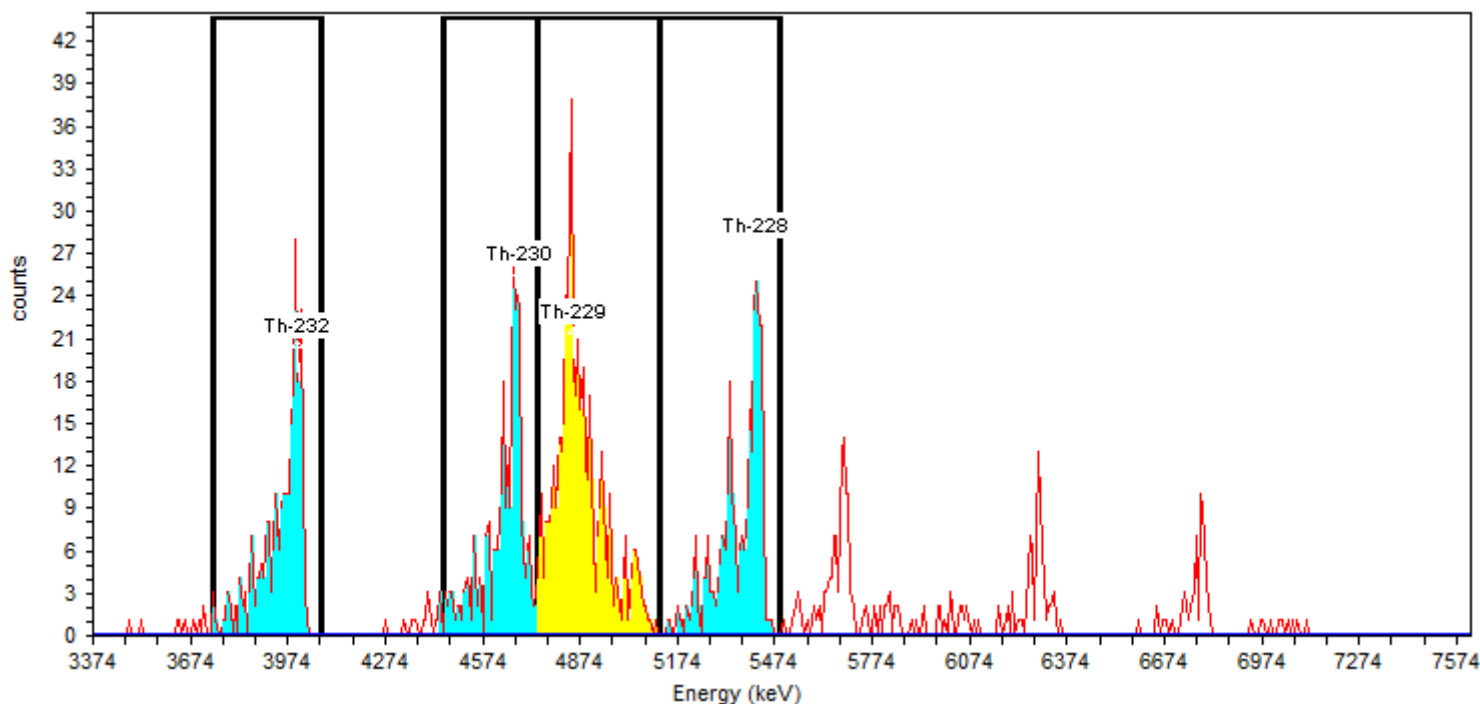
Tracer

Tracer Nuclide: Th-229
Tracer Recovery: 64.01%

Detector: AV175 SN: 50-117H1
Acquisition Start Date: 7/8/2016 12:38:29PM
Live Time: 400.00 min.
Real Time: 400.01 min.
Background Date: 6/24/2016 4:15:22PM
Bkgd Info: Sample: ICB;AV175; Det: AV175; Spectrum #1; 6/24/2016 4:15:22 PM

Acquisition

Energy Calibration: IC-7107;AV175-20151017
Efficiency Calibration:IC-7107;AV175-20151017
Calibration Date: 10/17/2015 6:01:46PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.38% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: Absolute Interactive ROI Analysis
Decay Correction: 7/7/2016 1:05:09PM
MDA Constants: $K\alpha = 1.64$, $K\beta = 1.64$

Nuclide Library: Thorium
MDA Source: Background

Manual Integration for
tailing. 07/11/2016 ALD

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	Peak Expected keV	Peak Diff keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity	Units
Th-232	3999.0	4,010.0	-11.0	3743.0	4072.0	58.5	100.2	246	0.0000	246.15	1.642E+000	pCi/g
Th-230	4688.0	4,687.5	0.5	4448.3	4739.1	86.0	99.7	266	0.4167	265.58	1.780E+000	pCi/g
Th-229	4848.0	4,845.3	2.7	4739.1	5119.5	90.5	99.6	454	1.6667	452.33	1.942E+000	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	53.5	99.8	278	5.4167	272.67	1.828E+000	pCi/g

Daily Checks

Alpha Spectroscopy Daily Pulser Check

Analysis Date: 07/08/16

Detector	Analysis Date	Gross Counts			FWHM (keV)			Pulser Center			Energy (keV)		
		Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F
AV148	07/08/16 08:48	6011	5686.2-6284.7	Pass	14.6	10-20	Pass	222.1	218.0-228.0	Pass	5023	4990.0-5070.0	Pass
AV175	07/08/16 08:47	6022	5634.8-6228.0	Pass	13.6	10-20	Pass	220.9	216.0-226.0	Pass	5015	4975.4-5055.4	Pass

Analysis Date: 07/11/16

Detector	Analysis Date	Gross Counts			FWHM (keV)			Pulser Center			Energy (keV)		
		Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F
AV191	07/11/16 09:24	5688	5518.8-6099.7	Pass	13.2	10-20	Pass	222.1	217.0-227.0	Pass	5023	4982.9-5062.9	Pass
AV194	07/11/16 09:24	5990	5662.9-6259.0	Pass	15.6	10-20	Pass	221.9	217.3-227.3	Pass	5022	4984.8-5064.8	Pass

Sample Name: Pulser;AV148

Comment:

Sample

Spectrum #10 Analysis #1

Batch

Batch Name: June2016a

Description:

Acquisition

Detector: AV148 , SN: 50-05/R2

Acquisition Start Date: 7/8/2016 8:48:00AM

Live Time: 1.00 min.

Real Time: 1.00 min.

Calibration Name: IC-8874;AV148-20151016a

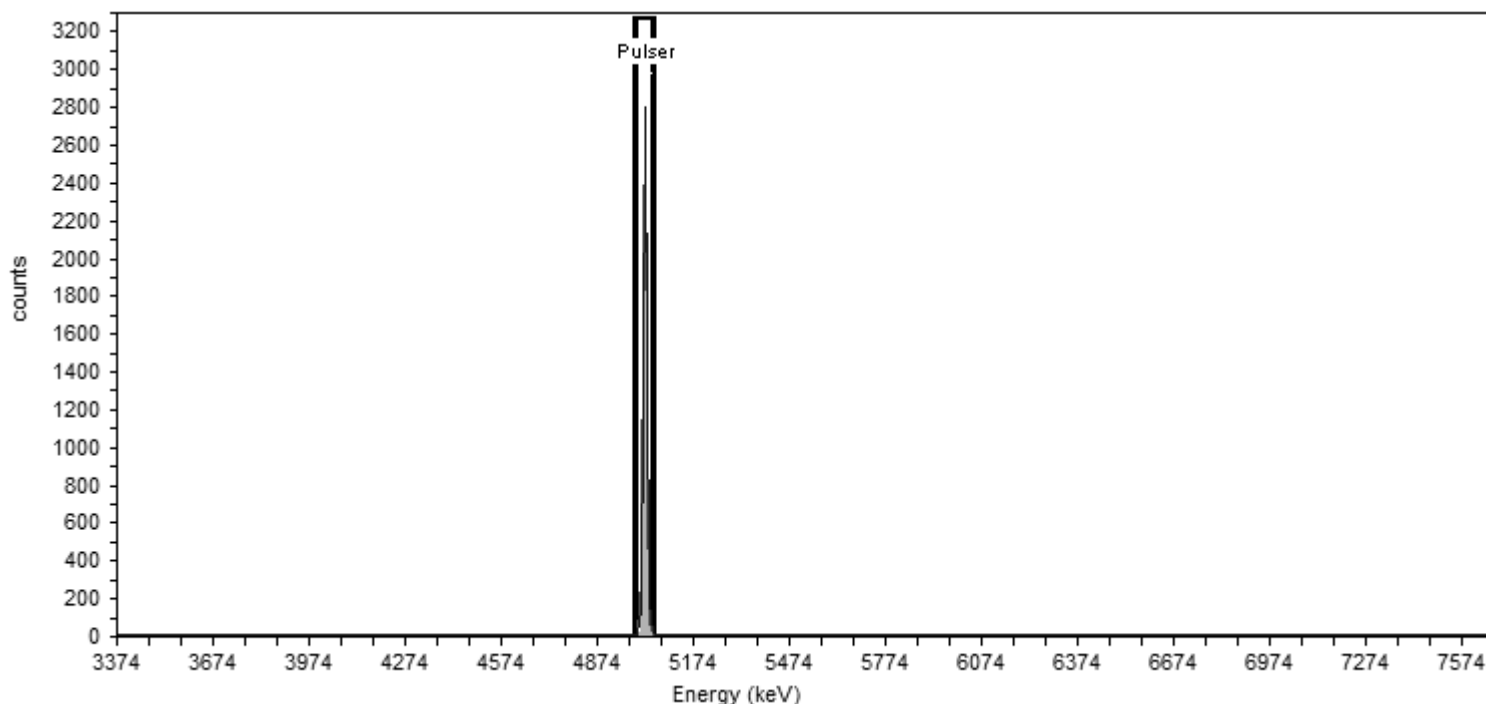
Calibration Date: 10/16/2015 6:47:19PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch

Offset = 3,366.95 keV

Quadratic = 0.0000 keV / Ch²



General Analysis

Analysis Method: Peak Fit Analysis

Nuclide Summary (Peak Search)

Nuclide	Peak Energy keV	Start Energy keV	End Energy keV	FWHM keV	Fit Area	Gross Counts
Pulser	5022.932	4998.096	5047.768	14.59	5,865.53	6,011.19

Sample Name: Pulser;AV175
Comment:

Sample

Spectrum #9 Analysis #1

Batch Name: June2016a
Description:

Batch

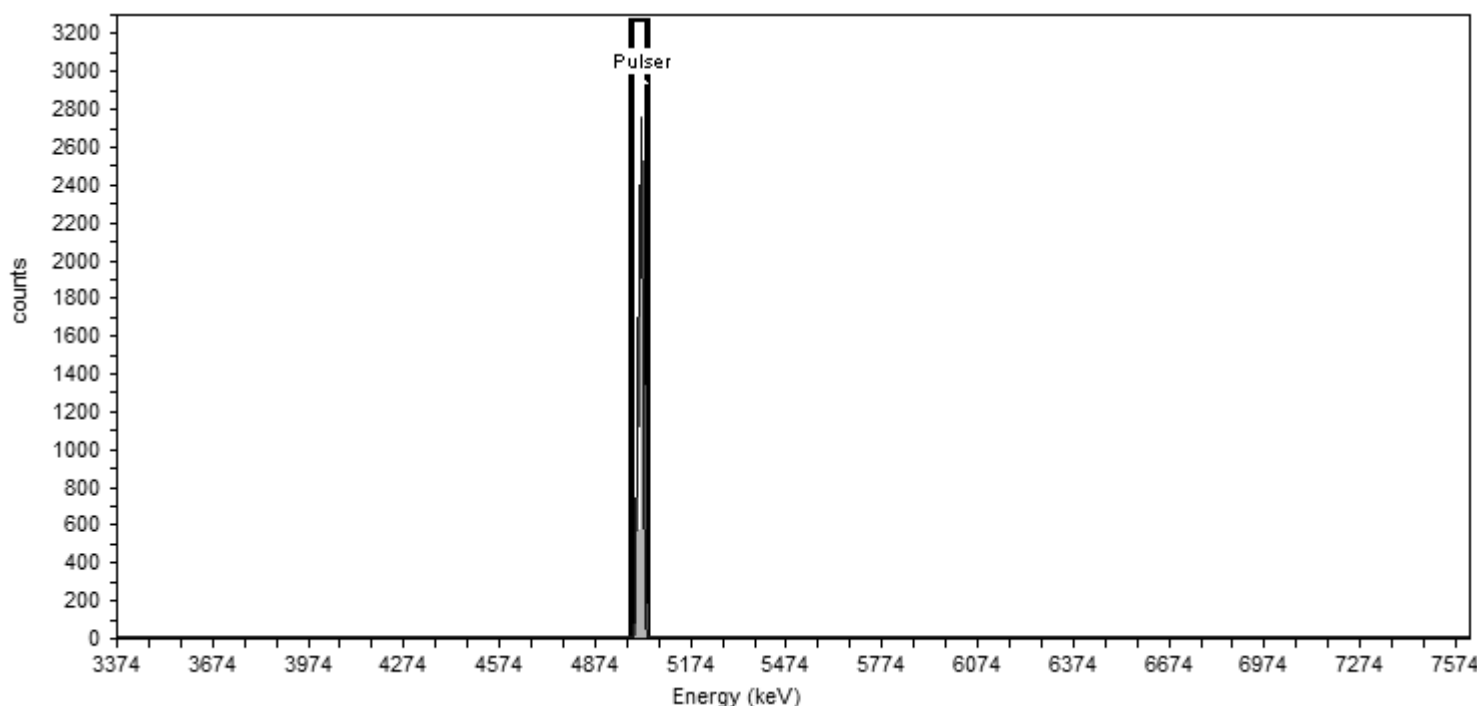
Detector: AV175 , SN: 50-117H1
Acquisition Start Date: 7/8/2016 8:47:58AM
Live Time: 1.00 min.
Real Time: 1.00 min.
Calibration Name: IC-7107;AV175-20151017
Calibration Date: 10/17/2015 6:01:46PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch

Offset = 3,366.95 keV

Quadratic = 0.0000 keV / Ch²



Analysis Method: Peak Fit Analysis

General Analysis

Nuclide Summary (Peak Search)						
Nuclide	Peak Energy keV	Start Energy keV	End Energy keV	FWHM keV	Fit Area	Gross Counts
Pulser	5014.563	4991.440	5037.685	13.58	5,375.39	6,021.87

Sample Name: Pulser;AV191

Comment:

Sample

Spectrum #10 Analysis #1

Batch

Batch Name: June2016b

Description:

Acquisition

Detector: AV191, SN: 50-112A2

Acquisition Start Date: 7/11/2016 9:24:19AM

Live Time: 1.00 min.

Real Time: 1.00 min.

Calibration Name: IC-8875;AV191-20151017

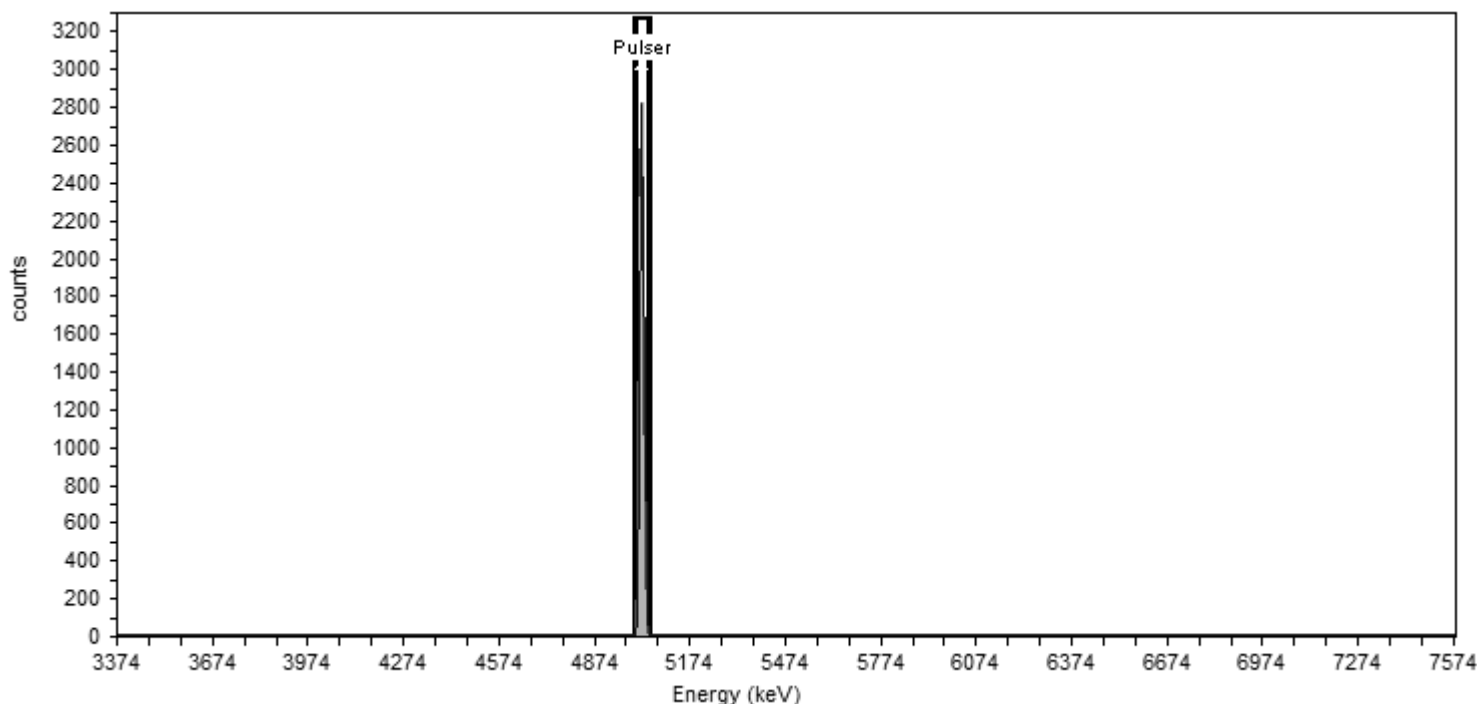
Calibration Date: 10/18/2015 3:55:04PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch

Offset = 3,366.95 keV

Quadratic = 0.0000 keV / Ch²



General Analysis

Analysis Method: Peak Fit Analysis

Nuclide Summary (Peak Search)

Nuclide	Peak Energy keV	Start Energy keV	End Energy keV	FWHM keV	Fit Area	Gross Counts
Pulser	5023.024	5000.513	5045.537	13.23	5,352.61	5,688.41

Sample Name: Pulser;AV194

Comment:

Sample

Spectrum #12 Analysis #1

Batch

Batch Name: June2016b

Description:

Acquisition

Detector: AV194 , SN: 50-119J2

Acquisition Start Date: 7/11/2016 9:24:19AM

Live Time: 1.00 min.

Real Time: 1.00 min.

Calibration Name: IC-9520;AV194-20151017

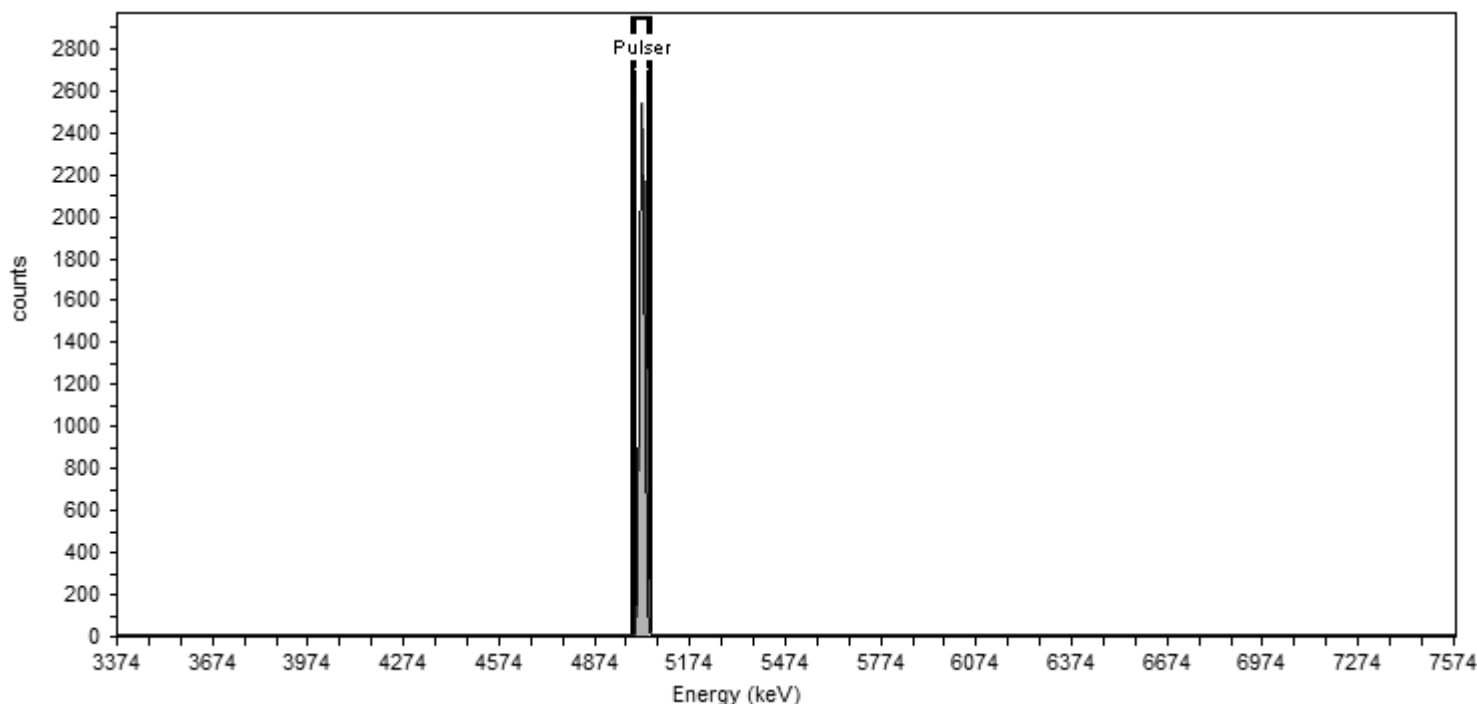
Calibration Date: 10/18/2015 3:55:14PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch

Offset = 3,366.95 keV

Quadratic = 0.0000 keV / Ch²



General Analysis

Analysis Method: Peak Fit Analysis

Nuclide Summary (Peak Search)

Nuclide	Peak Energy keV	Start Energy keV	End Energy keV	FWHM keV	Fit Area	Gross Counts
Pulser	5021.819	4995.215	5048.422	15.63	5,701.87	5,989.92

Initial Calibrations

Sample Name: IC-8874;AV148-20151016a
Description:
Detector: AV148

Calibration

Analyst: 60040
Analysis Date: 10/16/2015 6:47:19PM
Calibration Type: Energy And Efficiency

Certificate ID: 82233-334
Prepared by: Analytics
Description:

Source Info

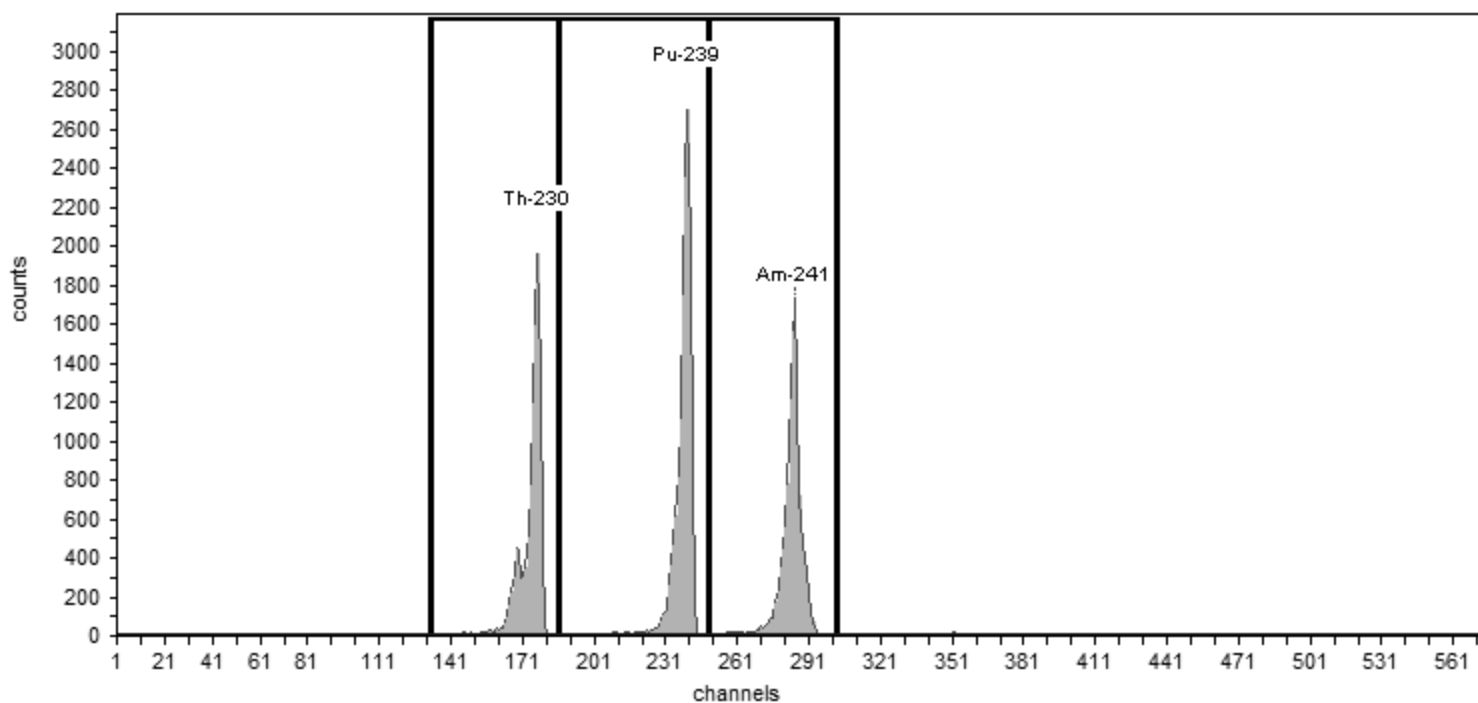
Certification Date: 6/3/2010 12:00:00PM

Acquisition

Detector: AV148 , SN: 50-05/R2
Acquisition Start Date: 10/16/2015 4:27:06PM

Live Time: 140.00 min.
Real Time: 140.01 min.

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency Calibration Name: IC-8874;AV148-20151016;
Efficiency: 26.72% +/- 0.38% TPU(2 sigma)



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	29.28	10,746.00	76.76
Pu-239	240	5,155.40	186	249	31.36	14,143.00	101.02
Am-241	284	5,485.70	249	303	32.16	11,206.00	80.04

Sample Name: IC-7107;AV175-20151017
Description:
Detector: AV175

Calibration

Analyst: 60040
Analysis Date: 10/17/2015 6:01:46PM
Calibration Type: Energy And Efficiency

Certificate ID: 82232-334
Prepared by: Analytics
Description:

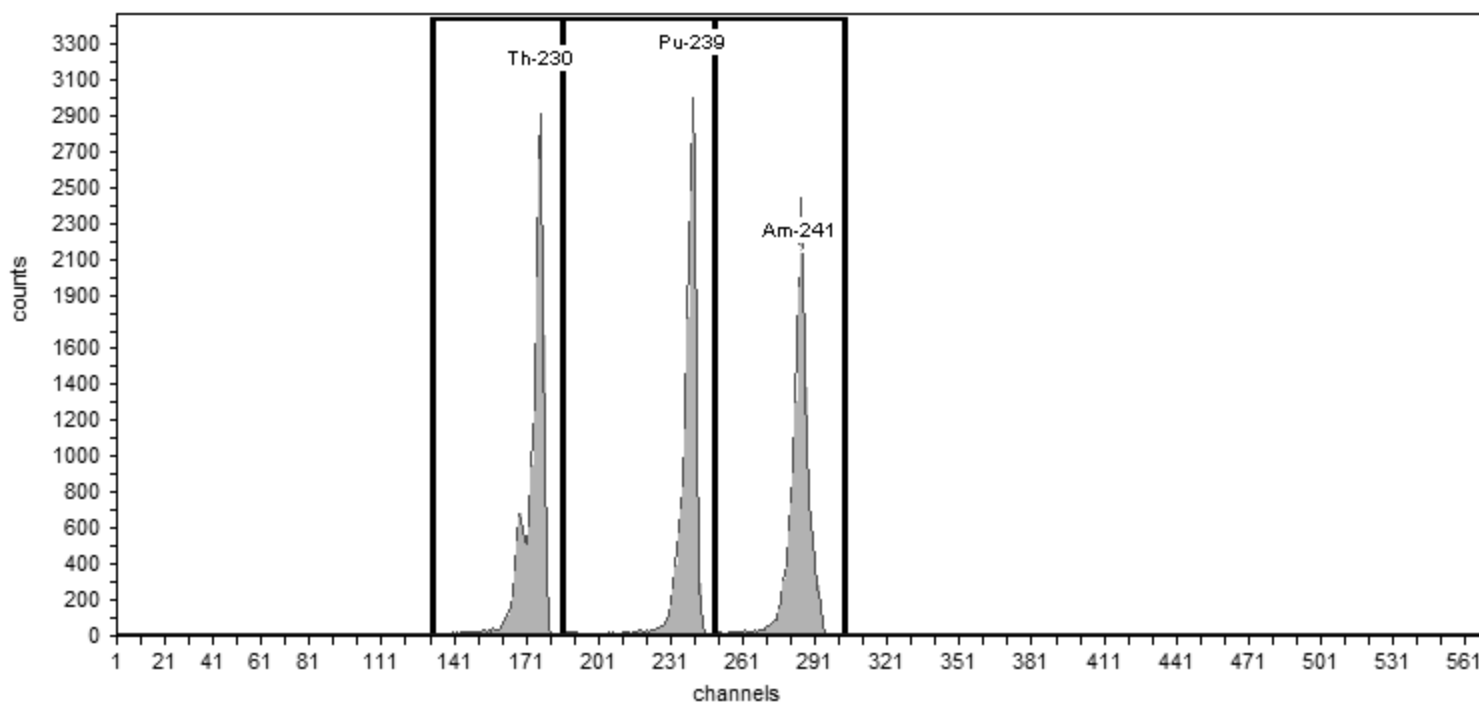
Source Info

Certification Date: 6/3/2010 12:00:00PM

Acquisition

Detector: AV175 , SN: 50-117H1
Acquisition Start Date: 10/17/2015 2:48:30PM
Live Time: 140.00 min.
Real Time: 140.01 min.

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency Calibration Name: IC-7107;AV175-20151017
Efficiency: 26.38% +/- 0.30% TPU(2 sigma)



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	29.12	16,621.00	118.72
Pu-239	240	5,155.40	186	249	31.81	16,209.00	115.78
Am-241	284	5,485.70	249	303	33.28	15,927.00	113.76

Sample Name: IC-8875;AV191-20151017
Description:
Detector: AV191

Calibration

Analyst: 60040
Analysis Date: 10/18/2015 3:55:04PM
Calibration Type: Energy And Efficiency

Certificate ID: 82234-334
Prepared by: Analytics
Description:

Source Info

Certification Date: 6/2/2010 12:00:00PM

Acquisition

Detector: AV191 , SN: 50-112A2
Acquisition Start Date: 10/17/2015 6:13:26PM

Live Time: 140.00 min.
Real Time: 140.01 min.

Energy Calibration Equation:

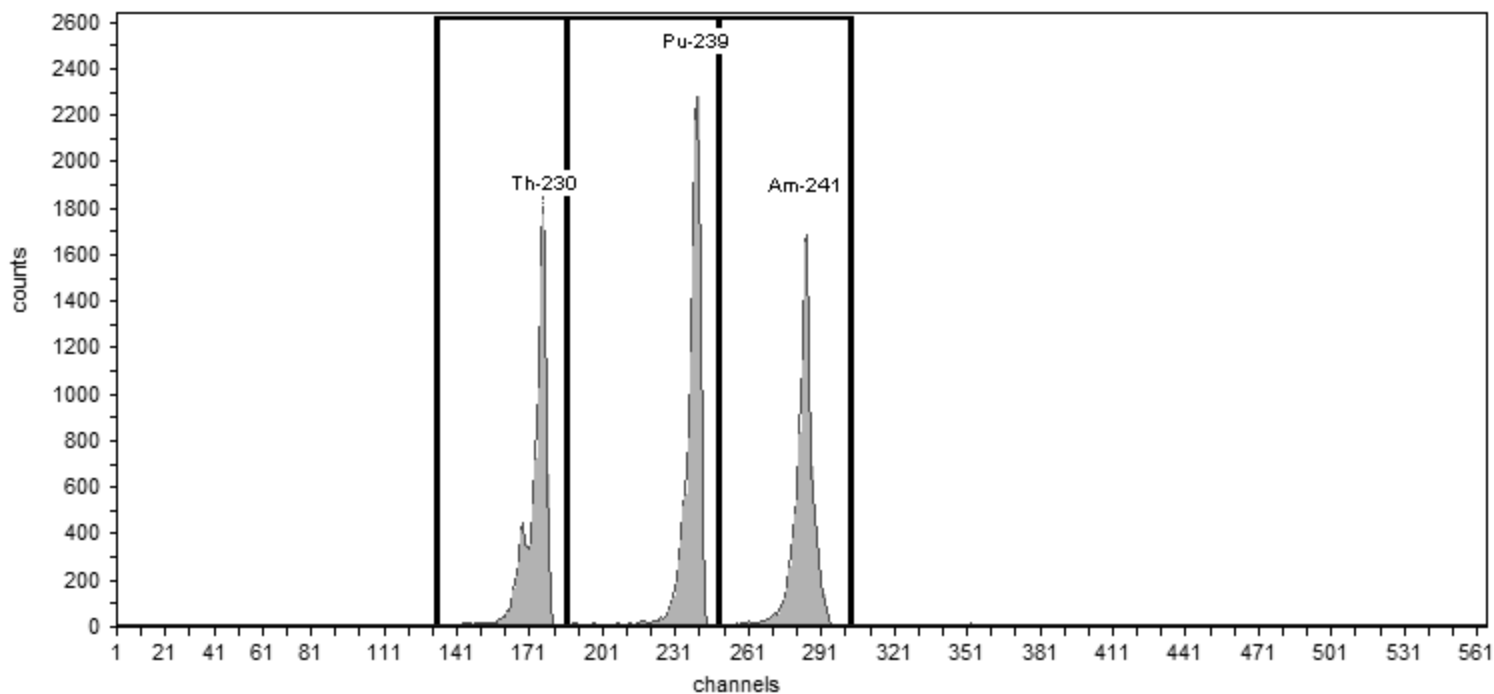
Gain = 7.4575 keV / Ch

Offset = 3,366.95 keV

Quadratic = 0.0000 keV / Ch²

Efficiency Calibration Name: IC-8875;AV191-20151017

Efficiency: 24.22% +/- 0.34% TPU(2 sigma)



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	29.72	11,130.00	79.50
Pu-239	240	5,155.40	186	249	33.56	12,810.00	91.50
Am-241	284	5,485.70	249	303	34.44	11,195.00	79.96

Initial Calibration Verifications

Alpha Spectroscopy Calibration Summary

Detector: AV148

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-223445/1	10/16/15 16:27	82233-334_00001	0.2672	0.20-0.32		
ICV 160-223563/1	10/26/15 19:10	82232-334_00001	0.2586	0.20-0.32	96.8	95-105
CCV 160-258276/1	06/27/16 10:48	82233-334_00001	0.2679	0.20-0.32	100.3	95-105

Detector: AV175

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-223472/1	10/17/15 14:48	82232-334_00001	0.2638	0.20-0.32		
ICV 160-223590/2	10/31/15 17:26	82233-334_00001	0.2671	0.20-0.32	101.3	95-105
CCV 160-258301/1	06/27/16 13:55	82232-334_00001	0.2601	0.20-0.32	98.6	95-105

Detector: AV191

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-223488/1	10/17/15 18:13	82234-334_00001	0.2422	0.20-0.32		
ICV 160-223606/2	11/01/15 18:11	82245-334_00001	0.2464	0.20-0.32	101.7	95-105
CCV 160-258354/1	06/28/16 09:29	82234-334_00001	0.2323	0.20-0.32	95.9	95-105

Sample Name: ICV-7107;AV148-20151026

Description:

Detector: AV148

Calibration

Analyst: 60040

Analysis Date: 10/26/2015 8:20:51PM

Calibration Type: Energy And Efficiency

Certificate ID: 82232-334

Prepared by: Analytics

Description:

Source Info

Certification Date: 6/3/2010 12:00:00PM

Acquisition

Detector: AV148 , SN: 50-05/R2

Acquisition Start Date: 10/26/2015 7:10:27PM

Live Time: 60.00 min.

Real Time: 60.01 min.

Energy Calibration Equation:

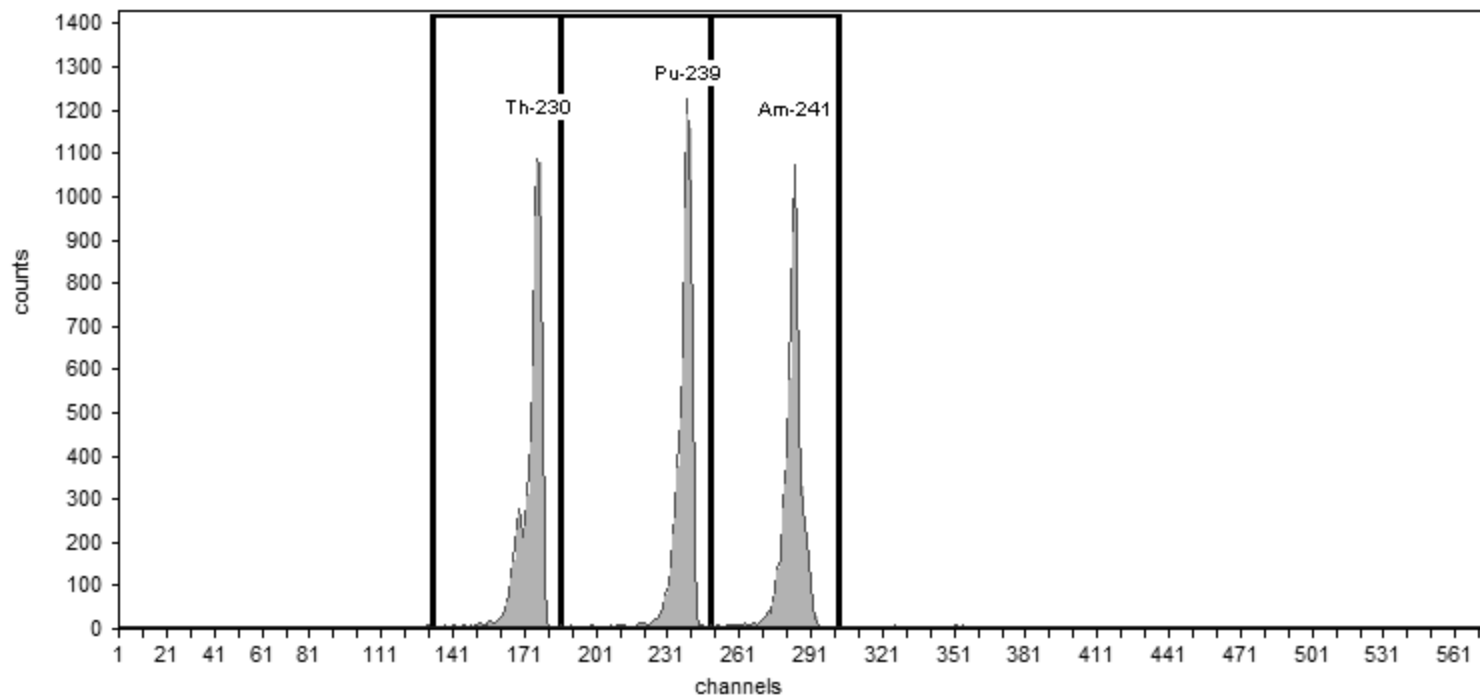
Gain = 7.4575 keV / Ch

Offset = 3,366.95 keV

Quadratic = 0.0000 keV / Ch²

Efficiency Calibration Name: ICV-7107;AV148-20151026

Efficiency: 25.86% +/- 0.40% TPU(2 sigma)



General Analysis

Method: Manual (ROI)

Algorithm: Linear

Initial Calibration: No

Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	33.29	7,000.00	116.67
Pu-239	240	5,155.40	186	249	31.50	6,783.00	113.05
Am-241	284	5,485.70	249	303	30.75	6,700.00	111.67

Sample Name: ICV-8874;AV175-20151031a
Description:
Detector: AV175

Calibration

Analyst: 60040
Analysis Date: 11/1/2015 1:49:56PM
Calibration Type: Energy And Efficiency

Certificate ID: 82233-334
Prepared by: Analytics
Description:

Source Info

Certification Date: 6/3/2010 12:00:00PM

Acquisition

Detector: AV175 , SN: 50-117H1
Acquisition Start Date: 10/31/2015 5:26:50PM

Live Time: 60.00 min.
Real Time: 60.00 min.

Energy Calibration Equation:

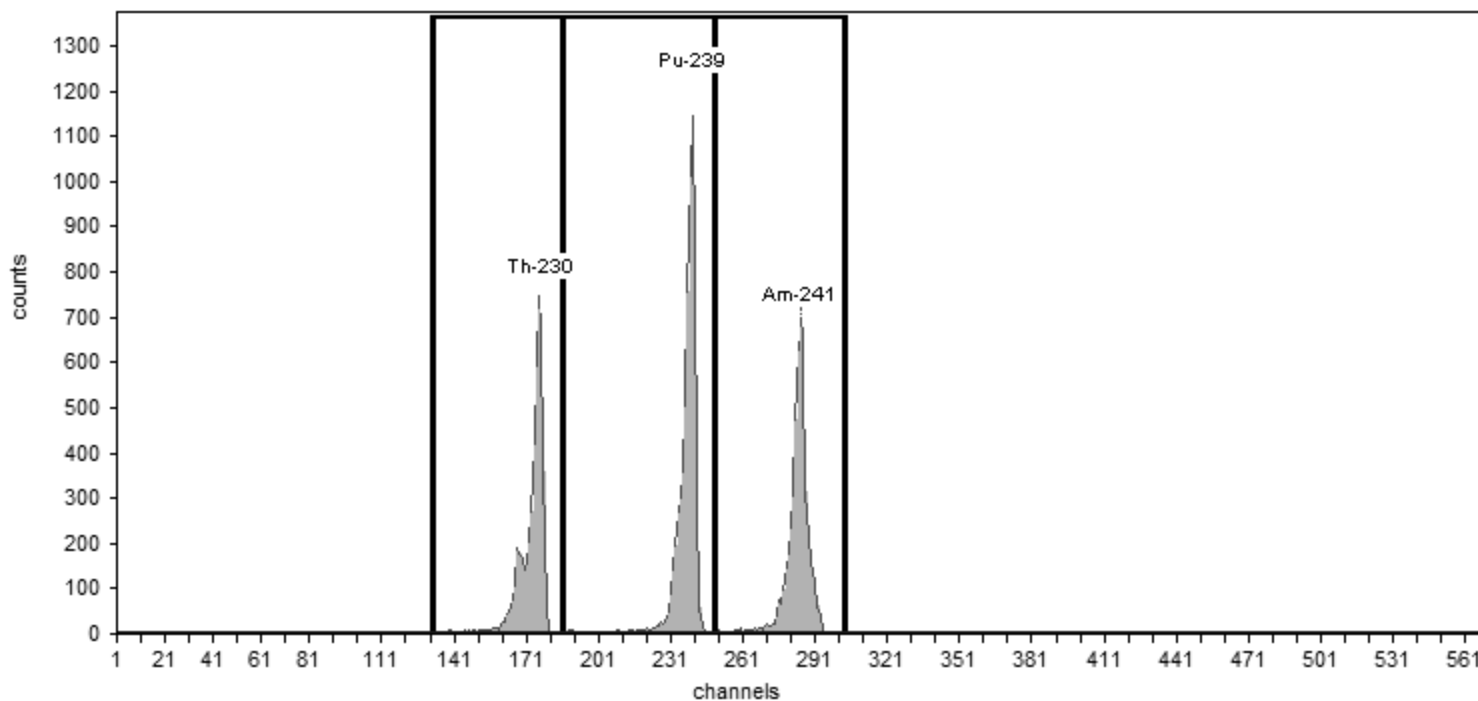
Gain = 7.4575 keV / Ch

Offset = 3,366.95 keV

Quadratic = 0.0000 keV / Ch²

Efficiency Calibration Name: ICV-8874;AV175-2015103

Efficiency: 26.71% +/- 0.50% TPU(2 sigma)



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	31.68	4,549.00	75.82
Pu-239	240	5,155.40	186	249	31.45	6,204.00	103.40
Am-241	284	5,485.70	249	303	31.89	4,741.00	79.02

Sample Name: ICV-9884;AV191-20151101a
Description:
Detector: AV191

Calibration

Analyst: 60040
Analysis Date: 11/1/2015 7:12:41PM
Calibration Type: Energy And Efficiency

Certificate ID: 82245-334
Prepared by: Analytics
Description:

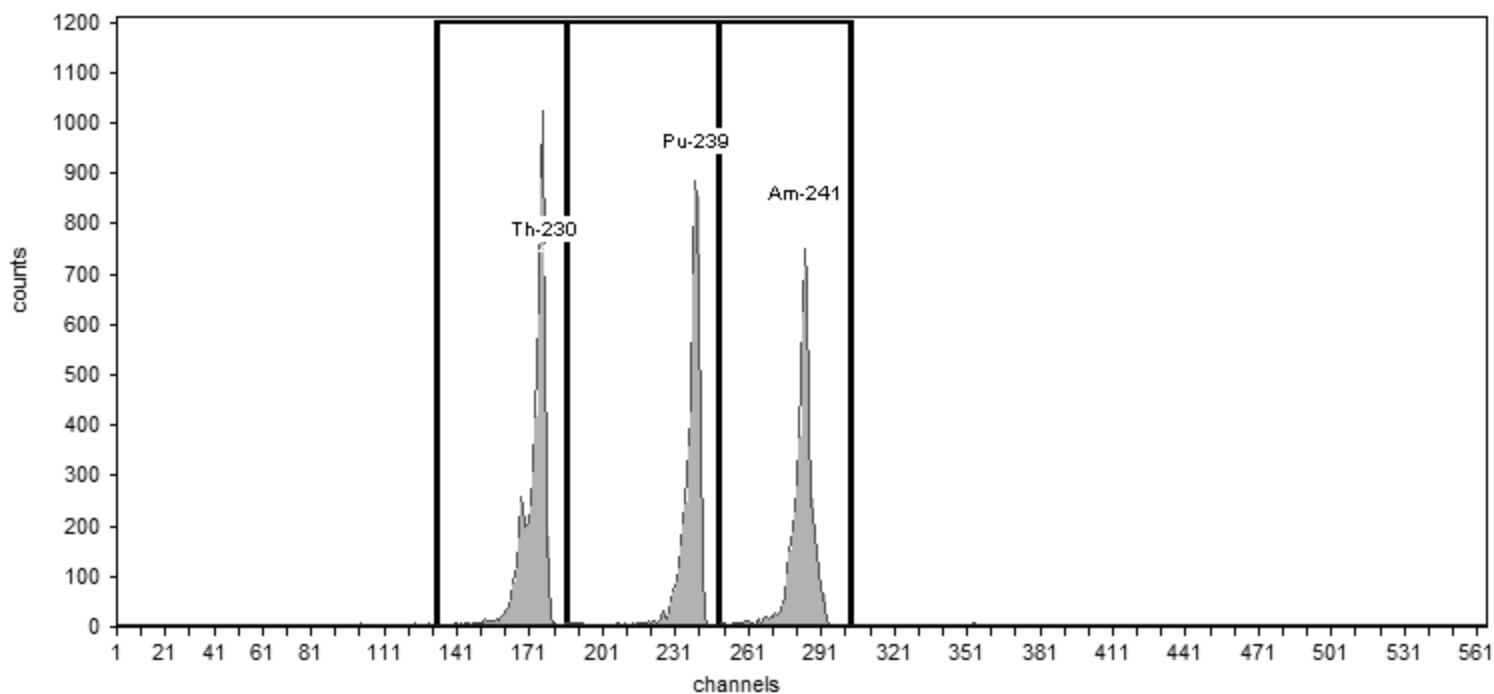
Source Info

Certification Date: 6/9/2010 12:00:00PM

Acquisition

Detector: AV191 , SN: 50-112A2
Acquisition Start Date: 11/1/2015 6:11:24PM
Live Time: 60.00 min.
Real Time: 60.00 min.
Efficiency Calibration Name: ICV-9884;AV191-20151101

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 24.64% +/- 0.46% TPU(2 sigma)



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	28.76	5,906.00	98.43
Pu-239	240	5,155.40	186	249	28.60	4,838.00	80.63
Am-241	284	5,485.70	249	303	31.58	4,920.00	82.00

Monthly Calibration Verifications

Sample Name: CCV-8874;AV148-20160627
Description:
Detector: AV148

Calibration

Analyst: 60040
Analysis Date: 6/27/2016 11:52:50AM
Calibration Type: Energy And Efficiency

Certificate ID: 82233-334
Prepared by: Analytics
Description:

Source Info

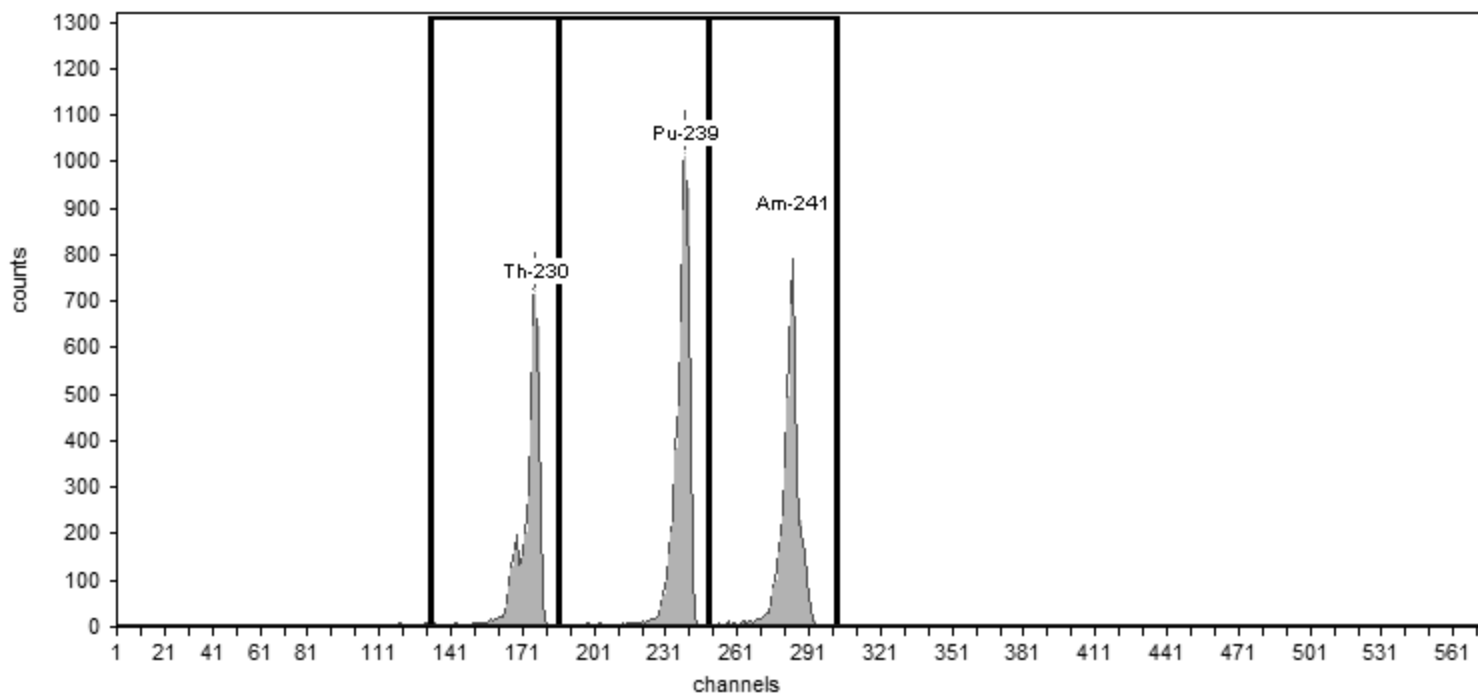
Certification Date: 6/3/2010 12:00:00PM

Acquisition

Detector: AV148 , SN: 50-05/R2
Acquisition Start Date: 6/27/2016 10:48:12AM
Live Time: 60.00 min.
Real Time: 60.02 min.

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.79% +/- 0.50% TPU(2 sigma)

Efficiency Calibration Name: CCV-8874;AV148-20160627



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	29.04	4,552.00	75.87
Pu-239	240	5,155.40	186	249	32.45	6,017.00	100.28
Am-241	284	5,485.70	249	303	32.21	4,950.00	82.50

Sample Name: CCV-7107;AV175-20160627a
Description:
Detector: AV175

Calibration

Analyst: 60040
Analysis Date: 6/27/2016 2:55:55PM
Calibration Type: Energy And Efficiency

Certificate ID: 82232-334
Prepared by: Analytics
Description:

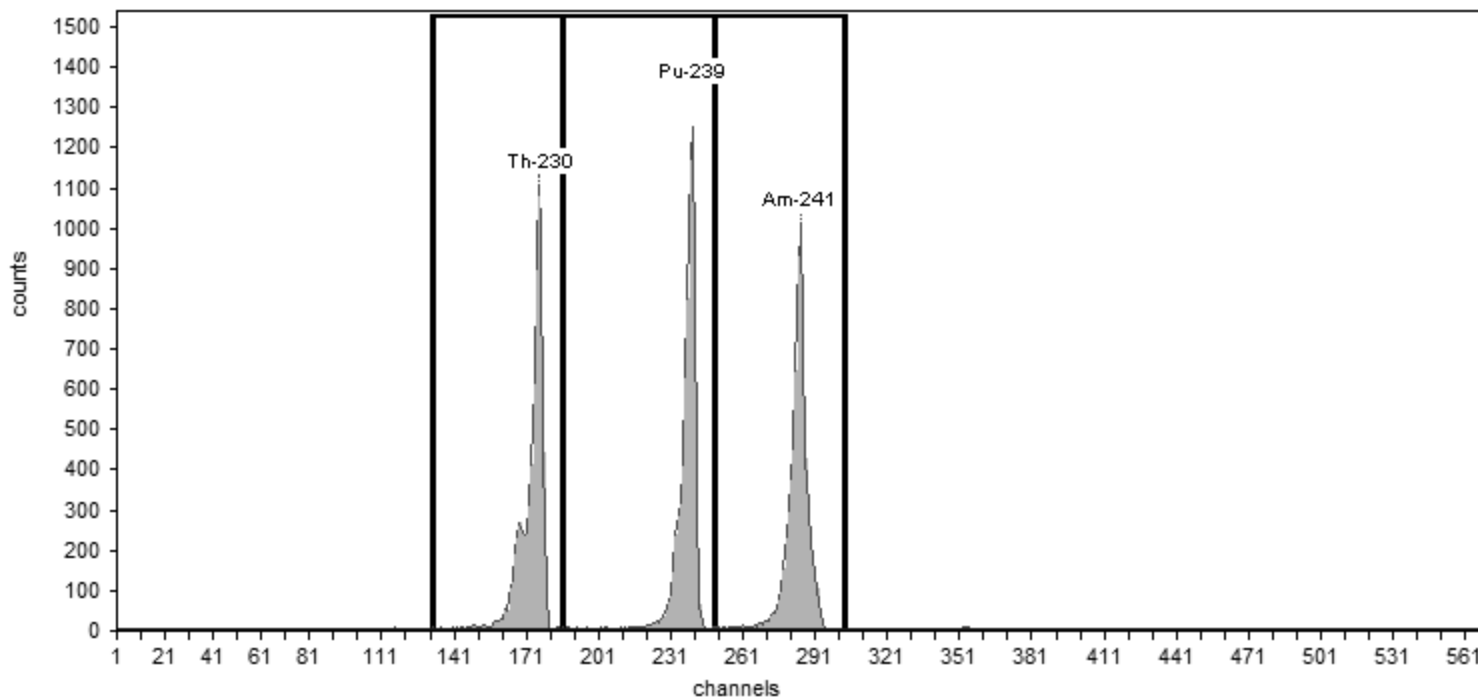
Source Info

Certification Date: 6/3/2010 12:00:00PM

Acquisition

Detector: AV175 , SN: 50-117H1
Acquisition Start Date: 6/27/2016 1:55:44PM
Live Time: 60.00 min.
Real Time: 60.00 min.

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency Calibration Name: CCV-7107;AV175-20160627a
Efficiency: 26.01% +/- 0.40% TPU(2 sigma)



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	29.71	6,867.00	114.45
Pu-239	240	5,155.40	186	249	33.60	7,005.00	116.75
Am-241	284	5,485.70	249	303	32.54	6,747.00	112.45

Sample Name: CCV-8875;AV191-20160628
Description:
Detector: AV191

Calibration

Analyst: 60040
Analysis Date: 6/28/2016 10:29:36AM
Calibration Type: Energy And Efficiency

Certificate ID: 82234-334
Prepared by: Analytics
Description:

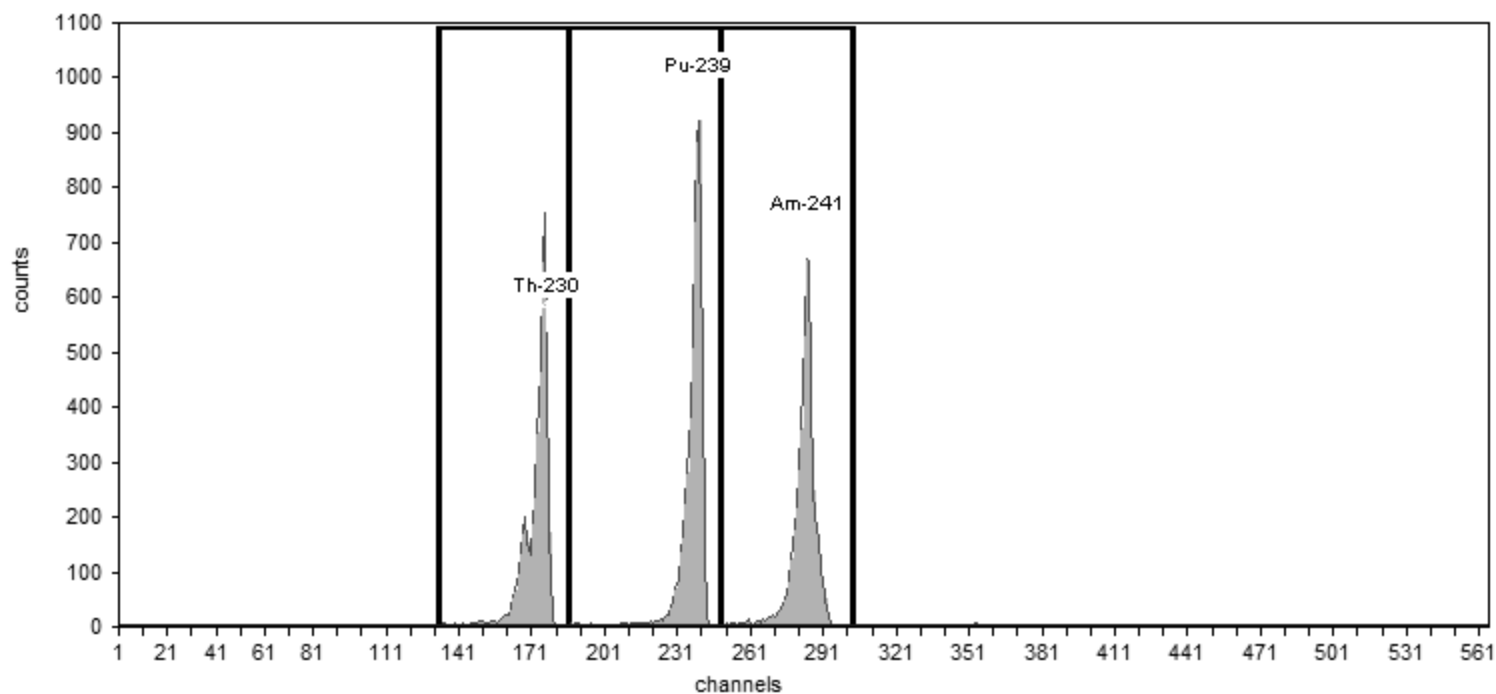
Source Info

Certification Date: 6/2/2010 12:00:00PM

Acquisition

Detector: AV191 , SN: 50-112A2
Acquisition Start Date: 6/28/2016 9:29:31AM
Live Time: 60.00 min.
Real Time: 60.00 min.
Efficiency Calibration Name: CCV-8875;AV191-20160628

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 23.23% +/- 0.44% TPU(2 sigma)



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
Th-230	177	4,687.50	132	186	31.08	4,524.00	75.40
Pu-239	240	5,155.40	186	249	32.78	5,225.00	87.08
Am-241	284	5,485.70	249	303	36.40	4,685.00	78.08

Monthly Backgrounds

Nuclide Summary (ROI)

<u>RegionName</u>	<u>Peak Energy</u> (keV)	<u>Start Energy</u> (keV)	<u>End Energy</u> (keV)	<u>GrossCounts</u>	<u>Count Rate</u> (CPM)	<u>CR Uncertainty</u> (CPM)
Th-232	3,985.93	3,754.75	4,053.05	1.00	1.042E-003	1.473E-003
U-238	4,135.08	3,918.81	4,239.49	0.00	0.000E+000	1.473E-003
U-235	4,358.81	4,261.86	4,463.21	0.00	0.000E+000	1.473E-003
Th-230	4,679.48	4,403.55	4,746.60	0.00	0.000E+000	1.473E-003
U-234	4,709.31	4,507.96	4,821.17	0.00	0.000E+000	1.473E-003
Pu-242	4,903.21	4,679.48	4,947.95	0.00	0.000E+000	1.473E-003
Th-229	4,858.46	4,739.14	5,119.48	2.00	2.083E-003	1.804E-003
Np-237	4,783.89	4,768.97	4,806.26	0.00	0.000E+000	1.473E-003
Po-209	4,918.12	4,903.21	4,933.04	0.00	0.000E+000	1.473E-003
Pu-239	5,179.14	4,970.33	5,238.80	3.00	3.125E-003	2.083E-003
Am-243	5,231.34	5,052.36	5,305.92	3.00	3.125E-003	2.083E-003
U-232	5,253.71	5,059.82	5,402.86	7.00	7.292E-003	2.946E-003
Th-228	5,447.61	5,186.59	5,507.27	14.00	1.458E-002	4.034E-003
Po-210	5,276.09	5,231.34	5,291.00	1.00	1.042E-003	1.473E-003
Pu-238	5,469.98	5,268.63	5,552.01	13.00	1.354E-002	3.898E-003
Am-241	5,484.90	5,298.46	5,604.22	16.00	1.667E-002	4.295E-003
Cm-245	5,417.78	5,395.41	5,447.61	9.00	9.375E-003	3.294E-003
Pu-236	5,760.83	5,611.67	5,887.60	55.00	5.729E-002	7.795E-003
Cm-244	5,775.74	5,641.51	5,902.52	54.00	5.625E-002	7.725E-003
Th-227	6,074.04	5,932.35	6,178.45	9.00	9.375E-003	3.294E-003
Cm-242	6,148.62	6,118.79	6,178.45	0.00	0.000E+000	1.473E-003

Sample Name: **ICB;AV175**

Comment:

Sample

Spectrum #1 Analysis #1

Analyst: **60040**

Batch

Batch Name: **June2016**

Description:

Acquisition

Detector: **AV175**, SN: **50-117H1**

Acquisition Start Date: **6/24/2016 4:15:22PM**

Live Time: **960.00 min.**

Real Time: **960.01 min.**

Calibration Name: **IC-7107;AV175-20151017**

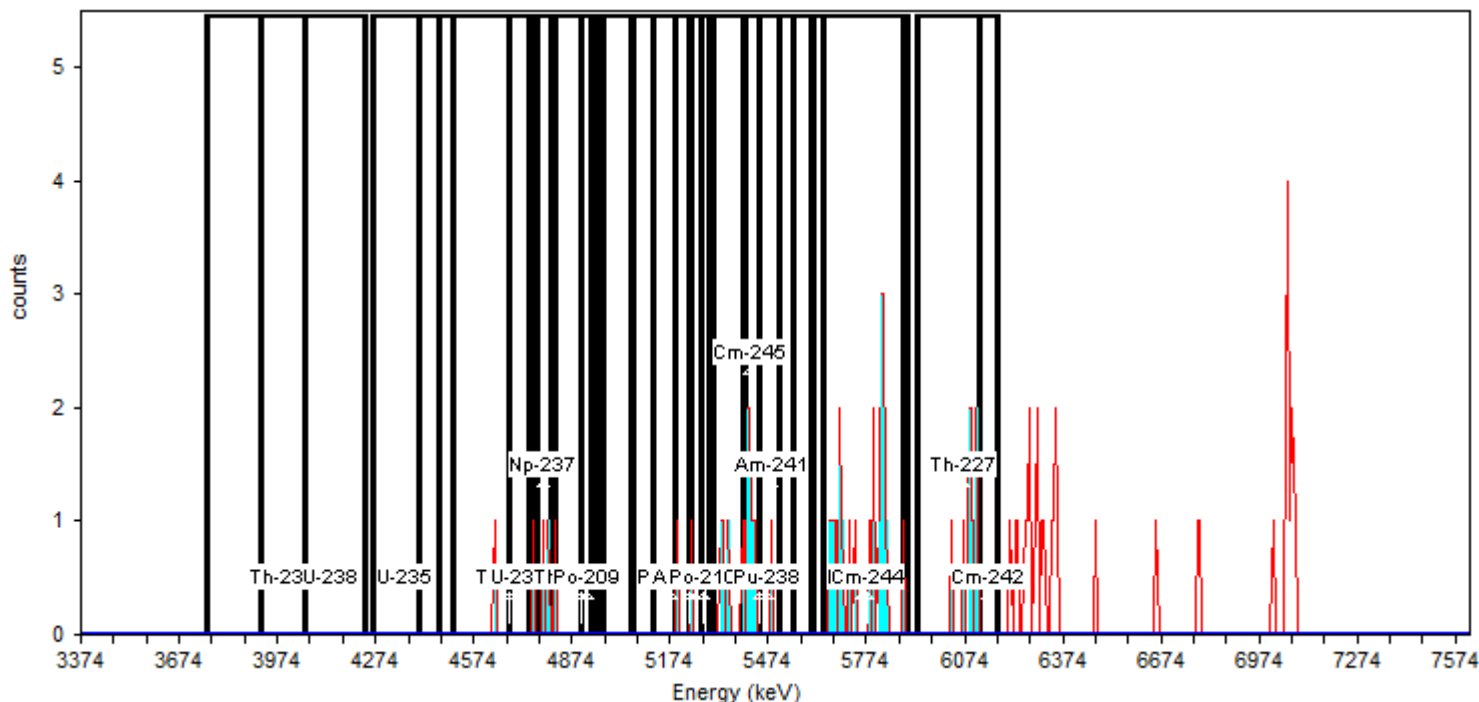
Calibration Date: **10/17/2015 6:01:46PM**

Energy Calibration Equation:

Gain = **7.4575 keV / Ch**

Offset = **3,366.95 keV**

Quadratic = **0.0000 keV / Ch²**



General Analysis

Analysis Method: **Absolute ROI Analysis**, Set Name = **11/05_BackgroundROI**, Nuclide Library: **Background ROI Library**

Total Background Counts: **77.00**

Nuclide Summary (ROI)

<u>RegionName</u>	<u>Peak Energy</u>	<u>Start Energy</u>	<u>End Energy</u>	<u>GrossCounts</u>	<u>Count Rate</u>	<u>CR Uncertainty</u>
	(keV)	(keV)	(keV)		(CPM)	(CPM)
Th-232	3,985.93	3,754.75	4,053.05	0.00	0.000E+000	1.473E-003
U-238	4,135.08	3,918.81	4,239.49	0.00	0.000E+000	1.473E-003
U-235	4,358.81	4,261.86	4,463.21	0.00	0.000E+000	1.473E-003
Th-230	4,679.48	4,403.55	4,746.60	1.00	1.042E-003	1.473E-003
U-234	4,709.31	4,507.96	4,821.17	5.00	5.208E-003	2.552E-003
Pu-242	4,903.21	4,679.48	4,947.95	4.00	4.167E-003	2.329E-003
Th-229	4,858.46	4,739.14	5,119.48	4.00	4.167E-003	2.329E-003
Np-237	4,783.89	4,768.97	4,806.26	2.00	2.083E-003	1.804E-003
Po-209	4,918.12	4,903.21	4,933.04	0.00	0.000E+000	1.473E-003
Pu-239	5,179.14	4,970.33	5,238.80	2.00	2.083E-003	1.804E-003
Am-243	5,231.34	5,052.36	5,305.92	2.00	2.083E-003	1.804E-003
U-232	5,253.71	5,059.82	5,402.86	6.00	6.250E-003	2.756E-003
Th-228	5,447.61	5,186.59	5,507.27	13.00	1.354E-002	3.898E-003
Po-210	5,276.09	5,231.34	5,291.00	1.00	1.042E-003	1.473E-003
Pu-238	5,469.98	5,268.63	5,552.01	11.00	1.146E-002	3.608E-003
Am-241	5,484.90	5,298.46	5,604.22	11.00	1.146E-002	3.608E-003
Cm-245	5,417.78	5,395.41	5,447.61	7.00	7.292E-003	2.946E-003
Pu-236	5,760.83	5,611.67	5,887.60	20.00	2.083E-002	4.774E-003
Cm-244	5,775.74	5,641.51	5,902.52	20.00	2.083E-002	4.774E-003
Th-227	6,074.04	5,932.35	6,178.45	8.00	8.333E-003	3.125E-003
Cm-242	6,148.62	6,118.79	6,178.45	0.00	0.000E+000	1.473E-003

Sample Name: **ICB;AV191**

Comment:

Sample

Spectrum #4 Analysis #1

Analyst: 60040

Batch

Batch Name: **June2016a**

Description:

Acquisition

Detector: **AV191**, SN: **50-112A2**

Acquisition Start Date: **6/26/2016 5:10:12PM**

Live Time: **960.00 min.**

Real Time: **960.01 min.**

Calibration Name: **IC-8875;AV191-20151017**

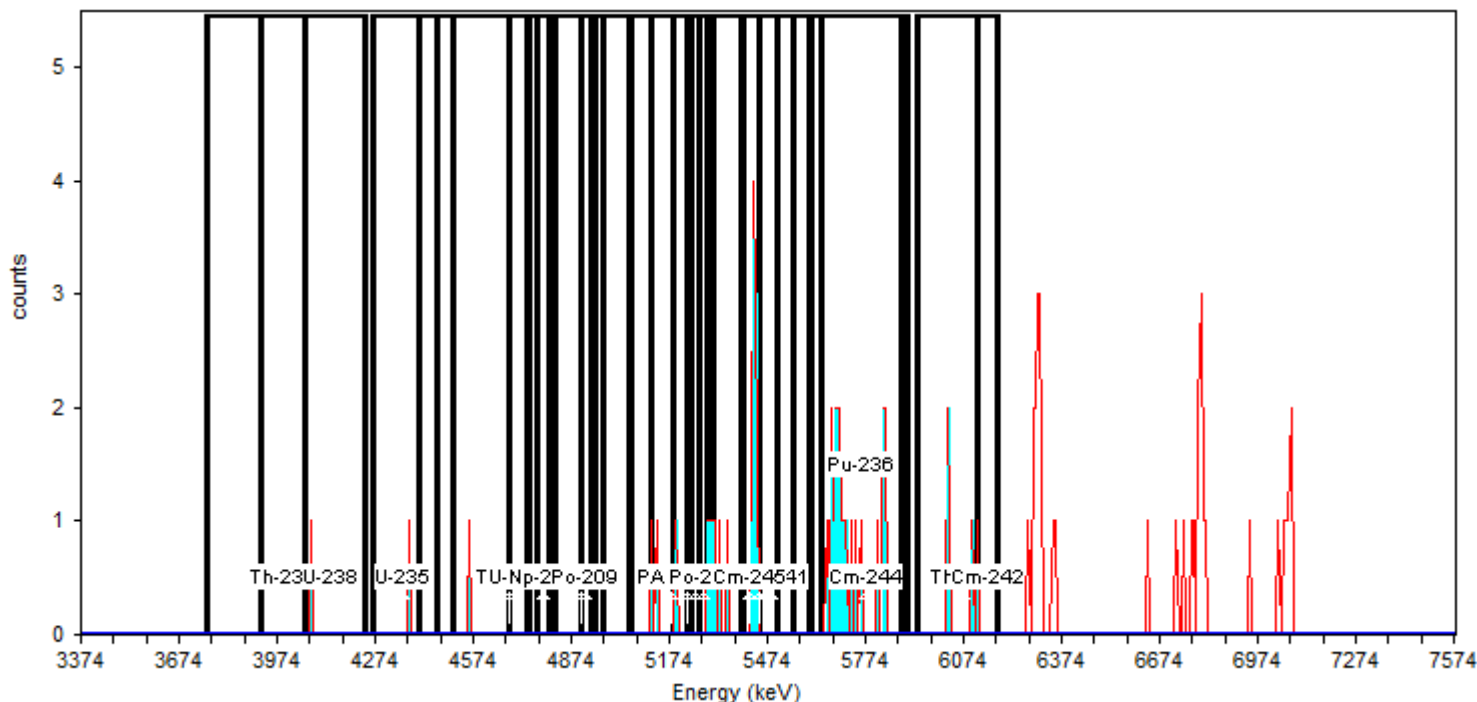
Calibration Date: **10/18/2015 3:55:04PM**

Energy Calibration Equation:

Gain = **7.4575 keV / Ch**

Offset = **3,366.95 keV**

Quadratic = **0.0000 keV / Ch²**



General Analysis

Analysis Method: **Absolute ROI Analysis**, Set Name = **11/05_BackgroundROI**, Nuclide Library: **Background ROI Library**

Total Background Counts: **75.00**

Nuclide Summary (ROI)

<u>RegionName</u>	<u>Peak Energy</u>	<u>Start Energy</u>	<u>End Energy</u>	<u>GrossCounts</u>	<u>Count Rate</u>	<u>CR Uncertainty</u>
	(keV)	(keV)	(keV)		(CPM)	(CPM)
Th-232	3,985.93	3,754.75	4,053.05	0.00	0.000E+000	1.473E-003
U-238	4,135.08	3,918.81	4,239.49	1.00	1.042E-003	1.473E-003
U-235	4,358.81	4,261.86	4,463.21	1.00	1.042E-003	1.473E-003
Th-230	4,679.48	4,403.55	4,746.60	1.00	1.042E-003	1.473E-003
U-234	4,709.31	4,507.96	4,821.17	1.00	1.042E-003	1.473E-003
Pu-242	4,903.21	4,679.48	4,947.95	0.00	0.000E+000	1.473E-003
Th-229	4,858.46	4,739.14	5,119.48	1.00	1.042E-003	1.473E-003
Np-237	4,783.89	4,768.97	4,806.26	0.00	0.000E+000	1.473E-003
Po-209	4,918.12	4,903.21	4,933.04	0.00	0.000E+000	1.473E-003
Pu-239	5,179.14	4,970.33	5,238.80	3.00	3.125E-003	2.083E-003
Am-243	5,231.34	5,052.36	5,305.92	6.00	6.250E-003	2.756E-003
U-232	5,253.71	5,059.82	5,402.86	9.00	9.375E-003	3.294E-003
Th-228	5,447.61	5,186.59	5,507.27	15.00	1.563E-002	4.167E-003
Po-210	5,276.09	5,231.34	5,291.00	1.00	1.042E-003	1.473E-003
Pu-238	5,469.98	5,268.63	5,552.01	14.00	1.458E-002	4.034E-003
Am-241	5,484.90	5,298.46	5,604.22	13.00	1.354E-002	3.898E-003
Cm-245	5,417.78	5,395.41	5,447.61	8.00	8.333E-003	3.125E-003
Pu-236	5,760.83	5,611.67	5,887.60	19.00	1.979E-002	4.658E-003
Cm-244	5,775.74	5,641.51	5,902.52	19.00	1.979E-002	4.658E-003
Th-227	6,074.04	5,932.35	6,178.45	4.00	4.167E-003	2.329E-003
Cm-242	6,148.62	6,118.79	6,178.45	1.00	1.042E-003	1.473E-003

Run Logs

Alpha Spectroscopy Run Log

Detector: AV148

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/16/15 16:27	140	IC 160-223445/1		223445			PS
10/26/15 19:10	60	ICV 160-223563/1		223563			PS
06/24/16 16:15	960	ICB 160-258037/1		258037			PS
06/27/16 10:48	60	CCV 160-258276/1		258276			PS
07/08/16 08:48	1	PULSER 160-259861/1		259861			ALD
07/08/16 12:38	400	LCS 160-257496/2-A		259861	257496	A-01-R	ALD

Detector: AV175

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 14:48	140	IC 160-223472/1		223472			PS
10/31/15 14:14	60	ICV 160-223590/1		223590			
10/31/15 17:26	60	ICV 160-223590/2		223590			PS
06/24/16 16:15	960	ICB 160-258064/1		258064			PS
06/27/16 13:55	60	CCV 160-258301/1		258301			PS
07/08/16 08:47	1	PULSER 160-259885/1		259885			ALD
07/08/16 12:38	400	160-17842-1	WR111-REF-018-SS-P-01	259885	257496	A-01-R	ALD

Detector: AV191

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 18:13	140	IC 160-223488/1		223488			PS
11/01/15 14:23	60	ICV 160-223606/1		223606			
11/01/15 18:11	60	ICV 160-223606/2		223606			PS
06/26/16 17:10	960	ICB 160-258139/1		258139			PS
06/28/16 09:29	60	CCV 160-258354/1		258354			PS
07/11/16 09:24	1	PULSER 160-260076/1		260076			ALD
07/11/16 11:38	240	ZZZZZ		260076			
07/11/16 19:29	400	MB 160-257496/1-A		260076	257496	A-01-R	ALD

Detector: AV194

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/17/15 18:13	140	IC 160-223491/1		223491			PS
11/01/15 14:24	60	ICV 160-223609/1		223609			PS
06/24/16 16:15	960	ICB 160-258075/1		258075			PS
06/27/16 13:49	60	CCV 160-258306/1		258306			PS
07/11/16 09:24	1	PULSER 160-260077/1		260077			ALD
07/11/16 11:38	240	ZZZZZ		260077			
07/11/16 19:29	400	ZZZZZ		260077			

GAMMA SPECTROSCOPY

Method 901.1

Ra-226

Radium-226 & Other Gamma Emitters
(GS) by Method 901.1

Prep Batch: 257318

Fill Geometry, 21-Day In-Growth

Gamma Spectroscopy Analysis Detail Report

Prep Batch: 257318

Lab ID: MB 160-257318/1-A Analyzed: 07/12/16 10:01 Ts: 30 Sigma: 2
Client ID: Detector: GV12 Decay Corrected: No

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	0.009406	0.0172	0.0173	U	pCi/g	0.500	0.284	260174

Lab ID: LCS 160-257318/2-A Analyzed: 07/12/16 09:59 Ts: 30 Sigma: 2
Client ID: Detector: GV16 Decay Corrected: No

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Americium-241	99.51	1.56	10.4		pCi/g		1.13	260175
Cesium-137	29.46	0.673	3.14		pCi/g		0.226	260175
Cobalt-60	16.65	0.409	1.72		pCi/g		0.0983	260175

Lab ID: 160-17842-1 Analyzed: 07/12/16 12:20 Ts: 30 Sigma: 2
Client ID: WR111-REF-018-SS-P-00 Detector: GV14 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	LOQ	MDC	Anly Batch
Radium-226	1.49	0.269	0.310		pCi/g	0.500	0.243	260176

Quality Control Summary

Method Blank ID:	Analyte	Parent Result	Spike Added	MB Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
MB 160-257318/1-A	Radium-226			0.009406	U	pCi/g							1.089641 66
Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-257318/2-A	Americium-241		97.1	99.51		pCi/g	102	87 - 116					.3286939 377
LCS 160-257318/2-A	Cesium-137		29.6	29.46		pCi/g	100	87 - 120					-.0594747 997
LCS 160-257318/2-A	Cobalt-60		16.9	16.65		pCi/g	98	87 - 115					-.2306063 569

Glossary:

Ts = Count Duration, Sample

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-17842-1

SDG No.: _____

Batch Number: 257318 Batch Start Date: 06/21/16 13:11 Batch Analyst: Sloan, Robert 1Batch Method: Fill_Geo-21 Batch End Date: 06/21/16 15:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	TareWeight	GrossWeight	InitialAmount	IngDecDate1	IngDecDate3	Geometry
MB 160-257318/1		Fill_Geo-21, 901.1				291.18 g	6/21/2016	7/12/2016	Tuna Can
LCS 160-257318/2		Fill_Geo-21, 901.1				341.9 g	6/21/2016	7/12/2016	Tuna Can
160-17842-A-1-A	WR111-REF-018-SS -P-00	Fill_Geo-21, 901.1	T	46.6 g	302.6 g	256 g	6/21/2016	7/12/2016	Tuna Can

Lab Sample ID	Client Sample ID	Method Chain	Basis	Tuna Can LCS 00005					
MB 160-257318/1		Fill_Geo-21, 901.1							
LCS 160-257318/2		Fill_Geo-21, 901.1		# g					
160-17842-A-1-A	WR111-REF-018-SS -P-00	Fill_Geo-21, 901.1	T						

Batch Notes	
Balance ID	1121432711
SOP Number	ST-RC-0003 ST-RC-0025

Basis	Basis Description
T	Total/NA

The pound sign (#) in the amount added field denotes that the reagent was used undiluted. All calculations are performed using the stated concentration for this reagent.

Sample Description: 257318_Gamma_MB 160-257318~1-A

Detector: Detector #12

Batch ID: 257318

Work Order Number: Gamma

Lot Number: MB 160-257318~1-A

Decay to Time: 7/12/2016 10:01 Live Time: 1800 sec
 Acquisition Time: 7/12/2016 10:01:40 Real Time: 1810 sec
 Analysis Time: 7/12/2016 10:33 Dead Time: 0.53 %
 Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 12_Soil_TunaCan.Clb

Efficiency Cal Desc: 12_TunaCanCal_90099_100212

Efficiency Cal Date: 10/4/2012 09:05

Energy Cal Date: 2/28/2012 13:26

Library: Client_Long_Rev11.lib

Bkgd Correction File: 12_2016-07-10_1414.PBC

Nuclide	Activity Bq/Sample	1-Sigma Counting Uncert %	1-Sigma Counting Uncert Bq/Sample	1-Sigma Total Uncert Bq/Sample	Minimum Detectable Activity Bq/Sample
BE-7	1.681E+00	110.5	1.857E+00	1.859E+00	6.427E+00
NA-22	-5.823E-01	64.8	3.773E-01	3.785E-01	1.243E+00
K-40	3.246E+00	73.0	2.371E+00	2.376E+00	7.749E+00
Sc-46	-3.562E-01	96.5	3.438E-01	3.443E-01	1.174E+00
CR-51	1.513E+00	180.1	2.725E+00	2.726E+00	9.351E+00
MN-54	-2.804E-02	698.2	1.958E-01	1.958E-01	5.374E-01
FE-59	-1.134E+00	26.5	3.001E-01	3.054E-01	2.226E+00
Co-56	4.335E-03	371.7	1.612E-02	1.612E-02	3.135E-01
CO-57	9.890E-02	190.9	1.888E-01	1.889E-01	4.719E-01
CO-58	-1.861E-01	174.3	3.244E-01	3.245E-01	1.141E+00
CO-60	1.050E-01	44.5	4.671E-02	4.701E-02	8.319E-01
ZN-65	0.000E+00	1.#INF	2.074E-01	2.074E-01	2.442E+00
NB-94	1.285E-01	82.5	1.059E-01	1.061E-01	7.607E-01
ZR-95	5.509E-01	37.8	2.085E-01	2.104E-01	5.287E-01
NB-95	1.975E-01	114.9	2.269E-01	2.271E-01	7.957E-01
RU-103	-2.106E-01	147.7	3.110E-01	3.112E-01	7.707E-01
RH-106	0.000E+00	1.#INF	4.811E-01	4.812E-01	1.380E+01
AG-108M	2.880E-02	562.7	1.621E-01	1.621E-01	4.576E-01
AG-110M	3.507E-02	330.5	1.159E-01	1.159E-01	1.255E+00
SN-113	-3.567E-01	118.6	4.230E-01	4.234E-01	1.443E+00
SB-124	7.453E-02	514.2	3.832E-01	3.832E-01	1.342E+00
SB-125	-1.192E+00	94.5	1.126E+00	1.128E+00	2.805E+00
I-131	3.247E-01	99.9	3.243E-01	3.247E-01	6.644E-01
Gd-153	3.840E-01	103.0	3.954E-01	3.961E-01	1.566E+00
Ga-68	-1.957E+01	89.5	1.751E+01	1.754E+01	3.866E+01
Tc-99m	1.114E-01	196.9	2.194E-01	2.195E-01	7.502E-01
BA-133	1.498E-01	165.9	2.485E-01	2.487E-01	6.638E-01
CS-134	9.229E-01	26.9	2.486E-01	2.532E-01	1.375E+00
CS-137	-2.952E-01	170.7	5.039E-01	5.041E-01	1.042E+00
CE-139	-3.566E-02	487.6	1.739E-01	1.739E-01	6.133E-01
Ba-140	5.283E-01	150.4	7.944E-01	7.948E-01	2.054E+00
La-140	1.422E-01	106.2	1.510E-01	1.512E-01	5.370E-01
CE-141	2.040E-01	208.2	4.247E-01	4.248E-01	1.451E+00

(Page 1 of 21)

CE-144	9.065E-01	191.4	1.735E+00	1.735E+00	5.919E+00
PM-144	9.893E-02	250.6	2.479E-01	2.480E-01	6.287E-01
EU-152	1.870E+00	22.4	4.181E-01	4.293E-01	2.254E+00
EU-154	-2.009E+00	113.0	2.270E+00	2.273E+00	7.905E+00
EU-155	3.459E-01	140.7	4.866E-01	4.869E-01	2.718E+00
HF-181	1.998E-01	165.3	3.303E-01	3.304E-01	9.075E-01
Ta-182	7.192E-02	639.3	4.598E-01	4.598E-01	3.554E+00
Hg-203	-1.316E-01	101.2	1.331E-01	1.333E-01	6.998E-01
TL-208	3.231E-01	46.1	1.489E-01	1.498E-01	4.997E-01
pm-146	2.521E-01	100.9	2.544E-01	2.548E-01	1.479E+00
y-88	5.451E-01	24.3	1.327E-01	1.356E-01	3.495E-01
Cd-113m	1.640E+03	133.5	2.189E+03	2.192E+03	7.658E+03
Cd-109	-2.468E+00	233.0	5.749E+00	5.750E+00	1.963E+01
Cf-251	-3.330E-01	273.3	9.100E-01	9.104E-01	2.454E+00
Cf-249	9.579E-02	371.9	3.563E-01	3.563E-01	1.257E+00
Sn-126	1.595E+00	132.4	2.112E+00	2.114E+00	7.204E+00
PB-210	-1.118E+01	69.0	7.718E+00	7.745E+00	2.805E+01
PB-212	2.677E-01	101.1	2.706E-01	2.712E-01	8.574E-01
PB-214	-3.290E-02	1263.9	4.158E-01	4.158E-01	1.515E+00
BI-207	-2.660E-02	225.1	5.987E-02	5.989E-02	7.642E-01
BI-212	2.166E+00	164.4	3.560E+00	3.562E+00	1.256E+01
BI-214	1.013E-01	91.6	9.285E-02	9.300E-02	3.058E+00
BI-210M	-3.310E-02	780.7	2.584E-01	2.584E-01	9.805E-01
AC-228	0.000E+00	1.#INF	2.191E-01	2.191E-01	2.703E+00
TH-227	2.587E+00	138.8	3.592E+00	3.595E+00	1.225E+01
TH-229	-2.179E+00	130.9	2.852E+00	2.857E+00	1.152E+01
TH-234	-7.803E+00	92.2	7.197E+00	7.208E+00	2.552E+01
PA-231	0.000E+00	1.#INF	1.991E+00	1.991E+00	3.421E+01
PA-233	0.000E+00	1.#INF	2.439E-01	2.439E-01	2.794E+00
PA-234	6.156E-01	159.0	9.785E-01	9.791E-01	3.336E+00
PA-234M	0.000E+00	1.#INF	5.767E+00	5.767E+00	1.578E+02
U-235	8.163E-01	132.5	1.082E+00	1.083E+00	6.282E+00
AM-241	6.015E-01	125.6	7.553E-01	7.559E-01	2.557E+00
Np-237	9.664E-01	133.2	1.287E+00	1.288E+00	4.386E+00
Ir-192	0.000E+00	1.#INF	6.792E-02	6.792E-02	1.167E+00
Cs-136	3.226E-01	95.6	3.085E-01	3.091E-01	1.055E+00
Np-239	-5.629E-01	158.0	8.891E-01	8.898E-01	3.019E+00
Nd-147	7.721E-02	1811.1	1.398E+00	1.398E+00	3.805E+00

Total	1.666E+03				
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Analyst: Amanda Dick

Sample description
257318_Gamma_MB 160-257318~1-A

Spectrum Filename: C:\User\SPC\Det12\12_Gamma_20161453.An1

Acquisition information

Start time: 7/12/2016 10:01:40 AM
Live time: 1800
Real time: 1810
Dead time: 0.53 %
Detector ID: 12

Detector system

Ge12 S/N10034336

Calibration

Filename: 12_Soil_TunaCan.Clb
12_TunaCanCal_90099_100212

Energy Calibration

Created: 2/28/2012 1:26:42 PM
Zero offset: 0.049 keV
Gain: 0.250 keV/channel
Quadratic: -3.945E-08 keV/channel^2

Efficiency Calibration

Created: 10/4/2012 9:05:44 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.70 %
Log(Eff): $-7.827468E-01 + (-3.001271E-01 * \text{Log}(E)) + (-3.369562E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 0.96 %
Log(Eff): $-2.288409E+01 + (8.352717E+00 * \text{Log}(E)) + (-8.812368E-01 * \text{Log}(E)^2)$

Library Files

Main analysis library: Client_Long_Rev11.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G800W064
Start channel: 150 (37.58keV)
Stop channel: 8000 (1999.36keV)
Peak rejection level: 1000.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00 +/- 0.000E+00%
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

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Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: 3
 Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	7/12/2016 10:01:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	12_2016-07-10_1414.PBC 7/10/2016 2:14:56 PM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 1 cutoff: 5.00E+01 %
 Energy Calibration
 Normalized diff: 0.2819

***** S U M M A R Y O F P E A K S I N R A N G E *****									
Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq/Sampl	Nuc	
46.54	-19.	69.03	0.89	2.229E-02	46.54	4.250	PBC<MDA	PB210	
50.14	9.	138.85	0.89	2.496E-02	50.14	8.000	PBC<MDA	TH227	
59.54	12.	125.58	0.90	3.122E-02	59.54	35.900	PBC<MDA	AM241	
63.29	-18.	92.23	0.91	3.338E-02	63.29	3.810	PBC<MDA	TH234	
64.28	9.	132.42	0.91	3.392E-02	64.28	9.700	PBC<MDA	Sn126	
80.99	8.	107.07	0.92	4.091E-02	80.99	34.060	PBC<MDA	BA133	
86.49	10.	133.16	0.93	4.242E-02	86.49	13.100	PBC<MDA	Np237	
					86.54	30.700	4.122E-01	EU155	
					86.94	9.040	1.397E+00	Sn126	
86.54	10.	140.68	0.93	4.243E-02	86.49	13.100	PBC<MDA	Np237	
					86.54	30.700	4.124E-01	EU155	
					86.94	9.040	1.397E+00	Sn126	
92.59	-21.	60.47	0.93	4.369E-02	92.59	5.584	PBC<MDA	TH234	
93.35	6.	118.97	0.93	4.382E-02	93.35	5.561	PBC<MDA	AC228	
97.50	8.	137.23	0.94	4.443E-02	97.50	30.000	PBC<MDA	Gd153	
99.50	8.	145.78	0.94	4.467E-02	99.50	15.000	PBC<MDA	Np239	
103.20	8.	153.55	0.94	4.502E-02	103.20	21.800	PBC<MDA	Gd153	
103.70	8.	161.38	0.94	4.505E-02	103.70	24.000	PBC<MDA	Np239	
105.31	4.	315.38	0.95	4.516E-02	105.31	21.200	PBC<MDA	EU155	
121.78	22.	35.79	0.96	4.528E-02	121.78	28.580	PBC<MDA	EU152	
					122.06	85.600	3.154E-01	CO57	
131.29	9.	158.96	0.97	4.468E-02	131.29	18.000	PBC<MDA	PA234	

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
133.02	9.	165.32	0.97	4.453E-02	133.02	43.300	PBC<MDA	HF181
133.54	8.	191.36	0.97	4.448E-02	133.54	11.090	PBC<MDA	CE144
136.30	9.	177.76	0.98	4.422E-02	136.30	5.850	PBC<MDA	HF181
					136.47	10.680	1.055E+00	CO57
136.47	8.	190.87	0.98	4.420E-02	136.30	5.850	PBC<MDA	HF181
					136.47	10.680	8.916E-01	CO57
140.51	8.	196.91	0.98	4.377E-02	140.51	89.300	PBC<MDA	Tc99m
143.79	4.	439.63	0.98	4.338E-02	143.79	10.960	PBC<MDA	U235
145.44	8.	208.18	0.98	4.318E-02	145.44	48.200	PBC<MDA	CE141
163.38	6.	132.53	1.00	4.061E-02	163.38	5.080	PBC<MDA	U235
224.72	15.	30.55	0.74	3.351E-02				
238.33	7.	101.10	1.32	3.220E-02	238.63	43.300	PBC<MDA	PB212
242.00	8.	149.96	1.07	3.189E-02	242.00	7.430	PBC<MDA	PB214
263.70	5.	133.46	1.09	3.010E-02	263.70	0.006	PBC<MDA	Cd113m
277.28	12.	46.07	1.11	2.910E-02	277.28	6.310	PBC<MDA	TL208
284.30	7.	121.71	1.11	2.861E-02	284.30	6.140	PBC<MDA	I131
300.03	8.	164.11	1.13	2.757E-02	300.03	3.280	PBC<MDA	PB212
					300.07	2.460	PBC<MDA	PA231
					300.18	6.200	PBC<MDA	PA233
320.08	7.	180.07	1.15	2.638E-02	320.08	9.940	PBC<MDA	CR51
328.76	8.	106.23	1.15	2.589E-02	328.76	20.300	PBC<MDA	La140
344.29	4.	195.31	1.17	2.508E-02	344.29	26.500	PBC<MDA	EU152
345.83	2.	503.19	1.17	2.500E-02	345.83	15.070	PBC<MDA	HF181
356.00	4.	165.93	1.18	2.450E-02	356.00	62.050	PBC<MDA	BA133
383.84	8.	109.69	1.20	2.325E-02	383.84	8.940	PBC<MDA	BA133
387.95	3.	371.91	1.21	2.307E-02	387.95	66.000	PBC<MDA	Cf249
433.94	1.	562.73	1.25	2.132E-02	433.94	90.480	PBC<MDA	AG108M
453.88	6.	100.92	1.27	2.065E-02	453.88	65.000	PBC<MDA	pm146
463.37	1.	496.33	1.28	2.035E-02	463.37	10.470	PBC<MDA	SB125
477.60	6.	110.47	1.29	1.991E-02	477.60	10.520	PBC<MDA	BE7
482.00	1.	716.60	1.29	1.978E-02	482.00	80.500	PBC<MDA	HF181
511.86	31.	51.28	2.57	1.895E-02	511.86	20.000	4.496E+00	RH106
537.26	4.	150.37	1.34	1.829E-02	537.26	24.390	PBC<MDA	Ba140
569.32	4.	136.93	1.37	1.754E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	1.545E+00	PA234
					569.70	97.740	PBC<MDA	BI207
583.02	2.	175.76	1.38	1.724E-02	583.02	84.500	PBC<MDA	TL208
600.50	7.	131.96	1.40	1.687E-02	600.50	17.860	PBC<MDA	SB125
602.73	2.	514.17	1.40	1.683E-02	602.73	98.260	PBC<MDA	SB124
609.31	-6.	189.81	1.41	1.669E-02	609.31	46.090	PBC<MDA	BI214
636.97	7.	99.87	1.43	1.616E-02	636.97	7.170	PBC<MDA	I131
657.76	2.	330.45	1.45	1.578E-02	657.76	94.640	PBC<MDA	AG110M
696.54	3.	250.62	1.48	1.513E-02	696.54	99.000	PBC<MDA	PM144
702.63	1.	800.00	1.49	1.503E-02	702.63	97.900	PBC<MDA	NB94
727.17	4.	164.36	1.51	1.465E-02	727.17	7.550	PBC<MDA	BI212
735.72	5.	146.39	1.51	1.452E-02	735.72	22.500	PBC<MDA	pm146
756.73	8.	37.84	1.53	1.422E-02	756.73	54.460	5.509E-01	ZR95
765.79	5.	114.89	1.54	1.410E-02	765.79	99.790	PBC<MDA	NB95

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					766.41	0.294	6.707E+01	PA234M
778.92	4.	184.30	1.55	1.392E-02	778.92	12.940	PBC<MDA	EU152
801.95	24.	26.93	1.57	1.362E-02	801.95	8.690	1.147E+01	CS134
818.50	8.	95.65	1.58	1.341E-02	818.50	100.000	PBC<MDA	Cs136
871.10	5.	82.46	1.63	1.279E-02	871.10	99.890	PBC<MDA	NB94
880.53	5.	107.85	1.63	1.269E-02	880.53	6.000	PBC<MDA	PA234
898.04	10.	33.46	1.65	1.250E-02	898.04	93.700	4.582E-01	y88
964.11	5.	81.01	1.70	1.184E-02	964.11	14.605	PBC<MDA	EU152
1063.66	1.	501.66	1.78	1.099E-02	1063.66	74.500	PBC<MDA	BI207
1112.07	20.	22.36	1.82	1.061E-02	1112.07	13.644	7.672E+00	EU152
1120.29	-4.	106.80	1.83	1.055E-02	1120.29	15.100	PBC<MDA	BI214
					1120.55	99.987	PBC<MDA	Sc46
1173.24	6.	44.47	1.87	1.018E-02	1173.24	99.900	PBC<MDA	CO60
1189.05	1.	796.87	1.88	1.008E-02	1189.05	16.200	PBC<MDA	Ta182
1238.28	1.	691.09	1.92	9.765E-03	1238.28	66.070	PBC<MDA	Co56
1460.83	5.	73.04	2.08	8.576E-03	1460.83	10.670	PBC<MDA	K40
1764.49	4.	91.63	2.30	7.376E-03	1764.49	15.400	PBC<MDA	BI214
1836.06	8.	35.36	2.35	7.144E-03	1836.06	99.200	6.271E-01	y88

***** U N I D E N T I F I E D P E A K S U M M A R Y *****								
Peak Centroid	Background	Net Area	Efficiency	Uncert	FWHM	Suspected		
Channel	Energy	Counts	Counts	* Area	1 Sigma %	keV	Nuclide	
897.97	224.72	2.	15.	4.476E+02	30.55	0.744	-	s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.

 This section based on library: Client_Long_Rev11.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****								
Nuclide	Peak	Centroid	Background	Net Area	Intensity	Uncert	FWHM	
	Channel	Energy	Counts	Counts	Cts/Sec	1 Sigma %	keV	
PB-210	185.80	46.54	94.	-19.	-0.011	69.03	0.889s	
TH-227	200.19	50.14	79.	9.	0.005	138.85	0.893s	
AM-241	237.74	59.54	110.	12.	0.007	125.58	0.902s	
TH-234	252.73	63.29	143.	-18.	-0.010	92.23	0.905	
Sn-126	256.70	64.28	74.	9.	0.005	132.42	0.906	
BA-133	323.48	80.99	23.	8.	0.005	107.07	0.922s	
Np-237	345.47	86.49	78.	10.	0.005	133.16	0.928s	
EU-155	345.68	86.54	88.	10.	0.005	140.68	0.928s	
Sn-126	347.27	86.94	150.	-13.	-0.007	137.18	0.928s	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Sn-126	349.78	87.57	142.	-17.	-0.010	96.83	0.929s
Cd-109	351.66	88.04	137.	-7.	-0.004	232.96	0.929s
TH-234	369.85	92.59	88.	-21.	-0.012	60.47	0.934
AC-228	372.88	93.35	27.	6.	0.004	118.97	0.934s
Gd-153	389.47	97.50	56.	8.	0.004	137.23	0.938s
Np-239	397.47	99.50	64.	8.	0.004	145.78	0.940s
Gd-153	412.25	103.20	72.	8.	0.004	153.55	0.944s
Np-239	414.25	103.70	80.	8.	0.004	161.38	0.944s
EU-155	420.70	105.31	90.	4.	0.002	315.38	0.946s
Np-239	423.96	106.13	130.	-10.	-0.006	157.97	0.946s
EU-152	486.50	121.78	20.	22.	0.012	35.79	0.961s
CO-57	487.64	122.06	42.	0.	0.000	1000.00	0.962s
EU-154	491.79	123.10	48.	-8.	-0.005	124.61	0.963s
PA-234	524.55	131.29	96.	9.	0.005	158.96	0.970s
HF-181	531.46	133.02	105.	9.	0.005	165.32	0.972s
CE-144	533.51	133.54	114.	8.	0.004	191.36	0.973s
HF-181	544.55	136.30	122.	9.	0.005	177.76	0.975s
CO-57	545.24	136.47	101.	8.	0.004	190.87	0.975s
Tc-99m	561.38	140.51	108.	8.	0.004	196.91	0.979s
U-235	574.47	143.79	120.	4.	0.002	439.63	0.982
CE-141	581.09	145.44	123.	8.	0.004	208.18	0.984s
Ba-140	649.91	162.66	70.	-12.	-0.006	106.58	1.000s
U-235	652.79	163.38	31.	6.	0.003	132.53	1.001s
CE-139	662.68	165.85	51.	-2.	-0.001	487.64	1.003s
Cf-251	705.64	176.60	33.	-4.	-0.002	273.29	1.013s
TH-229	773.22	193.51	44.	-6.	-0.004	130.87	1.029s
U-235	820.49	205.33	52.	-12.	-0.006	73.15	1.040
TH-229	842.54	210.85	29.	-8.	-0.005	126.43	1.046s
Cf-251	907.10	227.00	42.	-9.	-0.005	106.87	1.061s
PB-212	952.39	238.33	16.	7.	0.004	101.10	1.320s
PB-214	967.05	242.00	60.	8.	0.004	149.96	1.075s
EU-152	977.83	244.69	74.	-7.	-0.004	94.04	1.077s
TH-227	1023.99	256.24	33.	-7.	-0.004	158.11	1.088s
Cd-113m	1053.81	263.70	23.	5.	0.003	133.46	1.095s
BI-210M	1062.33	265.83	26.	-1.	0.000	780.66	1.097s
TL-208	1108.11	277.28	9.	12.	0.007	46.07	1.107s
Hg-203	1115.78	279.20	34.	-6.	-0.003	101.18	1.109s
I-131	1136.16	284.30	19.	7.	0.004	121.71	1.114s
PB-212	1199.05	300.03	88.	8.	0.005	164.11	1.128
PA-233	1199.65	300.18	97.	0.	0.000	1000.00	1.128s
PA-231	1209.52	302.65	97.	0.	0.000	1000.00	1.131s
BA-133	1210.33	302.85	97.	0.	0.000	1000.00	1.131s
Ba-140	1218.32	304.85	97.	0.	0.000	1000.00	1.133s
BI-210M	1218.50	304.90	97.	0.	0.000	1000.00	1.133s
Ir-192	1232.67	308.44	97.	0.	0.000	1000.00	1.136s
PA-233	1246.95	312.01	97.	0.	0.000	1000.00	1.139s
Ir-192	1264.85	316.49	97.	0.	0.000	1000.00	1.143s
CR-51	1279.22	320.08	79.	7.	0.004	180.07	1.147s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
La-140	1313.91	328.76	29.	8.	0.004	106.23	1.155s
Cf-249	1332.62	333.44	51.	-10.	-0.005	106.89	1.159s
Cs-136	1361.13	340.57	46.	0.	0.000	1000.00	1.165s
EU-152	1375.98	344.29	27.	4.	0.002	195.31	1.169s
HF-181	1382.15	345.83	34.	2.	0.001	503.19	1.170s
BA-133	1422.81	356.00	11.	4.	0.002	165.93	1.180s
I-131	1456.73	364.48	20.	-3.	-0.002	297.52	1.187s
BA-133	1534.13	383.84	38.	8.	0.005	109.69	1.205s
Cf-249	1550.56	387.95	46.	3.	0.001	371.91	1.209s
SN-113	1565.51	391.69	58.	-9.	-0.005	118.58	1.212s
SB-125	1710.19	427.88	40.	-14.	-0.008	94.48	1.245s
AG-108M	1734.43	433.94	8.	1.	0.001	562.73	1.250s
pm-146	1814.18	453.88	8.	6.	0.003	100.92	1.268s
SB-125	1852.11	463.37	23.	1.	0.001	496.33	1.277s
Ir-192	1870.88	468.06	23.	-1.	-0.001	685.57	1.281s
BE-7	1909.00	477.60	21.	6.	0.004	110.47	1.289s
HF-181	1926.61	482.00	25.	1.	0.001	716.60	1.293s
La-140	1946.69	487.02	28.	-1.	-0.001	754.98	1.298s
RU-103	1986.82	497.05	22.	-7.	-0.004	147.69	1.307s
RH-106	2046.04	511.86	33.	31.	0.017	51.28	2.570s
Ba-140	2147.60	537.26	9.	4.	0.002	150.37	1.342s
CS-134	2251.48	563.24	13.	-5.	-0.003	153.84	1.365s
CS-134	2275.81	569.32	13.	4.	0.002	136.93	1.370s
PA-234	2276.41	569.47	17.	0.	0.000	1000.00	1.370s
BI-207	2277.34	569.70	20.	-3.	-0.002	225.12	1.371s
TL-208	2330.60	583.02	5.	2.	0.001	175.76	1.382s
SB-125	2400.51	600.50	38.	7.	0.004	131.96	1.398s
SB-124	2409.43	602.73	64.	2.	0.001	514.17	1.399s
CS-134	2417.34	604.71	66.	0.	0.000	1000.00	1.401s
BI-214	2435.75	609.31	72.	-6.	-0.004	189.81	1.405
RU-103	2439.69	610.30	66.	0.	0.000	1000.00	1.406s
AG-108M	2455.62	614.28	66.	0.	0.000	1000.00	1.410s
PM-144	2470.74	618.06	66.	0.	0.000	1000.00	1.413s
RH-106	2486.16	621.92	66.	0.	0.000	1000.00	1.416s
SB-125	2542.05	635.89	22.	-11.	-0.006	66.46	1.428s
I-131	2546.39	636.97	21.	7.	0.004	99.87	1.429s
AG-110M	2629.52	657.76	14.	2.	0.001	330.45	1.447s
CS-137	2645.12	661.66	23.	-7.	-0.004	170.70	1.451s
PM-144	2784.64	696.54	9.	3.	0.001	250.62	1.481s
NB-94	2808.99	702.63	14.	1.	0.001	800.00	1.486s
SB-124	2889.61	722.79	15.	-4.	-0.002	145.77	1.503s
AG-108M	2890.22	722.94	19.	0.	0.000	1000.00	1.503s
EU-154	2891.89	723.36	19.	0.	0.000	1000.00	1.503s
ZR-95	2895.26	724.20	28.	-11.	-0.006	114.24	1.504s
BI-212	2907.15	727.17	23.	4.	0.002	164.36	1.507s
pm-146	2941.34	735.72	9.	5.	0.003	146.39	1.514s
pm-146	2987.11	747.16	5.	-1.	0.000	821.18	1.524s
ZR-95	3025.38	756.73	0.	8.	0.004	37.84	1.532s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
AG-110M	3054.24	763.94	17.	-2.	-0.001	300.00	1.538s
NB-95	3061.63	765.79	14.	5.	0.003	114.89	1.539s
PA-234M	3064.12	766.41	22.	-6.	-0.003	117.85	1.540s
EU-152	3114.15	778.92	9.	4.	0.002	184.30	1.550s
BI-212	3140.15	785.42	14.	-8.	-0.005	36.84	1.556s
CS-134	3181.95	795.87	21.	-9.	-0.005	76.11	1.565s
CS-134	3206.28	801.95	9.	24.	0.014	26.93	1.570s
CO-58	3241.58	810.78	28.	-4.	-0.002	174.27	1.577s
La-140	3261.56	815.77	33.	0.	0.000	1000.00	1.581s
Cs-136	3272.49	818.50	24.	8.	0.004	95.65	1.583s
MN-54	3337.89	834.85	5.	-1.	0.000	698.21	1.597s
Co-56	3385.58	846.77	1.	-1.	0.000	371.74	1.607s
TL-208	3440.76	860.56	10.	-2.	-0.001	154.94	1.619s
NB-94	3482.90	871.10	6.	5.	0.003	82.46	1.627s
EU-154	3491.44	873.23	18.	-6.	-0.003	113.00	1.629s
PA-234	3520.64	880.53	10.	5.	0.003	107.85	1.635s
PA-234	3531.48	883.24	15.	0.	0.000	1000.00	1.637s
AG-110M	3537.26	884.68	15.	0.	0.000	1000.00	1.638s
Sc-46	3555.65	889.28	26.	-8.	-0.004	96.51	1.642s
y-88	3590.70	898.04	0.	10.	0.005	33.46	1.649s
AC-228	3642.83	911.07	10.	0.	0.000	1000.00	1.660s
AG-110M	3748.54	937.49	30.	-14.	-0.008	88.12	1.682s
PA-234	3782.66	946.02	0.	0.	0.000	1000.00	1.688s
EU-152	3855.05	964.11	7.	5.	0.003	81.01	1.703s
AC-228	3874.49	968.97	30.	-10.	-0.006	81.34	1.707s
EU-154	3983.96	996.33	21.	-7.	-0.004	100.00	1.729s
PA-234M	4002.64	1001.00	28.	0.	0.000	1000.00	1.733s
EU-154	4017.76	1004.77	50.	-12.	-0.007	87.41	1.736s
Co-56	4150.07	1037.84	15.	-7.	-0.004	127.38	1.762s
Cs-136	4191.00	1048.07	0.	0.	0.000	1000.00	1.771s
RH-106	4200.17	1050.36	0.	0.	0.000	1000.00	1.772s
BI-207	4253.39	1063.66	5.	1.	0.001	501.66	1.783s
Ga-68	4308.37	1077.40	16.	-11.	-0.006	89.47	1.794s
FE-59	4395.81	1099.25	21.	-12.	-0.007	26.47	1.811s
EU-152	4447.13	1112.07	0.	20.	0.011	22.36	1.821s
ZN-65	4461.03	1115.55	20.	0.	0.000	1000.00	1.824s
BI-214	4480.00	1120.29	24.	-4.	-0.002	106.80	1.827s
Sc-46	4481.05	1120.55	20.	0.	0.000	1000.00	1.828s
Ta-182	4484.05	1121.30	20.	0.	0.000	1000.00	1.828s
CO-60	4691.91	1173.24	0.	6.	0.003	44.47	1.869
Ta-182	4755.20	1189.05	5.	1.	0.000	796.87	1.881s
Ta-182	4884.72	1221.41	11.	-4.	-0.002	209.09	1.906s
Co-56	4952.24	1238.28	6.	1.	0.000	691.09	1.919s
NA-22	5097.34	1274.53	16.	-10.	-0.006	64.81	1.946s
EU-154	5097.39	1274.54	26.	0.	0.000	1000.00	1.946s
CO-60	5329.39	1332.50	6.	-2.	-0.001	343.80	1.990s
AG-110M	5536.74	1384.30	0.	0.	0.000	1000.00	2.029s
EU-152	5631.64	1408.00	6.	-1.	0.000	846.32	2.046s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
K-40	5843.15	1460.83	5.	5.	0.003	73.04	2.085s
La-140	6385.21	1596.21	0.	0.	0.000	1000.00	2.182s
SB-124	6764.73	1690.98	0.	0.	0.000	1000.00	2.247s
BI-214	7059.14	1764.49	3.	4.	0.002	91.63	2.297s
Co-56	7086.61	1771.35	29.	-11.	-0.006	73.47	2.302s
y-88	7345.80	1836.06	0.	8.	0.004	35.36	2.345s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****									
- Nuclide -	Average	----- Peak -----							
Name	Code	Activity	Energy	Activity	Code	MDA	Value	COMMENTS	
		Bq/Sample	keV	Bq/Sample		Bq/Sample			
BE-7	C	1.6805E+00						5.31E+01	
			477.60	1.681E+00	?(	6.427E+00	1.10E+02	1.05E+01	G
NA-22	C	-5.8226E-01						9.50E+02	
			1274.53	-5.823E-01	?(	1.243E+00	6.48E+01	9.99E+01	G
K-40	N	3.2457E+00						4.66E+11	
			1460.83	3.246E+00	?(P	7.749E+00	7.30E+01	1.07E+01	G
Sc-46	F	-3.5625E-01						8.38E+01	
			889.28	-3.562E-01	?(	1.174E+00	9.65E+01	1.00E+02	G
			1120.55	0.000E+00	+	1.240E+00	1.00E+03	1.00E+02	G
CR-51	F	1.5134E+00						2.77E+01	
			320.08	1.513E+00	?(P	9.351E+00	1.80E+02	9.94E+00	G
MN-54	C	-2.8041E-02						3.12E+02	
			834.85	-2.804E-02	?(	5.374E-01	6.98E+02	1.00E+02	G
FE-59	F	-1.1337E+00						4.45E+01	
			1099.25	-1.134E+00	?(P	2.226E+00	2.65E+01	5.65E+01	G
			1291.60	-3.729E-02	% P	1.958E+00	2.07E+03	4.32E+01	G
Co-56	C	4.3353E-03						7.73E+01	
			846.77	-3.809E-02	?(P	3.135E-01	3.72E+02	9.99E+01	G
			1238.28	6.851E-02	?(P	1.233E+00	6.91E+02	6.61E+01	G
			1037.84	-2.458E+00	+	7.290E+00	1.27E+02	1.41E+01	G
			1771.35	-5.531E+00	+	1.357E+01	7.35E+01	1.55E+01	A
CO-57	C	9.8903E-02						2.72E+02	
			122.06	0.000E+00	?(	4.719E-01	1.00E+03	8.56E+01	G
			136.47	8.916E-01	?(	5.824E+00	1.91E+02	1.07E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CO-58	C -1.8612E-01						7.09E+01
		810.78	-1.861E-01	?(	1.141E+00	1.74E+02	9.95E+01 G
CO-60	F 1.0503E-01						1.93E+03
		1332.50	-1.004E-01	?(	8.319E-01	3.44E+02	1.00E+02 G
		1173.24	3.107E-01	?(P	4.025E-01	4.45E+01	9.99E+01 G
NB-94	I 1.2846E-01						7.41E+06
		702.63	3.776E-02	?(	7.607E-01	8.00E+02	9.79E+01 G
		871.10	2.174E-01	?(	6.140E-01	8.25E+01	9.99E+01 G
ZR-95	I 5.5093E-01						6.40E+01
		756.73	5.509E-01	?(P	5.287E-01	3.78E+01	5.45E+01 G
		724.20	-9.122E-01	- P	2.326E+00	1.14E+02	4.42E+01 G
NB-95	I 1.9748E-01						6.40E+01
		765.79	1.975E-01	&(	7.957E-01	1.15E+02	9.98E+01 G
RU-103	I -2.1056E-01						3.93E+01
		497.05	-2.106E-01	?(	7.707E-01	1.48E+02	9.09E+01 G
		610.30	0.000E+00	+	2.351E+01	1.00E+03	5.75E+00 GA
AG-108M	C 2.8799E-02						1.53E+05
		433.94	2.880E-02	?(	4.576E-01	5.63E+02	9.05E+01 G
		722.94	0.000E+00	-	9.569E-01	1.00E+03	9.08E+01 G
		614.28	0.000E+00	-	1.512E+00	1.00E+03	8.98E+01 G
AG-110M	F 3.5068E-02						2.50E+02
		884.68	0.000E+00	?(	1.255E+00	1.00E+03	7.27E+01 G
		657.76	6.200E-02	?(	7.571E-01	3.30E+02	9.46E+01 G
		937.49	-1.914E+00	+	3.773E+00	8.81E+01	3.44E+01 G
		1384.30	0.000E+00	-	1.884E+00	1.00E+03	2.43E+01 G
		763.94	-3.532E-01	+	3.871E+00	3.00E+02	2.23E+01 G
SN-113	F -3.5674E-01						1.15E+02
		391.69	-3.567E-01	?(	1.443E+00	1.19E+02	6.40E+01 G
SB-124	F 7.4527E-02						6.02E+01
		602.73	7.453E-02	?(P	1.342E+00	5.14E+02	9.83E+01 G
		1690.98	0.000E+00	-	1.122E+00	1.00E+03	4.78E+01 G
		722.79	-1.397E+00	+	7.249E+00	1.46E+02	1.08E+01 G
SB-125	I -1.1922E+00						1.01E+03
		427.88	-1.192E+00	?(	2.805E+00	9.45E+01	2.96E+01 G
		600.50	1.267E+00	+	5.772E+00	1.32E+02	1.79E+01 G
		635.89	-3.371E+00	+	7.409E+00	6.65E+01	1.13E+01 G
		463.37	3.595E-01	+ P	6.486E+00	4.96E+02	1.05E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
I-131	I	3.2470E-01					8.02E+00
		364.48-8.464E-02	?(	6.644E-01	2.98E+02	8.17E+01	G
		284.30 2.216E+00	?(P	7.281E+00	1.22E+02	6.14E+00	G
		636.97 3.369E+00	?(	1.157E+01	9.99E+01	7.17E+00	G
Gd-153	F	3.8398E-01					2.42E+02
		97.50 3.327E-01	&(	1.566E+00	1.37E+02	3.00E+01	G
		103.20 4.545E-01	* (	2.392E+00	1.54E+02	2.18E+01	G
Ga-68	C	-1.9568E+01					4.71E-02
		1077.40-1.957E+01	?(	3.866E+01	8.95E+01	3.30E+00	G
Tc-99m	I	1.1141E-01					2.51E-01
		140.51 1.114E-01	&(	7.502E-01	1.97E+02	8.93E+01	G
BA-133	F	1.4978E-01					3.85E+03
		356.00 1.498E-01	?(	6.638E-01	1.66E+02	6.20E+01	G
		302.85 0.000E+00	-	5.377E+00	1.00E+03	1.83E+01	G
		383.84 2.239E+00	&	8.403E+00	1.10E+02	8.94E+00	GA
		80.99 3.379E-01	?	1.005E+00	1.07E+02	3.41E+01	GA
CS-134	I	9.2291E-01					7.54E+02
		604.71 0.000E+00	?(	1.375E+00	1.00E+03	9.76E+01	G
		795.87-4.469E-01	&	1.141E+00	7.61E+01	8.55E+01	G
		569.32 8.237E-01	?(	4.018E+00	1.37E+02	1.54E+01	G
		801.95 1.147E+01	?(	7.988E+00	2.69E+01	8.69E+00	G
		563.24-1.882E+00	+	7.343E+00	1.54E+02	8.35E+00	G
CS-137	I	-2.9520E-01					1.10E+04
		661.66-2.952E-01	?(P	1.042E+00	1.71E+02	8.52E+01	G
CE-139	F	-3.5662E-02					1.38E+02
		165.85-3.566E-02	&(	6.133E-01	4.88E+02	7.99E+01	G
Ba-140	I	5.2828E-01					1.28E+01
		537.26 5.283E-01	&(P	2.054E+00	1.50E+02	2.44E+01	G
		162.66-2.528E+00	+	9.126E+00	1.07E+02	6.22E+00	G
		304.85 0.000E+00	-	2.308E+01	1.00E+03	4.29E+00	G
La-140	I	1.4218E-01					1.28E+01
		1596.21 0.000E+00	?(	5.370E-01	1.00E+03	9.54E+01	G
		487.02-6.218E-02	+	1.702E+00	7.55E+02	4.55E+01	G
		328.76 8.103E-01	?(	2.954E+00	1.06E+02	2.03E+01	G
		815.77 0.000E+00	-	5.233E+00	1.00E+03	2.33E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CE-141	I	2.0402E-01					3.25E+01
		145.44	2.040E-01	?(	1.451E+00	2.08E+02	4.82E+01 G
CE-144	I	9.0650E-01					2.85E+02
		133.54	9.065E-01	?(P	5.919E+00	1.91E+02	1.11E+01 G
PM-144	C	9.8932E-02					3.63E+02
		696.54	9.893E-02	?(	6.287E-01	2.51E+02	9.90E+01 G
		618.06	0.000E+00	&	1.377E+00	1.00E+03	9.91E+01 G
EU-152	F	1.8696E+00					4.94E+03
		344.29	3.268E-01	&(P	2.254E+00	1.95E+02	2.65E+01 G
		1112.07	7.672E+00	?(	2.827E+00	2.24E+01	1.36E+01 G
		121.78	9.445E-01	?(	1.011E+00	3.58E+01	2.86E+01 G
		778.92	1.131E+00	?(	5.228E+00	1.84E+02	1.29E+01 G
		964.11	1.713E+00	?(	4.734E+00	8.10E+01	1.46E+01 G
		244.69-1.685E+00		+ P	9.925E+00	9.40E+01	7.58E+00 G
		1408.00-1.997E-01		-	4.135E+00	8.46E+02	2.10E+01 GA
EU-154	I	-2.0091E+00					3.14E+03
		873.23-2.009E+00		?(	7.905E+00	1.13E+02	1.23E+01 G
		123.10-2.467E-01		+	1.054E+00	1.25E+02	4.08E+01 G
		1274.54	0.000E+00	+	4.377E+00	1.00E+03	3.52E+01 G
		723.36	0.000E+00	+	4.301E+00	1.00E+03	2.02E+01 G
		1004.77-3.246E+00		+	9.556E+00	8.74E+01	1.80E+01 G
		996.33-3.176E+00		+	1.092E+01	1.00E+02	1.06E+01 G
EU-155	I	3.4587E-01					1.81E+03
		105.31	2.496E-01	?(P	2.718E+00	3.15E+02	2.12E+01 G
		86.54	4.124E-01	?(	1.976E+00	1.41E+02	3.07E+01 G
HF-181	F	1.9977E-01					4.24E+01
		482.00	3.477E-02	?(	9.075E-01	7.17E+02	8.05E+01 G
		133.02	2.574E-01	?(	1.451E+00	1.65E+02	4.33E+01 G
		345.83	2.458E-01	&(	4.426E+00	5.03E+02	1.51E+01 G
		136.30	1.925E+00	?(	1.166E+01	1.78E+02	5.85E+00 G
Ta-182	F	7.1918E-02					1.14E+02
		1121.30	0.000E+00	?(	3.554E+00	1.00E+03	3.49E+01 G
		1221.41-7.644E-01		+	3.738E+00	2.09E+02	2.70E+01 G
		1189.05	2.269E-01	?(	4.584E+00	7.97E+02	1.62E+01 G
Hg-203	F	-1.3158E-01					4.66E+01
		279.20-1.316E-01		?(P	6.998E-01	1.01E+02	8.15E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
TL-208	N	3.2309E-01					6.98E+02
		583.02	7.723E-02	?(P	4.997E-01	1.76E+02	8.45E+01 G
		277.28	3.616E+00	&(P	5.062E+00	4.61E+01	6.31E+00 G
		860.56	8.187E-01	+ P	6.136E+00	1.55E+02	1.24E+01 G
pm-146	C	2.5210E-01					2.02E+03
		747.16	9.890E-02	?(P	1.479E+00	8.21E+02	3.40E+01 G
		735.72	7.934E-01	?(	2.881E+00	1.46E+02	2.25E+01 G
		453.88	2.483E-01	?(	6.577E-01	1.01E+02	6.50E+01 G
y-88	F	5.4508E-01					1.07E+02
		898.04	4.582E-01	?(P	3.495E-01	3.35E+01	9.37E+01 G
		1836.06	6.271E-01	?(	5.777E-01	3.54E+01	9.92E+01 G
Cd-113m		1.6404E+03					5.33E+03
		263.70	1.640E+03	?(	7.658E+03	1.33E+02	6.00E-03 K
Cd-109	F	-2.4677E+00					4.53E+02
		88.04	2.468E+00	&(	1.963E+01	2.33E+02	3.79E+00 G
Cf-251	T	-3.3296E-01					3.28E+05
		176.60	3.330E-01	&(	2.454E+00	2.73E+02	1.70E+01 G
		227.00	2.391E+00	+	8.719E+00	1.07E+02	6.30E+00 GA
Cf-249	T	9.5794E-02					1.28E+05
		387.95	9.579E-02	&(	1.257E+00	3.72E+02	6.60E+01 G
		333.44	1.378E+00	+	5.012E+00	1.07E+02	1.55E+01 G
Sn-126		1.5950E+00					3.65E+07
		87.57	6.034E-01	& P	2.019E+00	9.68E+01	3.75E+01 GA
		64.28	1.595E+00	&(	7.204E+00	1.32E+02	9.70E+00 G
		86.94	1.863E+00	+	8.639E+00	1.37E+02	9.04E+00 GA
PB-210	N	-1.1180E+01					8.14E+03
		46.54	1.118E+01	*(P	2.805E+01	6.90E+01	4.25E+00 G
PB-212	N	2.6767E-01					6.98E+02
		238.63	2.677E-01	(P	8.574E-01	1.01E+02	4.33E+01 G
		300.03	5.084E+00	P	2.852E+01	1.64E+02	3.28E+00 GA
PB-214	N	-3.2902E-02					5.84E+05
		351.93	3.290E-02	%(P	1.515E+00	1.26E+03	3.76E+01 G
		295.09	6.709E-02	% P	2.604E+00	1.34E+03	1.93E+01 G
		242.00	1.758E+00	?	9.062E+00	1.50E+02	7.43E+00 GA

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
BI-207	C	-2.6596E-02					1.18E+04
		569.70-9.861E-02	?(P	7.642E-01	2.25E+02	9.77E+01	G
		1063.66 6.788E-02	?(	8.913E-01	5.02E+02	7.45E+01	G
BI-212	N	2.1659E+00					6.98E+02
		727.17 2.166E+00	?(P	1.256E+01	1.64E+02	7.55E+00	G
		785.42-2.552E+01	+ P	6.348E+01	3.68E+01	1.28E+00	GA
BI-214	N	1.0134E-01					5.84E+05
		609.31-4.585E-01	?(P	3.058E+00	1.90E+02	4.61E+01	G
		1120.29-1.473E+00	+ P	8.940E+00	1.07E+02	1.51E+01	G
		1764.49 1.777E+00	?(P	5.507E+00	9.16E+01	1.54E+01	G
BI-210M	T	-3.3096E-02					1.10E+09
		265.83-3.310E-02	?(P	9.805E-01	7.81E+02	5.00E+01	G
		304.90 0.000E+00	+	3.536E+00	1.00E+03	2.80E+01	G
TH-227	N	2.5869E+00					7.95E+03
		50.14 2.587E+00	&(	1.225E+01	1.39E+02	8.00E+00	G
		256.24-1.810E+00	+	7.623E+00	1.58E+02	7.00E+00	G
TH-229	N	-2.1791E+00					2.68E+06
		193.51-2.179E+00	?(P	1.152E+01	1.31E+02	4.40E+00	G
		210.85-4.429E+00	+	1.486E+01	1.26E+02	2.99E+00	G
TH-234	N	-7.8029E+00					1.63E+12
		63.29-7.803E+00	(P	2.552E+01	9.22E+01	3.81E+00	G
		92.59-4.745E+00	+ P	1.058E+01	6.05E+01	5.58E+00	G
PA-234	N	6.1558E-01					1.63E+12
		131.29 6.156E-01	?(P	3.336E+00	1.59E+02	1.80E+01	G
		946.02 0.000E+00	-	2.543E+00	1.00E+03	1.34E+01	G
		569.47 0.000E+00	-	8.469E+00	1.00E+03	8.20E+00	G
		883.24 0.000E+00	-	9.488E+00	1.00E+03	9.60E+00	G
		880.53 3.405E+00	?	1.291E+01	1.08E+02	6.00E+00	GA
U-235	N	8.1631E-01					2.57E+11
		143.79 4.157E-01	?(P	6.282E+00	4.40E+02	1.10E+01	G
		205.33-3.585E+00	+ P	1.127E+01	7.31E+01	5.01E+00	G
		163.38 1.681E+00	?(P	7.706E+00	1.33E+02	5.08E+00	G
AM-241	T	6.0147E-01					1.58E+05
		59.54 6.015E-01	*(	2.557E+00	1.26E+02	3.59E+01	G
Np-237	F	9.6639E-01					2.14E+06
		86.49 9.664E-01	?(	4.386E+00	1.33E+02	1.31E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Cs-136	F	3.2257E-01					1.30E+01
		818.50	3.226E-01	?(	1.055E+00	9.56E+01	1.00E+02 G
		1048.07	0.000E+00	-	4.606E-01	1.00E+03	8.00E+01 G
		340.57	0.000E+00	&	1.609E+00	1.00E+03	4.69E+01 G
Np-239	T	-5.6286E-01					2.36E+00
		103.70	4.128E-01		2.281E+00	1.61E+02	2.40E+01 X
		106.13	-5.629E-01	?(	3.019E+00	1.58E+02	2.27E+01 G
		99.50	6.633E-01	?	3.316E+00	1.46E+02	1.50E+01 X
Nd-147		7.7208E-02					1.11E+01
		531.00	7.721E-02	%	3.805E+00	1.81E+03	1.30E+01 G
		91.10	-4.313E-08	%	2.654E+00	1.78E+09	2.83E+01 G

(- This peak used in the nuclide activity average.

- * - Peak is too wide, but only one peak in library.
- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction
- } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
 F - Fast Neutron Activation
 I - Fission Product
 N - Naturally Occurring Isotope
 P - Photon Reaction
 C - Charged Particle Reaction
 M - No MDA Calculation
 R - Coincidence Corrected
 H - Halflife limit exceeded

Peak Codes:

G - Gamma Ray
 X - X-Ray
 P - Positron Decay
 S - Single-Escape
 D - Double-Escape
 K - Key Line
 A - Not in Average
 C - Coincidence Peak

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	Activity %	
PB-210	46.54	94.	-19.	-0.011	69.03	-1.118E+01	P
TH-227	50.14	79.	9.	0.005	138.85	2.587E+00	
AM-241	59.54	110.	12.	0.007	125.58	6.015E-01	
TH-234	63.29	143.	-18.	-0.010	92.23	-7.803E+00	P
Sn-126	64.28	74.	9.	0.005	132.42	1.595E+00	
BA-133	80.99	23.	8.	0.005	107.07	3.379E-01	
Np-237	86.49	78.	10.	0.005	133.16	9.664E-01	
EU-155	86.54	88.	10.	0.005	140.68	4.124E-01	
Sn-126	86.94	150.	-13.	-0.007	137.18	-1.863E+00	
Sn-126	87.57	142.	-17.	-0.010	96.83	-6.034E-01	P
Cd-109	88.04	137.	-7.	-0.004	232.96	-2.468E+00	
TH-234	92.59	88.	-21.	-0.012	60.47	-4.745E+00	P
AC-228	93.35	27.	6.	0.004	118.97	1.480E+00	
Gd-153	97.50	56.	8.	0.004	137.23	3.327E-01	
Np-239	99.50	64.	8.	0.004	145.78	6.633E-01	
Gd-153	103.20	72.	8.	0.004	153.55	4.545E-01	
Np-239	103.70	80.	8.	0.004	161.38	4.128E-01	
EU-155	105.31	90.	4.	0.002	315.38	2.496E-01	P
Np-239	106.13	130.	-10.	-0.006	157.97	-5.629E-01	
EU-152	121.78	20.	22.	0.012	35.79	9.445E-01	
EU-154	123.10	48.	-8.	-0.005	124.61	-2.467E-01	
PA-234	131.29	96.	9.	0.005	158.96	6.156E-01	P
HF-181	133.02	105.	9.	0.005	165.32	2.574E-01	
CE-144	133.54	114.	8.	0.004	191.36	9.065E-01	P
HF-181	136.30	122.	9.	0.005	177.76	1.925E+00	
CO-57	136.47	101.	8.	0.004	190.87	8.916E-01	
Tc-99m	140.51	108.	8.	0.004	196.91	1.114E-01	
U-235	143.79	120.	4.	0.002	439.63	4.157E-01	P
CE-141	145.44	123.	8.	0.004	208.18	2.040E-01	
Ba-140	162.66	70.	-12.	-0.006	106.58	-2.528E+00	
U-235	163.38	31.	6.	0.003	132.53	1.681E+00	P
CE-139	165.85	51.	-2.	-0.001	487.64	-3.566E-02	
Cf-251	176.60	33.	-4.	-0.002	273.29	-3.330E-01	
TH-229	193.51	44.	-6.	-0.004	130.87	-2.179E+00	P
U-235	205.33	52.	-12.	-0.006	73.15	-3.585E+00	P
TH-229	210.85	29.	-8.	-0.005	126.43	-4.429E+00	
Cf-251	227.00	42.	-9.	-0.005	106.87	-2.391E+00	
PB-214	242.00	60.	8.	0.004	149.96	1.758E+00	
EU-152	244.69	74.	-7.	-0.004	94.04	-1.685E+00	P
TH-227	256.24	33.	-7.	-0.004	158.11	-1.810E+00	
Cd-113m	263.70	23.	5.	0.003	133.46	1.640E+03	
BI-210M	265.83	26.	-1.	0.000	780.66	-3.310E-02	P
TL-208	277.28	9.	12.	0.007	46.07	3.616E+00	P
Hg-203	279.20	34.	-6.	-0.003	101.18	-1.316E-01	P

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
I-131	284.30	19.	7.	0.004	121.71	2.216E+00	P
CR-51	320.08	79.	7.	0.004	180.07	1.513E+00	P
La-140	328.76	29.	8.	0.004	106.23	8.103E-01	
Cf-249	333.44	51.	-10.	-0.005	106.89	-1.378E+00	
EU-152	344.29	27.	4.	0.002	195.31	3.268E-01	P
HF-181	345.83	34.	2.	0.001	503.19	2.458E-01	
BA-133	356.00	11.	4.	0.002	165.93	1.498E-01	
I-131	364.48	20.	-3.	-0.002	297.52	-8.464E-02	
BA-133	383.84	38.	8.	0.005	109.69	2.239E+00	
Cf-249	387.95	46.	3.	0.001	371.91	9.579E-02	
SN-113	391.69	58.	-9.	-0.005	118.58	-3.567E-01	
SB-125	427.88	40.	-14.	-0.008	94.48	-1.192E+00	
AG-108M	433.94	8.	1.	0.001	562.73	2.880E-02	
pm-146	453.88	8.	6.	0.003	100.92	2.483E-01	
SB-125	463.37	23.	1.	0.001	496.33	3.595E-01	P
Ir-192	468.06	23.	-1.	-0.001	685.57	-5.314E-02	
BE-7	477.60	21.	6.	0.004	110.47	1.681E+00	
HF-181	482.00	25.	1.	0.001	716.60	3.477E-02	
La-140	487.02	28.	-1.	-0.001	754.98	-6.218E-02	
RU-103	497.05	22.	-7.	-0.004	147.69	-2.106E-01	
RH-106	511.86	33.	31.	0.017	51.28	4.496E+00	
Ba-140	537.26	9.	4.	0.002	150.37	5.283E-01	P
CS-134	563.24	13.	-5.	-0.003	153.84	-1.882E+00	
CS-134	569.32	13.	4.	0.002	136.93	8.237E-01	
BI-207	569.70	20.	-3.	-0.002	225.12	-9.861E-02	P
TL-208	583.02	5.	2.	0.001	175.76	7.723E-02	P
SB-125	600.50	38.	7.	0.004	131.96	1.267E+00	
SB-124	602.73	64.	2.	0.001	514.17	7.453E-02	P
BI-214	609.31	72.	-6.	-0.004	189.81	-4.585E-01	P
SB-125	635.89	22.	-11.	-0.006	66.46	-3.371E+00	
I-131	636.97	21.	7.	0.004	99.87	3.369E+00	
AG-110M	657.76	14.	2.	0.001	330.45	6.200E-02	
CS-137	661.66	23.	-7.	-0.004	170.70	-2.952E-01	P
PM-144	696.54	9.	3.	0.001	250.62	9.893E-02	
NB-94	702.63	14.	1.	0.001	800.00	3.776E-02	
SB-124	722.79	15.	-4.	-0.002	145.77	-1.397E+00	
BI-212	727.17	23.	4.	0.002	164.36	2.166E+00	P
pm-146	735.72	9.	5.	0.003	146.39	7.934E-01	
pm-146	747.16	5.	-1.	0.000	821.18	-9.890E-02	P
AG-110M	763.94	17.	-2.	-0.001	300.00	-3.532E-01	
NB-95	765.79	14.	5.	0.003	114.89	1.975E-01	
PA-234M	766.41	22.	-6.	-0.003	117.85	-8.048E+01	
EU-152	778.92	9.	4.	0.002	184.30	1.131E+00	
BI-212	785.42	14.	-8.	-0.005	36.84	-2.552E+01	P
CS-134	795.87	21.	-9.	-0.005	76.11	-4.469E-01	
CS-134	801.95	9.	24.	0.014	26.93	1.147E+01	
CO-58	810.78	28.	-4.	-0.002	174.27	-1.861E-01	
Cs-136	818.50	24.	8.	0.004	95.65	3.226E-01	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
MN-54	834.85	5.	-1.	0.000	698.21	-2.804E-02	
Co-56	846.77	1.	-1.	0.000	371.74	-3.809E-02	P
TL-208	860.56	10.	-2.	-0.001	154.94	-8.187E-01	P
NB-94	871.10	6.	5.	0.003	82.46	2.174E-01	
EU-154	873.23	18.	-6.	-0.003	113.00	-2.009E+00	
PA-234	880.53	10.	5.	0.003	107.85	3.405E+00	
Sc-46	889.28	26.	-8.	-0.004	96.51	-3.562E-01	
AG-110M	937.49	30.	-14.	-0.008	88.12	-1.914E+00	
EU-152	964.11	7.	5.	0.003	81.01	1.713E+00	
AC-228	968.97	30.	-10.	-0.006	81.34	-2.773E+00	
EU-154	996.33	21.	-7.	-0.004	100.00	-3.176E+00	
EU-154	1004.77	50.	-12.	-0.007	87.41	-3.246E+00	
Co-56	1037.84	15.	-7.	-0.004	127.38	-2.458E+00	
BI-207	1063.66	5.	1.	0.001	501.66	6.788E-02	
Ga-68	1077.40	16.	-11.	-0.006	89.47	-1.957E+01	
FE-59	1099.25	21.	-12.	-0.007	26.47	-1.134E+00	P
EU-152	1112.07	0.	20.	0.011	22.36	7.672E+00	
BI-214	1120.29	24.	-4.	-0.002	106.80	-1.473E+00	P
CO-60	1173.24	0.	6.	0.003	44.47	3.107E-01	P
Ta-182	1189.05	5.	1.	0.000	796.87	2.269E-01	
Ta-182	1221.41	11.	-4.	-0.002	209.09	-7.644E-01	
Co-56	1238.28	6.	1.	0.000	691.09	6.851E-02	P
NA-22	1274.53	16.	-10.	-0.006	64.81	-5.823E-01	
CO-60	1332.50	6.	-2.	-0.001	343.80	-1.004E-01	
EU-152	1408.00	6.	-1.	0.000	846.32	-1.997E-01	
K-40	1460.83	5.	5.	0.003	73.04	3.246E+00	P
BI-214	1764.49	3.	4.	0.002	91.63	1.777E+00	P
Co-56	1771.35	29.	-11.	-0.006	73.47	-5.531E+00	

P - Peakbackground subtraction

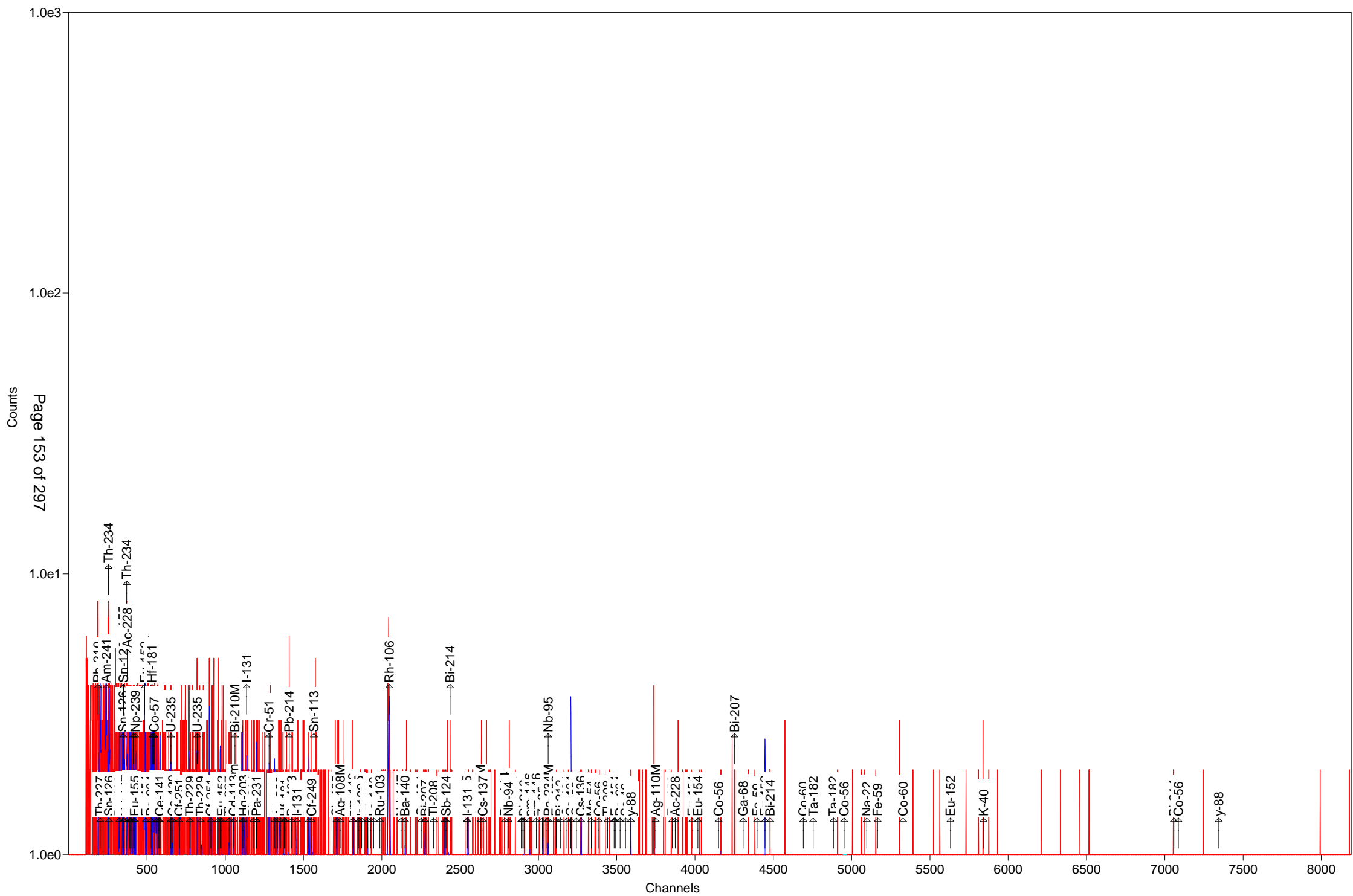
***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****					
Time of Count		Time Corrected		Uncertainty	
Activity		Activity		1 Sigma	
Nuclide	Activity	Activity	Counting	MDA	
	Bq/Sample	Bq/Sample		Bq/Sample	
BE-7 #A	1.6805E+00	1.6805E+00	1.105E+02%	6.43E+00	
NA-22 #A	-5.8226E-01	-5.8226E-01	6.481E+01%	1.24E+00	
K-40 #A	3.2457E+00	3.2457E+00	7.304E+01%	7.75E+00	
Sc-46 #A	-3.5625E-01	-3.5625E-01	9.651E+01%	1.17E+00	
CR-51 #A	1.5134E+00	1.5134E+00	1.801E+02%	9.35E+00	
MN-54 #A	-2.8041E-02	-2.8041E-02	6.982E+02%	5.37E-01	
FE-59 #A	-1.1336E+00	-1.1337E+00	2.647E+01%	2.23E+00	
Co-56 #A	4.3353E-03	4.3353E-03	3.717E+02%	3.13E-01	
CO-57 #A	9.8903E-02	9.8903E-02	1.909E+02%	4.72E-01	
CO-58 #A	-1.8612E-01	-1.8612E-01	1.743E+02%	1.14E+00	
CO-60 #A	1.0503E-01	1.0503E-01	4.447E+01%	8.32E-01	
ZN-65 #A	0.0000E+00	0.0000E+00	1.000E+03%	2.44E+00	

NB-94	#A	1.2846E-01	1.2846E-01	8.246E+01%	7.61E-01
ZR-95	#	5.5092E-01	5.5093E-01	3.784E+01%	5.29E-01
NB-95	#A	1.9748E-01	1.9748E-01	1.149E+02%	7.96E-01
RU-103	#A	-2.1056E-01	-2.1056E-01	1.477E+02%	7.71E-01
RH-106	#A	0.0000E+00	0.0000E+00	7.071E+02%	1.38E+01
AG-108M	#A	2.8799E-02	2.8799E-02	5.627E+02%	4.58E-01
AG-110M	#A	3.5068E-02	3.5068E-02	3.305E+02%	1.25E+00
SN-113	#A	-3.5674E-01	-3.5674E-01	1.186E+02%	1.44E+00
SB-124	#A	7.4526E-02	7.4527E-02	5.142E+02%	1.34E+00
SB-125	#A	-1.1922E+00	-1.1922E+00	9.448E+01%	2.80E+00
I-131	#A	3.2469E-01	3.2470E-01	9.987E+01%	6.64E-01
Gd-153	#A	3.8397E-01	3.8398E-01	1.030E+02%	1.57E+00
Ga-68	#A	-1.9435E+01	-1.9568E+01	8.947E+01%	3.87E+01
Tc-99m	#A	1.1127E-01	1.1141E-01	1.969E+02%	7.50E-01
BA-133	#A	1.4978E-01	1.4978E-01	1.659E+02%	6.64E-01
CS-134	#A	9.2291E-01	9.2291E-01	2.693E+01%	1.38E+00
CS-137	#A	-2.9520E-01	-2.9520E-01	1.707E+02%	1.04E+00
CE-139	#A	-3.5662E-02	-3.5662E-02	4.876E+02%	6.13E-01
Ba-140	#A	5.2826E-01	5.2828E-01	1.504E+02%	2.05E+00
La-140	#A	1.4217E-01	1.4218E-01	1.062E+02%	5.37E-01
CE-141	#A	2.0401E-01	2.0402E-01	2.082E+02%	1.45E+00
CE-144	#A	9.0650E-01	9.0650E-01	1.914E+02%	5.92E+00
PM-144	#A	9.8932E-02	9.8932E-02	2.506E+02%	6.29E-01
EU-152	#A	1.8696E+00	1.8696E+00	2.236E+01%	2.25E+00
EU-154	#A	-2.0091E+00	-2.0091E+00	1.130E+02%	7.91E+00
EU-155	#A	3.4587E-01	3.4587E-01	1.407E+02%	2.72E+00
HF-181	#A	1.9977E-01	1.9977E-01	1.653E+02%	9.07E-01
Ta-182	#A	7.1918E-02	7.1918E-02	6.393E+02%	3.55E+00
Hg-203	#A	-1.3158E-01	-1.3158E-01	1.012E+02%	7.00E-01
TL-208	#A	3.2309E-01	3.2309E-01	4.607E+01%	5.00E-01
pm-146	#A	2.5210E-01	2.5210E-01	1.009E+02%	1.48E+00
y-88	#	5.4508E-01	5.4508E-01	2.434E+01%	3.50E-01
Cd-113m	#A	1.6404E+03	1.6404E+03	1.335E+02%	7.66E+03
Cd-109	#A	-2.4677E+00	-2.4677E+00	2.330E+02%	1.96E+01
Cf-251	#A	-3.3296E-01	-3.3296E-01	2.733E+02%	2.45E+00
Cf-249	#A	9.5794E-02	9.5794E-02	3.719E+02%	1.26E+00
Sn-126	#A	1.5950E+00	1.5950E+00	1.324E+02%	7.20E+00
PB-210	#A	-1.1180E+01	-1.1180E+01	6.903E+01%	2.81E+01
PB-212	A	2.6767E-01	2.6767E-01	1.011E+02%	8.57E-01
PB-214	#A	-3.2902E-02	-3.2902E-02	1.264E+03%	1.51E+00
BI-207	#A	-2.6596E-02	-2.6596E-02	2.251E+02%	7.64E-01
BI-212	#A	2.1659E+00	2.1659E+00	1.644E+02%	1.26E+01
BI-214	#A	1.0134E-01	1.0134E-01	9.163E+01%	3.06E+00
BI-210M	#A	-3.3096E-02	-3.3096E-02	7.807E+02%	9.81E-01
AC-228	#A	0.0000E+00	0.0000E+00	1.000E+03%	2.70E+00
TH-227	#A	2.5869E+00	2.5869E+00	1.388E+02%	1.23E+01
TH-229	#A	-2.1791E+00	-2.1791E+00	1.309E+02%	1.15E+01
TH-234	#A	-7.8029E+00	-7.8029E+00	9.223E+01%	2.55E+01
PA-231	#A	0.0000E+00	0.0000E+00	1.000E+03%	3.42E+01

PA-233 #A	0.0000E+00	0.0000E+00	7.071E+02%	2.79E+00
PA-234 #A	6.1558E-01	6.1558E-01	1.590E+02%	3.34E+00
PA-234M#A	0.0000E+00	0.0000E+00	1.000E+03%	1.58E+02
U-235 #A	8.1631E-01	8.1631E-01	1.325E+02%	6.28E+00
AM-241 #A	6.0147E-01	6.0147E-01	1.256E+02%	2.56E+00
Np-237 #A	9.6639E-01	9.6639E-01	1.332E+02%	4.39E+00
Ir-192 #A	0.0000E+00	0.0000E+00	7.071E+02%	1.17E+00
Cs-136 #A	3.2256E-01	3.2257E-01	9.565E+01%	1.05E+00
Np-239 #A	-5.6279E-01	-5.6286E-01	1.580E+02%	3.02E+00
Nd-147 #A	7.7206E-02	7.7208E-02	1.811E+03%	3.81E+00

- All peaks for activity calculation had bad shape.
 * - Activity omitted from total
 & - Activity omitted from total and all peaks had bad shape.
 < - MDA value printed.
 A - Activity printed, but activity < MDA.
 B - Activity < MDA and failed test.
 C - Area < Critical level.
 F - Failed fraction or key line test.
 H - Halflife limit exceeded

----- S U M M A R Y -----
 Total Activity (37.6 to 1999.4 keV) 0.000E+00 Bq/Sample
 Total Decayed Activity (37.6 to 1999.4 keV) 0.0000000E+00 Bq/Sample



Sample Description: 257318_Gamma_LCS 160-257318~2-A

Detector: Detector #16

Batch ID: 257318

Work Order Number: Gamma

Lot Number: LCS 160-257318~2-A

Decay to Time: 7/12/2016 09:59 Live Time: 1800 sec
 Acquisition Time: 7/12/2016 09:59:17 Real Time: 1816 sec
 Analysis Time: 7/12/2016 10:29 Dead Time: 0.88 %
 Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 16_Soil_TunaCan.Clb
 Efficiency Cal Desc: 16_TunaCan_90099_071012
 Efficiency Cal Date: 7/13/2012 09:47
 Energy Cal Date: 2/28/2012 09:35
 Library: Client_Long_Rev11.lib
 Bkgd Correction File: 16_2016-07-10_0627.PBC

Nuclide	Activity Bq/Sample	1-Sigma Counting Uncert %	1-Sigma Counting Uncert Bq/Sample	1-Sigma Total Uncert Bq/Sample	Minimum Detectable Activity Bq/Sample
BE-7	-1.362E+01	110.2	1.501E+01	1.502E+01	4.978E+01
NA-22	7.239E-01	59.0	4.271E-01	4.286E-01	1.391E+00
K-40	-6.894E-01	862.0	5.942E+00	5.942E+00	1.564E+01
Sc-46	-1.856E+00	87.4	1.622E+00	1.625E+00	5.381E+00
CR-51	-1.143E+01	154.0	1.760E+01	1.761E+01	5.835E+01
MN-54	2.951E-01	502.7	1.483E+00	1.483E+00	3.251E+00
FE-59	7.751E-01	416.6	3.229E+00	3.230E+00	6.854E+00
Co-56	-1.892E+00	85.8	1.624E+00	1.627E+00	3.505E+00
CO-57	0.000E+00	1.#INF	8.215E-01	8.215E-01	3.427E+01
CO-58	8.171E-01	165.7	1.354E+00	1.355E+00	4.534E+00
CO-60	2.106E+02	1.2	2.589E+00	1.089E+01	1.243E+00
ZN-65	4.008E+00	65.9	2.642E+00	2.650E+00	8.724E+00
NB-94	-1.604E+00	47.3	7.583E-01	7.629E-01	4.264E+00
ZR-95	-2.493E+00	57.9	1.444E+00	1.449E+00	5.425E+00
NB-95	-7.401E-01	118.1	8.743E-01	8.751E-01	2.933E+00
RU-103	9.562E-01	142.3	1.360E+00	1.361E+00	3.167E+00
RH-106	-1.396E+01	126.7	1.769E+01	1.770E+01	5.876E+01
AG-108M	-3.324E-02	68.7	2.283E-02	2.289E-02	3.482E+00
AG-110M	1.794E+00	115.4	2.070E+00	2.072E+00	6.900E+00
SN-113	1.891E+00	98.0	1.853E+00	1.855E+00	6.144E+00
SB-124	6.723E-01	142.5	9.580E-01	9.587E-01	5.478E+00
SB-125	2.768E+00	160.2	4.434E+00	4.437E+00	1.013E+01
I-131	3.722E-01	354.9	1.321E+00	1.321E+00	3.212E+00
Gd-153	5.120E-01	496.1	2.540E+00	2.540E+00	1.472E+01
Ga-68	-7.351E+01	95.0	6.986E+01	6.999E+01	1.462E+02
Tc-99m	-8.903E-01	146.0	1.300E+00	1.301E+00	4.306E+00
BA-133	-2.533E-01	86.4	2.189E-01	2.193E-01	6.007E+00
CS-134	7.976E-01	103.7	8.272E-01	8.282E-01	5.527E+00
CS-137	3.727E+02	1.1	4.257E+00	1.985E+01	2.859E+00
CE-139	-9.688E-01	160.5	1.555E+00	1.557E+00	2.986E+00
Ba-140	6.474E+00	102.1	6.611E+00	6.619E+00	1.103E+01
La-140	5.863E-01	85.9	5.038E-01	5.048E-01	1.061E+00
CE-141	1.563E+00	147.0	2.298E+00	2.299E+00	7.612E+00

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CE-144	-6.775E+00	143.6	9.729E+00	9.735E+00	3.223E+01
PM-144	-1.468E+00	80.0	1.174E+00	1.176E+00	3.891E+00
EU-152	3.806E+00	131.8	5.016E+00	5.020E+00	1.960E+01
EU-154	3.965E+00	83.3	3.302E+00	3.308E+00	3.432E+01
EU-155	-3.487E+00	177.6	6.191E+00	6.194E+00	1.291E+01
HF-181	3.044E-01	265.9	8.095E-01	8.096E-01	6.441E+00
Ta-182	9.470E-01	438.1	4.149E+00	4.149E+00	1.403E+01
Hg-203	0.000E+00	1.#INF	7.964E-01	7.964E-01	3.355E+00
TL-208	3.692E+00	37.6	1.387E+00	1.400E+00	2.765E+00
pm-146	-4.382E+00	89.2	3.910E+00	3.917E+00	8.761E+00
y-88	-1.598E+00	119.5	1.910E+00	1.911E+00	4.136E+00
Cd-113m	9.272E+03	149.0	1.382E+04	1.383E+04	4.602E+04
Cd-109	2.113E+01	173.1	3.657E+01	3.659E+01	1.211E+02
Cf-251	8.217E-01	520.1	4.274E+00	4.274E+00	1.085E+01
Cf-249	0.000E+00	1.#INF	4.095E-01	4.095E-01	5.809E+00
Sn-126	-1.920E+01	223.0	4.282E+01	4.284E+01	1.414E+02
PB-210	9.986E+03	0.9	9.094E+01	5.933E+02	1.733E+02
PB-212	8.141E+00	20.5	1.669E+00	1.750E+00	4.133E+00
PB-214	6.520E+00	31.0	2.018E+00	2.047E+00	5.004E+00
BI-207	1.234E+00	63.9	7.885E-01	7.911E-01	2.601E+00
BI-212	-8.144E+00	169.6	1.381E+01	1.382E+01	4.640E+01
BI-214	6.099E+00	28.7	1.749E+00	1.778E+00	4.495E+00
BI-210M	1.720E+00	129.5	2.227E+00	2.229E+00	5.330E+00
AC-228	-6.289E-01	133.7	8.407E-01	8.413E-01	1.460E+01
TH-227	3.800E+01	61.8	2.348E+01	2.357E+01	7.739E+01
TH-229	1.241E+00	1594.3	1.979E+01	1.979E+01	5.019E+01
TH-234	-6.116E+01	141.7	8.668E+01	8.674E+01	3.635E+02
PA-231	3.622E+01	148.8	5.391E+01	5.394E+01	1.788E+02
PA-233	-3.080E+00	155.3	4.782E+00	4.784E+00	1.585E+01
PA-234	4.015E+00	82.7	3.319E+00	3.325E+00	2.001E+01
PA-234M	-9.997E+00	2034.3	2.034E+02	2.034E+02	6.653E+02
U-235	5.274E+00	153.4	8.089E+00	8.094E+00	3.501E+01
AM-241	1.259E+03	0.8	9.841E+00	6.607E+01	1.426E+01
Np-237	-6.154E+00	175.1	1.078E+01	1.078E+01	3.567E+01
Ir-192	2.772E-01	84.6	2.345E-01	2.350E-01	6.572E+00
Cs-136	1.981E-01	327.9	6.497E-01	6.498E-01	4.626E+00
Np-239	-3.351E+00	114.7	3.843E+00	3.848E+00	1.273E+01
Nd-147	9.010E-01	164.0	1.477E+00	1.478E+00	2.116E+01

Total	2.127E+04				

Analyst: Amanda Dick

Sample description
257318_Gamma_LCS 160-257318~2-A

Spectrum Filename: C:\User\SPC\Det16\16_Gamma_20161653.An1

Acquisition information

Start time: 7/12/2016 9:59:17 AM
Live time: 1800
Real time: 1816
Dead time: 0.88 %
Detector ID: 16

Detector system

Ge16 SN/11012217

Calibration

Filename: 16_Soil_TunaCan.Clb
16_TunaCan_90099_071012

Energy Calibration

Created: 2/28/2012 9:35:31 AM
Zero offset: 0.050 keV
Gain: 0.250 keV/channel
Quadratic: -2.285E-08 keV/channel^2

Efficiency Calibration

Created: 7/13/2012 9:47:24 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.01 %
Log(Eff): $1.477416E-02 + (-5.514266E-01 * \text{Log}(E)) + (-1.443482E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 1.17 %
Log(Eff): $-2.408438E+01 + (8.948554E+00 * \text{Log}(E)) + (-9.513599E-01 * \text{Log}(E)^2)$

Library Files

Main analysis library: Client_Long_Rev11.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G800W064
Start channel: 150 (37.57keV)
Stop channel: 8000 (1999.64keV)
Peak rejection level: 1000.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00 +/- 0.000E+00%
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

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Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: 3
 Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	7/12/2016 9:59:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	16_2016-07-10_0627.PBC 7/10/2016 6:27:28 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 32 cutoff: 5.00E+01 %
 Energy Calibration
 Normalized diff: 0.1702

***** S U M M A R Y O F P E A K S I N R A N G E *****								
Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq/Sampl	Nuc
46.55	17969.	0.91	0.96	2.350E-02	46.54	4.250	9.986E+03	PB210
49.82	147.	60.80	0.96	2.616E-02	50.14	8.000	3.863E+01	TH227
59.55	27061.	0.78	0.99	3.327E-02	59.54	35.900	1.259E+03	AM241
80.99	48.	150.26	0.99	4.361E-02	80.99	34.060	PBC<MDA	BA133
88.10	278.	22.59	1.02	4.552E-02	87.57	37.500	9.072E+00	Sn126
					88.04	3.790	8.955E+01	Cd109
91.10	66.	171.70	1.00	4.612E-02	91.10	28.300	PBC<MDA	Nd147
92.59	27.	418.88	1.00	4.638E-02	92.59	5.584	PBC<MDA	TH234
93.35	38.	293.60	1.00	4.651E-02	93.35	5.561	PBC<MDA	AC228
99.50	66.	169.28	1.01	4.728E-02	99.50	15.000	PBC<MDA	Np239
103.20	23.	496.14	1.01	4.755E-02	103.20	21.800	PBC<MDA	Gd153
					103.70	24.000	1.104E+00	Np239
123.10	59.	88.12	1.03	4.721E-02	123.10	40.790	PBC<MDA	EU154
144.14	24.	392.47	1.05	4.466E-02	143.79	10.960	PBC<MDA	U235
145.80	60.	147.00	1.05	4.440E-02	145.44	48.200	PBC<MDA	CE141
176.60	10.	520.10	1.08	3.977E-02	176.60	17.000	PBC<MDA	Cf251
205.64	35.	153.37	1.11	3.577E-02	205.33	5.010	PBC<MDA	U235
227.00	24.	218.22	1.13	3.332E-02	227.00	6.300	PBC<MDA	Cf251
238.70	204.	20.50	1.02	3.216E-02	238.63	43.300	8.141E+00	PB212
242.00	54.	98.09	1.14	3.185E-02	242.00	7.430	PBC<MDA	PB214
263.70	30.	149.00	1.16	2.996E-02	263.70	0.006	PBC<MDA	Cd113m
265.83	21.	203.68	1.16	2.979E-02	265.83	50.000	PBC<MDA	BI210M

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
277.28	23.	184.51	1.17	2.890E-02	277.28	6.310	PBC<MDA	TL208
287.30	42.	51.18	0.38	2.818E-02				
295.07	65.	55.39	0.65	2.765E-02	295.09	19.300	PBC<MDA	PB214
302.65	51.	148.81	1.19	2.715E-02	302.65	2.880	PBC<MDA	PA231
					302.85	18.330	5.694E+00	BA133
302.85	51.	147.46	1.19	2.714E-02	302.65	2.880	3.623E+01	PA231
					302.85	18.330	5.695E+00	BA133
304.85	51.	145.91	1.20	2.701E-02	304.85	4.290	PBC<MDA	Ba140
					304.90	28.000	3.752E+00	BI210M
304.90	46.	159.83	1.20	2.701E-02	304.85	4.290	2.214E+01	Ba140
					304.90	28.000	3.392E+00	BI210M
343.02	53.	131.79	1.23	2.475E-02	344.29	26.500	PBC<MDA	EU152
345.83	27.	265.90	1.23	2.467E-02	345.83	15.070	PBC<MDA	HF181
351.75	106.	30.96	0.62	2.437E-02	351.93	37.600	6.419E+00	PB214
363.76	13.	354.93	1.25	2.375E-02	364.48	81.700	PBC<MDA	I131
383.84	6.	800.07	1.27	2.288E-02	383.84	8.940	PBC<MDA	BA133
391.69	49.	97.99	1.27	2.255E-02	391.69	64.000	PBC<MDA	SN113
427.88	8.	611.27	1.31	2.115E-02	427.88	29.600	PBC<MDA	SB125
463.37	31.	160.22	1.34	1.996E-02	463.37	10.470	PBC<MDA	SB125
468.06	54.	84.57	1.34	1.981E-02	468.06	51.750	PBC<MDA	Ir192
489.06	96.	31.86	0.57	1.919E-02				
497.47	30.	142.26	1.37	1.896E-02	497.05	90.900	PBC<MDA	RU103
511.86	84.	76.40	2.63	1.856E-02	511.86	20.000	PBC<MDA	RH106
524.22	16.	85.29	0.19	1.824E-02				
537.26	26.	142.89	1.40	1.791E-02	537.26	24.390	PBC<MDA	Ba140
563.24	33.	103.71	1.43	1.730E-02	563.24	8.350	PBC<MDA	CS134
569.47	13.	197.17	1.43	1.716E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	5.131E+00	PA234
571.02	37.	63.88	1.43	1.716E-02	569.70	97.740	PBC<MDA	BI207
583.43	89.	37.56	1.23	1.687E-02	583.02	84.500	3.451E+00	TL208
600.50	15.	307.46	1.46	1.651E-02	600.50	17.860	PBC<MDA	SB125
609.20	68.	28.68	1.47	1.633E-02	609.31	46.090	5.034E+00	BI214
610.19	28.	167.01	1.47	1.631E-02	610.30	5.750	PBC<MDA	RU103
661.79	8784.	1.14	1.52	1.537E-02	661.66	85.210	3.727E+02	CS137
722.79	19.	142.49	1.57	1.439E-02	722.79	10.810	PBC<MDA	SB124
					722.94	90.840	8.074E-01	AG108M
					723.36	20.220	3.629E+00	EU154
722.94	30.	79.17	1.57	1.439E-02	722.79	10.810	1.065E+01	SB124
					722.94	90.840	1.268E+00	AG108M
					723.36	20.220	5.698E+00	EU154
723.36	30.	83.28	1.57	1.439E-02	722.79	10.810	PBC<MDA	SB124
					722.94	90.840	1.268E+00	AG108M
					723.36	20.220	5.699E+00	EU154
724.20	30.	87.17	1.57	1.437E-02	724.20	44.150	PBC<MDA	ZR95
735.72	18.	160.73	1.58	1.421E-02	735.72	22.500	PBC<MDA	pm146
778.92	8.	398.13	1.62	1.362E-02	778.92	12.940	PBC<MDA	EU152
785.42	33.	83.14	1.62	1.353E-02	785.42	1.280	PBC<MDA	BI212
795.87	12.	246.10	1.63	1.340E-02	795.87	85.530	PBC<MDA	CS134

pk energy	area	uncert	fw hm	corr	nuclide	brnch.	act.	nuc
810.78	19.	165.73	1.64	1.322E-02	810.78	99.460	PBC<MDA	CO58
820.88	73.	36.73	0.29	1.310E-02				
834.85	7.	502.66	1.66	1.293E-02	834.85	99.980	PBC<MDA	MN54
860.56	61.	50.02	1.69	1.264E-02	860.56	12.420	PBC<MDA	TL208
871.10	7.	331.05	1.69	1.253E-02	871.10	99.890	PBC<MDA	NB94
880.53	39.	79.63	1.70	1.243E-02	880.53	6.000	PBC<MDA	PA234
883.24	39.	82.66	1.71	1.240E-02	883.24	9.600	PBC<MDA	PA234
884.68	29.	115.37	1.71	1.238E-02	884.68	72.680	PBC<MDA	AG110M
968.97	17.	200.03	1.78	1.157E-02	968.97	17.460	PBC<MDA	AC228
996.33	27.	124.00	1.80	1.133E-02	996.33	10.600	PBC<MDA	EU154
1004.77	15.	251.25	1.81	1.126E-02	1004.77	18.010	PBC<MDA	EU154
1048.07	7.	327.95	1.84	1.091E-02	1048.07	80.000	PBC<MDA	Cs136
1099.25	8.	416.62	1.89	1.052E-02	1099.25	56.500	PBC<MDA	FE59
1115.55	38.	65.91	1.90	1.041E-02	1115.55	50.600	PBC<MDA	ZN65
1120.29	26.	99.92	1.91	1.037E-02	1120.29	15.100	PBC<MDA	BI214
					1120.55	99.987	PBC<MDA	Sc46
1121.30	6.	438.09	1.91	1.037E-02	1120.55	99.987	PBC<MDA	Sc46
					1121.30	34.900	9.470E-01	Ta182
1173.47	3717.	1.76	1.86	1.002E-02	1173.24	99.900	2.064E+02	CO60
1274.53	12.	59.00	2.03	9.409E-03	1274.53	99.940	PBC<MDA	NA22
					1274.54	35.190	2.056E+00	EU154
1274.54	10.	75.59	2.03	9.409E-03	1274.53	99.940	PBC<MDA	NA22
					1274.54	35.190	1.679E+00	EU154
1332.77	3518.	1.71	2.00	9.095E-03	1332.50	99.980	2.149E+02	CO60
1460.81	-1.	861.97	2.19	8.482E-03	1460.83	10.670	PBC<MDA	K40
1596.21	8.	85.93	2.29	7.928E-03	1596.21	95.400	PBC<MDA	La140
1836.06	8.	90.07	2.48	7.121E-03	1836.06	99.200	PBC<MDA	y88

***** U N I D E N T I F I E D P E A K S U M M A R Y *****

Peak Centroid Channel	Background Energy	Net Area Counts	Efficiency * Area	Uncert 1 Sigma	FWHM %	Suspected Nuclide
1148.35	287.30	275.	57. 2.033E+03	43.02	1.180	- sD
1955.37	489.06	218.	96. 4.994E+03	31.86	0.571	- s
2096.00	524.22	74.	16. 8.499E+02	85.29	0.187	- sc
3282.60	820.88	125.	73. 5.574E+03	36.73	0.294	- sM

s - Peak fails shape tests.
D - Peak area deconvoluted.
L - Peak written from unknown list.
C - Area < Critical level.
M - Peak is close to a library peak.

This section based on library: Client_Long_Rev11.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****							
Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	FWHM keV
PB-210	185.86	46.54	4401.	17969.	9.983	0.91	0.959D
TH-227	200.26	50.14	3926.	145.	0.080	61.80	0.962D
AM-241	237.88	59.55	4249.	27061.	15.034	0.78	0.986
TH-234	252.82	63.29	36069.	-149.	-0.083	141.72	0.975s
Sn-126	256.79	64.28	36555.	-121.	-0.067	222.98	0.976
BA-133	323.60	80.99	1448.	48.	0.026	150.26	0.991s
Np-237	345.59	86.49	6546.	-66.	-0.036	175.10	0.996
EU-155	345.80	86.54	6481.	-66.	-0.036	174.23	0.996
Sn-126	347.39	86.94	6386.	-32.	-0.018	351.69	0.997s
Sn-126	349.91	87.57	1076.	17.	0.009	241.38	0.997D
Cd-109	351.79	88.04	6412.	66.	0.036	173.06	0.998A
Nd-147	364.02	91.10	6346.	66.	0.037	171.70	1.001s
TH-234	369.98	92.59	6319.	27.	0.015	418.88	1.002
AC-228	373.02	93.35	6316.	38.	0.021	293.60	1.003s
Np-239	397.61	99.50	6265.	66.	0.037	169.28	1.008s
Gd-153	412.40	103.20	6331.	23.	0.013	496.14	1.012s
Np-239	414.40	103.70	6354.	0.	0.000	1000.00	1.012s
EU-155	420.85	105.31	2482.	-63.	-0.035	177.55	1.014s
Np-239	424.11	106.13	2770.	-65.	-0.036	114.69	1.014s
CO-57	487.81	122.06	1760.	0.	0.000	95.06	1.029A
EU-154	491.96	123.10	1309.	59.	0.033	88.12	1.030s
PA-234	524.73	131.29	4092.	-62.	-0.035	145.88	1.038s
HF-181	531.64	133.02	4029.	-62.	-0.035	144.56	1.039s
CE-144	533.70	133.54	3980.	-62.	-0.035	143.61	1.040
HF-181	544.74	136.30	4042.	-63.	-0.035	144.37	1.042s
CO-57	545.43	136.47	4105.	0.	0.000	145.47	1.042A
Tc-99m	561.57	140.51	4167.	-63.	-0.035	146.02	1.046s
U-235	574.67	143.79	4304.	24.	0.013	392.47	1.049s
CE-141	581.29	145.44	3886.	60.	0.033	147.00	1.050s
Ba-140	650.14	162.66	1027.	-17.	-0.009	272.98	1.066s
U-235	653.01	163.38	1043.	0.	0.000	1000.00	1.067
CE-139	662.90	165.85	1423.	-58.	-0.032	160.48	1.069
Cf-251	705.88	176.60	770.	10.	0.006	520.10	1.079s
U-235	820.76	205.33	827.	35.	0.020	153.37	1.105s
TH-229	842.82	210.85	848.	-14.	-0.008	381.43	1.110s
Cf-251	907.40	227.00	755.	24.	0.013	218.22	1.125s
PB-212	954.18	238.70	469.	204.	0.113	20.50	1.017
PB-214	967.37	242.00	1360.	54.	0.030	98.09	1.139
EU-152	978.14	244.69	1782.	-56.	-0.031	106.99	1.141s
TH-227	1024.32	256.24	776.	-35.	-0.019	156.74	1.152
Cd-113m	1054.15	263.70	984.	30.	0.017	149.00	1.158s
BI-210M	1062.67	265.83	905.	21.	0.012	203.68	1.160s
TL-208	1108.46	277.28	864.	23.	0.013	184.51	1.171
Hg-203	1116.13	279.20	887.	0.	0.000	1000.00	1.173s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
I-131	1136.52	284.30	848.	-29.	-0.016	80.62	1.177s
PB-214	1179.61	295.07	349.	65.	0.036	55.39	0.646s
PA-233	1200.02	300.18	3109.	-53.	-0.030	148.43	1.192s
PA-231	1209.90	302.65	2853.	51.	0.028	148.81	1.194s
BA-133	1210.70	302.85	2802.	51.	0.028	147.46	1.194s
Ba-140	1218.69	304.85	2751.	51.	0.028	145.91	1.196s
BI-210M	1218.88	304.90	2700.	46.	0.026	159.83	1.196s
Ir-192	1233.05	308.44	3414.	-53.	-0.029	156.87	1.199
PA-233	1247.34	312.01	3361.	-53.	-0.029	155.25	1.202s
Ir-192	1265.24	316.49	3308.	-53.	-0.030	153.51	1.206
CR-51	1279.62	320.08	3346.	-53.	-0.030	153.97	1.210s
La-140	1314.31	328.76	2559.	-55.	-0.031	64.91	1.217
Cf-249	1333.02	333.44	2531.	-54.	-0.030	133.59	1.222s
AC-228	1352.54	338.32	2584.	-54.	-0.030	134.49	1.226
Cs-136	1361.54	340.57	2345.	-53.	-0.030	128.77	1.228s
EU-152	1376.40	344.29	2407.	53.	0.029	131.79	1.231s
HF-181	1382.56	345.83	2502.	27.	0.015	265.90	1.233s
PB-214	1406.25	351.75	293.	106.	0.059	30.96	0.624s
BA-133	1423.24	356.00	1170.	-54.	-0.030	90.19	1.242s
I-131	1457.16	364.48	552.	13.	0.007	354.93	1.250s
BA-133	1534.57	383.84	1086.	6.	0.003	800.07	1.267s
Cf-249	1551.01	387.95	1092.	0.	0.000	1000.00	1.271s
SN-113	1565.96	391.69	1133.	49.	0.027	97.99	1.274
SB-125	1710.67	427.88	572.	8.	0.004	611.27	1.307s
AG-108M	1734.91	433.94	620.	-46.	-0.025	112.25	1.312s
pm-146	1814.67	453.88	633.	-11.	-0.006	482.31	1.330s
SB-125	1852.61	463.37	1250.	31.	0.017	160.22	1.338s
Ir-192	1871.38	468.06	1008.	54.	0.030	84.57	1.342
BE-7	1909.51	477.60	1514.	-50.	-0.028	110.19	1.351s
HF-181	1927.12	482.00	1464.	-11.	-0.006	501.42	1.355s
La-140	1947.21	487.02	1451.	-47.	-0.026	116.35	1.359s
RU-103	1987.33	497.05	420.	30.	0.016	142.26	1.368s
RH-106	2046.57	511.86	588.	84.	0.047	76.40	2.631s
Nd-147	2123.10	531.00	347.	-14.	-0.008	279.40	1.398s
Ba-140	2148.14	537.26	325.	26.	0.014	142.89	1.404s
CS-134	2252.03	563.24	265.	33.	0.018	103.71	1.427s
CS-134	2276.36	569.32	383.	-16.	-0.009	171.32	1.432s
PA-234	2276.96	569.47	322.	13.	0.007	197.17	1.432s
BI-207	2277.89	569.70	265.	37.	0.021	63.88	1.432s
TL-208	2332.80	583.43	214.	89.	0.049	37.56	1.226
SB-125	2401.07	600.50	1117.	15.	0.009	307.46	1.460s
SB-124	2409.99	602.73	1132.	0.	0.000	1000.00	1.462s
CS-134	2417.91	604.71	1132.	0.	0.000	1000.00	1.463s
BI-214	2436.31	609.31	156.	68.	0.038	28.68	1.467D
RU-103	2440.26	610.30	1104.	28.	0.016	167.01	1.468s
AG-108M	2456.19	614.28	1132.	0.	0.000	1000.00	1.472s
PM-144	2471.31	618.06	1132.	0.	0.000	1000.00	1.475
RH-106	2486.73	621.92	1273.	-40.	-0.022	126.68	1.479s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
SB-125	2542.62	635.89	303.	-37.	-0.021	100.31	1.491s
I-131	2546.96	636.97	400.	-16.	-0.009	174.93	1.492
CS-137	2646.21	661.79	193.	8784.	4.880	1.14	1.525
PM-144	2785.22	696.54	459.	-39.	-0.021	79.95	1.544s
NB-94	2809.57	702.63	535.	-42.	-0.023	47.28	1.549s
SB-124	2890.19	722.79	357.	19.	0.011	142.49	1.567
AG-108M	2890.80	722.94	264.	30.	0.017	79.17	1.567
EU-154	2892.47	723.36	294.	30.	0.017	83.28	1.567
ZR-95	2895.84	724.20	324.	30.	0.017	87.17	1.568s
BI-212	2907.73	727.17	354.	-16.	-0.009	169.61	1.570s
pm-146	2941.93	735.72	182.	18.	0.010	160.73	1.578s
pm-146	2987.69	747.16	243.	-38.	-0.021	89.23	1.588s
ZR-95	3025.97	756.73	234.	-34.	-0.019	57.91	1.596s
NB-95	3062.21	765.79	225.	-18.	-0.010	118.13	1.604s
EU-152	3114.73	778.92	205.	8.	0.004	398.13	1.615
BI-212	3140.74	785.42	163.	33.	0.019	83.14	1.621s
CS-134	3182.53	795.87	406.	12.	0.006	246.10	1.630s
CS-134	3206.86	801.95	489.	-41.	-0.023	77.12	1.635s
CO-58	3242.16	810.78	504.	19.	0.011	165.73	1.643s
La-140	3262.14	815.77	523.	0.	0.000	1000.00	1.647
Cs-136	3273.06	818.50	523.	0.	0.000	1000.00	1.649s
MN-54	3338.46	834.85	245.	7.	0.004	502.66	1.663s
Co-56	3386.15	846.77	280.	-44.	-0.024	85.82	1.674s
TL-208	3441.33	860.56	180.	61.	0.034	50.02	1.685
NB-94	3483.47	871.10	265.	7.	0.004	331.05	1.695s
EU-154	3492.00	873.23	390.	-18.	-0.010	161.47	1.696s
PA-234	3521.21	880.53	469.	39.	0.022	79.63	1.703s
PA-234	3532.05	883.24	509.	39.	0.022	82.66	1.705s
AG-110M	3537.82	884.68	548.	29.	0.016	115.37	1.706s
Sc-46	3556.21	889.28	628.	-41.	-0.023	87.40	1.710
y-88	3591.26	898.04	315.	-33.	-0.018	119.51	1.718s
AC-228	3643.38	911.07	370.	-24.	-0.013	177.38	1.729s
AG-110M	3749.09	937.49	335.	-27.	-0.015	150.27	1.751s
PA-234	3783.21	946.02	365.	-7.	-0.004	476.97	1.759s
EU-152	3855.58	964.11	533.	-28.	-0.015	119.50	1.774s
AC-228	3875.02	968.97	558.	17.	0.009	200.03	1.778s
EU-154	3984.48	996.33	533.	27.	0.015	124.00	1.801s
EU-154	4018.27	1004.77	272.	15.	0.008	251.25	1.808
Co-56	4150.56	1037.84	256.	-34.	-0.019	108.33	1.836s
Cs-136	4191.49	1048.07	260.	7.	0.004	327.95	1.845s
RH-106	4200.65	1050.36	329.	-40.	-0.022	66.05	1.847s
BI-207	4253.86	1063.66	283.	-47.	-0.026	25.35	1.858s
Ga-68	4308.84	1077.40	272.	-40.	-0.022	95.04	1.870s
FE-59	4396.27	1099.25	230.	8.	0.005	416.62	1.888s
ZN-65	4461.46	1115.55	294.	38.	0.021	65.91	1.901s
BI-214	4480.43	1120.29	334.	26.	0.015	99.92	1.906
Ta-182	4484.49	1121.30	362.	6.	0.003	438.09	1.906s
CO-60	4693.23	1173.47	89.	3717.	2.065	1.76	1.861

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Ta-182	4755.57	1189.05	108.	-14.	-0.008	180.10	1.963s
Ta-182	4885.06	1221.41	79.	-4.	-0.002	484.43	1.990s
Co-56	4952.57	1238.28	80.	-23.	-0.013	284.88	2.004
NA-22	5097.62	1274.53	20.	12.	0.007	59.00	2.034s
EU-154	5097.68	1274.54	24.	10.	0.006	75.59	2.034s
FE-59	5165.91	1291.60	57.	-8.	-0.005	773.72	2.048s
CO-60	5330.69	1332.77	14.	3518.	1.954	1.71	1.995
AG-110M	5536.89	1384.30	18.	-4.	-0.002	261.01	2.124s
EU-152	5631.75	1408.00	18.	0.	0.000	1000.00	2.143s
K-40	5843.19	1460.83	24.	-1.	-0.001	861.97	2.186
La-140	6385.02	1596.21	6.	8.	0.004	85.93	2.294s
SB-124	6764.37	1690.98	25.	-13.	-0.007	97.66	2.369s
BI-214	7058.61	1764.49	57.	-22.	-0.012	26.07	2.427s
y-88	7345.12	1836.06	7.	8.	0.004	90.07	2.483s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****									
- Nuclide -	Average	----- Peak -----							
Name	Code	Activity	Energy	Activity	Code	MDA	Value		
		Bq/Sample	keV	Bq/Sample		Bq/Sample		COMMENTS	
BE-7	C	-1.3621E+01						5.31E+01	
			477.60	-1.362E+01	?(	4.978E+01	1.10E+02	1.05E+01	G
NA-22	C	7.2386E-01						9.50E+02	
			1274.53	7.239E-01	&(	1.391E+00	5.90E+01	9.99E+01	G
K-40	N	-6.8935E-01						4.66E+11	
			1460.83	-6.894E-01	?(P	1.564E+01	8.62E+02	1.07E+01	G
Sc-46	F	-1.8556E+00						8.38E+01	
			889.28	-1.856E+00	?(	5.381E+00	8.74E+01	1.00E+02	G
			1120.55	-7.884E-02	% P	4.892E+00	1.79E+03	1.00E+02	G
CR-51	F	-1.1431E+01						2.77E+01	
			320.08	-1.143E+01	?(	5.835E+01	1.54E+02	9.94E+00	G
MN-54	C	2.9508E-01						3.12E+02	
			834.85	2.951E-01	?(P	3.251E+00	5.03E+02	1.00E+02	G
FE-59	F	7.7513E-01						4.45E+01	
			1099.25	7.751E-01	?(P	6.854E+00	4.17E+02	5.65E+01	G
			1291.60	-1.169E+00	+ P	5.252E+00	7.74E+02	4.32E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Co-56	C	-1.8920E+00					7.73E+01
		846.77-1.892E+00	?(	3.505E+00	8.58E+01	9.99E+01	G
		1238.28-2.011E+00	+ P	3.881E+00	2.85E+02	6.61E+01	G
		1037.84-1.217E+01	+	2.765E+01	1.08E+02	1.41E+01	G
		1771.35-2.451E-01	%	2.056E+01	2.38E+03	1.55E+01	A
CO-58	C	8.1707E-01					7.09E+01
		810.78 8.171E-01	&(	4.534E+00	1.66E+02	9.95E+01	G
CO-60	F	2.1062E+02					1.93E+03
		1332.50 2.149E+02	(	1.243E+00	1.71E+00	1.00E+02	G
		1173.24 2.064E+02	(P	2.588E+00	1.76E+00	9.99E+01	G
ZN-65	F	4.0084E+00					2.44E+02
		1115.55 4.008E+00	&(	8.724E+00	6.59E+01	5.06E+01	G
NB-94	I	-1.6041E+00					7.41E+06
		702.63-1.604E+00	(P	4.264E+00	4.73E+01	9.79E+01	G
		871.10 3.108E-01	+	3.488E+00	3.31E+02	9.99E+01	G
ZR-95	I	-2.4929E+00					6.40E+01
		756.73-2.493E+00	?(P	5.425E+00	5.79E+01	5.45E+01	G
		724.20 2.614E+00	+	7.577E+00	8.72E+01	4.42E+01	G
NB-95	I	-7.4014E-01					6.40E+01
		765.79-7.401E-01	&(	2.933E+00	1.18E+02	9.98E+01	G
RU-103	I	9.5618E-01					3.93E+01
		497.05 9.562E-01	?(	3.167E+00	1.42E+02	9.09E+01	G
		610.30 1.677E+01	?	9.331E+01	1.67E+02	5.75E+00	GA
RH-106	I	-1.3961E+01					3.74E+02
		621.92-1.396E+01	?(	5.876E+01	1.27E+02	9.93E+00	G
		1050.36-1.308E+02	+	2.853E+02	6.60E+01	1.56E+00	G
		511.86 1.255E+01	?	1.732E+01	7.64E+01	2.00E+01	GA
AG-108M	C	-3.3241E-02					1.53E+05
		433.94-1.339E+00	?(	3.482E+00	1.12E+02	9.05E+01	G
		722.94 1.268E+00	&(	3.333E+00	7.92E+01	9.08E+01	G
		614.28 0.000E+00	+	6.075E+00	1.00E+03	8.98E+01	G
AG-110M	F	1.7945E+00					2.50E+02
		884.68 1.794E+00	&(	6.900E+00	1.15E+02	7.27E+01	G
		657.76 1.395E-01	%	1.703E+01	3.68E+03	9.46E+01	G
		937.49-3.681E+00	&	1.200E+01	1.50E+02	3.44E+01	G
		1384.30-1.035E+00	-	5.819E+00	2.61E+02	2.43E+01	G
		763.94 2.407E-01	%	1.281E+01	1.56E+03	2.23E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
SN-113	F	1.8906E+00					1.15E+02
		391.69	1.891E+00	?(	6.144E+00	9.80E+01	6.40E+01 G
SB-124	F	6.7232E-01					6.02E+01
		602.73	0.000E+00	?(	5.478E+00	1.00E+03	9.83E+01 G
		1690.98	-2.043E+00	+	4.010E+00	9.77E+01	4.78E+01 G
		722.79	6.784E+00	(	3.240E+01	1.42E+02	1.08E+01 G
SB-125	I	2.7675E+00					1.01E+03
		427.88	7.099E-01	(	1.013E+01	6.11E+02	2.96E+01 G
		600.50	2.906E+00	?(	2.985E+01	3.07E+02	1.79E+01 G
		635.89	-1.159E+01	+	2.603E+01	1.00E+02	1.13E+01 G
		463.37	8.348E+00	?(P	4.452E+01	1.60E+02	1.05E+01 G
I-131	I	3.7216E-01					8.02E+00
		364.48	3.722E-01	&(	3.212E+00	3.55E+02	8.17E+01 G
		284.30	-9.249E+00	& P	4.411E+01	8.06E+01	6.14E+00 G
		636.97	-8.007E+00	+	4.702E+01	1.75E+02	7.17E+00 G
Gd-153	F	5.1198E-01					2.42E+02
		97.50	-6.003E-07	&(	1.472E+01	7.39E+08	3.00E+01 G
		103.20	1.217E+00	?(	2.002E+01	4.96E+02	2.18E+01 G
Ga-68	C	-7.3508E+01					4.71E-02
		1077.40	-7.351E+01	?(	1.462E+02	9.50E+01	3.30E+00 G
Tc-99m	I	-8.9032E-01					2.51E-01
		140.51	-8.903E-01	(	4.306E+00	1.46E+02	8.93E+01 G
BA-133	F	-2.5333E-01					3.85E+03
		356.00	-2.011E+00	?(	6.007E+00	9.02E+01	6.20E+01 G
		302.85	5.695E+00	?(	2.785E+01	1.47E+02	1.83E+01 G
		383.84	1.584E+00	&	4.245E+01	8.00E+02	8.94E+00 GA
		80.99	1.781E+00	& P	6.734E+00	1.50E+02	3.41E+01 GA
CS-134	I	7.9761E-01					7.54E+02
		604.71	0.000E+00	&(	5.527E+00	1.00E+03	9.76E+01 G
		795.87	5.655E-01	?(	4.684E+00	2.46E+02	8.55E+01 G
		569.32	-3.437E+00	&	1.977E+01	1.71E+02	1.54E+01 G
		801.95	-1.986E+01	+	5.072E+01	7.71E+01	8.69E+00 G
		563.24	1.250E+01	&(P	3.024E+01	1.04E+02	8.35E+00 G
CS-137	I	3.7268E+02					1.10E+04
		661.66	3.727E+02	(	2.859E+00	1.14E+00	8.52E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CE-139	F	-9.6882E-01					1.38E+02
		165.85-9.688E-01	&(P	2.986E+00	1.60E+02	7.99E+01	G
Ba-140	I	6.4744E+00					1.28E+01
		537.26 3.306E+00	&(	1.103E+01	1.43E+02	2.44E+01	G
		162.66-3.599E+00	+	3.283E+01	2.73E+02	6.22E+00	G
		304.85 2.449E+01	&(	1.185E+02	1.46E+02	4.29E+00	G
La-140	I	5.8632E-01					1.28E+01
		1596.21 5.863E-01	?(	1.061E+00	8.59E+01	9.54E+01	G
		487.02-2.961E+00	&	1.143E+01	1.16E+02	4.55E+01	G
		328.76-5.900E+00	& P	2.551E+01	6.49E+01	2.03E+01	G
		815.77 0.000E+00	-	1.982E+01	1.00E+03	2.33E+01	G
CE-141	I	1.5630E+00					3.25E+01
		145.44 1.563E+00	&(	7.612E+00	1.47E+02	4.82E+01	G
CE-144	I	-6.7746E+00					2.85E+02
		133.54-6.775E+00	(	3.223E+01	1.44E+02	1.11E+01	G
PM-144	C	-1.4679E+00					3.63E+02
		696.54-1.468E+00	&(	3.891E+00	8.00E+01	9.90E+01	G
		618.06 0.000E+00	&	5.533E+00	1.00E+03	9.91E+01	G
EU-152	F	3.8058E+00					4.94E+03
		344.29 4.484E+00	&(	1.960E+01	1.32E+02	2.65E+01	G
		1112.07 1.171E+00	%	4.062E+01	1.03E+03	1.36E+01	G
		121.78 0.000E+00	}	8.044E+00	3.65E+03	2.86E+01	G
		778.92 2.417E+00	(	2.191E+01	3.98E+02	1.29E+01	G
		964.11-9.063E+00	&	3.612E+01	1.19E+02	1.46E+01	G
		244.69-1.304E+01	+	4.625E+01	1.07E+02	7.58E+00	G
		1408.00 0.000E+00	&	6.816E+00	1.00E+03	2.10E+01	GA
EU-154	I	3.9652E+00					3.14E+03
		873.23-6.336E+00	?(	3.432E+01	1.61E+02	1.23E+01	G
		123.10 1.694E+00	&	4.942E+00	8.81E+01	4.08E+01	G
		1274.54 1.679E+00	&	4.252E+00	7.56E+01	3.52E+01	G
		723.36 5.699E+00	&(	1.577E+01	8.33E+01	2.02E+01	G
		1004.77 4.110E+00	&(	2.180E+01	2.51E+02	1.80E+01	G
		996.33 1.234E+01	(	5.104E+01	1.24E+02	1.06E+01	G
EU-155	I	-3.4867E+00					1.81E+03
		105.31-3.487E+00	(P	1.291E+01	1.78E+02	2.12E+01	G
		86.54-2.625E+00	+	1.514E+01	1.74E+02	3.07E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
HF-181	F	3.0443E-01					4.24E+01
		482.00-3.847E-01	&(	6.441E+00	5.01E+02	8.05E+01	G
		133.02-1.732E+00	&	8.293E+00	1.45E+02	4.33E+01	G
		345.83 3.986E+00	?(	3.523E+01	2.66E+02	1.51E+01	G
		136.30-1.298E+01	+	6.205E+01	1.44E+02	5.85E+00	G
Ta-182	F	9.4704E-01					1.14E+02
		1121.30 9.470E-01	?(	1.403E+01	4.38E+02	3.49E+01	G
		1221.41-9.176E-01	+	9.363E+00	4.84E+02	2.70E+01	G
		1189.05-4.726E+00	+	1.766E+01	1.80E+02	1.62E+01	G
TL-208	N	3.6916E+00					6.98E+02
		583.02 3.451E+00	(P	2.765E+00	3.76E+01	8.45E+01	G
		277.28 6.910E+00	(P	4.256E+01	1.85E+02	6.31E+00	G
		860.56 2.158E+01	+	2.308E+01	5.00E+01	1.24E+01	G
pm-146	C	-4.3822E+00					2.02E+03
		747.16-4.382E+00	?(	8.761E+00	8.92E+01	3.40E+01	G
		735.72 3.128E+00	+	1.140E+01	1.61E+02	2.25E+01	G
		453.88-4.500E-01	+	5.059E+00	4.82E+02	6.50E+01	G
y-88	F	-1.5977E+00					1.07E+02
		898.04-1.598E+00	(	4.136E+00	1.20E+02	9.37E+01	G
		1836.06 6.303E-01	+ P	1.182E+00	9.01E+01	9.92E+01	G
Cd-113m		9.2721E+03					5.33E+03
		263.70 9.272E+03	&(	4.602E+04	1.49E+02	6.00E-03	K
Cd-109	F	2.1133E+01					4.53E+02
							Derived Ave Activity
		88.04 2.113E+01	}(	1.211E+02	1.73E+02	3.79E+00	G
Cf-251	T	8.2173E-01					3.28E+05
		176.60 8.217E-01	(	1.085E+01	5.20E+02	1.70E+01	G
		227.00 6.263E+00	?	3.461E+01	2.18E+02	6.30E+00	GA
Sn-126		-1.9205E+01					3.65E+07
		87.57 5.417E-01	}	5.076E+00	2.41E+02	3.75E+01	GA
		64.28-1.920E+01	(	1.414E+02	2.23E+02	9.70E+00	G
		86.94-4.370E+00	+	5.094E+01	3.52E+02	9.04E+00	GA
PB-210	N	9.9857E+03					8.14E+03
		46.54 9.986E+03	(P	1.733E+02	9.11E-01	4.25E+00	G
PB-212	N	8.1414E+00					6.98E+02
		238.63 8.141E+00	(P	4.133E+00	2.05E+01	4.33E+01	G
		300.03 0.000E+00	}	1.614E+02	2.78E+03	3.28E+00	GA

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-214	N	6.5205E+00					5.84E+05
		351.93	6.419E+00	(P	5.004E+00	3.10E+01	3.76E+01 G
		295.09	6.718E+00	*(P	9.352E+00	5.54E+01	1.93E+01 G
		242.00	1.260E+01		4.098E+01	9.81E+01	7.43E+00 GA
BI-207	C	1.2344E+00					1.18E+04
		569.70	1.234E+00	&(	2.601E+00	6.39E+01	9.77E+01 G
		1063.66	-3.228E+00	- P	5.604E+00	2.54E+01	7.45E+01 G
BI-212	N	-8.1438E+00					6.98E+02
		727.17	-8.144E+00	?(	4.640E+01	1.70E+02	7.55E+00 G
		785.42	1.069E+02	?	1.997E+02	8.31E+01	1.28E+00 GA
BI-214	N	6.0994E+00					5.84E+05
		609.31	5.034E+00	(P	4.495E+00	2.87E+01	4.61E+01 G
		1120.29	9.351E+00	(P	3.115E+01	9.99E+01	1.51E+01 G
		1764.49	-1.058E+01	- P	1.855E+01	2.61E+01	1.54E+01 G
BI-210M	T	1.7201E+00					1.10E+09
		265.83	7.837E-01	&(P	5.330E+00	2.04E+02	5.00E+01 G
		304.90	3.392E+00	&(	1.799E+01	1.60E+02	2.80E+01 G
AC-228	N	-6.2889E-01					2.10E+03
		911.07	-3.795E+00	(	1.460E+01	1.77E+02	2.90E+01 G
		968.97	4.630E+00	*(	3.104E+01	2.00E+02	1.75E+01 G
		338.32	-9.918E+00	+	4.422E+01	1.34E+02	1.20E+01 G
		93.35	8.235E+00	*	8.013E+01	2.94E+02	5.56E+00 XA
TH-227	N	3.8001E+01					7.95E+03
		50.14	3.800E+01	!(	7.739E+01	6.18E+01	8.00E+00 G
		256.24	-9.085E+00	+	3.440E+01	1.57E+02	7.00E+00 G
TH-229	N	1.2413E+00					2.68E+06
		193.51	1.241E+00	&(	5.019E+01	1.59E+03	4.40E+00 G
		210.85	-7.511E+00	& P	7.326E+01	3.81E+02	2.99E+00 G
TH-234	N	-6.1161E+01					1.63E+12
		63.29	-6.116E+01	(P	3.635E+02	1.42E+02	3.81E+00 G
		92.59	5.764E+00	+ P	8.004E+01	4.19E+02	5.58E+00 G
PA-231	N	3.6224E+01					1.20E+07
		302.65	3.622E+01	?(	1.788E+02	1.49E+02	2.88E+00 G
		300.07	0.000E+00	}	2.148E+02	2.78E+03	2.46E+00 G
PA-233	C	-3.0799E+00					7.82E+08
		312.01	-3.080E+00	&(	1.585E+01	1.55E+02	3.60E+01 G
		300.18	-1.751E+01	&	8.614E+01	1.48E+02	6.20E+00 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PA-234	N	4.0150E+00				1.63E+12	
		131.29-4.141E+00	(	2.001E+01	1.46E+02	1.80E+01	G
		946.02-2.549E+00	+ P	3.230E+01	4.77E+02	1.34E+01	G
		569.47 5.131E+00	&(	3.408E+01	1.97E+02	8.20E+00	G
		883.24 1.835E+01	? (	5.032E+01	8.27E+01	9.60E+00	G
		880.53 2.926E+01	?	7.724E+01	7.96E+01	6.00E+00	GA
PA-234M	N	-9.9970E+00				1.63E+12	
		1001.00-9.997E+00	%(P	6.653E+02	2.03E+03	8.37E-01	G
		766.41 2.285E+00	&	1.067E+03	1.37E+04	2.94E-01	G
U-235	N	5.2745E+00				2.57E+11	
		143.79 2.687E+00	?(P	3.501E+01	3.92E+02	1.10E+01	G
		205.33 1.094E+01	?(P	4.238E+01	1.53E+02	5.01E+00	G
		163.38 0.000E+00	-	4.065E+01	1.00E+03	5.08E+00	G
AM-241	T	1.2589E+03				1.58E+05	
		59.54 1.259E+03	(P	1.426E+01	7.82E-01	3.59E+01	G
Np-237	F	-6.1540E+00				2.14E+06	
		86.49-6.154E+00	?(	3.567E+01	1.75E+02	1.31E+01	G
Ir-192	F	2.7724E-01				7.40E+01	
		316.49-1.291E+00	?(	6.572E+00	1.54E+02	8.70E+01	G
		468.06 2.915E+00	(	8.165E+00	8.46E+01	5.18E+01	G
		308.44-3.454E+00	&	1.796E+01	1.57E+02	3.18E+01	G
Cs-136	F	1.9810E-01				1.30E+01	
		818.50 0.000E+00	?(	4.626E+00	1.00E+03	1.00E+02	G
		1048.07 4.457E-01	?(	4.957E+00	3.28E+02	8.00E+01	G
		340.57-2.540E+00	&	1.084E+01	1.29E+02	4.69E+01	G
Np-239	T	-3.3506E+00				2.36E+00	
		103.70 0.000E+00	&	1.820E+01	1.00E+03	2.40E+01	X
		106.13-3.351E+00	?(	1.273E+01	1.15E+02	2.27E+01	G
		99.50 5.194E+00	&	2.911E+01	1.69E+02	1.50E+01	X
Nd-147		9.0104E-01				1.11E+01	
		531.00-3.233E+00	&(	2.116E+01	2.79E+02	1.30E+01	G
		91.10 2.800E+00	?(	1.592E+01	1.72E+02	2.83E+01	G

(- This peak used in the nuclide activity average.

* - Peak is too wide, but only one peak in library.

! - Peak is part of a multiplet and this area went negative during deconvolution.

? - Peak is too narrow.

@ - Peak is too wide at FW25M, but ok at FWHM.
% - Peak fails sensitivity test.
\$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
+ - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
= - Peak outside analysis energy range.
& - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
P - Peakbackground subtraction
} - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
F - Fast Neutron Activation
I - Fission Product
N - Naturally Occurring Isotope
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded

Peak Codes:

G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape
K - Key Line
A - Not in Average
C - Coincidence Peak

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	Activity	
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TH-234	63.29	36069.	-149.	-0.083	141.72	-6.116E+01	P
BA-133	80.99	1448.	48.	0.026	150.26	1.781E+00	P
Np-237	86.49	6546.	-66.	-0.036	175.10	-6.154E+00	
EU-155	86.54	6481.	-66.	-0.036	174.23	-2.625E+00	
Nd-147	91.10	6346.	66.	0.037	171.70	2.800E+00	
TH-234	92.59	6319.	27.	0.015	418.88	5.764E+00	P
AC-228	93.35	6316.	38.	0.021	293.60	8.235E+00	
Np-239	99.50	6265.	66.	0.037	169.28	5.194E+00	
Gd-153	103.20	6331.	23.	0.013	496.14	1.217E+00	
EU-155	105.31	2482.	-63.	-0.035	177.55	-3.487E+00	P
Np-239	106.13	2770.	-65.	-0.036	114.69	-3.351E+00	
EU-154	123.10	1309.	59.	0.033	88.12	1.694E+00	
PA-234	131.29	4092.	-62.	-0.035	145.88	-4.141E+00	
HF-181	133.02	4029.	-62.	-0.035	144.56	-1.732E+00	
CE-144	133.54	3980.	-62.	-0.035	143.61	-6.775E+00	
HF-181	136.30	4042.	-63.	-0.035	144.37	-1.298E+01	
Tc-99m	140.51	4167.	-63.	-0.035	146.02	-8.903E-01	
Ba-140	162.66	1027.	-17.	-0.009	272.98	-3.599E+00	
CE-139	165.85	1423.	-58.	-0.032	160.48	-9.688E-01	P
Cf-251	176.60	770.	10.	0.006	520.10	8.217E-01	
TH-229	210.85	848.	-14.	-0.008	381.43	-7.511E+00	P
Cf-251	227.00	755.	24.	0.013	218.22	6.263E+00	
Cd-113m	263.70	984.	30.	0.017	149.00	9.272E+03	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
BI-210M	265.83	905.	21.	0.012	203.68	7.837E-01	P
PA-233	300.18	3109.	-53.	-0.030	148.43	-1.751E+01	
BA-133	302.85	2802.	51.	0.028	147.46	5.695E+00	
Ba-140	304.85	2751.	51.	0.028	145.91	2.449E+01	
BI-210M	304.90	2700.	46.	0.026	159.83	3.392E+00	
Ir-192	308.44	3414.	-53.	-0.029	156.87	-3.454E+00	
PA-233	312.01	3361.	-53.	-0.029	155.25	-3.080E+00	
Ir-192	316.49	3308.	-53.	-0.030	153.51	-1.291E+00	
CR-51	320.08	3346.	-53.	-0.030	153.97	-1.143E+01	
La-140	328.76	2559.	-55.	-0.031	64.91	-5.900E+00	P
Cf-249	333.44	2531.	-54.	-0.030	133.59	-7.572E+00	
AC-228	338.32	2584.	-54.	-0.030	134.49	-9.918E+00	
Cs-136	340.57	2345.	-53.	-0.030	128.77	-2.540E+00	
HF-181	345.83	2502.	27.	0.015	265.90	3.986E+00	
BA-133	356.00	1170.	-54.	-0.030	90.19	-2.011E+00	
BA-133	383.84	1086.	6.	0.003	800.07	1.584E+00	
SN-113	391.69	1133.	49.	0.027	97.99	1.891E+00	
SB-125	427.88	572.	8.	0.004	611.27	7.099E-01	
AG-108M	433.94	620.	-46.	-0.025	112.25	-1.339E+00	
pm-146	453.88	633.	-11.	-0.006	482.31	-4.500E-01	
SB-125	463.37	1250.	31.	0.017	160.22	8.348E+00	P
Ir-192	468.06	1008.	54.	0.030	84.57	2.915E+00	
BE-7	477.60	1514.	-50.	-0.028	110.19	-1.362E+01	
HF-181	482.00	1464.	-11.	-0.006	501.42	-3.847E-01	
La-140	487.02	1451.	-47.	-0.026	116.35	-2.961E+00	
RH-106	511.86	588.	84.	0.047	76.40	1.255E+01	
Nd-147	531.00	347.	-14.	-0.008	279.40	-3.233E+00	
Ba-140	537.26	325.	26.	0.014	142.89	3.306E+00	
CS-134	563.24	265.	33.	0.018	103.71	1.250E+01	P
CS-134	569.32	383.	-16.	-0.009	171.32	-3.437E+00	
PA-234	569.47	322.	13.	0.007	197.17	5.131E+00	
SB-125	600.50	1117.	15.	0.009	307.46	2.906E+00	
RH-106	621.92	1273.	-40.	-0.022	126.68	-1.396E+01	
SB-125	635.89	303.	-37.	-0.021	100.31	-1.159E+01	
PM-144	696.54	459.	-39.	-0.021	79.95	-1.468E+00	
NB-94	702.63	535.	-42.	-0.023	47.28	-1.604E+00	P
AG-108M	722.94	264.	30.	0.017	79.17	1.268E+00	
EU-154	723.36	294.	30.	0.017	83.28	5.699E+00	
ZR-95	724.20	324.	30.	0.017	87.17	2.614E+00	
BI-212	727.17	354.	-16.	-0.009	169.61	-8.144E+00	
pm-146	735.72	182.	18.	0.010	160.73	3.128E+00	
pm-146	747.16	243.	-38.	-0.021	89.23	-4.382E+00	
ZR-95	756.73	234.	-34.	-0.019	57.91	-2.493E+00	P
NB-95	765.79	225.	-18.	-0.010	118.13	-7.401E-01	
BI-212	785.42	163.	33.	0.019	83.14	1.069E+02	
CS-134	795.87	406.	12.	0.006	246.10	5.655E-01	
CS-134	801.95	489.	-41.	-0.023	77.12	-1.986E+01	
CO-58	810.78	504.	19.	0.011	165.73	8.171E-01	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
MN-54	834.85	245.	7.	0.004	502.66	2.951E-01	P
Co-56	846.77	280.	-44.	-0.024	85.82	-1.892E+00	
NB-94	871.10	265.	7.	0.004	331.05	3.108E-01	
EU-154	873.23	390.	-18.	-0.010	161.47	-6.336E+00	
PA-234	880.53	469.	39.	0.022	79.63	2.926E+01	
PA-234	883.24	509.	39.	0.022	82.66	1.835E+01	
AG-110M	884.68	548.	29.	0.016	115.37	1.794E+00	
Sc-46	889.28	628.	-41.	-0.023	87.40	-1.856E+00	
y-88	898.04	315.	-33.	-0.018	119.51	-1.598E+00	
AC-228	911.07	370.	-24.	-0.013	177.38	-3.795E+00	
AG-110M	937.49	335.	-27.	-0.015	150.27	-3.681E+00	
PA-234	946.02	365.	-7.	-0.004	476.97	-2.549E+00	P
AC-228	968.97	558.	17.	0.009	200.03	4.630E+00	
EU-154	996.33	533.	27.	0.015	124.00	1.234E+01	
EU-154	1004.77	272.	15.	0.008	251.25	4.110E+00	
Co-56	1037.84	256.	-34.	-0.019	108.33	-1.217E+01	
Cs-136	1048.07	260.	7.	0.004	327.95	4.457E-01	
RH-106	1050.36	329.	-40.	-0.022	66.05	-1.308E+02	
Ga-68	1077.40	272.	-40.	-0.022	95.04	-7.351E+01	
FE-59	1099.25	230.	8.	0.005	416.62	7.751E-01	P
ZN-65	1115.55	294.	38.	0.021	65.91	4.008E+00	
Ta-182	1121.30	362.	6.	0.003	438.09	9.470E-01	
Ta-182	1189.05	108.	-14.	-0.008	180.10	-4.726E+00	
Ta-182	1221.41	79.	-4.	-0.002	484.43	-9.176E-01	
Co-56	1238.28	80.	-23.	-0.013	284.88	-2.011E+00	P
NA-22	1274.53	20.	12.	0.007	59.00	7.239E-01	
EU-154	1274.54	24.	10.	0.006	75.59	1.679E+00	
FE-59	1291.60	57.	-8.	-0.005	773.72	-1.169E+00	P
AG-110M	1384.30	18.	-4.	-0.002	261.01	-1.035E+00	
K-40	1460.83	24.	-1.	-0.001	861.97	-6.894E-01	P
La-140	1596.21	6.	8.	0.004	85.93	5.863E-01	
y-88	1836.06	7.	8.	0.004	90.07	6.303E-01	P

P - Peakbackground subtraction

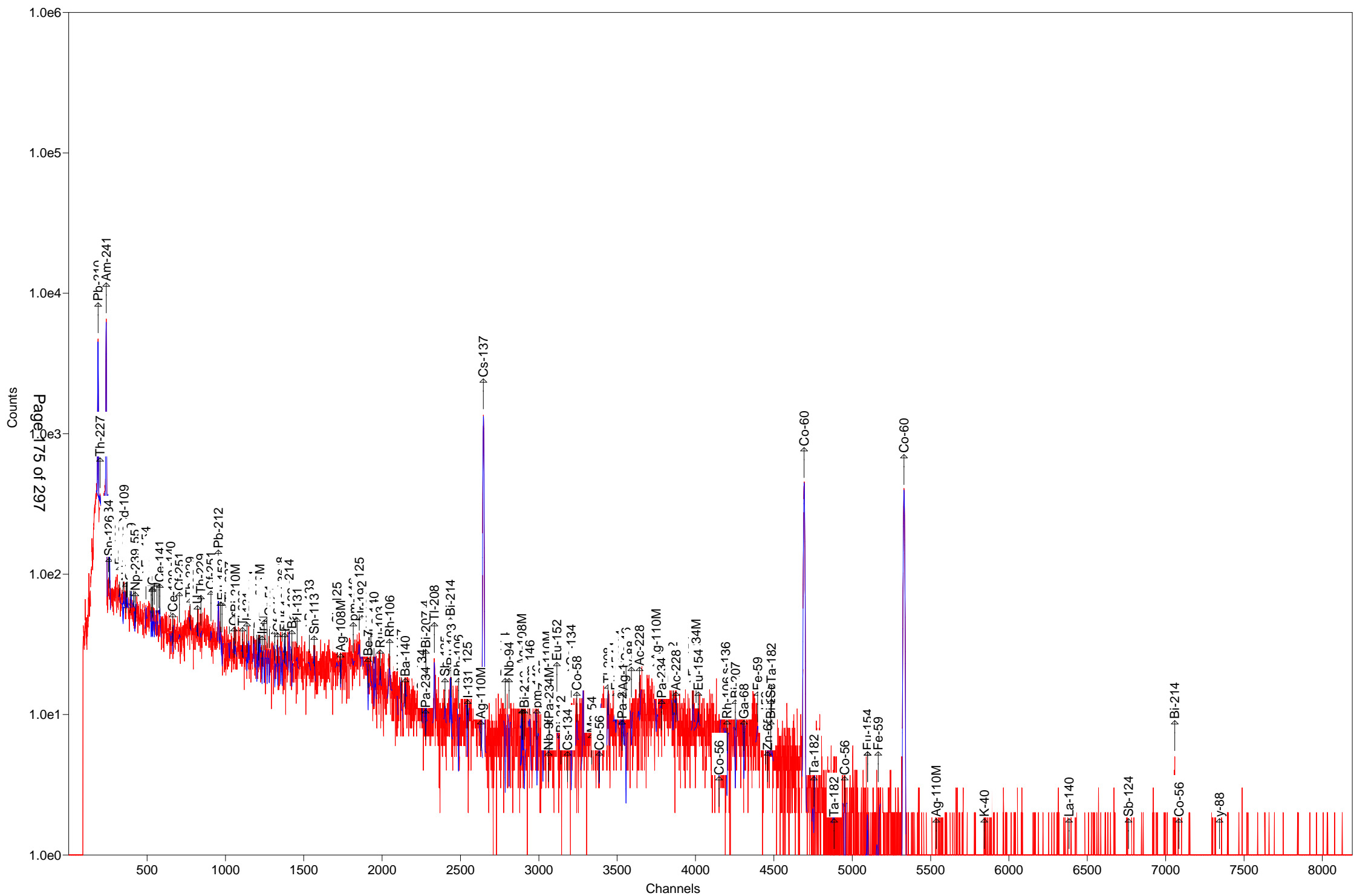
***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****					
Time of Count		Time Corrected		Uncertainty	1 Sigma
Nuclide	Activity	Activity	Counting		MDA
	Bq/Sample	Bq/Sample			Bq/Sample
BE-7 #A	-1.3621E+01	-1.3621E+01	1.102E+02%		4.98E+01
NA-22 #A	7.2386E-01	7.2386E-01	5.900E+01%		1.39E+00
K-40 #A	-6.8935E-01	-6.8935E-01	8.620E+02%		1.56E+01
Sc-46 #A	-1.8556E+00	-1.8556E+00	8.740E+01%		5.38E+00
CR-51 #A	-1.1431E+01	-1.1431E+01	1.540E+02%		5.83E+01
MN-54 #A	2.9508E-01	2.9508E-01	5.027E+02%		3.25E+00
FE-59 #A	7.7513E-01	7.7513E-01	4.166E+02%		6.85E+00
Co-56 #A	-1.8920E+00	-1.8920E+00	8.582E+01%		3.51E+00

CO-57	#A	0.0000E+00	0.0000E+00	1.000E+03%	3.43E+01
CO-58	#A	8.1707E-01	8.1707E-01	1.657E+02%	4.53E+00
CO-60		2.1062E+02	2.1062E+02	1.229E+00%	1.24E+00
ZN-65	#A	4.0083E+00	4.0084E+00	6.591E+01%	8.72E+00
NB-94	#A	-1.6041E+00	-1.6041E+00	4.728E+01%	4.26E+00
ZR-95	#A	-2.4929E+00	-2.4929E+00	5.791E+01%	5.43E+00
NB-95	#A	-7.4014E-01	-7.4014E-01	1.181E+02%	2.93E+00
RU-103	#A	9.5618E-01	9.5618E-01	1.423E+02%	3.17E+00
RH-106	#A	-1.3961E+01	-1.3961E+01	1.267E+02%	5.88E+01
AG-108M	#A	-3.3241E-02	-3.3241E-02	6.868E+01%	3.48E+00
AG-110M	#A	1.7945E+00	1.7945E+00	1.154E+02%	6.90E+00
SN-113	#A	1.8906E+00	1.8906E+00	9.799E+01%	6.14E+00
SB-124	A	6.7232E-01	6.7232E-01	1.425E+02%	5.48E+00
SB-125	#A	2.7675E+00	2.7675E+00	1.602E+02%	1.01E+01
I-131	#A	3.7215E-01	3.7216E-01	3.549E+02%	3.21E+00
Gd-153	#A	5.1198E-01	5.1198E-01	4.961E+02%	1.47E+01
Ga-68	#A	-7.3295E+01	-7.3508E+01	9.504E+01%	1.46E+02
Tc-99m	#A	-8.8984E-01	-8.9032E-01	1.460E+02%	4.31E+00
BA-133	#A	-2.5333E-01	-2.5333E-01	8.643E+01%	6.01E+00
CS-134	#A	7.9761E-01	7.9761E-01	1.037E+02%	5.53E+00
CS-137		3.7268E+02	3.7268E+02	1.142E+00%	2.86E+00
CE-139	#A	-9.6882E-01	-9.6882E-01	1.605E+02%	2.99E+00
Ba-140	#A	6.4743E+00	6.4744E+00	1.021E+02%	1.10E+01
La-140	#A	5.8631E-01	5.8632E-01	8.593E+01%	1.06E+00
CE-141	#A	1.5630E+00	1.5630E+00	1.470E+02%	7.61E+00
CE-144	#A	-6.7746E+00	-6.7746E+00	1.436E+02%	3.22E+01
PM-144	#A	-1.4679E+00	-1.4679E+00	7.995E+01%	3.89E+00
EU-152	A	3.8058E+00	3.8058E+00	1.318E+02%	1.96E+01
EU-154	#A	3.9652E+00	3.9652E+00	8.328E+01%	3.43E+01
EU-155	#A	-3.4867E+00	-3.4867E+00	1.776E+02%	1.29E+01
HF-181	#A	3.0443E-01	3.0443E-01	2.659E+02%	6.44E+00
Ta-182	#A	9.4704E-01	9.4704E-01	4.381E+02%	1.40E+01
Hg-203	#A	0.0000E+00	0.0000E+00	1.000E+03%	3.36E+00
TL-208		3.6916E+00	3.6916E+00	3.756E+01%	2.77E+00
pm-146	#A	-4.3822E+00	-4.3822E+00	8.923E+01%	8.76E+00
y-88	#A	-1.5977E+00	-1.5977E+00	1.195E+02%	4.14E+00
Cd-113m	#A	9.2721E+03	9.2721E+03	1.490E+02%	4.60E+04
Cd-109	#A	2.1133E+01	2.1133E+01	1.731E+02%	1.21E+02
Cf-251	#A	8.2173E-01	8.2173E-01	5.201E+02%	1.08E+01
Cf-249	#A	0.0000E+00	0.0000E+00	1.000E+03%	5.81E+00
Sn-126	A	-1.9205E+01	-1.9205E+01	2.230E+02%	1.41E+02
PB-210		9.9857E+03	9.9857E+03	9.107E-01%	1.73E+02
PB-212		8.1414E+00	8.1414E+00	2.050E+01%	4.13E+00
PB-214		6.5205E+00	6.5205E+00	3.096E+01%	5.00E+00
BI-207	#A	1.2344E+00	1.2344E+00	6.388E+01%	2.60E+00
BI-212	#A	-8.1438E+00	-8.1438E+00	1.696E+02%	4.64E+01
BI-214		6.0994E+00	6.0994E+00	2.868E+01%	4.49E+00
BI-210M	#A	1.7201E+00	1.7201E+00	1.295E+02%	5.33E+00
AC-228	#A	-6.2889E-01	-6.2889E-01	1.337E+02%	1.46E+01

TH-227 #A	3.8001E+01	3.8001E+01	6.180E+01%	7.74E+01
TH-229 #A	1.2413E+00	1.2413E+00	1.594E+03%	5.02E+01
TH-234 #A	-6.1161E+01	-6.1161E+01	1.417E+02%	3.63E+02
PA-231 #A	3.6224E+01	3.6224E+01	1.488E+02%	1.79E+02
PA-233 #A	-3.0799E+00	-3.0799E+00	1.553E+02%	1.59E+01
PA-234 #A	4.0150E+00	4.0150E+00	8.266E+01%	2.00E+01
PA-234M#A	-9.9970E+00	-9.9970E+00	2.034E+03%	6.65E+02
U-235 #A	5.2745E+00	5.2745E+00	1.534E+02%	3.50E+01
AM-241	1.2589E+03	1.2589E+03	7.817E-01%	1.43E+01
Np-237 #A	-6.1540E+00	-6.1540E+00	1.751E+02%	3.57E+01
Ir-192 #A	2.7724E-01	2.7724E-01	8.457E+01%	6.57E+00
Cs-136 #A	1.9810E-01	1.9810E-01	3.279E+02%	4.63E+00
Np-239 #A	-3.3504E+00	-3.3506E+00	1.147E+02%	1.27E+01
Nd-147 #A	9.0103E-01	9.0104E-01	1.640E+02%	2.12E+01

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (37.6 to 1999.6 keV) 1.185E+04 Bq/Sample
Total Decayed Activity (37.6 to 1999.6 keV) 1.1852344E+04 Bq/Sample



Sample Description: 257318_Gamma_160-17842-A-1-B

Detector: Detector #14

Batch ID: 257318

Work Order Number: Gamma

Lot Number: 160-17842-A-1-B

Decay to Time: 7/12/2016 12:19 Live Time: 1800 sec
 Acquisition Time: 7/12/2016 12:20:04 Real Time: 1806 sec
 Analysis Time: 7/12/2016 12:50 Dead Time: 0.33 %
 Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 14_Soil_TunaCan.Clb

Efficiency Cal Desc: 14_TunaCan_90099_042312

Efficiency Cal Date: 4/23/2012 11:29

Energy Cal Date: 2/28/2012 10:48

Library: Client_Long_Rev11.lib

Bkgd Correction File: 14_2016-07-10_0624.PBC

Nuclide	Activity Bq/Sample	1-Sigma Counting Uncert %	1-Sigma Counting Uncert Bq/Sample	1-Sigma Total Uncert Bq/Sample	Minimum Detectable Activity Bq/Sample
BE-7	2.480E+00	150.0	3.720E+00	3.722E+00	1.275E+01
NA-22	-9.625E-02	497.5	4.789E-01	4.789E-01	1.749E+00
K-40	2.522E+02	5.6	1.407E+01	1.909E+01	1.055E+01
Sc-46	6.690E-01	87.9	5.878E-01	5.888E-01	2.238E+00
CR-51	-4.343E+00	87.8	3.811E+00	3.818E+00	1.531E+01
MN-54	3.323E-01	109.0	3.621E-01	3.625E-01	8.966E-01
FE-59	-5.653E-01	201.7	1.140E+00	1.140E+00	2.663E+00
Co-56	-1.261E-02	65.6	8.270E-03	8.295E-03	1.785E+00
CO-57	2.151E-01	144.6	3.111E-01	3.113E-01	1.048E+00
CO-58	1.002E-01	441.6	4.426E-01	4.426E-01	1.575E+00
CO-60	-5.337E-02	102.3	5.460E-02	5.467E-02	1.833E+00
ZN-65	-1.779E+00	94.7	1.684E+00	1.687E+00	5.670E+00
NB-94	1.270E+00	32.4	4.111E-01	4.164E-01	8.849E-01
ZR-95	-3.055E-01	243.5	7.437E-01	7.439E-01	2.463E+00
NB-95	1.883E-01	327.6	6.167E-01	6.168E-01	2.137E+00
RU-103	1.582E-01	265.4	4.199E-01	4.199E-01	1.088E+00
RH-106	-5.829E+00	192.5	1.122E+01	1.122E+01	3.771E+01
AG-108M	2.679E-01	132.0	3.538E-01	3.540E-01	9.429E-01
AG-110M	0.000E+00	1.#INF	2.328E-01	2.328E-01	3.229E+00
SN-113	-4.352E-01	74.4	3.239E-01	3.247E-01	1.637E+00
SB-124	3.804E-01	109.6	4.171E-01	4.175E-01	3.437E+00
SB-125	6.231E-01	92.1	5.739E-01	5.748E-01	3.660E+00
I-131	-5.483E-02	434.6	2.383E-01	2.383E-01	1.342E+00
Gd-153	4.262E-02	2222.6	9.474E-01	9.474E-01	2.736E+00
Ga-68	-1.789E+01	166.4	2.977E+01	2.978E+01	6.772E+01
Tc-99m	2.735E-01	135.7	3.711E-01	3.715E-01	1.246E+00
BA-133	-4.724E-01	228.1	1.077E+00	1.078E+00	3.633E+00
CS-134	6.537E-01	91.4	5.976E-01	5.986E-01	3.386E+00
CS-137	3.260E+00	18.0	5.870E-01	6.110E-01	1.040E+00
CE-139	-1.906E-01	200.7	3.825E-01	3.830E-01	1.294E+00
Ba-140	-2.104E+00	155.3	3.266E+00	3.268E+00	5.394E+00
La-140	3.059E-01	104.9	3.210E-01	3.214E-01	6.716E-01
CE-141	6.111E-02	1186.9	7.253E-01	7.254E-01	2.462E+00

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CE-144	-3.533E-03	69999.8	2.473E+00	2.473E+00	1.121E+01
PM-144	-3.711E-01	164.9	6.121E-01	6.124E-01	1.487E+00
EU-152	-2.461E-01	144.2	3.548E-01	3.550E-01	6.813E+00
EU-154	3.290E+00	86.1	2.832E+00	2.837E+00	1.149E+01
EU-155	1.062E+00	125.6	1.334E+00	1.335E+00	4.475E+00
HF-181	5.022E-01	100.9	5.069E-01	5.075E-01	1.713E+00
Ta-182	2.452E+00	69.5	1.704E+00	1.709E+00	6.983E+00
Hg-203	-4.499E-01	100.5	4.521E-01	4.528E-01	1.517E+00
TL-208	5.983E+00	9.9	5.919E-01	6.683E-01	7.801E-01
pm-146	8.256E-02	1421.2	1.173E+00	1.173E+00	3.039E+00
y-88	1.686E-01	228.4	3.851E-01	3.852E-01	1.186E+00
Cd-113m	3.992E+03	103.3	4.123E+03	4.131E+03	1.396E+04
Cd-109	-8.856E+00	161.7	1.432E+01	1.433E+01	4.779E+01
Cf-251	-1.629E+00	95.0	1.547E+00	1.554E+00	5.181E+00
Cf-249	3.386E-01	104.1	3.523E-01	3.527E-01	2.135E+00
Sn-126	7.157E-01	622.1	4.452E+00	4.453E+00	1.509E+01
PB-210	3.200E+01	39.0	1.248E+01	1.262E+01	3.248E+01
PB-212	1.645E+01	6.4	1.046E+00	1.492E+00	2.120E+00
PB-214	1.314E+01	9.2	1.215E+00	1.394E+00	2.338E+00
BI-207	2.813E-01	132.2	3.719E-01	3.722E-01	1.226E+00
BI-212	-1.027E-01	8784.2	9.018E+00	9.018E+00	2.367E+01
BI-214	1.412E+01	9.0	1.274E+00	1.470E+00	2.298E+00
BI-210M	4.823E-01	105.0	5.065E-01	5.073E-01	1.715E+00
AC-228	1.912E+01	8.7	1.671E+00	1.935E+00	1.393E+00
TH-227	1.082E+01	46.3	5.013E+00	5.048E+00	1.377E+01
TH-229	4.743E+00	136.2	6.462E+00	6.473E+00	1.757E+01
TH-234	2.798E+01	35.0	9.782E+00	9.891E+00	2.606E+01
PA-231	0.000E+00	1.#INF	6.128E+00	6.128E+00	5.957E+01
PA-233	1.093E-01	941.8	1.029E+00	1.029E+00	3.553E+00
PA-234	7.191E-01	67.3	4.840E-01	4.855E-01	6.601E+00
PA-234M	5.103E+01	94.4	4.818E+01	4.825E+01	2.282E+02
U-235	2.989E+00	88.9	2.656E+00	2.660E+00	9.911E+00
AM-241	2.019E-01	576.1	1.163E+00	1.163E+00	3.345E+00
Np-237	0.000E+00	1.#INF	4.493E+00	4.493E+00	1.498E+01
Ir-192	-2.648E-02	70.2	1.858E-02	1.865E-02	1.514E+00
Cs-136	-4.582E-03	61.4	2.815E-03	2.827E-03	1.811E+00
Np-239	9.325E-01	88.1	8.215E-01	8.234E-01	2.751E+00
Nd-147	-1.637E+00	220.3	3.607E+00	3.608E+00	9.175E+00

Total 4.465E+03

Analyst: Mike Aldridge

Sample description
257318_Gamma_160-17842-A-1-B

Spectrum Filename: C:\User\SPC\Det14\14_Gamma_20161799.An1

Acquisition information

Start time: 7/12/2016 12:20:04 PM
Live time: 1800
Real time: 1806
Dead time: 0.33 %
Detector ID: 14

Detector system

Ge14 SN/11080670

Calibration

Filename: 14_Soil_TunaCan.Clb
14_TunaCan_90099_042312

Energy Calibration

Created: 2/28/2012 10:48:23 AM
Zero offset: 0.130 keV
Gain: 0.250 keV/channel
Quadratic: -2.050E-08 keV/channel^2

Efficiency Calibration

Created: 4/23/2012 11:29:47 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.02 %
Log(Eff): $2.101260E-01 + (-5.951973E-01 * \text{Log}(E)) + (-1.605331E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 1.28 %
Log(Eff): $-2.391492E+01 + (8.828985E+00 * \text{Log}(E)) + (-9.371496E-01 * \text{Log}(E)^2)$

Library Files

Main analysis library: Client_Long_Rev11.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G800W064
Start channel: 150 (37.64keV)
Stop channel: 8000 (1999.51keV)
Peak rejection level: 1000.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00 +/- 0.000E+00%
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

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Random error: 4.0000000E+00
Systematic error: 4.0000000E+00
Fraction Limit: 0.000%
Background width: 3
Half lives decay limit: 12.000
Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	7/12/2016 12:19:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	14_2016-07-10_0624.PBC 7/10/2016 6:24:26 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 34 cutoff: 5.00E+01 %
Energy Calibration
Normalized diff: 0.2505

***** S U M M A R Y O F P E A K S I N R A N G E *****								
Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq/Sampl	Nuc
46.66	53.	38.98	0.94	2.180E-02	46.54	4.250	PBC<MDA	PB210
50.14	38.	46.33	0.75	2.439E-02	50.14	8.000	PBC<MDA	TH227
59.54	4.	576.09	0.76	3.065E-02	59.54	35.900	PBC<MDA	AM241
63.32	63.	34.96	0.76	3.282E-02	63.29	3.810	2.798E+01	TH234
64.28	4.	622.08	0.77	3.334E-02	64.28	9.700	PBC<MDA	Sn126
74.86	187.	11.82	0.78	3.817E-02				
77.17	278.	8.57	0.78	3.900E-02				
86.56	21.	93.63	0.79	4.164E-02	86.49	13.100	PBC<MDA	Np237
					86.54	30.700	9.246E-01	EU155
					86.94	9.040	3.133E+00	Sn126
87.36	94.	19.68	0.79	4.182E-02	86.94	9.040	1.380E+01	Sn126
					87.57	37.500	3.317E+00	Sn126
					88.04	3.790	3.274E+01	Cd109
90.09	64.	25.94	0.79	4.236E-02				
92.61	38.	50.20	0.80	4.279E-02	92.59	5.584	PBC<MDA	TH234
93.37	25.	149.41	0.80	4.291E-02	93.35	5.561	PBC<MDA	AC228
99.50	19.	107.38	0.80	4.365E-02	99.50	15.000	PBC<MDA	Np239
103.70	8.	284.80	0.81	4.395E-02	103.70	24.000	PBC<MDA	Np239
105.31	18.	125.61	0.81	4.403E-02	105.31	21.200	PBC<MDA	EU155
106.13	17.	88.09	0.81	4.406E-02	106.13	22.700	PBC<MDA	Np239
122.06	15.	144.63	0.83	4.378E-02	121.78	28.580	PBC<MDA	EU152
					122.06	85.600	PBC<MDA	CO57

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
140.51	18.	135.71	0.85	4.193E-02	140.51	89.300	PBC<MDA	Tc99m
144.04	20.	52.68	0.62	4.145E-02	143.79	10.960	2.444E+00	U235
163.38	17.	115.93	0.87	3.841E-02	163.38	5.080	PBC<MDA	U235
175.77	16.	48.41	0.51	3.705E-02				
193.51	13.	136.25	0.90	3.443E-02	193.51	4.400	PBC<MDA	TH229
209.02	44.	27.90	0.52	3.246E-02				
238.21	396.	7.00	0.96	2.935E-02	238.63	43.300	1.692E+01	PB212
241.58	17.	206.33	0.95	2.900E-02	242.00	7.430	PBC<MDA	PB214
244.69	14.	245.91	0.95	2.875E-02	244.69	7.580	PBC<MDA	EU152
256.24	2.	917.61	0.96	2.775E-02	256.24	7.000	PBC<MDA	TH227
263.70	12.	103.30	0.97	2.714E-02	263.70	0.006	PBC<MDA	Cd113m
265.83	12.	105.01	0.97	2.697E-02	265.83	50.000	PBC<MDA	BI210M
277.44	14.	87.58	0.98	2.610E-02	277.28	6.310	PBC<MDA	TL208
294.72	106.	15.00	1.23	2.489E-02	295.09	19.300	1.177E+01	PB214
312.01	2.	941.76	1.02	2.381E-02	312.01	36.000	PBC<MDA	PA233
328.76	15.	104.94	1.03	2.286E-02	328.76	20.300	PBC<MDA	La140
333.44	10.	104.05	1.04	2.261E-02	333.44	15.510	PBC<MDA	Cf249
337.94	98.	14.21	1.05	2.237E-02	338.32	12.010	2.022E+01	AC228
351.43	211.	9.11	1.04	2.170E-02	351.93	37.600	1.384E+01	PB214
383.84	13.	108.30	1.09	2.025E-02	383.84	8.940	PBC<MDA	BA133
433.94	8.	132.04	1.13	1.838E-02	433.94	90.480	PBC<MDA	AG108M
463.37	14.	92.10	1.16	1.745E-02	463.37	10.470	PBC<MDA	SB125
468.06	12.	105.92	1.17	1.731E-02	468.06	51.750	PBC<MDA	Ir192
477.60	8.	150.00	1.18	1.704E-02	477.60	10.520	PBC<MDA	BE7
482.00	12.	100.93	1.18	1.691E-02	482.00	80.500	PBC<MDA	HF181
497.05	4.	265.41	1.19	1.650E-02	497.05	90.900	PBC<MDA	RU103
511.86	93.	23.89	2.46	1.612E-02	511.86	20.000	1.600E+01	RH106
563.22	2.	591.04	1.25	1.494E-02	563.24	8.350	PBC<MDA	CS134
569.70	7.	132.22	1.26	1.481E-02	569.32	15.380	1.707E+00	CS134
					569.47	8.200	3.202E+00	PA234
					569.70	97.740	2.687E-01	BI207
569.97	6.	131.23	1.26	1.481E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	2.745E+00	PA234
					569.70	97.740	2.304E-01	BI207
582.80	132.	9.89	1.41	1.453E-02	583.02	84.500	5.983E+00	TL208
600.50	3.	947.68	1.29	1.419E-02	600.50	17.860	PBC<MDA	SB125
604.46	12.	209.51	1.29	1.412E-02	604.71	97.620	PBC<MDA	CS134
609.05	185.	7.87	1.16	1.403E-02	609.31	46.090	1.511E+01	BI214
					610.30	5.750	1.273E+02	RU103
661.37	66.	18.00	1.39	1.313E-02	661.66	85.210	3.260E+00	CS137
702.63	28.	32.37	1.38	1.251E-02	702.63	97.900	1.270E+00	NB94
722.79	10.	109.64	1.40	1.223E-02	722.79	10.810	PBC<MDA	SB124
					722.94	90.840	4.835E-01	AG108M
					723.36	20.220	2.173E+00	EU154
765.79	4.	327.56	1.43	1.167E-02	765.79	99.790	PBC<MDA	NB95
					766.41	0.294	6.394E+01	PA234M
766.41	10.	94.42	1.43	1.167E-02	765.79	99.790	PBC<MDA	NB95
					766.41	0.294	1.615E+02	PA234M

pk energy	area	uncert	fw hm	corr	nuclide	brnch.	act.	nuc
785.42	10.	93.61	1.45	1.144E-02	785.42	1.280	PBC<MDA	BI212
795.82	12.	91.41	1.46	1.131E-02	795.87	85.530	PBC<MDA	CS134
810.78	2.	441.59	1.47	1.115E-02	810.78	99.460	PBC<MDA	CO58
834.85	7.	108.97	1.49	1.088E-02	834.85	99.980	PBC<MDA	MN54
860.72	9.	94.86	1.51	1.062E-02	860.56	12.420	PBC<MDA	TL208
873.23	3.	224.50	1.52	1.049E-02	873.23	12.270	PBC<MDA	EU154
889.28	8.	149.20	1.54	1.034E-02	889.28	99.984	PBC<MDA	Sc46
898.04	2.	340.85	1.54	1.026E-02	898.04	93.700	PBC<MDA	y88
910.90	99.	10.10	1.63	1.014E-02	911.07	29.000	1.866E+01	AC228
946.02	9.	94.28	1.58	9.832E-03	946.02	13.400	PBC<MDA	PA234
968.81	14.	89.35	1.60	9.642E-03	968.97	17.460	PBC<MDA	AC228
996.33	10.	86.08	1.62	9.425E-03	996.33	10.600	PBC<MDA	EU154
1001.00	2.	525.06	1.63	9.389E-03	1001.00	0.837	PBC<MDA	PA234M
1048.07	8.	64.91	1.66	9.043E-03	1048.07	80.000	PBC<MDA	Cs136
1063.66	4.	244.53	1.67	8.934E-03	1063.66	74.500	PBC<MDA	BI207
1120.33	12.	119.91	1.72	8.562E-03	1120.29	15.100	PBC<MDA	BI214
					1120.55	99.987	PBC<MDA	Sc46
1120.55	14.	92.80	1.72	8.561E-03	1120.29	15.100	PBC<MDA	BI214
					1120.55	99.987	9.000E-01	Sc46
1121.77	10.	108.57	1.72	8.556E-03	1121.30	34.900	PBC<MDA	Ta182
1173.24	6.	122.85	1.76	8.244E-03	1173.24	99.900	PBC<MDA	CO60
1188.83	9.	86.79	1.77	8.153E-03	1189.05	16.200	PBC<MDA	Ta182
1238.28	12.	94.24	1.80	7.886E-03	1238.28	66.070	PBC<MDA	Co56
1408.00	7.	89.34	1.92	7.092E-03	1408.00	21.005	PBC<MDA	EU152
1460.75	333.	5.58	1.40	6.879E-03	1460.83	10.670	2.522E+02	K40
1764.09	17.	27.57	2.14	5.878E-03	1764.49	15.400	1.066E+01	BI214
1836.06	2.	304.14	2.19	5.686E-03	1836.06	99.200	PBC<MDA	y88

***** U N I D E N T I F I E D P E A K S U M M A R Y *****

Peak Centroid Channel	Background Energy	Net Area Counts	Efficiency * Area	Uncert 1 Sigma	FWHM %	Suspected Nuclide
298.81	74.92	151.	187. 4.910E+03	11.82	0.777	- sD
308.06	77.23	145.	278. 7.129E+03	8.57	0.780	- D
348.85	87.36	145.	85. 2.033E+03	22.78	0.790	- sD
359.78	90.09	107.	63. 1.494E+03	26.28	0.793	- D
702.67	175.77	29.	23. 6.341E+02	38.58	0.882	- sD
835.13	209.02	54.	44. 1.346E+03	28.25	0.915	- sD

s - Peak fails shape tests.
D - Peak area deconvoluted.
L - Peak written from unknown list.
C - Area < Critical level.

This section based on library: Client_Long_Rev11.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****							
Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	FWHM keV
PB-210	186.05	46.66	121.	53.	0.030	38.98	0.935s
TH-227	199.98	50.14	96.	38.	0.021	46.33	0.751s
AM-241	237.55	59.54	186.	4.	0.002	576.09	0.761s
TH-234	252.68	63.32	144.	63.	0.035	34.96	0.761s
Sn-126	256.52	64.28	334.	4.	0.002	622.08	0.766
Np-237	345.33	86.49	960.	0.	0.000	174.34	0.789A
EU-155	345.54	86.54	919.	21.	0.012	93.63	0.790D
Sn-126	347.13	86.94	893.	-25.	-0.014	168.18	0.790
Sn-126	349.65	87.57	868.	-25.	-0.014	165.65	0.791D
Cd-109	351.53	88.04	828.	-25.	-0.014	161.74	0.791s
Nd-147	363.77	91.10	781.	-20.	-0.011	199.98	0.794s
TH-234	369.72	92.59	165.	38.	0.021	50.20	0.796D
AC-228	372.76	93.35	706.	25.	0.014	149.41	0.797s
Np-239	397.36	99.50	136.	19.	0.010	107.38	0.803
Gd-153	412.15	103.20	279.	-14.	-0.008	169.40	0.807s
Np-239	414.15	103.70	257.	8.	0.004	284.80	0.807s
EU-155	420.60	105.31	242.	18.	0.010	125.61	0.809s
Np-239	423.87	106.13	101.	17.	0.009	88.09	0.810D
EU-152	486.43	121.78	266.	-22.	-0.012	103.32	0.826s
CO-57	487.58	122.06	213.	15.	0.008	144.63	0.826s
EU-154	491.73	123.10	249.	-17.	-0.009	133.58	0.828s
PA-234	524.50	131.29	367.	-22.	-0.012	96.10	0.836
HF-181	531.42	133.02	389.	-10.	-0.006	202.35	0.838s
Tc-99m	561.35	140.51	285.	18.	0.010	135.71	0.845
U-235	574.45	143.79	283.	18.	0.010	134.69	0.849s
U-235	652.81	163.38	175.	17.	0.009	115.93	0.869
CE-139	662.70	165.85	222.	-11.	-0.006	200.67	0.871s
Cf-251	705.68	176.60	143.	-18.	-0.010	94.96	0.882
TH-229	773.30	193.51	94.	13.	0.007	136.25	0.899s
U-235	820.58	205.33	318.	-21.	-0.012	42.03	0.912s
TH-229	842.65	210.85	289.	-20.	-0.011	124.49	0.917
Cf-251	907.23	227.00	113.	-7.	-0.004	260.96	0.933s
PB-212	953.75	238.63	96.	376.	0.209	6.36	0.944D
PB-214	967.21	242.00	593.	17.	0.009	206.33	0.948s
EU-152	977.99	244.69	592.	14.	0.008	245.91	0.951s
TH-227	1024.17	256.24	73.	2.	0.001	917.61	0.962s
Cd-113m	1054.01	263.70	67.	12.	0.006	103.30	0.970
BI-210M	1062.53	265.83	70.	12.	0.007	105.01	0.972
TL-208	1108.33	277.28	72.	14.	0.008	87.58	0.983
Hg-203	1115.99	279.20	140.	-17.	-0.010	100.49	0.985s
I-131	1136.39	284.30	103.	-19.	-0.010	67.37	0.990s
PB-214	1178.05	294.72	44.	102.	0.057	15.81	1.234s
PB-212	1199.30	300.03	225.	-15.	-0.008	141.50	1.006s
PA-231	1199.46	300.07	240.	-3.	-0.001	846.71	1.006s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
PA-233	1199.90	300.18	243.	0.	0.000	1000.00	1.006s
PA-231	1209.78	302.65	243.	0.	0.000	1000.00	1.008s
BA-133	1210.59	302.85	243.	0.	0.000	1000.00	1.009s
Ir-192	1232.94	308.44	225.	-15.	-0.009	140.35	1.014s
PA-233	1247.22	312.01	125.	2.	0.001	941.76	1.018
Ir-192	1265.13	316.49	130.	-18.	-0.010	92.07	1.022s
CR-51	1279.51	320.08	173.	-18.	-0.010	87.76	1.026s
La-140	1314.21	328.76	63.	15.	0.008	104.94	1.034s
Cf-249	1332.92	333.44	29.	10.	0.006	104.05	1.039s
AC-228	1350.93	337.94	24.	98.	0.054	14.28	1.050
Cs-136	1361.44	340.57	233.	-14.	-0.008	155.69	1.045s
EU-152	1376.30	344.29	219.	-14.	-0.008	150.54	1.049s
PB-214	1404.86	351.43	46.	203.	0.113	9.59	1.043s
BA-133	1423.15	356.00	328.	-11.	-0.006	228.05	1.060s
I-131	1457.08	364.48	70.	-2.	-0.001	434.64	1.069s
BA-133	1534.50	383.84	94.	13.	0.007	108.30	1.087s
SN-113	1565.90	391.69	56.	-10.	-0.006	74.41	1.095
SB-125	1710.63	427.88	52.	-6.	-0.003	129.92	1.129s
AG-108M	1734.87	433.94	30.	8.	0.004	132.04	1.135s
pm-146	1814.64	453.88	56.	-13.	-0.007	116.07	1.154s
SB-125	1852.59	463.37	70.	14.	0.008	92.10	1.163s
Ir-192	1871.36	468.06	77.	12.	0.007	105.92	1.167s
BE-7	1909.50	477.60	68.	8.	0.004	150.00	1.176s
HF-181	1927.10	482.00	71.	12.	0.007	100.93	1.180s
La-140	1947.19	487.02	44.	-5.	-0.003	263.57	1.185s
RU-103	1987.33	497.05	33.	4.	0.002	265.41	1.194s
RH-106	2046.57	511.86	63.	93.	0.052	23.89	2.458s
Nd-147	2123.11	531.00	44.	-6.	-0.003	220.27	1.225s
Ba-140	2148.15	537.26	53.	-14.	-0.008	155.26	1.231s
CS-134	2252.06	563.24	32.	2.	0.001	591.04	1.255s
CS-134	2276.40	569.32	28.	6.	0.003	131.23	1.260s
PA-234	2276.99	569.47	48.	-11.	-0.006	96.52	1.261
BI-207	2277.92	569.70	39.	7.	0.004	132.22	1.261
TL-208	2330.32	582.80	10.	132.	0.073	9.89	1.408
SB-125	2401.12	600.50	316.	3.	0.001	947.68	1.289s
CS-134	2417.96	604.71	304.	12.	0.007	209.51	1.292s
BI-214	2436.36	609.31	27.	164.	0.091	9.02	1.296D
RU-103	2440.31	610.30	316.	3.	0.002	867.55	1.297s
AG-108M	2456.25	614.28	319.	0.	0.000	1000.00	1.301s
PM-144	2471.37	618.06	319.	0.	0.000	1000.00	1.304s
RH-106	2486.79	621.92	376.	-14.	-0.008	192.45	1.308s
SB-125	2542.69	635.89	44.	-15.	-0.008	69.98	1.320s
I-131	2547.03	636.97	65.	-4.	-0.002	257.67	1.321s
AG-110M	2630.18	657.76	118.	-13.	-0.007	119.67	1.339
CS-137	2644.59	661.37	15.	66.	0.036	18.00	1.391
PM-144	2785.32	696.54	43.	-8.	-0.005	164.92	1.374s
NB-94	2809.67	702.63	13.	28.	0.016	32.37	1.379s
SB-124	2890.31	722.79	51.	10.	0.005	109.64	1.396s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
AG-108M	2890.91	722.94	61.	0.	0.000	1000.00	1.397s
EU-154	2892.59	723.36	61.	0.	0.000	1000.00	1.397s
pm-146	2942.05	735.72	35.	-7.	-0.004	222.86	1.408s
ZR-95	3026.09	756.73	31.	-4.	-0.002	243.48	1.426s
AG-110M	3054.96	763.94	82.	-19.	-0.011	70.41	1.432s
NB-95	3062.34	765.79	82.	4.	0.002	327.56	1.433s
PA-234M	3064.83	766.41	39.	10.	0.006	94.42	1.434s
BI-212	3140.88	785.42	17.	10.	0.005	93.61	1.450s
CS-134	3182.67	795.87	26.	12.	0.007	91.41	1.459s
CS-134	3207.01	801.95	33.	-10.	-0.005	129.48	1.464s
CO-58	3242.31	810.77	38.	2.	0.001	441.59	1.471s
La-140	3262.30	815.77	40.	0.	0.000	1000.00	1.475s
Cs-136	3273.22	818.50	51.	-10.	-0.006	104.33	1.478s
MN-54	3338.63	834.85	10.	7.	0.004	108.97	1.492s
Co-56	3386.32	846.77	47.	-17.	-0.009	91.16	1.501s
TL-208	3441.51	860.56	14.	9.	0.005	94.86	1.513s
NB-94	3483.65	871.10	24.	-3.	-0.001	327.78	1.522s
EU-154	3492.19	873.23	26.	3.	0.002	224.50	1.523s
PA-234	3521.39	880.53	61.	-13.	-0.007	89.21	1.529s
PA-234	3532.24	883.24	74.	-4.	-0.002	310.19	1.531s
AG-110M	3538.01	884.68	78.	0.	0.000	1000.00	1.533s
Sc-46	3556.40	889.28	70.	8.	0.005	149.20	1.536s
y-88	3591.45	898.04	15.	2.	0.001	340.85	1.543s
AC-228	3642.90	910.90	0.	99.	0.055	10.10	1.635s
AG-110M	3749.30	937.49	47.	-17.	-0.010	87.03	1.576s
PA-234	3783.42	946.02	14.	9.	0.005	94.28	1.582s
EU-152	3855.80	964.11	115.	-16.	-0.009	99.80	1.597s
AC-228	3875.25	968.97	71.	14.	0.008	89.35	1.601s
EU-154	3984.71	996.33	30.	10.	0.005	86.08	1.622s
PA-234M	4003.39	1001.00	40.	2.	0.001	525.06	1.626s
EU-154	4018.51	1004.77	54.	-10.	-0.005	113.62	1.629s
Co-56	4150.81	1037.84	35.	-15.	-0.008	90.47	1.655s
Cs-136	4191.74	1048.07	10.	8.	0.005	64.91	1.663
RH-106	4200.91	1050.36	34.	-2.	-0.001	385.59	1.665s
BI-207	4254.12	1063.66	15.	4.	0.002	244.53	1.675s
Ga-68	4309.10	1077.40	35.	-8.	-0.004	166.38	1.685s
FE-59	4396.54	1099.25	20.	-5.	-0.003	201.66	1.702s
EU-152	4447.85	1112.07	95.	-15.	-0.008	97.85	1.712s
ZN-65	4461.74	1115.55	80.	-14.	-0.008	94.70	1.714s
BI-214	4480.72	1120.29	93.	12.	0.007	119.91	1.718s
Sc-46	4481.77	1120.55	76.	14.	0.008	92.80	1.718s
Ta-182	4484.77	1121.30	56.	10.	0.006	108.57	1.719s
CO-60	4692.60	1173.24	10.	6.	0.003	122.85	1.757s
Ta-182	4755.88	1189.05	10.	9.	0.005	86.79	1.769s
Ta-182	4885.38	1221.41	48.	-15.	-0.008	108.12	1.792s
Co-56	4952.89	1238.28	22.	12.	0.007	94.24	1.805s
NA-22	5097.96	1274.53	21.	-1.	-0.001	497.49	1.831s
EU-154	5098.01	1274.54	23.	0.	0.000	1000.00	1.831s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
FE-59	5166.25	1291.60	21.	-2.	-0.001	454.68	1.843s
CO-60	5329.96	1332.50	22.	-7.	-0.004	163.65	1.871s
EU-152	5632.13	1408.00	5.	7.	0.004	89.34	1.923s
K-40	5843.27	1460.75	6.	333.	0.185	5.58	1.404s
La-140	6385.44	1596.21	0.	0.	0.000	1000.00	2.044s
SB-124	6764.81	1690.98	6.	-2.	-0.001	343.80	2.102s
BI-214	7059.07	1764.49	3.	17.	0.010	27.57	2.145
Co-56	7086.53	1771.35	41.	-11.	-0.006	91.33	2.149s
y-88	7345.59	1836.06	6.	2.	0.001	304.14	2.185s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****									
- Nuclide -	Average	----- Peak -----							
Name	Code	Activity	Energy	Activity	Code	MDA Value			
		Bq/Sample	keV	Bq/Sample		Bq/Sample	COMMENTS		
BE-7	C	2.4798E+00					5.31E+01		
			477.60	2.480E+00	(	1.275E+01	1.50E+02	1.05E+01	G
NA-22	C	-9.6254E-02					9.50E+02		
			1274.53	-9.625E-02	?(	1.749E+00	4.97E+02	9.99E+01	G
K-40	N	2.5221E+02					4.66E+11		
			1460.83	2.522E+02	(P	1.055E+01	5.58E+00	1.07E+01	G
Sc-46	F	6.6904E-01					8.38E+01		
			889.28	4.381E-01	?(P	2.238E+00	1.49E+02	1.00E+02	G
			1120.55	9.000E-01	?(	2.810E+00	9.28E+01	1.00E+02	G
CR-51	F	-4.3427E+00					2.77E+01		
			320.08	-4.343E+00	&(P	1.531E+01	8.78E+01	9.94E+00	G
MN-54	C	3.3231E-01					3.12E+02		
			834.85	3.323E-01	&(P	8.966E-01	1.09E+02	1.00E+02	G
FE-59	F	-5.6533E-01					4.45E+01		
			1099.25	-5.653E-01	?(	2.663E+00	2.02E+02	5.65E+01	G
			1291.60	-3.940E-01	+	4.092E+00	4.55E+02	4.32E+01	G
Co-56	C	-1.2615E-02					7.73E+01		
			846.77	-8.529E-01	?(	1.785E+00	9.12E+01	9.99E+01	G
			1238.28	1.258E+00	(P	2.624E+00	9.42E+01	6.61E+01	G
			1037.84	-6.470E+00	+	1.306E+01	9.05E+01	1.41E+01	G
			1771.35	-6.476E+00	+	2.001E+01	9.13E+01	1.55E+01	A

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CO-57	C	2.1511E-01					2.72E+02
		122.06	2.151E-01	?(P	1.048E+00	1.45E+02	8.56E+01 G
		136.47	1.434E-01	% P	1.175E+01	1.82E+03	1.07E+01 G
CO-58	C	1.0023E-01					7.09E+01
		810.78	1.002E-01	?(	1.575E+00	4.42E+02	9.95E+01 G
CO-60	F	-5.3367E-02					1.93E+03
		1332.50	5.111E-01	?(P	1.833E+00	1.64E+02	1.00E+02 G
		1173.24	4.048E-01	?(	1.177E+00	1.23E+02	9.99E+01 G
ZN-65	F	-1.7786E+00					2.44E+02
		1115.55	1.779E+00	?(	5.670E+00	9.47E+01	5.06E+01 G
NB-94	I	1.2699E+00					7.41E+06
		702.63	1.270E+00	(	8.849E-01	3.24E+01	9.79E+01 G
		871.10	1.381E-01	- P	1.341E+00	3.28E+02	9.99E+01 G
ZR-95	I	-3.0547E-01					6.40E+01
		756.73	3.055E-01	?(P	2.463E+00	2.43E+02	5.45E+01 G
		724.20	8.326E-02	% P	4.055E+00	1.84E+03	4.42E+01 G
NB-95	I	1.8826E-01					6.40E+01
		765.79	1.883E-01	?(	2.137E+00	3.28E+02	9.98E+01 G
RU-103	I	1.5820E-01					3.93E+01
		497.05	1.582E-01	&(P	1.088E+00	2.65E+02	9.09E+01 G
		610.30	2.003E+00	?	5.900E+01	8.68E+02	5.75E+00 GA
RH-106	I	-5.8285E+00					3.74E+02
		621.92	5.829E+00	?(	3.771E+01	1.92E+02	9.93E+00 G
		1050.36	8.593E+00	+	1.182E+02	3.86E+02	1.56E+00 G
		511.86	1.600E+01	? P	6.846E+00	2.39E+01	2.00E+01 GA
AG-108M	C	2.6792E-01					1.53E+05
		433.94	2.679E-01	*(P	9.429E-01	1.32E+02	9.05E+01 G
		722.94	0.000E+00	-	1.956E+00	1.00E+03	9.08E+01 G
		614.28	0.000E+00	&	3.812E+00	1.00E+03	8.98E+01 G
SN-113	F	-4.3524E-01					1.15E+02
		391.69	4.352E-01	&(P	1.637E+00	7.44E+01	6.40E+01 G
SB-124	F	3.8040E-01					6.02E+01
		602.73	2.464E-02	%(P	3.437E+00	2.13E+03	9.83E+01 G
		1690.98	3.181E-01	+	2.634E+00	3.44E+02	4.78E+01 G
		722.79	4.062E+00	?(	1.517E+01	1.10E+02	1.08E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
SB-125	I	6.2314E-01					1.01E+03
		427.88-5.846E-01	?(P	3.660E+00	1.30E+02	2.96E+01	G
		600.50 5.829E-01	?(	1.876E+01	9.48E+02	1.79E+01	G
		635.89-5.259E+00	+	1.222E+01	7.00E+01	1.13E+01	G
		463.37 4.106E+00	&(P	1.272E+01	9.21E+01	1.05E+01	G
I-131	I	-5.4829E-02					8.02E+00
		364.48-5.483E-02	?(P	1.342E+00	4.35E+02	8.17E+01	G
		284.30-6.654E+00	+ P	1.770E+01	6.74E+01	6.14E+00	G
		636.97-2.566E+00	+	2.297E+01	2.58E+02	7.17E+00	G
Gd-153	F	4.2624E-02					2.42E+02
		97.50 4.262E-02	% (	2.736E+00	2.22E+03	3.00E+01	G
		103.20-8.194E-01	+	4.674E+00	1.69E+02	2.18E+01	G
Ga-68	C	-1.7892E+01					4.71E-02
		1077.40-1.789E+01	?(	6.772E+01	1.66E+02	3.30E+00	G
Tc-99m	I	2.7348E-01					2.51E-01
		140.51 2.735E-01	(	1.246E+00	1.36E+02	8.93E+01	G
BA-133	F	-4.7243E-01					3.85E+03
		356.00-4.724E-01	?(	3.633E+00	2.28E+02	6.20E+01	G
		302.85 0.000E+00	+	9.365E+00	1.00E+03	1.83E+01	G
		383.84 4.019E+00	&	1.470E+01	1.08E+02	8.94E+00	GA
		80.99 1.203E-02	% P	2.775E+00	8.00E+03	3.41E+01	GA
CS-134	I	6.5374E-01					7.54E+02
		604.71 4.793E-01	?(	3.386E+00	2.10E+02	9.76E+01	G
		795.87 6.889E-01	?(	1.520E+00	9.14E+01	8.55E+01	G
		569.32 1.463E+00	&(	6.674E+00	1.31E+02	1.54E+01	G
		801.95-5.496E+00	&	1.668E+01	1.29E+02	8.69E+00	G
		563.24 8.425E-01	?(P	1.297E+01	5.91E+02	8.35E+00	G
CS-137	I	3.2602E+00					1.10E+04
		661.66 3.260E+00	(	1.040E+00	1.80E+01	8.52E+01	G
CE-139	F	-1.9064E-01					1.38E+02
		165.85-1.906E-01	&(	1.294E+00	2.01E+02	7.99E+01	G
Ba-140	I	-2.1039E+00					1.28E+01
		537.26-2.104E+00	?(P	5.394E+00	1.55E+02	2.44E+01	G
		162.66-4.637E-01	%	1.647E+01	1.04E+03	6.22E+00	G
		304.85-2.777E-01	& P	4.026E+01	3.10E+03	4.29E+00	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
La-140	I	3.0592E-01				1.28E+01	
			1596.21	0.000E+00	?(	6.716E-01	1.00E+03 9.54E+01 G
			487.02	-3.640E-01	+	2.447E+00	2.64E+02 4.55E+01 G
			328.76	1.744E+00	?(P	4.738E+00	1.05E+02 2.03E+01 G
			815.77	0.000E+00	-	6.925E+00	1.00E+03 2.33E+01 G
CE-141	I	6.1111E-02				3.25E+01	
			145.44	6.111E-02	% (	2.462E+00	1.19E+03 4.82E+01 G
CE-144	I	-3.5327E-03				2.85E+02	
			133.54	-3.533E-03	%(P	1.121E+01	7.00E+04 1.11E+01 G
PM-144	C	-3.7113E-01				3.63E+02	
			696.54	-3.711E-01	?(	1.487E+00	1.65E+02 9.90E+01 G
			618.06	0.000E+00	&	3.473E+00	1.00E+03 9.91E+01 G
EU-152	F	-2.4609E-01				4.94E+03	
			344.29	-1.343E+00	(	6.813E+00	1.51E+02 2.65E+01 G
			1112.07	-6.893E+00	+	2.269E+01	9.78E+01 1.36E+01 G
			121.78	-9.632E-01	& P	3.493E+00	1.03E+02 2.86E+01 G
			778.92	-3.729E-01	%	9.871E+00	1.05E+03 1.29E+01 G
			964.11	-6.171E+00	+	2.070E+01	9.98E+01 1.46E+01 G
			244.69	3.588E+00	*(P	2.959E+01	2.46E+02 7.58E+00 G
			1408.00	2.449E+00	? P	5.062E+00	8.93E+01 2.10E+01 GA
EU-154	I	3.2903E+00				3.14E+03	
			873.23	1.438E+00	?(	1.149E+01	2.24E+02 1.23E+01 G
			123.10	-5.296E-01	&	2.377E+00	1.34E+02 4.08E+01 G
			1274.54	0.000E+00	-	5.104E+00	1.00E+03 3.52E+01 G
			723.36	0.000E+00	-	8.791E+00	1.00E+03 2.02E+01 G
			1004.77	-3.131E+00	+	1.213E+01	1.14E+02 1.80E+01 G
			996.33	5.434E+00	?(	1.582E+01	8.61E+01 1.06E+01 G
EU-155	I	1.0617E+00				1.81E+03	
			105.31	1.062E+00	&(P	4.475E+00	1.26E+02 2.12E+01 G
			86.54	9.246E-01	}	6.256E+00	9.36E+01 3.07E+01 G
HF-181	F	5.0219E-01				4.24E+01	
			482.00	5.022E-01	?(	1.713E+00	1.01E+02 8.05E+01 G
			133.02	-3.121E-01	- P	2.833E+00	2.02E+02 4.33E+01 G
			345.83	-3.028E-01	%	1.164E+01	1.12E+03 1.51E+01 G
			136.30	-2.617E-01	& P	2.144E+01	1.81E+03 5.85E+00 G
Ta-182	F	2.4521E+00				1.14E+02	
			1121.30	1.892E+00	?(	6.983E+00	1.09E+02 3.49E+01 G
			1221.41	-3.870E+00	+	9.029E+00	1.08E+02 2.70E+01 G
			1189.05	3.660E+00	?(	7.338E+00	8.68E+01 1.62E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Hg-203	F	-4.4985E-01					4.66E+01
		279.20-4.499E-01	?(	1.517E+00	1.00E+02	8.15E+01	G
TL-208	N	5.9834E+00					6.98E+02
		583.02 5.983E+00	(P	7.801E-01	9.89E+00	8.45E+01	G
		277.28 4.856E+00	- P	1.426E+01	8.76E+01	6.31E+00	G
		860.56 3.778E+00	- P	8.523E+00	9.49E+01	1.24E+01	G
pm-146	C	8.2556E-02					2.02E+03
		747.16 8.256E-02	%(P	3.039E+00	1.42E+03	3.40E+01	G
		735.72-1.372E+00	+ P	6.177E+00	2.23E+02	2.25E+01	G
		453.88-6.264E-01	+	1.811E+00	1.16E+02	6.50E+01	G
y-88	F	1.6860E-01					1.07E+02
		898.04 1.386E-01	?(P	1.186E+00	3.41E+02	9.37E+01	G
		1836.06 1.970E-01	?(	1.391E+00	3.04E+02	9.92E+01	G
Cd-113m		3.9919E+03					5.33E+03
		263.70 3.992E+03	&(	1.396E+04	1.03E+02	6.00E-03	K
Cd-109	F	-8.8563E+00					4.53E+02
		88.04-8.856E+00	?(	4.779E+01	1.62E+02	3.79E+00	G
Cf-251	T	-1.6290E+00					3.28E+05
		176.60-1.629E+00	&(	5.181E+00	9.50E+01	1.70E+01	G
		227.00-2.123E+00	+	1.515E+01	2.61E+02	6.30E+00	GA
Cf-249	T	3.3859E-01					1.28E+05
		387.95 3.800E-02	&(	2.135E+00	1.62E+03	6.60E+01	G
		333.44 1.618E+00	?(	4.428E+00	1.04E+02	1.55E+01	G
Sn-126		7.1573E-01					3.65E+07
		87.57-8.966E-01	+	4.954E+00	1.66E+02	3.75E+01	GA
		64.28 7.157E-01	(	1.509E+01	6.22E+02	9.70E+00	G
		86.94-3.728E+00	+	2.091E+01	1.68E+02	9.04E+00	GA
PB-210	N	3.2004E+01					8.14E+03
		46.54 3.200E+01	(P	3.248E+01	3.90E+01	4.25E+00	G
PB-212	N	1.6446E+01					6.98E+02
		238.63 1.645E+01	(P	2.120E+00	6.36E+00	4.33E+01	G
		300.03-1.051E+01	&	5.008E+01	1.41E+02	3.28E+00	GA
PB-214	N	1.3140E+01					5.84E+05
		351.93 1.384E+01	@(P	2.338E+00	9.59E+00	3.76E+01	G
		295.09 1.177E+01	(P	3.904E+00	1.58E+01	1.93E+01	G
		242.00 4.333E+00	&	2.995E+01	2.06E+02	7.43E+00	GA

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
BI-207	C	2.8127E-01					1.18E+04
		569.70	2.687E-01	?(	1.226E+00	1.32E+02	9.77E+01 G
		1063.66	2.977E-01	?(	1.733E+00	2.45E+02	7.45E+01 G
BI-212	N	-1.0266E-01					6.98E+02
		727.17	-1.027E-01	%(P	2.367E+01	8.78E+03	7.55E+00 G
		785.42	3.669E+01	?	8.392E+01	9.36E+01	1.28E+00 GA
BI-214	N	1.4123E+01					5.84E+05
		609.31	1.412E+01	(P	2.298E+00	9.02E+00	4.61E+01 G
		1120.29	5.053E+00	- P	2.051E+01	1.20E+02	1.51E+01 G
		1764.49	1.066E+01	- P	6.297E+00	2.76E+01	1.54E+01 G
BI-210M	T	4.8229E-01					1.10E+09
		265.83	4.823E-01	?(	1.715E+00	1.05E+02	5.00E+01 G
		304.90	-8.511E-02	& P	6.176E+00	1.56E+03	2.80E+01 G
AC-228	N	1.9116E+01					2.10E+03
		911.07	1.866E+01	@(P	1.393E+00	1.01E+01	2.90E+01 G
		968.97	4.623E+00	- P	1.388E+01	8.94E+01	1.75E+01 G
		338.32	2.022E+01	(P	5.313E+00	1.43E+01	1.20E+01 G
		93.35	5.908E+00	-	2.946E+01	1.49E+02	5.56E+00 XA
TH-227	N	1.0820E+01					7.95E+03
		50.14	1.082E+01	(	1.377E+01	4.63E+01	8.00E+00 G
		256.24	4.768E-01	&	1.219E+01	9.18E+02	7.00E+00 G
TH-229	N	4.7426E+00					2.68E+06
		193.51	4.743E+00	?(P	1.757E+01	1.36E+02	4.40E+00 G
		210.85	-1.132E+01	+	4.725E+01	1.24E+02	2.99E+00 G
TH-234	N	2.7983E+01					1.63E+12
		63.29	2.798E+01	(P	2.606E+01	3.50E+01	3.81E+00 G
		92.59	8.939E+00	- P	1.455E+01	5.02E+01	5.58E+00 G
PA-233	C	1.0926E-01					7.82E+08
		312.01	1.093E-01	&(P	3.553E+00	9.42E+02	3.60E+01 G
		300.18	0.000E+00	&	2.750E+01	1.00E+03	6.20E+00 G
PA-234	N	7.1908E-01					1.63E+12
		131.29	-1.571E+00	?(P	6.601E+00	9.61E+01	1.80E+01 G
		946.02	3.795E+00	?(	8.495E+00	9.43E+01	1.34E+01 G
		569.47	-4.880E+00	+	1.596E+01	9.65E+01	8.20E+00 G
		883.24	-2.212E+00	+	2.382E+01	3.10E+02	9.60E+00 G
		880.53	-1.157E+01	&	3.474E+01	8.92E+01	6.00E+00 GA

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PA-234M	N	5.1026E+01					1.63E+12
		1001.00	1.221E+01	?(	2.282E+02	5.25E+02	8.37E-01 G
		766.41	1.615E+02	?(	5.173E+02	9.44E+01	2.94E-01 G
U-235	N	2.9890E+00					2.57E+11
		143.79	2.192E+00	?(	9.911E+00	1.35E+02	1.10E+01 G
		205.33	7.123E+00	+ P	2.891E+01	4.20E+01	5.01E+00 G
		163.38	4.707E+00	(P	1.833E+01	1.16E+02	5.08E+00 G
AM-241	T	2.0195E-01					1.58E+05
		59.54	2.019E-01	*(	3.345E+00	5.76E+02	3.59E+01 G
Ir-192	F	-2.6478E-02					7.40E+01
		316.49	4.910E-01	&(	1.514E+00	9.21E+01	8.70E+01 G
		468.06	7.547E-01	?(	2.704E+00	1.06E+02	5.18E+01 G
		308.44	1.119E+00	+	5.286E+00	1.40E+02	3.18E+01 G
Cs-136	F	-4.5821E-03					1.30E+01
		818.50	5.107E-01	?(	1.811E+00	1.04E+02	1.00E+02 G
		1048.07	6.280E-01	?(	1.340E+00	6.49E+01	8.00E+01 G
		340.57	7.497E-01	+	3.934E+00	1.56E+02	4.69E+01 G
Np-239	T	9.3251E-01					2.36E+00
		103.70	4.226E-01	&	4.078E+00	2.85E+02	2.40E+01 X
		106.13	9.325E-01	(	2.751E+00	8.81E+01	2.27E+01 G
		99.50	1.589E+00		4.843E+00	1.07E+02	1.50E+01 X
Nd-147		-1.6375E+00					1.11E+01
		531.00	1.637E+00	(	9.175E+00	2.20E+02	1.30E+01 G
		91.10	9.176E-01	+	6.134E+00	2.00E+02	2.83E+01 G

(- This peak used in the nuclide activity average.

* - Peak is too wide, but only one peak in library.

! - Peak is part of a multiplet and this area went negative during deconvolution.

? - Peak is too narrow.

@ - Peak is too wide at FW25M, but ok at FWHM.

% - Peak fails sensitivity test.

\$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.

+ - Peak activity higher than counting uncertainty range.

- - Peak activity lower than counting uncertainty range.

= - Peak outside analysis energy range.

& - Calculated peak centroid is not close enough to the library energy centroid for positive identification.

P - Peakbackground subtraction

} - Peak is too close to another for the activity
to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
F - Fast Neutron Activation
I - Fission Product
N - Naturally Occurring Isotope
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded

Peak Codes:

G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape
K - Key Line
A - Not in Average
C - Coincidence Peak

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	Activity
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TH-227	50.14	96.	38.	0.021	46.33	1.082E+01
AM-241	59.54	186.	4.	0.002	576.09	2.019E-01
Cd-109	88.04	828.	-25.	-0.014	161.74	-8.856E+00
Nd-147	91.10	781.	-20.	-0.011	199.98	-9.176E-01
Gd-153	103.20	279.	-14.	-0.008	169.40	-8.194E-01
EU-152	121.78	266.	-22.	-0.012	103.32	-9.632E-01 P
CO-57	122.06	213.	15.	0.008	144.63	2.151E-01 P
EU-154	123.10	249.	-17.	-0.009	133.58	-5.296E-01
PA-234	131.29	367.	-22.	-0.012	96.10	-1.571E+00 P
HF-181	133.02	389.	-10.	-0.006	202.35	-3.121E-01 P
Tc-99m	140.51	285.	18.	0.010	135.71	2.735E-01
CE-139	165.85	222.	-11.	-0.006	200.67	-1.906E-01
Cf-251	176.60	143.	-18.	-0.010	94.96	-1.629E+00
TH-229	193.51	94.	13.	0.007	136.25	4.743E+00 P
TH-229	210.85	289.	-20.	-0.011	124.49	-1.132E+01
Cf-251	227.00	113.	-7.	-0.004	260.96	-2.123E+00
EU-152	244.69	592.	14.	0.008	245.91	3.588E+00 P
TH-227	256.24	73.	2.	0.001	917.61	4.768E-01
Cd-113m	263.70	67.	12.	0.006	103.30	3.992E+03
BI-210M	265.83	70.	12.	0.007	105.01	4.823E-01
Hg-203	279.20	140.	-17.	-0.010	100.49	-4.499E-01
I-131	284.30	103.	-19.	-0.010	67.37	-6.654E+00 P
PA-231	300.07	240.	-3.	-0.001	846.71	-2.387E+00
Ir-192	308.44	225.	-15.	-0.009	140.35	-1.119E+00
PA-233	312.01	125.	2.	0.001	941.76	1.093E-01 P
Ir-192	316.49	130.	-18.	-0.010	92.07	-4.910E-01
CR-51	320.08	173.	-18.	-0.010	87.76	-4.343E+00 P
La-140	328.76	63.	15.	0.008	104.94	1.744E+00 P
Cf-249	333.44	29.	10.	0.006	104.05	1.618E+00
Cs-136	340.57	233.	-14.	-0.008	155.69	-7.497E-01
EU-152	344.29	219.	-14.	-0.008	150.54	-1.343E+00
BA-133	356.00	328.	-11.	-0.006	228.05	-4.724E-01
I-131	364.48	70.	-2.	-0.001	434.64	-5.483E-02 P

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
BA-133	383.84	94.	13.	0.007	108.30	4.019E+00	
SN-113	391.69	56.	-10.	-0.006	74.41	-4.352E-01	P
SB-125	427.88	52.	-6.	-0.003	129.92	-5.846E-01	P
AG-108M	433.94	30.	8.	0.004	132.04	2.679E-01	P
pm-146	453.88	56.	-13.	-0.007	116.07	-6.264E-01	
SB-125	463.37	70.	14.	0.008	92.10	4.106E+00	P
Ir-192	468.06	77.	12.	0.007	105.92	7.547E-01	
BE-7	477.60	68.	8.	0.004	150.00	2.480E+00	
HF-181	482.00	71.	12.	0.007	100.93	5.022E-01	
La-140	487.02	44.	-5.	-0.003	263.57	-3.640E-01	
RU-103	497.05	33.	4.	0.002	265.41	1.582E-01	P
RH-106	511.86	63.	93.	0.052	23.89	1.600E+01	P
Nd-147	531.00	44.	-6.	-0.003	220.27	-1.637E+00	
Ba-140	537.26	53.	-14.	-0.008	155.26	-2.104E+00	P
PA-234	569.47	48.	-11.	-0.006	96.52	-4.880E+00	
BI-207	569.70	39.	7.	0.004	132.22	2.687E-01	
SB-125	600.50	316.	3.	0.001	947.68	5.829E-01	
RU-103	610.30	316.	3.	0.002	867.55	2.003E+00	
RH-106	621.92	376.	-14.	-0.008	192.45	-5.829E+00	
SB-125	635.89	44.	-15.	-0.008	69.98	-5.259E+00	
I-131	636.97	65.	-4.	-0.002	257.67	-2.566E+00	
AG-110M	657.76	118.	-13.	-0.007	119.67	-5.860E-01	
PM-144	696.54	43.	-8.	-0.005	164.92	-3.711E-01	
SB-124	722.79	51.	10.	0.005	109.64	4.062E+00	
pm-146	735.72	35.	-7.	-0.004	222.86	-1.372E+00	P
ZR-95	756.73	31.	-4.	-0.002	243.48	-3.055E-01	P
AG-110M	763.94	82.	-19.	-0.011	70.41	-4.111E+00	
NB-95	765.79	82.	4.	0.002	327.56	1.883E-01	
PA-234M	766.41	39.	10.	0.006	94.42	1.615E+02	
BI-212	785.42	17.	10.	0.005	93.61	3.669E+01	
CO-58	810.77	38.	2.	0.001	441.59	1.002E-01	
Cs-136	818.50	51.	-10.	-0.006	104.33	-5.107E-01	
MN-54	834.85	10.	7.	0.004	108.97	3.323E-01	P
Co-56	846.77	47.	-17.	-0.009	91.16	-8.529E-01	
EU-154	873.23	26.	3.	0.002	224.50	1.438E+00	
PA-234	880.53	61.	-13.	-0.007	89.21	-1.157E+01	
PA-234	883.24	74.	-4.	-0.002	310.19	-2.212E+00	
Sc-46	889.28	70.	8.	0.005	149.20	4.381E-01	P
y-88	898.04	15.	2.	0.001	340.85	1.386E-01	P
AG-110M	937.49	47.	-17.	-0.010	87.03	-2.828E+00	
PA-234	946.02	14.	9.	0.005	94.28	3.795E+00	
EU-152	964.11	115.	-16.	-0.009	99.80	-6.171E+00	
EU-154	996.33	30.	10.	0.005	86.08	5.434E+00	
PA-234M	1001.00	40.	2.	0.001	525.06	1.221E+01	
EU-154	1004.77	54.	-10.	-0.005	113.62	-3.131E+00	
Co-56	1037.84	35.	-15.	-0.008	90.47	-6.470E+00	
Cs-136	1048.07	10.	8.	0.005	64.91	6.280E-01	
RH-106	1050.36	34.	-2.	-0.001	385.59	-8.593E+00	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
BI-207	1063.66	15.	4.	0.002	244.53	2.977E-01	
Ga-68	1077.40	35.	-8.	-0.004	166.38	-1.789E+01	
FE-59	1099.25	20.	-5.	-0.003	201.66	-5.653E-01	
EU-152	1112.07	95.	-15.	-0.008	97.85	-6.893E+00	
ZN-65	1115.55	80.	-14.	-0.008	94.70	-1.779E+00	
Sc-46	1120.55	76.	14.	0.008	92.80	9.000E-01	
CO-60	1173.24	10.	6.	0.003	122.85	4.048E-01	
Co-56	1238.28	22.	12.	0.007	94.24	1.258E+00	P
NA-22	1274.53	21.	-1.	-0.001	497.49	-9.625E-02	
FE-59	1291.60	21.	-2.	-0.001	454.68	-3.940E-01	
CO-60	1332.50	22.	-7.	-0.004	163.65	-5.111E-01	P
EU-152	1408.00	5.	7.	0.004	89.34	2.449E+00	P
SB-124	1690.98	6.	-2.	-0.001	343.80	-3.181E-01	
Co-56	1771.35	41.	-11.	-0.006	91.33	-6.476E+00	
y-88	1836.06	6.	2.	0.001	304.14	1.970E-01	

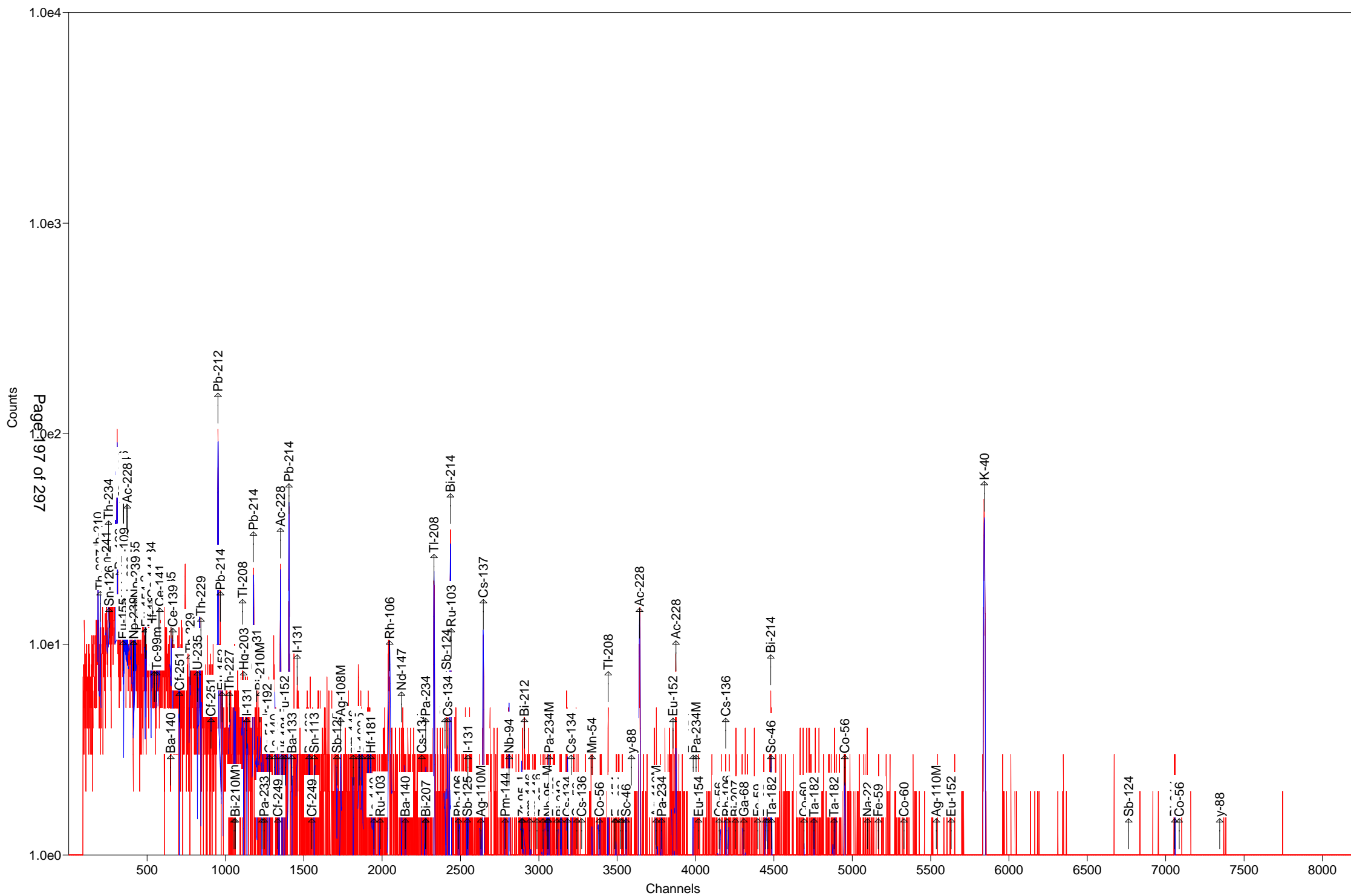
P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****					
Time of Count		Time Corrected		Uncertainty 1 Sigma	
Nuclide	Activity Bq/Sample	Activity Bq/Sample	Counting	MDA Bq/Sample	
BE-7 #A	2.4798E+00	2.4798E+00	1.500E+02%	1.28E+01	
NA-22 #A	-9.6254E-02	-9.6254E-02	4.975E+02%	1.75E+00	
K-40	2.5221E+02	2.5221E+02	5.579E+00%	1.05E+01	
Sc-46 #A	6.6904E-01	6.6904E-01	8.786E+01%	2.24E+00	
CR-51 #A	-4.3426E+00	-4.3427E+00	8.776E+01%	1.53E+01	
MN-54 #A	3.3231E-01	3.3231E-01	1.090E+02%	8.97E-01	
FE-59 #A	-5.6533E-01	-5.6533E-01	2.017E+02%	2.66E+00	
Co-56 #A	-1.2615E-02	-1.2615E-02	6.556E+01%	1.78E+00	
CO-57 #A	2.1511E-01	2.1511E-01	1.446E+02%	1.05E+00	
CO-58 #A	1.0023E-01	1.0023E-01	4.416E+02%	1.58E+00	
CO-60 #A	-5.3367E-02	-5.3367E-02	1.023E+02%	1.83E+00	
ZN-65 #A	-1.7786E+00	-1.7786E+00	9.470E+01%	5.67E+00	
NB-94 #	1.2699E+00	1.2699E+00	3.237E+01%	8.85E-01	
ZR-95 #A	-3.0546E-01	-3.0547E-01	2.435E+02%	2.46E+00	
NB-95 #A	1.8826E-01	1.8826E-01	3.276E+02%	2.14E+00	
RU-103 #A	1.5819E-01	1.5820E-01	2.654E+02%	1.09E+00	
RH-106 #A	-5.8285E+00	-5.8285E+00	1.925E+02%	3.77E+01	
AG-108M#A	2.6792E-01	2.6792E-01	1.320E+02%	9.43E-01	
AG-110M#A	0.0000E+00	0.0000E+00	1.000E+03%	3.23E+00	
SN-113 #A	-4.3524E-01	-4.3524E-01	7.441E+01%	1.64E+00	
SB-124 #A	3.8039E-01	3.8040E-01	1.096E+02%	3.44E+00	
SB-125 #A	6.2314E-01	6.2314E-01	9.210E+01%	3.66E+00	
I-131 #A	-5.4826E-02	-5.4829E-02	4.346E+02%	1.34E+00	
Gd-153 #A	4.2624E-02	4.2624E-02	2.223E+03%	2.74E+00	
Ga-68 #A	-1.7697E+01	-1.7892E+01	1.664E+02%	6.77E+01	

Tc-99m #A	2.7292E-01	2.7348E-01	1.357E+02%	1.25E+00
BA-133 #A	-4.7243E-01	-4.7243E-01	2.281E+02%	3.63E+00
CS-134 #A	6.5374E-01	6.5374E-01	9.141E+01%	3.39E+00
CS-137	3.2602E+00	3.2602E+00	1.800E+01%	1.04E+00
CE-139 #A	-1.9064E-01	-1.9064E-01	2.007E+02%	1.29E+00
Ba-140 #A	-2.1038E+00	-2.1039E+00	1.553E+02%	5.39E+00
La-140 #A	3.0591E-01	3.0592E-01	1.049E+02%	6.72E-01
CE-141 #A	6.1110E-02	6.1111E-02	1.187E+03%	2.46E+00
CE-144 #A	-3.5327E-03	-3.5327E-03	7.000E+04%	1.12E+01
PM-144 #A	-3.7113E-01	-3.7113E-01	1.649E+02%	1.49E+00
EU-152 #A	-2.4609E-01	-2.4609E-01	1.442E+02%	6.81E+00
EU-154 #A	3.2903E+00	3.2903E+00	8.608E+01%	1.15E+01
EU-155 #A	1.0617E+00	1.0617E+00	1.256E+02%	4.48E+00
HF-181 #A	5.0218E-01	5.0219E-01	1.009E+02%	1.71E+00
Ta-182 #A	2.4521E+00	2.4521E+00	6.950E+01%	6.98E+00
Hg-203 #A	-4.4985E-01	-4.4985E-01	1.005E+02%	1.52E+00
TL-208	5.9834E+00	5.9834E+00	9.892E+00%	7.80E-01
pm-146 #A	8.2556E-02	8.2556E-02	1.421E+03%	3.04E+00
y-88 #A	1.6860E-01	1.6860E-01	2.284E+02%	1.19E+00
Cd-113m#A	3.9919E+03	3.9919E+03	1.033E+02%	1.40E+04
Cd-109 #A	-8.8562E+00	-8.8563E+00	1.617E+02%	4.78E+01
Cf-251 #A	-1.6290E+00	-1.6290E+00	9.496E+01%	5.18E+00
Cf-249 #A	3.3859E-01	3.3859E-01	1.041E+02%	2.14E+00
Sn-126 A	7.1573E-01	7.1573E-01	6.221E+02%	1.51E+01
PB-210 A	3.2004E+01	3.2004E+01	3.898E+01%	3.25E+01
PB-212	1.6446E+01	1.6446E+01	6.360E+00%	2.12E+00
PB-214	1.3140E+01	1.3140E+01	9.247E+00%	2.34E+00
BI-207 #A	2.8127E-01	2.8127E-01	1.322E+02%	1.23E+00
BI-212 #A	-1.0266E-01	-1.0266E-01	8.784E+03%	2.37E+01
BI-214 #	1.4123E+01	1.4123E+01	9.019E+00%	2.30E+00
BI-210M#A	4.8229E-01	4.8229E-01	1.050E+02%	1.71E+00
AC-228	1.9116E+01	1.9116E+01	8.744E+00%	1.39E+00
TH-227 #A	1.0820E+01	1.0820E+01	4.633E+01%	1.38E+01
TH-229 #A	4.7426E+00	4.7426E+00	1.362E+02%	1.76E+01
TH-234 #	2.7983E+01	2.7983E+01	3.496E+01%	2.61E+01
PA-231 #A	0.0000E+00	0.0000E+00	1.000E+03%	5.96E+01
PA-233 #A	1.0926E-01	1.0926E-01	9.418E+02%	3.55E+00
PA-234 #A	7.1908E-01	7.1908E-01	6.731E+01%	6.60E+00
PA-234M#A	5.1026E+01	5.1026E+01	9.442E+01%	2.28E+02
U-235 A	2.9890E+00	2.9890E+00	8.886E+01%	9.91E+00
AM-241 #A	2.0195E-01	2.0195E-01	5.761E+02%	3.35E+00
Np-237 #A	0.0000E+00	0.0000E+00	1.000E+03%	1.50E+01
Ir-192 #A	-2.6478E-02	-2.6478E-02	7.017E+01%	1.51E+00
Cs-136 #A	-4.5819E-03	-4.5821E-03	6.144E+01%	1.81E+00
Np-239 A	9.3231E-01	9.3251E-01	8.809E+01%	2.75E+00
Nd-147 #A	-1.6374E+00	-1.6375E+00	2.203E+02%	9.18E+00

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (37.6 to 1999.5 keV) 3.843E+02 Bq/Sample
Total Decayed Activity (37.6 to 1999.5 keV) 3.8426340E+02 Bq/Sample



Daily Checks

Test America
St. Louis
Quality Control Check

Spectrum: 12_20160712001_QCAsLeft
Description: Quality control Check (QC Source 'H') Post Stabilization
Acquired: 7/12/2016 1:32:41 AM
Detector: Detector #12

Quality Control Evaluation Criteria:

- 1) Notify Supervisor if 'AS FOUND' parameters exceed Tolerance or Control Limits.
- 2) Place out of service if 'AS LEFT' parameters exceed Tolerance or Control Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results

QA-60							
Channel	238.00	236.00	237.00	237.80	239.00	240.00	PASS
Energy	59.54	59.04	59.29	59.56	59.79	60.04	PASS
FWHM	0.90	0.00	0.00	0.89	2.00	2.10	PASS
ActivityDiff	691.00	-5.00	-4.00	2.08	4.00	5.00	PASS

QA-662							
FWHM	1.48	0.00	0.00	1.41	3.18	3.28	PASS
ActivityDiff	659.00	-5.00	-4.00	2.65	4.00	5.00	PASS

QA-1332							
Channel	5330.00	5327.00	5328.00	5329.10	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.44	1333.01	1333.26	PASS
FWHM	2.00	0.00	0.00	1.96	4.20	4.30	PASS
ActivityDiff	1274.00	-5.00	-4.00	0.86	4.00	5.00	PASS

Analyst: Aaron Schroder

Reviewer: Amanda Dick

Test America
St. Louis
Background Check

Spectrum: 12_20160712002_BG
Description: Background Contamination Check
Acquired: 7/12/2016 2:06:53 AM
Detector: Detector #12

Background Evaluation Criteria:

- 1) Place instrument out of service if Countrate exceeds Control Limits.
- 2) Investigate high countrate and take corrective action as necessary if Countrate exceeds Tolerance Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results
Bkgd							
Countrate	2.08	1.93	1.98	2.06	2.18	2.23	PASS

Analyst: Aaron Schroder

Reviewer: Amanda Dick

Test America
St. Louis
Background Check

Spectrum: 14_20160712001_BG
Description: Background Contamination Check
Acquired: 7/12/2016 1:04:23 AM
Detector: Detector #14

Background Evaluation Criteria:

- 1) Place instrument out of service if Countrate exceeds Control Limits.
- 2) Investigate high countrate and take corrective action as necessary if Countrate exceeds Tolerance Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results
Bkgd							
Countrate	1.80	1.66	1.71	1.82	1.90	1.94	PASS

Analyst: Aaron Schroder

Reviewer: Amanda Dick

Test America
St. Louis
Quality Control Check

Spectrum: 14_20160712002_QCAsLeft
Description: Quality control Check (QC Source 'E') Post Stabilization
Acquired: 7/12/2016 2:26:51 AM
Detector: Detector #14
Quality Control Evaluation Criteria:
1) Notify Supervisor if 'AS FOUND' parameters exceed Tolerance or Control Limits.
2) Place out of service if 'AS LEFT' parameters exceed Tolerance or Control Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results

QA-60							
Channel	238.00	236.00	237.00	237.90	239.00	240.00	PASS
Energy	59.54	59.04	59.29	59.65	59.79	60.04	PASS
FWHM	0.76	0.00	0.00	0.89	1.86	1.96	PASS
ActivityDiff	671.90	-5.00	-4.00	-0.37	4.00	5.00	PASS

QA-662							
FWHM	1.35	0.00	0.00	1.45	3.05	3.15	PASS
ActivityDiff	628.85	-5.00	-4.00	-1.23	4.00	5.00	PASS

QA-1332							
Channel	5330.00	5327.00	5328.00	5329.50	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.41	1333.01	1333.26	PASS
FWHM	1.91	0.00	0.00	1.92	4.11	4.21	PASS
ActivityDiff	1224.59	-5.00	-4.00	1.40	4.00	5.00	PASS

Analyst: Aaron Schroder

Reviewer: Amanda Dick

Test America
St. Louis
Background Check

Spectrum: 16_20160712001_BG
Description: Background Contamination Check
Acquired: 7/12/2016 1:05:38 AM
Detector: Detector #16

Background Evaluation Criteria:

- 1) Place instrument out of service if Countrate exceeds Control Limits.
- 2) Investigate high countrate and take corrective action as necessary if Countrate exceeds Tolerance Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results
Bkgd							
Countrate	2.68	2.51	2.56	2.59	2.80	2.86	PASS

Analyst: Aaron Schroder

Reviewer: Amanda Dick

Test America
St. Louis
Quality Control Check

Spectrum: 16_20160712002_QCAsLeft
Description: Quality control Check (QC Source 'G') Post Stabilization
Acquired: 7/12/2016 2:28:23 AM
Detector: Detector #16

Quality Control Evaluation Criteria:

- 1) Notify Supervisor if 'AS FOUND' parameters exceed Tolerance or Control Limits.
- 2) Place out of service if 'AS LEFT' parameters exceed Tolerance or Control Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results

QA-60							
Channel	238.00	236.00	237.00	238.00	239.00	240.00	PASS
Energy	59.54	59.04	59.29	59.59	59.79	60.04	PASS
FWHM	0.96	0.00	0.00	0.99	2.06	2.16	PASS
ActivityDiff	602.10	-5.00	-4.00	0.29	4.00	5.00	PASS

QA-662							
FWHM	1.53	0.00	0.00	1.50	3.23	3.33	PASS
ActivityDiff	571.13	-5.00	-4.00	-0.37	4.00	5.00	PASS

QA-1332							
Channel	5330.00	5327.00	5328.00	5330.70	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.78	1333.01	1333.26	PASS
FWHM	2.09	0.00	0.00	2.07	4.29	4.39	PASS
ActivityDiff	1139.05	-5.00	-4.00	-1.06	4.00	5.00	PASS

Analyst: Aaron Schroder

Reviewer: Amanda Dick

Initial Calibrations

Gamma Verification per Geometry

Detector: Ge12
 Geometry: Tunacan
 Reference date 1/1/2012
 Calibration Standard: 90099
 Standard volume g / vial 1550
 Standard volume transferred in g / geometry 317.8
 lab ID# of cal standard 6699

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	γ abundance	Bq/sample	Count Results	%recovery
Pb-210	3094	634	0.0425	14926	14446	96.8
Am-241	2037	418	0.3590	1163	1221.2	105.0
Cd-109	2881	591	0.0361	16363	16047	98.1
Co-57	1511	310	0.8560	362	351.89	97.2
Ce-139	2139	439	0.7990	549	541.18	98.6
Hg-203	4651	954	0.8146	1171	1185.4	101.3
Sn-113	3015	618	0.6400	966	985.86	102.1
Cs-137	1938	397	0.8510	467	464.95	99.6
Y-88	7264	1489	0.9370	1589	1567.8	98.6
Co-60	3580	734	0.9997	734	723.38	98.5
Co-60	3581	734	0.9999	734	722.83	98.4
Y-88	7690	1577	0.9920	1589	1631.1	102.6

Reviewed By: Jody Watson

Date: 10/4/2012

Calibration Data from file: 12_Soil_TunaCan.Clb
 Energy Calibration Date: 10/4/2012 Time: 8:58:25 AM
 Efficiency Calibration Date: 10/4/2012 Time: 9:05:44 AM

Calibration Description:
 12_TunaCanCal_90099_100212

Energy Calibration Fit

Energy = 0.0090 +0.250225*Channel -3.66218e-008*Channel**2
 FWHM (ch) = 3.4167 +0.000958*Channel -2.51787e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
186.06	46.54	46.56	-0.05%	0.90	0.90	0.39%
237.95	59.54	59.55	-0.01%	0.89	0.91	-2.27%
351.83	88.03	88.04	-0.01%	0.93	0.94	-1.36%
487.89	122.06	122.08	-0.02%	0.97	0.97	0.15%
663.08	165.85	165.91	-0.04%	1.00	1.01	-0.90%
1115.49	279.17	279.09	0.03%	1.15	1.11	3.32%
1565.26	391.69	391.59	0.03%	1.21	1.21	-0.06%
2645.31	661.66	661.67	-0.00%	1.46	1.44	1.36%
3590.75	898.02	898.03	-0.00%	1.65	1.63	0.91%
4692.00	1173.24	1173.26	-0.00%	1.80	1.84	-2.15%
5329.54	1332.50	1332.55	-0.00%	1.94	1.95	-0.63%
7345.18	1836.01	1835.98	0.00%	2.29	2.27	0.67%

Efficiency Calibration Fit

Knee Energy = 165.85 keV
 Above the Knee: Quadratic Uncertainty = 0.6978 %
 Ln(Eff) = -0.7827 -0.300127*Ln(Eng) -0.0336956*(Ln(Eng))**2
 Below the Knee: Quadratic Uncertainty = 0.9642 %
 Ln(Eff) = -22.8841 +8.352717*Ln(Eng) -0.881237*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	2.1587E-002	2.2292E-002	-3.26%
59.54	3.2562E-002	3.1219E-002	4.12%
88.03	4.1933E-002	4.2777E-002	-2.01%
122.06	4.3987E-002	4.5264E-002	-2.90%
165.85	===== Knee =====		
165.85	4.0281E-002	4.0886E-002	-1.50%
279.17	2.9349E-002	2.8963E-002	1.31%
391.69	2.3406E-002	2.2919E-002	2.08%
661.66	1.5679E-002	1.5712E-002	-0.21%
898.02	1.2338E-002	1.2502E-002	-1.33%
1173.24	1.0026E-002	1.0183E-002	-1.57%
1332.50	9.0782E-003	9.2201E-003	-1.56%
1836.01	7.3324E-003	7.1442E-003	2.57%

Calibration Certificate Table

Isotope	Energy	Pct	Half-life	Activity	GPS	Error	Date & Time
Pb-210	46.54	4.25	8.15E+003	14918.00	634.00	4.10%	1/1/2012 11:00:00 AM
Am-241	59.54	35.70	1.58E+005	1170.90	418.00	3.50%	1/1/2012 11:00:00 AM
Cd-109	88.03	3.61	4.63E+002	16371.00	591.00	4.70%	1/1/2012 11:00:00 AM
Co-57	122.06	85.60	2.72E+002	362.15	310.00	4.10%	1/1/2012 11:00:00 AM
Ce-139	165.85	79.90	1.38E+002	549.44	439.00	3.90%	1/1/2012 11:00:00 AM
Hg-203	279.17	81.50	4.66E+001	1170.60	954.00	3.80%	1/1/2012 11:00:00 AM
Sn-113	391.69	64.00	1.15E+002	965.63	618.00	3.90%	1/1/2012 11:00:00 AM
Cs-137	661.66	85.21	1.10E+004	465.91	397.00	4.00%	1/1/2012 11:00:00 AM
Y-88	898.02	93.70	1.07E+002	1589.10	1489.00	3.90%	1/1/2012 11:00:00 AM
Co-60	1173.24	99.90	1.93E+003	734.73	734.00	4.00%	1/1/2012 11:00:00 AM
Co-60	1332.50	99.98	1.93E+003	734.15	734.00	4.00%	1/1/2012 11:00:00 AM
Y-88	1836.01	99.20	1.07E+002	1589.70	1577.00	4.00%	1/1/2012 11:00:00 AM

ORTEC g v - i (1087) Env32 G53W4.25 10/4/2012 9:11:35 AM
TestAmerica, Inc Spectrum name: 12_TunaCan_20122189.An1

Sample description
12_TunaCan_90099

Spectrum Filename: C:\User\SPC\Det12\12_TunaCan_20122189.An1

Acquisition information

Start time: 10/2/2012 10:17:00 AM
Live time: 7200
Real time: 7302
Dead time: 1.40 %
Detector ID: 12

Detector system
Ge12 S/N10034336

Calibration

Filename: 12_Soil_TunaCan.Clb
12_TunaCanCal_90099_100212

Energy Calibration

Created: 10/4/2012 8:58:25 AM
Zero offset: 0.009 keV
Gain: 0.250 keV/channel
Quadratic: $-3.662\text{E-}08 \text{ keV/channel}^2$

Efficiency Calibration

Created: 10/4/2012 9:05:44 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.70 %
Log(Eff): $-7.827468\text{E-}01 + (-3.001271\text{E-}01 * \text{Log}(E)) + (-3.369562\text{E-}02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 0.96 %
Log(Eff): $-2.288409\text{E+}01 + (8.352717\text{E+}00 * \text{Log}(E)) + (-8.812368\text{E-}01 * \text{Log}(E)^2)$

Library Files

Main analysis library: DET_EnergyStandardMix & Pb.Lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G53W4.25
Start channel: 150 (37.54keV)
Stop channel: 8000 (1999.46keV)
Peak rejection level: 10.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000\text{E+}00 / (1.0000\text{E+}00 * 1.0000\text{E+}00) = 1.0000\text{E+}00$
Detection limit method: Reg. Guide 4.16 Method

ORTEC g v - i (1087) Env32 G53W4.25 10/4/2012 9:11:35 AM
 TestAmerica, Inc Spectrum name: 12_TunaCan_20122189.An1

Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: average of three points.
 Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	1/1/2012 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%
 Energy Calibration
 Normalized diff: 0.0301

***** S U M M A R Y O F P E A K S I N R A N G E *****

Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq	Nuc
46.56	96262.	0.47	0.90	2.231E-02	46.54	4.250	1.445E+04	Pb210
59.55	97880.	0.49	0.89	3.122E-02	59.54	35.700	1.221E+03	AM241
88.04	118171.	0.40	0.93	4.278E-02	88.03	3.610	1.605E+04	CD109
122.08	48689.	0.66	0.97	4.526E-02	122.06	85.600	3.519E+02	CO57
136.52	6070.	3.34	0.99	4.419E-02				
165.91	31873.	0.80	1.00	4.088E-02	165.85	79.900	5.412E+02	Ce139
279.09	3381.	4.68	1.15	2.897E-02	279.17	81.500	1.185E+03	Hg203
391.58	19876.	1.11	1.21	2.292E-02	391.69	64.000	9.859E+02	SN113
661.67	44047.	0.60	1.46	1.571E-02	661.66	85.210	4.649E+02	CS137
898.03	22124.	1.09	1.65	1.250E-02	898.02	93.700	1.568E+03	Y898
1173.25	47992.	0.54	1.80	1.018E-02	1173.24	99.900	7.234E+02	Co1173
1332.54	43454.	0.53	1.94	9.220E-03	1332.50	99.982	7.228E+02	Co1332
1835.96	13783.	0.98	2.29	7.144E-03	1836.01	99.200	1.614E+03	Y1836

***** U N I D E N T I F I E D P E A K S U M M A R Y *****

Peak Centroid Channel	Background Energy	Net Area Counts	Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide
545.60	136.52	8754.	6070.	1.374E+05	3.34	0.989	-

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.

 This section based on library: DET_EnergyStandardMix & Pb.Lib

***** I D E N T I F I E D P E A K S U M M A R Y *****

Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	FWHM keV
Pb-210	186.06	46.56	27968.	96262.	13.370	0.47	0.903
AM-241	237.95	59.55	29903.	97880.	13.594	0.49	0.891
CD-109	351.83	88.04	24170.	118171.	16.413	0.40	0.926
CO-57	487.89	122.08	12523.	48689.	6.762	0.66	0.972
Ce-139	663.08	165.91	7948.	31873.	4.427	0.80	1.002
Hg-203	1115.49	279.09	5203.	3381.	0.470	4.68	1.152
SN-113	1565.25	391.58	5206.	19876.	2.760	1.11	1.214
CS-137	2645.31	661.67	4245.	44047.	6.118	0.60	1.464
Y-898	3590.75	898.03	4771.	22124.	3.073	1.09	1.649
Co-1173	4691.96	1173.25	2353.	47992.	6.666	0.54	1.802
Co-1332	5329.49	1332.54	1369.	43454.	6.035	0.53	1.941
Y-1836	7345.05	1835.95	424.	13925.	1.934	0.97	2.293

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

✓

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****

- Nuclide - Name	- Average Code	Activity Bq	Energy keV	Activity Bq	Code	MDA Value Bq	COMMENTS
Pb-210	N	1.4446E+04	46.54	1.445E+04	(	1.174E+02	8.15E+03 4.69E-01 4.25E+00 G
AM-241		1.2212E+03	59.54	1.221E+03	(	1.009E+01	1.58E+05 4.87E-01 3.57E+01 G
CD-109		1.6047E+04	88.03	1.605E+04	(	9.875E+01	4.63E+02 4.00E-01 3.61E+00 G
CO-57		3.5189E+02	122.06	3.519E+02	(	3.789E+00	2.72E+02 6.59E-01 8.56E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ce-139	5.4118E+02	165.85	5.412E+02	(	7.100E+00	8.00E-01	1.38E+02 7.99E+01 G
Hg-203	1.1854E+03	279.17	1.185E+03	(	1.188E+02	4.68E+00	4.66E+01 8.15E+01 G
SN-113	9.8586E+02	391.69	9.859E+02	(	1.681E+01	1.11E+00	1.15E+02 6.40E+01 G
CS-137	4.6495E+02	661.66	4.649E+02	(	3.233E+00	5.99E-01	1.10E+04 8.52E+01 G
Y-898	1.5678E+03	898.02	1.568E+03	(	2.300E+01	1.09E+00	1.07E+02 9.37E+01 G
Co-1173	7.2338E+02	1173.24	7.234E+02	(	3.448E+00	5.35E-01	1.93E+03 9.99E+01 G
Co-1332	7.2283E+02	1332.50	7.228E+02	(	2.913E+00	5.31E-01	1.93E+03 1.00E+02 G
Y-1836	1.6311E+03	1836.01	1.631E+03	(	1.156E+01	9.66E-01	1.07E+02 9.92E+01 G

(- This peak used in the nuclide activity average.

- * - Peak is too wide, but only one peak in library.
- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction
- } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
 F - Fast Neutron Activation
 I - Fission Product
 N - Naturally Occurring Isotope

Peak Codes:

G - Gamma Ray
 X - X-Ray
 P - Positron Decay
 S - Single-Escape

Gamma Verification per Geometry

Detector: Ge14
 Geometry: Tunacan
 Reference date 1/1/2012
 Calibration Standard: 90099
 Standard volume g / vial 1550
 Standard volume transferred in g / geometry 317.8
 lab ID# of cal standard 6699

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	γ abundance	Bq/sample	Count Results	%recovery
Pb-210	3094	634	0.0425	14926	14422	96.6
Am-241	2037	418	0.3590	1163	1222.5	105.1
Cd-109	2881	591	0.0361	16363	16145	98.7
Co-57	1511	310	0.8560	362	349.28	96.5
Ce-139	2139	439	0.7990	549	538.52	98.1
Hg-203	4651	954	0.8146	1171	1205.9	103.0
Sn-113	3015	618	0.6400	966	971.36	100.6
Cs-137	1938	397	0.8510	467	465.65	99.7
Y-88	7264	1489	0.9370	1589	1570	98.8
Co-60	3580	734	0.9997	734	724.16	98.6
Co-60	3581	734	0.9999	734	720.6	98.1
Y-88	7690	1577	0.9920	1589	1634	102.8

Reviewed By: Jody Watson

Date: 4/23/2012

Calibration Data from file: 14_Soil_TunaCan.Clb
 Energy Calibration Date: 4/23/2012 Time: 11:29:29 AM
 Efficiency Calibration Date: 4/23/2012 Time: 11:29:47 AM

Calibration Description:
 14_TunaCan_90099_042312

Energy Calibration Fit

Energy = 0.1578 +0.250077*Channel -1.95882e-008*Channel**2
 FWHM (ch) = 2.7879 +0.000947*Channel -1.45727e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
186.01	46.54	46.67	-0.29%	0.73	0.74	-2.18%
237.82	59.54	59.63	-0.15%	0.74	0.75	-1.99%
351.26	88.03	88.00	0.04%	0.78	0.78	-0.25%
487.04	122.06	121.95	0.09%	0.82	0.81	0.58%
662.28	165.85	165.77	0.05%	0.86	0.85	1.23%
1115.71	279.17	279.15	0.01%	0.98	0.96	2.15%
1565.69	391.69	391.65	0.01%	1.09	1.06	2.42%
2645.83	661.66	661.68	-0.00%	1.30	1.30	0.28%
3591.53	898.02	898.06	-0.00%	1.42	1.50	-5.87%
4692.63	1173.24	1173.24	-0.00%	1.76	1.73	2.11%
5329.97	1332.50	1332.50	-0.00%	1.88	1.86	1.08%
7345.32	1836.01	1836.00	0.00%	2.23	2.24	-0.37%

Efficiency Calibration Fit

Knee Energy = 165.85 keV
 Above the Knee: Quadratic Uncertainty = 1.0212 %
 Ln(Eff) = 0.2101 -0.595197*Ln(Eng) -0.0160533*(Ln(Eng))**2
 Below the Knee: Quadratic Uncertainty = 1.2797 %
 Ln(Eff) = -23.9149 +8.828985*Ln(Eng) -0.93715*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	2.0990E-002	2.1711E-002	-3.44%
59.54	3.2006E-002	3.0654E-002	4.23%
88.03	4.1381E-002	4.1960E-002	-1.40%
122.06	4.2230E-002	4.3784E-002	-3.68%
165.85	===== Knee =====		
165.85	3.7957E-002	3.8722E-002	-2.02%
279.17	2.6754E-002	2.5963E-002	2.96%
391.69	2.0047E-002	1.9926E-002	0.60%
661.66	1.3125E-002	1.3132E-002	-0.05%
898.02	1.0136E-002	1.0258E-002	-1.20%
1173.24	8.1251E-003	8.2437E-003	-1.46%
1332.50	7.2859E-003	7.4227E-003	-1.88%
1836.01	5.8454E-003	5.6863E-003	2.72%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time	
Pb-210	46.54	4.25	8.15E+003	14918.00	634.00	4.10%	1/1/2012	11:00:00 AM
Am-241	59.54	35.70	1.58E+005	1170.90	418.00	3.50%	1/1/2012	11:00:00 AM
Cd-109	88.03	3.61	4.63E+002	16371.00	591.00	4.70%	1/1/2012	11:00:00 AM
Co-57	122.06	85.60	2.72E+002	362.15	310.00	4.10%	1/1/2012	11:00:00 AM
Ce-139	165.85	79.90	1.38E+002	549.44	439.00	3.90%	1/1/2012	11:00:00 AM
Hg-203	279.17	81.50	4.66E+001	1170.60	954.00	3.80%	1/1/2012	11:00:00 AM
Sn-113	391.69	64.00	1.15E+002	965.63	618.00	3.90%	1/1/2012	11:00:00 AM
Cs-137	661.66	85.21	1.10E+004	465.91	397.00	4.00%	1/1/2012	11:00:00 AM
Y-88	898.02	93.70	1.07E+002	1589.10	1489.00	3.90%	1/1/2012	11:00:00 AM
Co-60	1173.24	99.90	1.93E+003	734.73	734.00	4.00%	1/1/2012	11:00:00 AM
Co-60	1332.50	99.98	1.93E+003	734.15	734.00	4.00%	1/1/2012	11:00:00 AM
Y-88	1836.01	99.20	1.07E+002	1589.70	1577.00	4.00%	1/1/2012	11:00:00 AM

14_TunaCan_20120385

ORTEC g v - i (1087) Env32 G53W4.25 7/6/2012 11:13:09 AM Page 1
TestAmerica, Inc. Spectrum name: 14_TunaCan_20120385.An1

Sample description
17_TunaCan_90099_032612

Spectrum Filename: C:\User\Cal\Spectra\Det14\14_TunaCan_20120385.An1

Acquisition information
Start time: 4/23/2012 9:56:44 AM
Live time: 3600
Real time: 3665
Dead time: 1.77 %
Detector ID: 14

Detector system
Ge17 SN/11080671

Calibration
Filename: 14_Soil_TunaCan.Clb
14_TunaCan_90099_042312

Energy Calibration
Created: 4/23/2012 11:29:29 AM
Zero offset: 0.158 keV
Gain: 0.250 keV/channel
Quadratic: -1.959E-08 keV/channel^2

Efficiency Calibration
Created: 4/23/2012 11:29:47 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.02 %
Log(Eff): $2.101260E-01 + (-5.951973E-01 * \text{Log}(E)) + (-1.605331E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 1.28 %
Log(Eff): $-2.391492E+01 + (8.828985E+00 * \text{Log}(E)) + (-9.371496E-01 * \text{Log}(E)^2)$

Library Files
Main analysis library: DET_EnergyStandardMix & Pb.Lib
Library Match width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.67keV)
Stop channel: 8000 (1999.52keV)
Peak rejection level: 10.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

□

ORTEC g v - i (1087) Env32 G53W4.25 7/6/2012 11:13:09 AM Page 2
TestAmerica, Inc. Spectrum name: 14_TunaCan_20120385.An1
Page 1

14_TunaCan_20120385

Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: average of three points.

Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy: 0.000
 Multiplet shift channel: 2.000

Corrections	Status	Comments
Decay correct to date:	YES	1/1/2012 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%
 Energy Calibration
 Normalized diff: 0.0575

***** S U M M A R Y O F P E A K S I N R A N G E *****								
Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq	Nuc
46.67	47449.	0.64	0.73	2.181E-02	46.54	4.250	1.442E+04	Pb210
59.63	48139.	0.67	0.74	3.071E-02	59.54	35.700	1.223E+03	AM241
72.88	1815.	8.13	0.77	3.737E-02				
88.00	74331.	0.47	0.79	4.195E-02	88.03	3.610	1.614E+04	CD109
121.95	35331.	0.76	0.82	4.379E-02	122.06	85.600	3.493E+02	CO57
136.39	4314.	3.84	0.82	4.244E-02				
165.77	33960.	0.70	0.89	3.800E-02	165.85	79.900	5.385E+02	Ce139
279.15	17136.	1.05	1.00	2.596E-02	279.17	81.500	1.206E+03	Hg203
391.65	22586.	0.85	1.13	1.993E-02	391.69	64.000	9.714E+02	SN113
661.68	18625.	0.92	1.36	1.313E-02	661.66	85.210	4.657E+02	CS137
898.06	26064.	0.74	1.56	1.026E-02	898.02	93.700	1.570E+03	Y898
1173.24	20614.	0.80	1.76	8.244E-03	1173.24	99.900	7.242E+02	Co1173
1332.50	18485.	0.81	1.88	7.423E-03	1332.50	99.982	7.206E+02	Co1332
1835.98	15919.	0.83	2.23	5.686E-03	1836.01	99.200	1.634E+03	Y1836

***** U N I D E N T I F I E D P E A K S U M M A R Y *****								
Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma	FWHM %	Suspected Nuclide	
290.81	72.88	9094.	1708.	4.569E+04	9.16	0.857	-	
544.77	136.39	6618.	4314.	1.017E+05	3.84	0.819	-	

□

ORTEC g v - i (1087) Env32 G53W4.25 7/6/2012 11:13:09 AM Page 3
 TestAmerica, Inc. Spectrum name: 14_TunaCan_20120385.An1

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.

14_TunaCan_20120385

 This section based on library: DET_EnergyStandardMix & Pb.Lib

***** I D E N T I F I E D P E A K S U M M A R Y *****							
Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	FWHM keV
Pb-210	186.01	46.67	13580.	47449.	13.180	0.64	0.728
AM-241	237.82	59.63	14856.	48139.	13.372	0.67	0.736
CD-109	351.26	88.00	13424.	74331.	20.647	0.47	0.793
CO-57	487.04	121.95	9138.	35331.	9.814	0.76	0.820
Ce-139	662.28	165.77	5743.	33960.	9.433	0.70	0.887
Hg-203	1115.71	279.15	3658.	17136.	4.760	1.05	0.998
SN-113	1565.69	391.65	3032.	22586.	6.274	0.85	1.125
CS-137	2645.83	661.68	2231.	18625.	5.174	0.92	1.364
Y-898	3591.53	898.06	1967.	26064.	7.240	0.74	1.562
Co-1173	4692.63	1173.24	1001.	20614.	5.726	0.80	1.765
Co-1332	5329.97	1332.50	650.	18485.	5.135	0.81	1.875
Y-1836	7345.28	1835.98	147.	15919.	4.422	0.83	2.232

s - Peak fails shape tests.

D - Peak area deconvoluted.

A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****							
- Nuclide - Name	Code	Average Activity Bq	Energy keV	Peak Activity Bq	Code	MDA Value Bq	COMMENTS
Pb-210	N	1.4422E+04	46.54	1.442E+04	(	1.659E+02	8.15E+03 6.42E-01 4.25E+00 G
AM-241		1.2225E+03	59.54	1.223E+03	(	1.449E+01	1.58E+05 6.65E-01 3.57E+01 G
CD-109		1.6145E+04	88.03	1.614E+04	(	1.179E+02	4.63E+02 4.73E-01 3.61E+00 G
CO-57		3.4928E+02	122.06	3.493E+02	(	4.431E+00	2.72E+02 7.59E-01 8.56E+01 G

ORTEC g v - i (1087) Env32 G53W4.25 7/6/2012 11:13:09 AM Page 4
 TestAmerica, Inc. Spectrum name: 14_TunaCan_20120385.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
Ce-139	5.3852E+02	165.85	5.385E+02	(	5.643E+00	1.38E+02 6.97E-01 7.99E+01 G
Hg-203	1.2059E+03	279.17	1.206E+03	(	2.002E+01	4.66E+01 1.05E+00 8.15E+01 G
SN-113	9.7136E+02	391.69	9.714E+02	(	1.115E+01	1.15E+02 8.54E-01 6.40E+01 G
CS-137	4.6565E+02	661.66	4.657E+02	(	5.571E+00	1.10E+04 9.21E-01 8.52E+01 G
Y-898	1.5700E+03					1.07E+02

14_TunaCan_20120385
898.02 1.570E+03 (1.261E+01 7.43E-01 9.37E+01 G
Co-1173 7.2416E+02 1173.24 7.242E+02 (5.275E+00 7.99E-01 9.99E+01 G
Co-1332 7.2060E+02 1332.50 7.206E+02 (4.737E+00 8.09E-01 1.00E+02 G
Y-1836 1.6340E+03 1836.01 1.634E+03 (6.084E+00 8.27E-01 9.92E+01 G
(- This peak used in the nuclide activity average.

- * - Peak is too wide, but only one peak in library.
- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction
- } - Peak is too close to another for the activity to be found directly.

Nuclide Codes: Peak Codes:
T - Thermal Neutron Activation G - Gamma Ray
F - Fast Neutron Activation X - X-Ray
I - Fission Product P - Positron Decay
N - Naturally Occurring Isotope S - Single-Escape

□

ORTEC g v - i (1087) Env32 G53W4.25 7/6/2012 11:13:09 AM Page 5
TestAmerica, Inc. Spectrum name: 14_TunaCan_20120385.An1

P - Photon Reaction D - Double-Escape
C - Charged Particle Reaction K - Key Line
M - No MDA Calculation A - Not in Average
R - Coincidence Corrected C - Coincidence Peak
H - Halflife limit exceeded

- - - - -

***** D I S C A R D E D I S O T O P E P E A K S *****
Nuclide Centroid Background Net Area Intensity Uncert Activity
Energy Counts Counts Cts/Sec 1 Sigma %

P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
Time of Count Time Corrected Uncertainty 1 Sigma
Nuclide Activity Activity Counting MDA
Bq Bq

Pb-210	1.4284E+04	1.4422E+04	6.417E-01%	1.66E+02
AM-241	1.2219E+03	1.2225E+03	6.654E-01%	1.45E+01
CD-109	1.3631E+04	1.6145E+04	4.729E-01%	1.18E+02

Page 4

		14_TunaCan_20120385		
CO-57	2.6186E+02	3.4928E+02	7.589E-01%	4.43E+00
Ce-139	3.0490E+02	5.3852E+02	6.967E-01%	5.64E+00
Hg-203	2.2495E+02	1.2059E+03	1.050E+00%	2.00E+01
SN-113	4.9196E+02	9.7136E+02	8.544E-01%	1.12E+01
CS-137	4.6235E+02	4.6565E+02	9.207E-01%	5.57E+00
Y-898	7.5323E+02	1.5700E+03	7.434E-01%	1.26E+01
Co-1173	6.9530E+02	7.2416E+02	7.989E-01%	5.27E+00
Co-1332	6.9188E+02	7.2060E+02	8.094E-01%	4.74E+00
Y-1836	7.8390E+02	1.6340E+03	8.273E-01%	6.08E+00

< - MDA value printed.

A - Activity printed, but activity < MDA.

B - Activity < MDA and failed test.

C - Area < Critical level.

F - Failed fraction or key line test.

H - Halflife limit exceeded

S U M M A R Y			
Total Activity (	37.7 to	1999.5 keV)	3.381E+04 Bq
Total Decayed Activity (	37.7 to	1999.5 keV)	3.9968746E+04 Bq

Gamma Verification per Geometry

Detector: Ge16

Geometry: Tunacan

Reference date 1/1/2012

Calibration Standard: 90099

Standard volume g / vial 1550

Standard volume transferred in g / geometry 317.8

lab ID# of cal standard 6699

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	γ abundance	Bq/sample	Count Results	%recovery
Pb-210	3094	634	0.0425	14926	14377	96.3
Am-241	2037	418	0.3590	1163	1228.5	105.6
Cd-109	2881	591	0.0361	16363	16032	98.0
Co-57	1511	310	0.8560	362	349.8	96.7
Ce-139	2139	439	0.7990	549	538.18	98.0
Sn-113	3015	618	0.6400	966	969.68	100.4
Cs-137	1938	397	0.8510	467	468.24	100.3
Y-88	7264	1489	0.9370	1589	1552.4	97.7
Co-60	3580	734	0.9997	734	725.6	98.8
Co-60	3581	734	0.9999	734	726.23	98.9
Y-88	7690	1577	0.9920	1589	1629.1	102.5

Reviewed By: Jody Watson

Date: 7/13/2012

Calibration Data from file: 16_Soil_TunaCan.Clb
 Energy Calibration Date: 7/13/2012 Time: 9:47:11 AM
 Efficiency Calibration Date: 7/13/2012 Time: 9:47:24 AM

Calibration Description:
 16_TunaCan_90099_071012

Energy Calibration Fit

Energy = $0.1106 + 0.250095 * \text{Channel} - 1.95476e-008 * \text{Channel}^2$
 FWHM (ch) = $3.6339 + 0.000937 * \text{Channel} - 2.1273e-008 * \text{Channel}^2$

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
185.57	46.54	46.52	0.04%	0.97	0.95	1.52%
237.71	59.54	59.56	-0.03%	0.95	0.96	-1.11%
351.71	88.03	88.07	-0.05%	1.00	0.99	0.52%
487.80	122.06	122.10	-0.04%	1.03	1.02	1.07%
662.91	165.85	165.89	-0.03%	1.08	1.06	1.71%
1115.49	279.17	279.06	0.04%	1.13	1.16	-3.06%
1565.59	391.69	391.61	0.02%	1.25	1.26	-0.74%
2645.84	661.66	661.68	-0.00%	1.44	1.49	-3.61%
3591.32	898.02	898.03	-0.00%	1.74	1.68	3.44%
4692.55	1173.24	1173.26	-0.00%	1.94	1.89	2.70%
5329.87	1332.50	1332.53	-0.00%	1.95	2.01	-2.97%
7344.93	1836.01	1835.99	0.00%	2.34	2.34	0.11%

Efficiency Calibration Fit

Knee Energy = 165.85 keV

Above the Knee: Quadratic

Uncertainty = 1.0068 %

$\text{Ln}(\text{Eff}) = 0.0148 - 0.551427 * \text{Ln}(\text{Eng}) - 0.0144348 * (\text{Ln}(\text{Eng}))^2$

Below the Knee: Quadratic

Uncertainty = 1.1708 %

$\text{Ln}(\text{Eff}) = -24.0844 + 8.948554 * \text{Ln}(\text{Eng}) - 0.95136 * (\text{Ln}(\text{Eng}))^2$

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	2.2670E-002	2.3523E-002	-3.76%
59.54	3.4907E-002	3.3268E-002	4.69%
88.03	4.4561E-002	4.5501E-002	-2.11%
122.06	4.5678E-002	4.7288E-002	-3.52%
165.85	===== Knee =====		
165.85	4.0710E-002	4.1557E-002	-2.08%
279.17	2.9697E-002	2.8765E-002	3.14%
391.69	2.2647E-002	2.2549E-002	0.43%
661.66	1.5445E-002	1.5368E-002	0.50%
898.02	1.1965E-002	1.2246E-002	-2.35%
1173.24	9.8925E-003	1.0017E-002	-1.26%
1332.50	8.9987E-003	9.0965E-003	-1.09%
1836.01	7.2985E-003	7.1212E-003	2.43%

Calibration Certificate Table

Isotope	Energy	Pct	Half-life	Activity	GPS	Error	Date & Time
Pb-210	46.54	4.25	8.15E+003	14918.00	634.00	4.10%	1/1/2012 11:00:00 AM
Am-241	59.54	35.70	1.58E+005	1170.90	418.00	3.50%	1/1/2012 11:00:00 AM
Cd-109	88.03	3.61	4.63E+002	16371.00	591.00	4.70%	1/1/2012 11:00:00 AM
Co-57	122.06	85.60	2.72E+002	362.15	310.00	4.10%	1/1/2012 11:00:00 AM
Ce-139	165.85	79.90	1.38E+002	549.44	439.00	3.90%	1/1/2012 11:00:00 AM
Hg-203	279.17	81.50	4.66E+001	1170.60	954.00	3.80%	1/1/2012 11:00:00 AM
Sn-113	391.69	64.00	1.15E+002	965.63	618.00	3.90%	1/1/2012 11:00:00 AM
Cs-137	661.66	85.21	1.10E+004	465.91	397.00	4.00%	1/1/2012 11:00:00 AM
Y-88	898.02	93.70	1.07E+002	1589.10	1489.00	3.90%	1/1/2012 11:00:00 AM
Co-60	1173.24	99.90	1.93E+003	734.73	734.00	4.00%	1/1/2012 11:00:00 AM
Co-60	1332.50	99.98	1.93E+003	734.15	734.00	4.00%	1/1/2012 11:00:00 AM
Y-88	1836.01	99.20	1.07E+002	1589.70	1577.00	4.00%	1/1/2012 11:00:00 AM

ORTEC g v - i (1087) Env32 G53W4.25 7/13/2012 9:50:48 AM
TestAmerica, Inc. Spectrum name: 16_Soil_TunaCan_90099_20120752.A

Sample description
16_Soil_TunaCan_90099_071012

Spectrum Filename: C:\User\SPC\Det16\16_Soil_TunaCan_90099_20120752.A

Acquisition information

Start time: 7/10/2012 10:35:34 AM
Live time: 3600
Real time: 3674
Dead time: 2.03 %
Detector ID: 16

Detector system

Ge16 SN/11012217

Calibration

Filename: 16_Soil_TunaCan.Clb
16_TunaCan_90099_071012

Energy Calibration

Created: 7/13/2012 9:47:11 AM
Zero offset: 0.111 keV
Gain: 0.250 keV/channel
Quadratic: -1.955E-08 keV/channel^2

Efficiency Calibration

Created: 7/13/2012 9:47:24 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.01 %
Log(Eff): $1.477416E-02 + (-5.514266E-01 * \text{Log}(E)) + (-1.443482E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 1.17 %
Log(Eff): $-2.408438E+01 + (8.948554E+00 * \text{Log}(E)) + (-9.513599E-01 * \text{Log}(E)^2)$

Library Files

Main analysis library: DET_EnergyStandardMix & Pb.Lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G53W4.25
Start channel: 150 (37.62keV)
Stop channel: 8000 (1999.62keV)
Peak rejection level: 10.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

ORTEC g v - i (1087) Env32 G53W4.25 7/13/2012 9:50:48 AM
 TestAmerica, Inc. Spectrum name: 16_Soil_TunaCan_90099_20120752.A

Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: average of three points.
 Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	1/1/2012 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%
 Energy Calibration
 Normalized diff: 0.0309

***** S U M M A R Y O F P E A K S I N R A N G E *****

Peak Energy	Area	Uncert	FWHM	Corrcn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq	Nuc
46.52	50908.	0.67	0.97	2.351E-02	46.54	4.250	1.438E+04	Pb210
59.56	52484.	0.66	0.95	3.328E-02	59.54	35.700	1.229E+03	AM241
88.07	71211.	0.52	1.00	4.551E-02	88.03	3.610	1.603E+04	CD109
122.10	31320.	0.80	1.03	4.728E-02	122.06	85.600	3.498E+02	CO57
136.55	3896.	3.92	1.12	4.572E-02				
165.89	24588.	0.86	1.08	4.155E-02	165.85	79.900	5.382E+02	Ce139
279.05	6035.	2.82	1.13	2.877E-02	279.17	81.500	1.223E+03	Hg203
391.61	15948.	1.14	1.25	2.255E-02	391.69	64.000	9.697E+02	SN113
661.68	21809.	0.83	1.44	1.537E-02	661.66	85.210	4.682E+02	CS137
898.03	18524.	0.90	1.74	1.225E-02	898.02	93.700	1.552E+03	Y898
1173.26	24403.	0.75	1.94	1.002E-02	1173.24	99.900	7.256E+02	Co1173
1332.53	22198.	0.75	1.95	9.096E-03	1332.50	99.982	7.262E+02	Co1332
1835.98	11967.	0.97	2.34	7.121E-03	1836.01	99.200	1.629E+03	Y1836

***** U N I D E N T I F I E D P E A K S U M M A R Y *****

Peak Centroid Channel	Background Energy	Net Area Counts	Area Counts	Efficiency * Area	Uncert 1 Sigma	FWHM %	Suspected Nuclide
545.57	136.55	5299.	3896.	8.521E+04	3.92	1.117	-

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.

 This section based on library: DET_EnergyStandardMix & Pb.Lib

***** I D E N T I F I E D P E A K S U M M A R Y *****

Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	FWHM %
Pb-210	185.57	46.52	16008.	50908.	14.141	0.67	0.967
AM-241	237.71	59.56	16109.	52484.	14.579	0.66	0.954
CD-109	351.71	88.07	14747.	71211.	19.781	0.52	0.996
CO-57	487.80	122.10	7590.	31320.	8.700	0.80	1.033
Ce-139	662.91	165.89	4947.	24588.	6.830	0.86	1.080
Hg-203	1115.49	279.06	4192.	5963.	1.656	2.79	1.129
SN-113	1565.60	391.61	3105.	15948.	4.430	1.14	1.253
CS-137	2645.84	661.68	2129.	21809.	6.058	0.83	1.439
Y-898	3591.32	898.03	1720.	18524.	5.145	0.90	1.741
Co-1173	4692.53	1173.26	1220.	24403.	6.779	0.75	1.944
Co-1332	5329.86	1332.53	680.	22198.	6.166	0.75	1.948
Y-1836	7344.92	1835.98	144.	11967.	3.324	0.97	2.344

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****

- Nuclide - Name	- Average Code	Activity Bq	Energy keV	Peak Activity Bq	Code	MDA Value Bq	COMMENTS
Pb-210	N	1.4377E+04	46.54	1.438E+04	(	1.673E+02 6.66E-01 4.25E+00	G
AM-241		1.2285E+03	59.54	1.229E+03	(	1.391E+01 6.59E-01 3.57E+01	G
CD-109		1.6032E+04	88.03	1.603E+04	(	1.280E+02 5.16E-01 3.61E+00	G
CO-57		3.4980E+02	122.06	3.498E+02	(	4.565E+00 8.01E-01 8.56E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ce-139	5.3818E+02	165.85	5.382E+02	(	7.233E+00	8.57E-01	1.38E+02 7.99E+01 G
Hg-203	1.2081E+03	279.17	1.208E+03	(	6.167E+01	2.79E+00	4.66E+01 8.15E+01 G
SN-113	9.6968E+02	391.69	9.697E+02	(	1.595E+01	1.14E+00	1.15E+02 6.40E+01 G
CS-137	4.6824E+02	661.66	4.682E+02	(	4.675E+00	8.31E-01	1.10E+04 8.52E+01 G
Y-898	1.5524E+03	898.02	1.552E+03	(	1.643E+01	8.98E-01	1.07E+02 9.37E+01 G
Co-1173	7.2560E+02	1173.24	7.256E+02	(	4.920E+00	7.53E-01	1.93E+03 9.99E+01 G
Co-1332	7.2623E+02	1332.50	7.262E+02	(	4.064E+00	7.46E-01	1.93E+03 1.00E+02 G
Y-1836	1.6291E+03	1836.01	1.629E+03	(	7.981E+00	9.68E-01	1.07E+02 9.92E+01 G

(- This peak used in the nuclide activity average.

- * - Peak is too wide, but only one peak in library.
- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction
- } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
 F - Fast Neutron Activation
 I - Fission Product
 N - Naturally Occurring Isotope

Peak Codes:

G - Gamma Ray
 X - X-Ray
 P - Positron Decay
 S - Single-Escape

P - Photon Reaction D - Double-Escape
 C - Charged Particle Reaction K - Key Line
 M - No MDA Calculation A - Not in Average
 R - Coincidence Corrected C - Coincidence Peak
 H - Halflife limit exceeded

***** D I S C A R D E D I S O T O P E P E A K S *****
 Nuclide Centroid Background Net Area Intensity Uncert Activity
 Energy Counts Counts Cts/Sec 1 Sigma %

P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
 Time of Count Time Corrected Uncertainty 1 Sigma
 Nuclide Activity Activity Counting MDA
 Bq Bq

Pb-210	1.4145E+04	1.4377E+04	6.660E-01%	1.67E+02
AM-241	1.2275E+03	1.2285E+03	6.589E-01%	1.39E+01
CD-109	1.2043E+04	1.6032E+04	5.162E-01%	1.28E+02
CO-57	2.1493E+02	3.4980E+02	8.011E-01%	4.56E+00
Ce-139	2.0570E+02	5.3818E+02	8.567E-01%	7.23E+00
Hg-203	7.0659E+01	1.2081E+03	2.787E+00%	6.17E+01
SN-113	3.0697E+02	9.6968E+02	1.140E+00%	1.60E+01
CS-137	4.6263E+02	4.6824E+02	8.306E-01%	4.67E+00
Y-898	4.4842E+02	1.5524E+03	8.985E-01%	1.64E+01
Co-1173	6.7738E+02	7.2560E+02	7.529E-01%	4.92E+00
Co-1332	6.7797E+02	7.2623E+02	7.458E-01%	4.06E+00
Y-1836	4.7056E+02	1.6291E+03	9.676E-01%	7.98E+00

< - MDA value printed.
 A - Activity printed, but activity < MDA.
 B - Activity < MDA and failed test.
 C - Area < Critical level.
 F - Failed fraction or key line test.
 H - Halflife limit exceeded

----- S U M M A R Y -----
 Total Activity (37.6 to 1999.6 keV) 3.095E+04 Bq
 Total Decayed Activity (37.6 to 1999.6 keV) 3.9805016E+04 Bq

Analyzed by: _____
 403135

Reviewed by: _____
 Supervisor

Laboratory: TestAmerica, Inc.

Initial Calibration Verifications

2nd Source Verification

Detector: Ge12

Geometry: Tunacan

Reference date 1/1/2010

Source: 81427-334

Standard volume g / vial 1550

Standard volume transferred in g / geometry 318.5

lab ID# of cal standard 6665

Isotope	Certified Activity gammas/sec	Geometry Activity	γ abundance	Bq/sample	Count Results	%recovery
Am-241	2034	418	0.359	1164	1143.6	98.2
Cs-137	1926	396	0.851	465	442.3	95.1
Co-60	3611	742	0.99974	742	688.36	92.7
Co-60	3612	742	0.999856	742	696.49	93.8

Reviewed By: Jody Watson

Date: 10/4/2012

ORTEC g v - i (3263) Env32 G53W4.25 10/4/2012 1:47:48 PM
TestAmerica, Inc Spectrum name: 12_TunaCan2nd_20122201.An1

Sample description
12_TunaCan2nd_81427_104012

Spectrum Filename: C:\User\SPC\Det12\12_TunaCan2nd_20122201.An1

Acquisition information

Start time: 10/4/2012 9:10:35 AM
Live time: 7200
Real time: 7274
Dead time: 1.02 %
Detector ID: 12

Detector system

Ge12 S/N10034336

Calibration

Filename: 12_Soil_TunaCan.Clb
12_TunaCanCal_90099_100212

Energy Calibration

Created: 10/4/2012 8:58:25 AM
Zero offset: 0.009 keV
Gain: 0.250 keV/channel
Quadratic: $-3.662\text{E-}08 \text{ keV/channel}^2$

Efficiency Calibration

Created: 10/4/2012 9:05:44 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.70 %
Log(Eff): $-7.827468\text{E-}01 + (-3.001271\text{E-}01 * \text{Log}(E)) + (-3.369562\text{E-}02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 0.96 %
Log(Eff): $-2.288409\text{E+}01 + (8.352717\text{E+}00 * \text{Log}(E)) + (-8.812368\text{E-}01 * \text{Log}(E)^2)$

Library Files

Main analysis library: DET_EnergyStandardMix & Pb.Lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G53W4.25
Start channel: 150 (37.54keV)
Stop channel: 8000 (1999.46keV)
Peak rejection level: 1000.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000\text{E+}00 / (1.0000\text{E+}00 * 1.0000\text{E+}00) = 1.0000\text{E+}00$
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: average of three points.
 Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	1/1/2010 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	12_2012-09-01_2017.PBC 9/1/2012 8:17:39 PM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 11 cutoff: 5.00E+01%
 Energy Calibration
 Normalized diff: 0.0602

***** S U M M A R Y O F P E A K S I N R A N G E *****								
Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq/Sampl	Nuc
36.51	1416.	10.10	0.96	1.441E-02				
46.55	84361.	0.42	0.90	2.227E-02	46.54	4.250	1.345E+04	Pb210
49.64	1661.	13.12	1.17	2.460E-02				
59.51	91361.	0.43	0.89	3.120E-02	59.54	35.700	1.144E+03	AM241
74.70	192.	60.04	0.37	3.873E-02				
87.98	38152.	0.76	0.95	4.277E-02	88.03	3.610	1.551E+04	CD109
122.02	7369.	2.14	0.99	4.527E-02	122.06	85.600	3.444E+02	CO57
136.48	773.	12.58	1.02	4.420E-02				
165.75	856.	13.18	0.97	4.024E-02	165.85	79.900	5.800E+02	Ce139
238.46	426.	21.37	0.80	3.221E-02				
270.42	104.	53.05	0.50	2.960E-02				
277.12	37.	187.22	1.11	2.896E-02	279.17	81.500	HL>Cutoff	Hg203
294.88	216.	34.45	0.89	2.790E-02				
351.76	281.	28.30	0.91	2.471E-02				
385.62	79.	49.11	0.42	2.317E-02				
391.36	361.	28.92	0.71	2.293E-02	391.69	64.000	1.472E+03	SN113
469.80	98.	76.63	0.28	2.015E-02				
506.86	66.	63.64	1.31	1.908E-02				
510.13	151.	39.24	1.32	1.899E-02				
517.01	68.	58.29	0.42	1.881E-02				
661.58	40010.	0.58	1.44	1.571E-02	661.66	85.210	4.423E+02	CS137
897.91	201.	34.47	0.69	1.250E-02	898.02	93.700	1.665E+03	Y898
1072.91	53.	57.37	0.45	1.091E-02				
1090.45	58.	68.49	0.42	1.078E-02				
1173.14	35088.	0.63	1.82	1.018E-02	1173.24	99.900	6.884E+02	Co1173
1332.41	32170.	0.59	1.94	9.221E-03	1332.50	99.982	6.965E+02	Co1332
1835.69	150.	11.35	3.27	7.144E-03	1836.01	99.200	2.050E+03	Y1836

***** U N I D E N T I F I E D P E A K S U M M A R Y *****								
Peak Centroid Channel	Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
145.90	36.51	6010.	1416.	9.823E+04	10.10	0.958	-	S
198.34	49.64	14478.	1661.	6.751E+04	13.12	1.174	-	SM

298.51 74.70 5238. 192. 4.958E+03 60.04 0.372 - s

ORTEC g v - i (3263) Env32 G53W4.25 10/4/2012 1:47:48 PM
 TestAmerica, Inc Spectrum name: 12_TunaCan2nd_20122201.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
545.45	136.48	2894.	773.	1.749E+04	12.58	1.017	-
953.09	238.46	2483.	426.	1.323E+04	21.37	0.799	- s
1080.86	270.42	1260.	104.	3.514E+03	53.05	0.496	- s
1178.62	294.88	1774.	216.	7.741E+03	34.45	0.889	- s
1406.03	351.76	1808.	281.	1.136E+04	28.30	0.914	- s
1541.40	385.62	713.	79.	3.409E+03	49.11	0.419	- s
1877.98	469.80	1744.	98.	4.856E+03	76.63	0.281	- s
2026.19	506.79	849.	66.	3.459E+03	63.64	1.314	- sc
2039.28	510.06	1671.	151.	7.930E+03	39.24	1.317	- D
2066.76	517.01	651.	68.	3.633E+03	58.29	0.422	- s
4290.46	1072.91	405.	53.	4.872E+03	57.37	0.452	- s
4360.63	1090.45	570.	58.	5.382E+03	68.49	0.425	- s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.
 M - Peak is close to a library peak.

 This section based on library: DET_EnergyStandardMix & Pb.Lib

***** I D E N T I F I E D P E A K S U M M A R Y *****							
Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	FWHM % keV
Pb-210	185.85	46.51	23444.	86492.	12.013	0.48	0.868
AM-241	237.80	59.51	16320.	91361.	12.689	0.43	0.894
CD-109	351.60	87.98	9992.	38152.	5.299	0.76	0.948
CO-57	487.64	122.02	4562.	7369.	1.024	2.14	0.992
Ce-139	662.45	165.75	3243.	856.	0.119	13.18	0.970
Hg-203	1107.62	277.12	2320.	37.	0.005	187.22	1.114s
SN-113	1565.46	391.64	1973.	296.	0.041	29.35	0.690s
CS-137	2644.92	661.58	2210.	40010.	5.557	0.58	1.443
Y-898	3590.25	897.91	1259.	201.	0.028	34.47	0.688s
Co-1173	4691.52	1173.14	1694.	35088.	4.873	0.63	1.818
Co-1332	5328.99	1332.41	521.	32170.	4.468	0.59	1.937
Y-1836	7344.02	1835.69	28.	150.	0.021	11.35	3.274s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A - Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****									
- Nuclide -		Average		----- Peak -----					
Name	Code	Activity	Energy	Activity	Code	MDA	Value		
		Bq/Sample	keV	Bq/Sample		Bq/Sample		COMMENTS	
Pb-210	N	1.3814E+04					8.15E+03		
			46.54	1.381E+04	(P	1.144E+02	4.84E-01	4.25E+00	G
AM-241		1.1436E+03					1.58E+05		
			59.54	1.144E+03	(	7.486E+00	4.26E-01	3.57E+01	G
CD-109		1.5513E+04					4.63E+02		
			88.03	1.551E+04	(	1.905E+02	7.56E-01	3.61E+00	G
CO-57		3.4441E+02					2.72E+02		
			122.06	3.444E+02	(	1.484E+01	2.14E+00	8.56E+01	G
Ce-139		5.7998E+02					1.38E+02		
			165.85	5.800E+02	(	1.816E+02	1.32E+01	7.99E+01	G
Hg-203		2.1493E-01					4.66E+01		
			279.17	2.149E-01	?(	1.337E+00	1.87E+02	8.15E+01	G
SN-113		1.2045E+03					1.15E+02		
			391.69	1.204E+03	(	8.544E+02	2.94E+01	6.40E+01	G
CS-137		4.4230E+02					1.10E+04		
			661.66	4.423E+02	(	2.452E+00	5.77E-01	8.52E+01	G
Y-898		1.6647E+03					1.07E+02		
			898.02	1.665E+03	(	1.389E+03	3.45E+01	9.37E+01	G
Co-1173		6.8836E+02					1.93E+03		
			1173.24	6.884E+02	(	3.816E+00	6.32E-01	9.99E+01	G
Co-1332		6.9649E+02					1.93E+03		
			1332.50	6.965E+02	(	2.361E+00	5.94E-01	1.00E+02	G
Y-1836		2.0501E+03					1.07E+02		
			1836.01	2.050E+03	(	3.740E+02	1.14E+01	9.92E+01	G
(- This peak used in the nuclide activity average.									
* - Peak is too wide, but only one peak in library.									
! - Peak is part of a multiplet and this area went negative during deconvolution.									
? - Peak is too narrow.									

@ - Peak is too wide at FW25M, but ok at FWHM.
 % - Peak fails sensitivity test.
 \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
 + - Peak activity higher than counting uncertainty range.
 - - Peak activity lower than counting uncertainty range.
 = - Peak outside analysis energy range.
 & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
 P - Peakbackground subtraction
 } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:	Peak Codes:
T - Thermal Neutron Activation	G - Gamma Ray
F - Fast Neutron Activation	X - X-Ray
I - Fission Product	P - Positron Decay
N - Naturally Occurring Isotope	S - Single-Escape
P - Photon Reaction	D - Double-Escape
C - Charged Particle Reaction	K - Key Line
M - No MDA Calculation	A - Not in Average
R - Coincidence Corrected	C - Coincidence Peak
H - Halflife limit exceeded	

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	Activity
---------	-----------------	-------------------	-----------------	-------------------	------------------	----------

Hg-203	277.12	2320.	37.	0.005	187.22	0.000E+00
P - Peakbackground subtraction						

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty Counting	1 Sigma	MDA Bq/Sample
Pb-210	1.2680E+04	1.3814E+04	4.851E-01%		1.14E+02
AM-241	1.1385E+03	1.1436E+03	4.256E-01%		7.49E+00
CD-109	3.4313E+03	1.5513E+04	7.557E-01%		1.91E+02
CO-57	2.6416E+01	3.4441E+02	2.139E+00%		1.48E+01
Ce-139	3.6407E+00	5.7998E+02	1.318E+01%		1.82E+02
Hg-203 #A	2.1493E-01	>12 Halflives	1.8722E+02%	1.3367E+00	
SN-113	2.7995E+00	1.2045E+03	2.935E+01%		8.54E+02
CS-137	4.1507E+02	4.4230E+02	5.769E-01%		2.45E+00
Y-898	2.3870E+00	1.6647E+03	3.447E+01%		1.39E+03
Co-1173	4.7903E+02	6.8836E+02	6.322E-01%		3.82E+00
Co-1332	4.8469E+02	6.9649E+02	5.939E-01%		2.36E+00
Y-1836	2.9396E+00	2.0501E+03	1.135E+01%		3.74E+02

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (516.8 to 1999.5 keV) 1.867E+04 Bq/Sample
Total Decayed Activity (516.8 to 1999.5 keV) 3.8141477E+04 Bq/Sample

Analyzed by: _____
admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica, Inc

2nd Source Verification

Detector: Ge14

Geometry: Tunacan

Reference date 1/1/2010

Source: 81427-334

Standard volume g / vial 1550

Standard volume transferred in g / geometry 318.5

lab ID# of cal standard 6665

Isotope	Certified Activity gammas/sec	Geometry Activity	γ abundance	Bq/sample	Count Results	%recovery
Am-241	2034	418	0.359	1164	1140.8	98.0
Cs-137	1926	396	0.851	465	447.55	96.2
Co-60	3611	742	0.99974	742	690.01	93.0
Co-60	3612	742	0.999856	742	699.61	94.2

Reviewed By: Jody Watson

Date: 4/24/2012

14_TunaCan2nd_20120390

ORTEC g v - i (3263) Env32 G53W4.25 7/6/2012 9:20:28 AM Page 1
TestAmerica, Inc. Spectrum name: 14_TunaCan2nd_20120390.An1

Sample description
14_TunaCan2nd_rad10_042412

Spectrum Filename: C:\User\SPC\Det14\14_TunaCan2nd_20120390.An1

Acquisition information
Start time: 4/24/2012 8:12:45 AM
Live time: 3600
Real time: 3635
Dead time: 0.95 %
Detector ID: 14

Detector system
Ge14 SN/11080670

Calibration
Filename: 14_Soil_TunaCan.Clb
14_TunaCan_90099_042312

Energy Calibration
Created: 4/23/2012 11:29:29 AM
Zero offset: 0.158 keV
Gain: 0.250 keV/channel
Quadratic: -1.959E-08 keV/channel^2

Efficiency Calibration
Created: 4/23/2012 11:29:47 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.02 %
Log(Eff): $2.101260E-01 + (-5.951973E-01 * \text{Log}(E)) + (-1.605331E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 1.28 %
Log(Eff): $-2.391492E+01 + (8.828985E+00 * \text{Log}(E)) + (-9.371496E-01 * \text{Log}(E)^2)$

Library Files
Main analysis library: DET_EnergyStandardMix & Pb.Lib
Library Match width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.67keV)
Stop channel: 8000 (1999.52keV)
Peak rejection level: 1000.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

□

ORTEC g v - i (3263) Env32 G53W4.25 7/6/2012 9:20:28 AM Page 2
TestAmerica, Inc. Spectrum name: 14_TunaCan2nd_20120390.An1
Page 1

14_TunaCan2nd_20120390

Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: average of three points.

Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy: 0.000
 Multiplet shift channel: 2.000

Corrections	Status	Comments
Decay correct to date:	YES	1/1/2010 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	14_2012-04-01_0328.PBC 4/1/2012 3:28:19 AM

Absorption (Internal): NO
 Geometry correction: NO
 Random summing: NO

total peaks alloc. 11 cutoff: 5.00E+01%
 Energy Calibration
 Normalized diff: 0.0804

***** S U M M A R Y O F P E A K S I N R A N G E *****								
Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq/Samp	Nuc
36.65	636.	14.35	0.68	1.394E-02				
46.70	42844.	0.65	0.73	2.183E-02	46.54	4.250	1.384E+04	Pb210
49.57	579.	23.20	1.08	2.397E-02				
59.66	44776.	0.62	0.73	3.072E-02	59.54	35.700	1.141E+03	AM241
88.02	24143.	0.88	0.79	4.196E-02	88.03	3.610	1.568E+04	CD109
121.97	5150.	2.07	0.81	4.379E-02	122.06	85.600	3.284E+02	CO57
136.39	594.	12.74	0.84	4.244E-02				
165.76	922.	8.50	0.93	3.800E-02	165.85	79.900	5.802E+02	Ce139
238.43	269.	23.37	0.71	2.933E-02				
315.48	114.	42.70	0.42	2.361E-02				
327.51	51.	61.93	0.45	2.293E-02				
351.90	216.	23.90	0.91	2.167E-02				
364.95	52.	64.29	0.48	2.106E-02				
374.52	129.	45.68	0.49	2.064E-02				
391.67	297.	17.91	1.16	1.993E-02	391.69	64.000	1.044E+03	SN113
510.55	153.	33.44	0.60	1.616E-02				
661.74	16713.	0.81	1.30	1.313E-02	661.66	85.210	4.376E+02	CS137
665.93	55.	47.01	1.30	1.306E-02				
682.98	51.	73.33	0.31	1.280E-02				
802.77	123.	33.88	0.65	1.124E-02				
897.96	328.	20.32	1.77	1.026E-02	898.02	93.700	2.290E+03	Y898
978.13	53.	59.31	0.31	9.568E-03				
1173.32	15097.	0.91	1.81	8.243E-03	1173.24	99.900	6.900E+02	Co1173
1332.58	13794.	0.88	1.91	7.422E-03	1332.50	99.982	6.996E+02	Co1332
1836.21	153.	8.94	1.16	5.686E-03	1836.01	99.200	1.816E+03	Y1836

***** U N I D E N T I F I E D P E A K S U M M A R Y *****							
Peak Centroid Channel	Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide

14_TunaCan2nd_20120390

145.93	36.65	2712.	636.	4.559E+04	14.35	0.681	-	S
197.59	49.57	6158.	579.	2.414E+04	23.20	1.078	-	S
544.79	136.39	1623.	594.	1.400E+04	12.74	0.836	-	
952.87	238.43	1166.	269.	9.182E+03	23.37	0.709	-	

ORTEC g v - i (3263) Env32 G53W4.25 7/6/2012 9:20:28 AM Page 3
 TestAmerica, Inc. Spectrum name: 14_TunaCan2nd_20120390.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
1261.02	315.48	752.	114.	4.829E+03	42.70	0.415	- S
1309.15	327.51	440.	51.	2.232E+03	61.93	0.449	- S
1406.69	351.90	776.	216.	9.981E+03	23.90	0.914	-
1458.89	364.95	463.	52.	2.484E+03	64.29	0.475	- S
1497.18	374.52	912.	129.	6.250E+03	45.68	0.487	- S
2041.26	510.55	669.	153.	9.449E+03	33.44	0.603	- S
2662.75	665.91	160.	40.	3.074E+03	48.94	0.586	- SM
2731.03	682.98	385.	51.	3.984E+03	73.33	0.306	- S
3210.25	802.77	443.	123.	1.098E+04	33.88	0.654	- S
3911.87	978.13	330.	53.	5.539E+03	59.31	0.307	- S

S - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.
 M - Peak is close to a library peak.

 This section based on library: DET_EnergyStandardMix & Pb.Lib

***** I D E N T I F I E D P E A K S U M M A R Y *****

Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	FWHM keV
Pb-210	186.10	46.70	10276.	42803.	11.890	0.65	0.733
AM-241	237.93	59.66	8589.	44776.	12.438	0.62	0.733
CD-109	351.36	88.02	4956.	24143.	6.706	0.88	0.785
CO-57	487.12	121.97	1860.	5150.	1.431	2.07	0.805
Ce-139	662.24	165.76	1490.	922.	0.256	8.50	0.930s
Hg-203	1114.33	278.80	1377.	-40.	-0.011	133.76	0.957s
SN-113	1565.78	391.67	802.	297.	0.083	17.91	1.165
CS-137	2645.99	661.72	749.	17094.	4.748	0.86	1.367
Y-898	3591.10	897.96	851.	328.	0.091	20.32	1.769s
Co-1173	4692.93	1173.32	513.	15097.	4.194	0.91	1.810
Co-1332	5330.26	1332.58	105.	13794.	3.832	0.88	1.907
Y-1836	7346.17	1836.21	5.	153.	0.042	8.94	1.165s

S - Peak fails shape tests.
 D - Peak area deconvoluted.
 A - Derived peak area.

ORTEC g v - i (3263) Env32 G53W4.25 7/6/2012 9:20:28 AM Page 4
 TestAmerica, Inc. Spectrum name: 14_TunaCan2nd_20120390.An1

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****

- Nuclide -	Average	Peak	MDA Value	COMMENTS
Name Code	Activity Bq/Sample	Energy keV Activity Bq/Sample	Code Bq/Sample	

14_TunaCan2nd_20120390

Pb-210	N	1.3845E+04	46.54	1.384E+04	(P	1.537E+02	8.15E+03	6.55E-01	4.25E+00	G
AM-241		1.1408E+03	59.54	1.141E+03	(	1.107E+01	1.58E+05	6.17E-01	3.57E+01	G
CD-109		1.5678E+04	88.03	1.568E+04	(	2.148E+02	4.63E+02	8.77E-01	3.61E+00	G
CO-57		3.2838E+02	122.06	3.284E+02	(	1.299E+01	2.72E+02	2.07E+00	8.56E+01	G
Ce-139		5.8018E+02	165.85	5.802E+02	*(	1.149E+02	1.38E+02	8.50E+00	7.99E+01	G
Hg-203	-5.1862E-01		279.17	-5.186E-01	?(	2.305E+00	4.66E+01	1.34E+02	8.15E+01	G
SN-113		1.0438E+03	391.69	1.044E+03	(	4.727E+02	1.15E+02	1.79E+01	6.40E+01	G
CS-137		4.4755E+02	661.66	4.475E+02	(	3.410E+00	1.10E+04	8.57E-01	8.52E+01	G
Y-898		2.2899E+03	898.02	2.290E+03	*(	9.680E+02	1.07E+02	2.03E+01	9.37E+01	G
Co-1173		6.9001E+02	1173.24	6.900E+02	(	4.948E+00	1.93E+03	9.10E-01	9.99E+01	G
Co-1332		6.9961E+02	1332.50	6.996E+02	(	2.559E+00	1.93E+03	8.77E-01	1.00E+02	G
Y-1836		1.8162E+03	1836.01	1.816E+03	(	1.603E+02	1.07E+02	8.94E+00	9.92E+01	G

(- This peak used in the nuclide activity average.

- * - Peak is too wide, but only one peak in library.
- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.

□

ORTEC g v - i (3263) Env32 G53W4.25 7/6/2012 9:20:28 AM Page 5
TestAmerica, Inc. Spectrum name: 14_TunaCan2nd_20120390.An1

- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction
- } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
F - Fast Neutron Activation

Peak Codes:

G - Gamma Ray
X - X-Ray

Page 4

14_TunaCan2nd_20120390

I - Fission Product P - Positron Decay
 N - Naturally Occurring Isotope S - Single-Escape
 P - Photon Reaction D - Double-Escape
 C - Charged Particle Reaction K - Key Line
 M - No MDA Calculation A - Not in Average
 R - Coincidence Corrected C - Coincidence Peak
 H - Halflife limit exceeded

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	Activity %
---------	-----------------	-------------------	-----------------	-------------------	----------------	------------

Hg-203	278.80	1377.	-40.	-0.011	133.76	0.000E+00
P - Peakbackground subtraction						

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty Counting	1 Sigma	MDA Bq/Sample
---------	----------------------------------	-----------------------------------	----------------------	---------	---------------

Pb-210	1.2885E+04	1.3845E+04	6.553E-01%		1.54E+02
AM-241	1.1366E+03	1.1408E+03	6.168E-01%		1.11E+01
CD-109	4.4274E+03	1.5678E+04	8.766E-01%		2.15E+02
CO-57	3.8172E+01	3.2838E+02	2.068E+00%		1.30E+01
Ce-139 #	8.2779E+00	5.8018E+02	8.497E+00%		1.15E+02
Hg-203 #A	-5.1862E-01	>12 Halflives	1.3376E+02%	2.3053E+00	
SN-113	6.4765E+00	1.0438E+03	1.791E+01%		4.73E+02
CS-137	4.2434E+02	4.4755E+02	8.571E-01%		3.41E+00
Y-898 #	9.4790E+00	2.2899E+03	2.032E+01%		9.68E+02
Co-1173	5.0921E+02	6.9001E+02	9.096E-01%		4.95E+00
Co-1332	5.1630E+02	6.9961E+02	8.770E-01%		2.56E+00
Y-1836	7.5179E+00	1.8162E+03	8.944E+00%		1.60E+02

□

ORTEC g v - i (3263) Env32 G53W4.25 7/6/2012 9:20:28 AM Page 6
 TestAmerica, Inc. Spectrum name: 14_TunaCan2nd_20120390.An1

- All peaks for activity calculation had bad shape.
 * - Activity omitted from total
 & - Activity omitted from total and all peaks had bad shape.
 < - MDA value printed.
 A - Activity printed, but activity < MDA.
 B - Activity < MDA and failed test.
 C - Area < Critical level.
 F - Failed fraction or key line test.
 H - Halflife limit exceeded

----- S U M M A R Y -----
 Total Activity (37.7 to 1999.5 keV) 1.997E+04 Bq/Sample
 Total Decayed Activity (37.7 to 1999.5 keV) 3.8559289E+04 Bq/Sample

2nd Source Verification

Detector: Ge16

Geometry: Tunacan

Reference date 1/1/2010

Source: 81427-334

Standard volume g / vial 1550

Standard volume transferred in g / geometry 318.5

lab ID# of cal standard 6665

Isotope	Certified Activity gammas/sec	Geometry Activity	γ abundance	Bq/sample	Count Results	%recovery
Am-241	2034	418	0.359	1164	1175.5	101.0
Cs-137	1926	396	0.851	465	456.26	98.1
Co-60	3611	742	0.99974	742	696.55	93.8
Co-60	3612	742	0.999856	742	694.91	93.6

Reviewed By: Jody Watson

Date: 7/17/2012

16_TunaCan2nd_81427_071712

ORTEC g v - i (3263) Env32 G53W4.25 7/17/2012 12:43:11 PM Page 1
TestAmerica, Inc. Spectrum name: 16_TunaCan2nd_81427_071712.An1

Sample description
16_Soil_TunaCan2nd_81427

Spectrum Filename: C:\User\SPC\Det16\16_TunaCan2nd_81427_071712.An1

Acquisition information

Start time: 7/17/2012 11:27:38 AM
Live time: 3600
Real time: 3637
Dead time: 1.01 %
Detector ID: 16

Detector system

Ge16 SN/11012217

Calibration

Filename: 16_Soil_TunaCan.Clb
16_TunaCan_90099_071012

Energy Calibration

Created: 7/13/2012 9:47:11 AM
Zero offset: 0.111 keV
Gain: 0.250 keV/channel
Quadratic: -1.955E-08 keV/channel^2

Efficiency Calibration

Created: 7/13/2012 9:47:24 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.01 %
Log(Eff): $1.477416E-02 + (-5.514266E-01 * \text{Log}(E)) + (-1.443482E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 1.17 %
Log(Eff): $-2.408438E+01 + (8.948554E+00 * \text{Log}(E)) + (-9.513599E-01 * \text{Log}(E)^2)$

Library Files

Main analysis library: DET_EnergyStandardMix & Pb.Lib
Library Match width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G53W4.25
Start channel: 150 (37.62keV)
Stop channel: 8000 (1999.62keV)
Peak rejection level: 1000.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

□

ORTEC g v - i (3263) Env32 G53W4.25 7/17/2012 12:43:11 PM Page 2
TestAmerica, Inc. Spectrum name: 16_TunaCan2nd_81427_071712.An1
Page 1

16_TunaCan2nd_81427_071712

Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: average of three points.

Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy: 0.000
 Multiplet shift channel: 2.000

Corrections	Status	Comments
Decay correct to date:	YES	1/1/2010 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	16_2012-07-01_0410.PBC 7/1/2012 4:10:46 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 11 cutoff: 5.00E+01%
 Energy Calibration
 Normalized diff: 0.0735

***** S U M M A R Y O F P E A K S I N R A N G E *****

Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. Bq/Samp	Nuc
36.61	662.	16.00	0.95	1.502E-02				
46.61	44788.	0.57	0.95	2.354E-02	46.54	4.250	1.344E+04	Pb210
49.73	846.	14.98	0.96	2.615E-02				
51.93	67.	175.93	0.96	2.781E-02				
59.60	50058.	0.62	0.95	3.331E-02	59.54	35.700	1.176E+03	AM241
67.02	327.	40.04	0.43	3.772E-02				
77.05	248.	35.16	0.66	4.226E-02				
88.11	23229.	0.97	1.00	4.552E-02	88.03	3.610	1.578E+04	CD109
92.72	154.	41.19	0.62	4.641E-02				
102.49	234.	36.86	0.72	4.751E-02				
122.18	4603.	2.65	1.08	4.728E-02	122.06	85.600	3.368E+02	CO57
136.63	690.	11.63	1.03	4.571E-02				
165.89	573.	14.69	0.88	4.155E-02	165.85	79.900	5.132E+02	Ce139
279.05	48.	131.87	1.16	2.876E-02	279.17	81.500	HL>Cutoff	Hg203
383.49	28.	109.64	0.60	2.290E-02				
391.47	391.	21.81	0.93	2.256E-02	391.69	64.000	2.012E+03	SN113
416.76	115.	47.52	0.73	2.156E-02				
454.44	148.	42.64	0.71	2.024E-02				
470.03	138.	36.11	1.33	1.974E-02				
471.50	87.	46.19	1.33	1.970E-02				
609.23	184.	25.35	0.44	1.633E-02				
661.72	20285.	0.80	1.52	1.537E-02	661.66	85.210	4.563E+02	CS137
688.53	70.	44.77	0.67	1.492E-02				
756.44	34.	63.94	0.34	1.392E-02				
891.54	148.	42.73	0.38	1.231E-02				
898.03	342.	24.68	0.43	1.225E-02	898.02	93.700	3.456E+03	Y898
1092.88	180.	35.97	0.46	1.057E-02				
1173.34	17966.	0.81	1.90	1.002E-02	1173.24	99.900	6.965E+02	Co1173
1332.62	16290.	0.80	2.05	9.096E-03	1332.50	99.982	6.949E+02	Co1332
1836.30	109.	12.59	1.70	7.121E-03	1836.01	99.200	1.789E+03	Y1836

16_TunaCan2nd_81427_071712

***** U N I D E N T I F I E D P E A K S U M M A R Y *****
 Peak Centroid Background Net Area Efficiency Uncert FWHM Suspected
 Channel Energy Counts Counts * Area 1 Sigma % keV Nuclide

145.94	36.61	3330.	662.	4.407E+04	16.00	0.954	-	
198.40	49.77	7608.	846.	3.236E+04	14.98	0.955	-	D
206.87	51.89	6455.	301.	1.081E+04	38.23	0.957	-	D

□

ORTEC g v - i (3263) Env32 G53W4.25 7/17/2012 12:43:11 PM Page 3
 TestAmerica, Inc. Spectrum name: 16_TunaCan2nd_81427_071712.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
267.54	67.02	4805.	327.	8.670E+03	40.04	0.431	- s
307.65	77.05	2954.	248.	5.881E+03	35.16	0.659	- s
370.31	92.72	1548.	154.	3.319E+03	41.19	0.623	- s
409.40	102.49	2168.	234.	4.932E+03	36.86	0.719	- s
545.90	136.63	1724.	690.	1.509E+04	11.63	1.033	-
1533.12	383.49	438.	28.	1.245E+03	109.64	0.596	- C
1666.20	416.76	856.	115.	5.319E+03	47.52	0.732	- s
1816.90	454.44	1051.	148.	7.328E+03	42.64	0.711	- s
1879.23	470.27	1171.	138.	6.985E+03	36.11	1.330	- D
1885.13	471.75	760.	87.	4.406E+03	46.19	1.331	- D
2436.00	609.23	541.	184.	1.125E+04	25.35	0.437	- s
2753.21	688.53	304.	70.	4.691E+03	44.77	0.673	- s
3024.88	756.44	198.	34.	2.419E+03	63.94	0.336	- s
3565.37	891.54	821.	148.	1.199E+04	42.73	0.382	- SM
4370.93	1092.88	734.	180.	1.708E+04	35.97	0.458	- s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.
 M - Peak is close to a library peak.

 This section based on library: DET_EnergyStandardMix & Pb.Lib

***** I D E N T I F I E D P E A K S U M M A R Y *****
 Nuclide Peak Centroid Background Net Area Intensity Uncert FWHM
 Channel Energy Counts Counts Cts/Sec 1 Sigma % keV

Pb-210	185.74	46.56	12987.	46638.	12.955	0.67	0.934
AM-241	237.89	59.60	10773.	50058.	13.905	0.62	0.952
CD-109	351.86	88.11	5903.	23229.	6.452	0.97	0.996
CO-57	488.11	122.18	2577.	4603.	1.279	2.65	1.080
Ce-139	662.88	165.89	1776.	573.	0.159	14.69	0.876
Hg-203	1115.44	279.05	1953.	48.	0.013	131.87	1.164s
SN-113	1566.59	391.86	1251.	282.	0.078	26.27	0.890s
CS-137	2645.99	661.72	1025.	20285.	5.635	0.80	1.515
Y-898	3591.33	898.03	1130.	342.	0.095	24.68	0.434s
Co-1173	4692.85	1173.34	496.	17966.	4.991	0.81	1.896
Co-1332	5330.25	1332.62	94.	16290.	4.525	0.80	2.052
Y-1836	7346.21	1836.30	14.	109.	0.030	12.59	1.698s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

□

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****									
- Nuclide - Name	Code	Average Activity Bq/Sample	Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS		
Pb-210	N	1.4024E+04	46.54	1.402E+04	(P	1.605E+02	6.71E-01	4.25E+00	G
AM-241		1.1755E+03	59.54	1.176E+03	(	1.142E+01	6.21E-01	3.57E+01	G
CD-109		1.5779E+04	88.03	1.578E+04	(	2.451E+02	9.70E-01	3.61E+00	G
CO-57		3.3677E+02	122.06	3.368E+02	(	1.751E+01	2.65E+00	8.56E+01	G
Ce-139		5.1324E+02	165.85	5.132E+02	(	1.783E+02	1.47E+01	7.99E+01	G
Hg-203		5.6505E-01	279.17	5.651E-01	*(	2.473E+00	1.32E+02	8.15E+01	G
SN-113		1.4529E+03	391.69	1.453E+03	(	8.626E+02	2.63E+01	6.40E+01	G
CS-137		4.5626E+02	661.66	4.563E+02	(	3.417E+00	8.02E-01	8.52E+01	G
Y-898		3.4565E+03	898.02	3.456E+03	*(	1.611E+03	2.47E+01	9.37E+01	G
Co-1173		6.9655E+02	1173.24	6.965E+02	(	4.129E+00	8.09E-01	9.99E+01	G
Co-1332		6.9491E+02	1332.50	6.949E+02	(	2.043E+00	8.03E-01	1.00E+02	G
Y-1836		1.7894E+03	1836.01	1.789E+03	(	3.307E+02	1.26E+01	9.92E+01	G
(- This peak used in the nuclide activity average.									

- * - Peak is too wide, but only one peak in library.
 ! - Peak is part of a multiplet and this area went negative during deconvolution.
 ? - Peak is too narrow.

□

- @ - Peak is too wide at FW25M, but ok at FWHM.
 % - Peak fails sensitivity test.
 \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
 + - Peak activity higher than counting uncertainty range.
 - - Peak activity lower than counting uncertainty range.
 = - Peak outside analysis energy range.

- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
 P - Peakbackground subtraction
 } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
 F - Fast Neutron Activation
 I - Fission Product
 N - Naturally Occurring Isotope
 P - Photon Reaction
 C - Charged Particle Reaction
 M - No MDA Calculation
 R - Coincidence Corrected
 H - Halflife limit exceeded

Peak Codes:

G - Gamma Ray
 X - X-Ray
 P - Positron Decay
 S - Single-Escape
 D - Double-Escape
 K - Key Line
 A - Not in Average
 C - Coincidence Peak

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	Activity
Hg-203	279.05	1953.	48.	0.013	131.87	0.000E+00
P - Peakbackground subtraction						

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count	Time Corrected	Uncertainty Counting	1 Sigma	MDA Bq/Sample
	Activity Bq/Sample	Activity Bq/Sample			
Pb-210	1.2959E+04	1.4024E+04	6.724E-01%		1.60E+02
AM-241	1.1708E+03	1.1755E+03	6.214E-01%		1.14E+01
CD-109	3.9282E+03	1.5779E+04	9.701E-01%		2.45E+02
CO-57	3.1587E+01	3.3677E+02	2.653E+00%		1.75E+01
Ce-139	4.7936E+00	5.1324E+02	1.469E+01%		1.78E+02
Hg-203 #A	5.6505E-01	>12 Halflives	1.3187E+02%	2.4725E+00	
SN-113	5.4311E+00	1.4529E+03	2.627E+01%		8.63E+02
CS-137	4.3030E+02	4.5626E+02	8.015E-01%		3.42E+00
Y-898 #	8.2791E+00	3.4565E+03	2.468E+01%		1.61E+03
Co-1173	4.9870E+02	6.9655E+02	8.087E-01%		4.13E+00
Co-1332	4.9753E+02	6.9491E+02	8.032E-01%		2.04E+00
Y-1836	4.2861E+00	1.7894E+03	1.259E+01%		3.31E+02

□

ORTEC g v - i (3263) Env32 G53W4.25 7/17/2012 12:43:11 PM Page 6
 TestAmerica, Inc. Spectrum name: 16_TunaCan2nd_81427_071712.An1

- # - All peaks for activity calculation had bad shape.
 * - Activity omitted from total
 & - Activity omitted from total and all peaks had bad shape.
 < - MDA value printed.
 A - Activity printed, but activity < MDA.
 B - Activity < MDA and failed test.
 C - Area < Critical level.
 F - Failed fraction or key line test.
 H - Halflife limit exceeded

----- S U M M A R Y -----
 Total Activity (609.2 to 1999.6 keV) 1.954E+04 Bq/Sample
 Total Decayed Activity (609.2 to 1999.6 keV) 4.0374930E+04 Bq/Sample
 Page 5

Annual Calibration Verifications

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #12**

SpectrumID: 12_20160128006_EffVerif

Analysis Description: ACVTop-776670;TunaCan2006

Calibration: 12_TunaCanCal_90099_100212

Detector: Ge12 S/N10034336

Verification Date: 2016-01-28 13:28

Source Assay Date/Time: 2006-10-01 11:00

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Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) <u>Assay-Actual</u> Assay
Am-241	59.54	449	4.53E+02	-0.9%
Cs-137	661.66	400	3.91E+02	2.2%
Co-1332	1332.5	777	7.46E+02	4.0%

Comments:

Perform _____ Jody Watson 1/29/16 _____

Review _____ Aaron Schroder 1/29/2016 _____

C:\User\CRpt\12_20160128006_EffVerif.xls

Sample Description: ACVTop-776670;TunaCan2006

Detector: Ge12 S/N10034336

Source Date: 10/1/2006 11:00

Acquired: 1/28/2016 13:28:46

Analyzed: 1/29/2016 13:56

Analyst: Jody Watson

Efficiency: 12_TunaCanCal_90099_100212

Library: DET_EfficiencyVerification.lib

Nuclide	Activity uCi/Source	Uncertainty %
AM-241	4.532E+02	0.41
CS-137	3.911E+02	0.59
Co-1332	7.456E+02	0.90
Total	1.590E+03	

Sample description
ACVTop-776670;TunaCan2006

Spectrum Filename: C:\User\SPC\Det12\12_20160128006_EffVerif.An1

Acquisition information

Start time: 1/28/2016 1:28:46 PM
Live time: 7200
Real time: 7326
Dead time: 1.72 %
Detector ID: 12

Detector system

Gel2 S/N10034336

Calibration

Filename: 12_Soil_TunaCan.Clb
12_TunaCanCal_90099_100212

Energy Calibration

Created: 2/28/2012 1:26:42 PM
Zero offset: 0.049 keV
Gain: 0.250 keV/channel
Quadratic: -3.945E-08 keV/channel^2

Efficiency Calibration

Created: 10/4/2012 9:05:44 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.70 %
Log(Eff): $-7.827468E-01 + (-3.001271E-01 * \text{Log}(E)) + (-3.369562E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 0.96 %
Log(Eff): $-2.288409E+01 + (8.352717E+00 * \text{Log}(E)) + (-8.812368E-01 * \text{Log}(E)^2)$

Library Files

Main analysis library: DET_EfficiencyVerification.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G53W4.25
Start channel: 150 (37.58keV)
Stop channel: 8000 (1999.36keV)
Peak rejection level: 10.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.0000000E+00
Systematic error: 4.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.
Half lives decay limit: 12.000
Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	10/1/2006 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 3 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0294

***** S U M M A R Y O F P E A K S I N R A N G E *****

Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. uCi/Sour	Nuc
36.56	1334.	9.60	1.00	1.444E-02				
46.60	72273.	0.45	0.89	2.231E-02				
59.55	100350.	0.41	0.89	3.122E-02	59.54	100.000	4.532E+02	AM241
87.89	1239.	8.96	1.09	4.274E-02				
238.48	1003.	9.18	1.15	3.221E-02				
661.61	35682.	0.59	1.40	1.571E-02	661.66	100.000	3.911E+02	CS137
1173.14	15564.	0.95	1.81	1.018E-02				
1332.40	14520.	0.90	1.94	9.221E-03	1332.50	100.000	7.456E+02	Co1332

***** U N I D E N T I F I E D P E A K S U M M A R Y *****

Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide
145.90	36.56	4764.	1334.	9.239E+04	9.60	0.995	- s
185.89	46.56	20938.	74360.	3.333E+06	0.53	0.874	-
351.04	87.89	3330.	1239.	2.899E+04	8.96	1.086	- s
953.01	238.48	2037.	1003.	3.113E+04	9.18	1.146	-
4691.52	1173.14	752.	15564.	1.528E+06	0.95	1.813	-

s - Peak fails shape tests.
D - Peak area deconvoluted.
L - Peak written from unknown list.
C - Area < Critical level.

This section based on library: DET_EfficiencyVerification.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****							
Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	FWHM % keV
AM-241	237.79	59.55	16419.	100350.	13.938	0.41	0.888
CS-137	2644.93	661.61	1381.	35682.	4.956	0.59	1.395
Co-1332	5329.01	1332.40	280.	14520.	2.017	0.90	1.943

s - Peak fails shape tests.
D - Peak area deconvoluted.
A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****							
- Nuclide - Name	Average Code	Activity uCi/Source	Energy keV	Peak Activity uCi/Source	Code	MDA Value uCi/Source	COMMENTS
AM-241	4.5317E+02		59.54	4.532E+02	(	2.709E+00 4.06E-01	1.58E+05 1.00E+02 G
CS-137	3.9106E+02		661.66	3.911E+02	(	1.928E+00 5.91E-01	1.10E+04 1.00E+02 G
Co-1332	7.4558E+02		1332.50	7.456E+02	(	4.143E+00 8.99E-01	1.93E+03 1.00E+02 G

(- This peak used in the nuclide activity average.

* - Peak is too wide, but only one peak in library.
! - Peak is part of a multiplet and this area went negative during deconvolution.
? - Peak is too narrow.
@ - Peak is too wide at FW25M, but ok at FWHM.
% - Peak fails sensitivity test.
\$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
+ - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
= - Peak outside analysis energy range.
& - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
P - Peakbackground subtraction
} - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
F - Fast Neutron Activation
I - Fission Product

Peak Codes:

G - Gamma Ray
X - X-Ray
P - Positron Decay

N - Naturally Occurring Isotope S - Single-Escape
P - Photon Reaction D - Double-Escape
C - Charged Particle Reaction K - Key Line
M - No MDA Calculation A - Not in Average
R - Coincidence Corrected C - Coincidence Peak
H - Halflife limit exceeded

***** D I S C A R D E D I S O T O P E P E A K S *****
Nuclide Centroid Background Net Area Intensity Uncert Activity
Energy Counts Counts Cts/Sec 1 Sigma %

P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
Time of Count Time Corrected Uncertainty 1 Sigma
Nuclide Activity Activity Counting MDA
uCi/Source uCi/Source

AM-241	4.4645E+02	4.5317E+02	4.060E-01%	2.71E+00
CS-137	3.1542E+02	3.9106E+02	5.907E-01%	1.93E+00
Co-1332	2.1873E+02	7.4558E+02	8.990E-01%	4.14E+00

< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (37.6 to 1999.4 keV) 9.806E+02 uCi/Source
Total Decayed Activity (37.6 to 1999.4 keV) 1.5898042E+03 uCi/Source

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #14**

SpectrumID: 14_20160125003_EffVerif

Analysis Description: ACVTop-776670;TunaCan2006

Calibration: 14_TunaCan_90099_042312

Detector: Ge14 SN/11080670

Verification Date: 2016-01-25 12:29

Source Assay Date/Time: 2006-10-01 11:00

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Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) <u>Assay-Actual</u> Assay
Am-241	59.54	449	4.55E+02	-1.4%
Cs-137	661.66	400	3.95E+02	1.3%
Co-1332	1332.5	777	7.57E+02	2.6%

Comments:

Perform ___Kody Saulters 2/4/16_____

Review ___Jody Watson 2/4/16_____

C:\User\CRpt\14_20160125003_EffVerif.xls

Sample Description: ACVTop-776670;TunaCan2006

Detector: Ge14 SN/11080670

Source Date: 10/1/2006 11:00

Acquired: 1/25/2016 12:29:45

Analyzed: 2/4/2016 09:35

Analyst: Jody Watson

Efficiency: 14_TunaCan_90099_042312

Library: DET_EfficiencyVerification.lib

Nuclide	Activity uCi/Source	Uncertainty %
AM-241	4.553E+02	0.40
CS-137	3.948E+02	0.62
Co-1332	7.566E+02	0.94
Total	1.607E+03	

Sample description
ACVTop-776670;TunaCan2006

Spectrum Filename: C:\User\SPC\Det14\14_20160125003_EffVerif.An1

Acquisition information

Start time: 1/25/2016 12:29:45 PM
Live time: 7200
Real time: 7259
Dead time: 0.81 %
Detector ID: 14

Detector system

Gel4 SN/11080670

Calibration

Filename: 14_Soil_TunaCan.Clb
14_TunaCan_90099_042312

Energy Calibration

Created: 2/28/2012 10:48:23 AM
Zero offset: 0.130 keV
Gain: 0.250 keV/channel
Quadratic: -2.050E-08 keV/channel^2

Efficiency Calibration

Created: 4/23/2012 11:29:47 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.02 %
Log(Eff): $2.101260E-01 + (-5.951973E-01 * \text{Log}(E)) + (-1.605331E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 1.28 %
Log(Eff): $-2.391492E+01 + (8.828985E+00 * \text{Log}(E)) + (-9.371496E-01 * \text{Log}(E)^2)$

Library Files

Main analysis library: DET_EfficiencyVerification.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G53W4.25
Start channel: 150 (37.64keV)
Stop channel: 8000 (1999.52keV)
Peak rejection level: 10.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.0000000E+00
 Systematic error: 4.0000000E+00
 Fraction Limit: 0.000%
 Background width: average of three points.
 Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	10/1/2006 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 3 cutoff: 5.00E+01%
 Energy Calibration
 Normalized diff: 0.1953

***** S U M M A R Y O F P E A K S I N R A N G E *****

Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. uCi/Sour	Nuc
46.67	73404.	0.51	0.89	2.181E-02				
59.66	98988.	0.40	0.90	3.073E-02	59.54	100.000	4.553E+02	AM241
87.86	1381.	7.63	1.19	4.192E-02				
238.23	859.	9.01	1.08	2.935E-02				
661.34	30113.	0.62	1.47	1.314E-02	661.66	100.000	3.948E+02	CS137
1172.91	13023.	0.94	1.74	8.246E-03				
1332.21	11875.	0.94	1.86	7.424E-03	1332.50	100.000	7.566E+02	Co1332

***** U N I D E N T I F I E D P E A K S U M M A R Y *****

Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide
186.09	46.67	18352.	73404.	3.366E+06	0.51	0.888	- s
350.79	87.86	3068.	1381.	3.294E+04	7.63	1.186	- s
952.14	238.23	1621.	859.	2.928E+04	9.01	1.079	-
4691.29	1172.91	312.	13023.	1.579E+06	0.94	1.737	-

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.

 This section based on library: DET_EfficiencyVerification.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****							
Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	FWHM % keV
AM-241	238.04	59.66	15017.	98988.	13.748	0.40	0.897s
CS-137	2644.50	661.34	859.	30113.	4.182	0.62	1.470
Co-1332	5328.79	1332.21	65.	11875.	1.649	0.94	1.861

s - Peak fails shape tests.
D - Peak area deconvoluted.
A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****							
- Nuclide - Name	Average Code	Activity uCi/Source	Energy keV	Peak Activity uCi/Source	Code	MDA Value uCi/Source	COMMENTS
AM-241	4.5525E+02		59.54	4.553E+02	(	2.639E+00 4.00E-01	1.58E+05 1.00E+02 G
CS-137	3.9479E+02		661.66	3.948E+02	(	1.826E+00 6.21E-01	1.10E+04 1.00E+02 G
Co-1332	7.5658E+02		1332.50	7.566E+02	(	2.566E+00 9.36E-01	1.93E+03 1.00E+02 G

(- This peak used in the nuclide activity average.

* - Peak is too wide, but only one peak in library.
! - Peak is part of a multiplet and this area went negative during deconvolution.
? - Peak is too narrow.
@ - Peak is too wide at FW25M, but ok at FWHM.
% - Peak fails sensitivity test.
\$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
+ - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
= - Peak outside analysis energy range.
& - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
P - Peakbackground subtraction
} - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
F - Fast Neutron Activation
I - Fission Product

Peak Codes:

G - Gamma Ray
X - X-Ray
P - Positron Decay

N - Naturally Occurring Isotope S - Single-Escape
P - Photon Reaction D - Double-Escape
C - Charged Particle Reaction K - Key Line
M - No MDA Calculation A - Not in Average
R - Coincidence Corrected C - Coincidence Peak
H - Halflife limit exceeded

***** D I S C A R D E D I S O T O P E P E A K S *****
Nuclide Centroid Background Net Area Intensity Uncert Activity
Energy Counts Counts Cts/Sec 1 Sigma %

P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
Time of Count Time Corrected Uncertainty 1 Sigma
Nuclide Activity Activity Counting MDA
uCi/Source uCi/Source

AM-241 #	4.4851E+02	4.5525E+02	3.997E-01%	2.64E+00
CS-137	3.1849E+02	3.9479E+02	6.211E-01%	1.83E+00
Co-1332	2.2220E+02	7.5658E+02	9.363E-01%	2.57E+00

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (37.6 to 1999.5 keV) 9.892E+02 uCi/Source
Total Decayed Activity (37.6 to 1999.5 keV) 1.6066273E+03 uCi/Source

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #16**

SpectrumID: 16_20160122005_EffVerif

Analysis Description: ACVTop-776670;TunaCan2006

Calibration: 16_TunaCan_90099_071012

Detector: Ge16 SN/11012217

Verification Date: 2016-01-22 10:56

Source Assay Date/Time: 2006-10-01 11:00

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Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) <u>Assay-Actual</u> Assay
Am-241	59.54	449	4.42E+02	1.6%
Cs-137	661.66	400	3.99E+02	0.2%
Co-1332	1332.5	777	7.69E+02	1.0%

Comments:

Perform Amanda Dick 01/22/2016

Review Jody Watson 01/22/2016

C:\User\CRpt\16_20160122005_EffVerif.xls

Sample Description: ACVTop-776670;TunaCan2006

Detector: Ge16 SN/11012217

Source Date: 10/1/2006 11:00

Acquired: 1/22/2016 10:56:41

Analyzed: 2/3/2016 14:54

Analyst: Jody Watson

Efficiency: 16_TunaCan_90099_071012

Library: DET_EfficiencyVerification.lib

Nuclide	Activity uCi/Source	Uncertainty %
AM-241	4.416E+02	0.43
CS-137	3.993E+02	0.57
Co-1332	7.690E+02	0.84
Total	1.610E+03	

Sample description
ACVTop-776670;TunaCan2006

Spectrum Filename: C:\User\SPC\Det16\16_20160122005_EffVerif.An1

Acquisition information

Start time: 1/22/2016 10:56:41 AM
Live time: 7200
Real time: 7636
Dead time: 5.70 %
Detector ID: 16

Detector system

Gel6 SN/11012217

Calibration

Filename: 16_Soil_TunaCan.Clb
16_TunaCan_90099_071012

Energy Calibration

Created: 2/28/2012 9:35:31 AM
Zero offset: 0.050 keV
Gain: 0.250 keV/channel
Quadratic: -2.285E-08 keV/channel^2

Efficiency Calibration

Created: 7/13/2012 9:47:24 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.01 %
Log(Eff): $1.477416E-02 + (-5.514266E-01 * \text{Log}(E)) + (-1.443482E-02 * \text{Log}(E)^2)$
Below the Knee: Quadratic Uncertainty = 1.17 %
Log(Eff): $-2.408438E+01 + (8.948554E+00 * \text{Log}(E)) + (-9.513599E-01 * \text{Log}(E)^2)$

Library Files

Main analysis library: DET_EfficiencyVerification.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G53W4.25
Start channel: 150 (37.57keV)
Stop channel: 8000 (1999.63keV)
Peak rejection level: 10.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00
Activity scaling factor: $1.0000E+00 / (1.0000E+00 * 1.0000E+00) = 1.0000E+00$
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.0000000E+00
Systematic error: 4.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.
Half lives decay limit: 12.000
Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	10/1/2006 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 3 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0291

***** S U M M A R Y O F P E A K S I N R A N G E *****

Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. uCi/Sour	Nuc
36.50	1362.	9.86	0.91	1.492E-02				
46.55	73583.	0.45	0.96	2.349E-02				
59.54	104212.	0.43	0.98	3.327E-02	59.54	100.000	4.416E+02	AM241
238.61	855.	9.53	1.14	3.217E-02				
661.72	35644.	0.57	1.53	1.537E-02	661.66	100.000	3.992E+02	CS137
1173.34	16190.	0.90	1.97	1.002E-02				
1332.60	14808.	0.84	2.11	9.096E-03	1332.50	100.000	7.690E+02	Co1332

***** U N I D E N T I F I E D P E A K S U M M A R Y *****

Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide
145.72	36.50	4998.	1362.	9.127E+04	9.86	0.911	- s
185.73	46.51	21549.	77213.	3.286E+06	0.52	0.970	-
953.82	238.61	1829.	855.	2.659E+04	9.53	1.137	-
4692.71	1173.34	609.	16190.	1.616E+06	0.90	1.966	-

s - Peak fails shape tests.
D - Peak area deconvoluted.
L - Peak written from unknown list.
C - Area < Critical level.

This section based on library: DET_EfficiencyVerification.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****							
Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	FWHM % keV
AM-241	237.84	59.54	19873.	104212.	14.474	0.43	0.978
CS-137	2645.94	661.72	925.	35644.	4.951	0.57	1.529
Co-1332	5330.01	1332.60	89.	14808.	2.057	0.84	2.112

s - Peak fails shape tests.
D - Peak area deconvoluted.
A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****							
- Nuclide - Name	Average Code	Activity uCi/Source	Energy keV	Peak Activity uCi/Source	Code	MDA Value uCi/Source	COMMENTS
AM-241	4.4160E+02		59.54	4.416E+02	(	2.795E+00 4.26E-01	1.58E+05 1.00E+02 G
CS-137	3.9925E+02		661.66	3.992E+02	(	1.618E+00 5.70E-01	1.10E+04 1.00E+02 G
Co-1332	7.6901E+02		1332.50	7.690E+02	(	2.422E+00 8.41E-01	1.93E+03 1.00E+02 G

(- This peak used in the nuclide activity average.

* - Peak is too wide, but only one peak in library.
! - Peak is part of a multiplet and this area went negative during deconvolution.
? - Peak is too narrow.
@ - Peak is too wide at FW25M, but ok at FWHM.
% - Peak fails sensitivity test.
\$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
+ - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
= - Peak outside analysis energy range.
& - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
P - Peakbackground subtraction
} - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
F - Fast Neutron Activation
I - Fission Product

Peak Codes:

G - Gamma Ray
X - X-Ray
P - Positron Decay

N - Naturally Occurring Isotope S - Single-Escape
P - Photon Reaction D - Double-Escape
C - Charged Particle Reaction K - Key Line
M - No MDA Calculation A - Not in Average
R - Coincidence Corrected C - Coincidence Peak
H - Halflife limit exceeded

***** D I S C A R D E D I S O T O P E P E A K S *****
Nuclide Centroid Background Net Area Intensity Uncert Activity
Energy Counts Counts Cts/Sec 1 Sigma %

P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
Time of Count Time Corrected Uncertainty 1 Sigma
Nuclide Activity Activity Counting MDA
uCi/Source uCi/Source
AM-241 4.3507E+02 4.4160E+02 4.259E-01% 2.80E+00
CS-137 3.2214E+02 3.9925E+02 5.705E-01% 1.62E+00
Co-1332 2.2610E+02 7.6901E+02 8.409E-01% 2.42E+00

< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (37.6 to 1999.6 keV) 9.833E+02 uCi/Source
Total Decayed Activity (37.6 to 1999.6 keV) 1.6098567E+03 uCi/Source

Monthly Backgrounds

Test America
St. Louis
Background Check

Spectrum: 12_20160709004_BGLong
Description: Background Long PBC Count
Acquired: 7/9/2016 6:02:45 PM
Detector: Detector #12

Background Evaluation Criteria:

- 1) Place instrument out of service if Countrate exceeds Control Limits.
- 2) Investigate high countrate and take corrective action as necessary if Countrate exceeds Tolerance Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results
Bkgd							
Countrate	2.08	1.93	1.98	2.04	2.18	2.23	PASS

Analyst: Aaron Schroder Reviewer:

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det12\12_20160709004_BGLong.An1

Acquisition information

Start time: 7/9/2016 6:02:45 PM
Live time: 72000
Real time: 72724
Dead time: 0.99 %
Detector ID: 12

Detector system

Ge12 S/N10034336

Calibration

Filename: 12_QC.Clb
12_QC-H_83725-334_060211

Energy Calibration

Created: 2/28/2012 1:26:42 PM
Zero offset: 0.049 keV
Gain: 0.250 keV/channel
Quadratic: -3.945E-08 keV/channel^2

Efficiency Calibration

Created: 6/3/2011 6:41:14 AM
Knee Energy: 0.00 keV
Above the Knee: Interpolative Uncertainty = 0.00 %
Below the Knee: Interpolative Uncertainty = 0.00 %

Library Files

Main analysis library: DET_Long Background PBC.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G800W064
Start channel: 150 (37.58keV)
Stop channel: 8000 (1999.36keV)
Peak rejection level: 30.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00 +/- 0.000E+00%
Activity scaling factor: 1.0000E+00/(1.0000E+00* 1.0000E+00) =
1.0000E+00
Detection limit method: Reg. Guide 4.16 Method
Random error: 4.0000000E+00
Systematic error: 4.0000000E+00
Fraction Limit: 0.000%
Background width: 3

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Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	NO	
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 23 cutoff: 5.00E+01 %
 Energy Calibration
 Normalized diff: 0.1469

***** S U M M A R Y O F P E A K S I N R A N G E *****								
Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. DPS	Nuc
46.65	1191.	7.31	0.92	6.312E-02	46.54	4.250	6.179E+00	PB210
63.33	829.	9.08	1.00	8.574E-02	63.29	3.810	3.528E+00	TH234
75.04	200.	23.47	0.92	1.016E-01				
77.23	255.	18.37	0.92	1.046E-01				
87.48	179.	26.78	0.99	1.185E-01	86.49	13.100	1.620E-01	Np237
					86.54	30.700	6.910E-02	EU155
92.71	1283.	5.79	1.14	1.198E-01	92.59	5.584	2.663E+00	TH234
					93.35	5.561	2.672E+00	AC228
140.07	162.	23.79	0.98	1.188E-01				
143.77	162.	25.34	0.98	1.177E-01	143.79	10.960	1.749E-01	U235
185.81	679.	11.75	1.14	1.067E-01	185.72	54.000	1.636E-01	U235
					185.99	3.280	2.696E+00	Ra226
238.60	478.	11.15	0.94	9.395E-02	238.63	43.300	1.632E-01	PB212
295.21	201.	20.77	1.00	8.024E-02	295.09	19.300	1.799E-01	PB214
351.90	302.	17.63	1.30	6.651E-02	351.93	37.600	1.677E-01	PB214
511.11	2424.	4.50	2.49	4.819E-02	511.86	20.000	3.496E+00	RH106
569.79	102.	29.17	0.98	4.393E-02	569.70	97.740	3.289E-02	BI207
					569.32	15.380	2.089E-01	CS134
					569.47	8.200	3.919E-01	PA234
583.18	199.	16.73	1.09	4.294E-02	583.02	84.500	7.615E-02	TL208
609.37	254.	17.69	1.20	4.104E-02	609.31	46.090	1.865E-01	BI214
					610.30	5.750	1.497E+00	RU103
1121.05	169.	18.52	2.11	2.185E-02	1120.29	15.100	7.115E-01	BI214
					1120.55	99.987	1.075E-01	Sc46
					1121.30	34.900	3.081E-01	Ta182
1460.16	186.	16.50	1.84	1.768E-02	1460.83	10.670	1.371E+00	K40
1763.54	135.	25.14	1.84	1.522E-02	1764.49	15.400	7.981E-01	BI214

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pk energy area uncert fwhm corr nuclide brnch. act. nuc

***** U N I D E N T I F I E D P E A K S U M M A R Y *****

Peak Centroid	Background	Net Area	Efficiency	Uncert	FWHM	Suspected	
Channel Energy	Counts	Counts	* Area	1 Sigma %	keV	Nuclide	
299.70	75.04	1001.	200. 1.968E+03	23.47	0.917	-	D
308.44	77.22	973.	255. 2.443E+03	18.37	0.919	-	D
349.43	87.48	748.	179. 1.511E+03	26.78	0.991	-	M
559.52	140.03	664.	163. 1.369E+03	23.74	0.979	-	sD
2043.03	511.11	902.	2424. 5.029E+04	4.50	2.492	-	s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.
 M - Peak is close to a library peak.

 This section based on library: DET_Long Background PBC.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****

Nuclide	Peak	Centroid	Background	Net Area	Intensity	Uncert	FWHM
	Channel	Energy	Counts	Counts	Cts/Sec	1 Sigma %	keV
PB-210	186.23	46.65	1473.	1191.	0.017	7.31	0.916
TH-234	252.92	63.33	1261.	829.	0.012	9.08	0.997
TH-234	370.34	92.71	1102.	1283.	0.018	5.79	1.143s
U-235	574.47	143.79	766.	163.	0.002	25.28	0.982D
U-235	742.09	185.72	1158.	609.	0.008	7.62	1.022D
PB-212	953.48	238.60	675.	478.	0.007	11.15	0.937
PB-214	1179.79	295.21	485.	201.	0.003	20.77	0.995
PB-214	1406.43	351.90	608.	302.	0.004	17.63	1.298
BI-207	2277.70	569.79	233.	102.	0.001	29.17	0.976s
TL-208	2331.23	583.18	248.	199.	0.003	16.73	1.085
BI-214	2436.00	609.37	441.	254.	0.004	17.69	1.202
BI-214	4483.04	1121.05	128.	169.	0.002	18.52	2.107s
K-40	5840.44	1460.16	111.	186.	0.003	16.50	1.842s
BI-214	7055.31	1763.54	108.	135.	0.002	25.14	1.845

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****									
- Nuclide -		Average	----- Peak -----						
Name	Code	Activity DPS	Energy keV	Activity DPS	Code	MDA	Value	COMMENTS	
K-40	N	1.3710E+00							
			1460.83	1.371E+00	@(	3.812E-01	1.65E+01	1.07E+01	G
TL-208	N	7.6145E-02							
							6.98E+02		
			583.02	7.615E-02	(	2.912E-02	1.67E+01	8.45E+01	G
			277.28	0.000E+00	%	1.793E-01	4.83E+01	6.31E+00	G
			860.56	0.000E+00	%	1.772E-01	3.52E+01	1.24E+01	G
PB-210	N	6.1788E+00							
							8.14E+03		
			46.54	6.179E+00	(	9.423E-01	7.31E+00	4.25E+00	G
PB-212	N	1.6322E-01							
							6.98E+02		
			238.63	1.632E-01	(	4.227E-02	1.11E+01	4.33E+01	G
			300.03	0.000E+00	%	3.532E-01	9.65E+01	3.28E+00	GA
PB-214	N	1.7186E-01							
							5.84E+05		
			351.93	1.677E-01	(	6.533E-02	1.76E+01	3.76E+01	G
			295.09	1.799E-01	(	9.447E-02	2.08E+01	1.93E+01	G
			242.00	0.000E+00		2.316E-01	0.00E+00	7.43E+00	GA
BI-207	C	3.2890E-02							
							1.18E+04		
			569.70	3.289E-02	(	2.390E-02	2.92E+01	9.77E+01	G
			1063.66	0.000E+00	%	3.700E-02	1.00E+03	7.45E+01	G
BI-214	N	1.8649E-01							
							5.84E+05		
			609.31	1.865E-01	(	7.384E-02	1.77E+01	4.61E+01	G
			1120.29	7.115E-01	+	2.334E-01	1.85E+01	1.51E+01	G
			1764.49	7.981E-01	+	3.035E-01	2.51E+01	1.54E+01	G
TH-234	N	3.5279E+00							
							1.63E+12		
			63.29	3.528E+00	(	7.156E-01	9.08E+00	3.81E+00	G
			92.59	2.663E+00	-	3.268E-01	5.79E+00	5.58E+00	G
U-235	N	1.7532E-01							
							2.57E+11		
			185.72	1.466E-01	}	3.886E-02	7.62E+00	5.40E+01	GA
			143.79	1.753E-01	(	1.418E-01	2.53E+01	1.10E+01	G
			205.33	0.000E+00	%	2.206E-01	3.41E+02	5.01E+00	G
			163.38	0.000E+00	%	2.024E-01	8.40E+01	5.08E+00	G

(- This peak used in the nuclide activity average.

* - Peak is too wide, but only one peak in library.

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction
- } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
F - Fast Neutron Activation
I - Fission Product
N - Naturally Occurring Isotope
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded

Peak Codes:

G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape
K - Key Line
A - Not in Average
C - Coincidence Peak

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	Activity %
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P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count	Activity DPS	Uncertainty Counting	1 Sigma	MDA
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BE-7	<	2.7219E-01			
NA-22	<	3.8002E-02			
K-40	#	1.3710E+00	1.6500E+01%		3.812E-01
Sc-46	<	3.1031E-02			
CR-51	<	1.2683E-01			
MN-54	<	2.3180E-02			
FE-59	<	4.4375E-02			
Co-56	<	2.4196E-02			
CO-57	<	1.1945E-02			
CO-58	<	2.9618E-02			
CO-60	<	2.8127E-02			
ZN-65	<	6.1363E-02			

NB-94	<	2.4173E-02		
ZR-95	<	3.6132E-02		
NB-95	<	3.7318E-02		
RU-103	<	1.8591E-02		
RH-106	<	2.4818E-01		
AG-108M	<	1.6125E-02		
AG-110M	<	4.4107E-02		
SN-113	<	2.2566E-02		
SB-124	<	2.1697E-02		
SB-125	<	4.8742E-02		
I-131	<	1.6921E-02		
BA-133	<	1.4245E-02		
CS-134	<	3.0737E-02		
CS-137	<	2.0647E-02		
CE-139	<	2.2731E-02		
Ba-140	<	6.7390E-02		
La-140	<	3.4685E-02		
CE-141	<	2.7179E-02		
CE-144	<	8.5240E-02		
PM-144	<	2.4647E-02		
EU-152	<	4.8089E-02		
EU-154	<	1.8340E-01		
EU-155	<	4.3244E-02		
HF-181	<	2.5325E-02		
Ta-182	<	8.5978E-02		
Hg-203	<	1.3768E-02		
TL-208		7.6145E-02	1.6729E+01%	2.912E-02
pm-146	<	6.0880E-02		
y-88	<	2.5292E-02		
PB-210		6.1788E+00	7.3098E+00%	9.423E-01
PB-212		1.6322E-01	1.1150E+01%	4.227E-02
PB-214		1.7186E-01	1.3623E+01%	6.533E-02
BI-207		3.2890E-02	2.9169E+01%	2.390E-02
BI-212	<	2.6646E-01		
BI-214		1.8649E-01	1.7686E+01%	7.384E-02
BI-210M	<	2.2674E-02		
RA-224	<	4.7397E-01		
AC-228	<	1.3987E-01		
TH-227	<	1.4594E-01		
TH-229	<	2.3434E-01		
TH-234		3.5279E+00	9.0752E+00%	7.156E-01
PA-231	<	4.6876E-01		
PA-233	<	3.5166E-02		
PA-234	<	5.4518E-02		
PA-234M	<	4.9708E+00		
U-235		1.7532E-01	2.5280E+01%	1.418E-01
AM-241	<	7.8631E-02		
Np-237	<	1.1310E-01		

(Page 7 of 8)

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (37.6 to 1999.4 keV) 1.188E+01 DPS

Test America
St. Louis
Background Check

Spectrum: 14_20160709006_BGLong
Description: Background Long PBC Count
Acquired: 7/9/2016 6:21:58 PM
Detector: Detector #14

Background Evaluation Criteria:

- 1) Place instrument out of service if Countrate exceeds Control Limits.
- 2) Investigate high countrate and take corrective action as necessary if Countrate exceeds Tolerance Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results
Bkgd							
Countrate	1.80	1.66	1.71	1.80	1.90	1.94	PASS

Analyst: Aaron Schroder Reviewer:

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det14\14_20160709006_BGLong.An1

Acquisition information

Start time: 7/9/2016 6:21:58 PM
Live time: 43200
Real time: 43317
Dead time: 0.27 %
Detector ID: 14

Detector system

Ge14 SN/11080670

Calibration

Filename: 14_QC.Clb
14_QC_79670-334_SOURCE E_042211

Energy Calibration

Created: 2/28/2012 10:48:23 AM
Zero offset: 0.130 keV
Gain: 0.250 keV/channel
Quadratic: -2.050E-08 keV/channel^2

Efficiency Calibration

Created: 5/1/2011 8:43:09 AM
Knee Energy: 0.00 keV
Above the Knee: Interpolative Uncertainty = 0.00 %
Below the Knee: Interpolative Uncertainty = 0.00 %

Library Files

Main analysis library: DET_Long Background PBC.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G800W064
Start channel: 150 (37.64keV)
Stop channel: 8000 (1999.51keV)
Peak rejection level: 30.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00 +/- 0.000E+00%
Activity scaling factor: 1.0000E+00/(1.0000E+00* 1.0000E+00) = 1.0000E+00
Detection limit method: Reg. Guide 4.16 Method
Random error: 4.0000000E+00
Systematic error: 4.0000000E+00
Fraction Limit: 0.000%
Background width: 3

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Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	5/26/2005 8:30:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 15 cutoff: 5.00E+01 %
 Energy Calibration
 Normalized diff: 0.1740

***** S U M M A R Y O F P E A K S I N R A N G E *****								
Peak Energy	Area	Uncert	FWHM	Corrcn Factor	Nuclide Energy	Brnch. Ratio	Act. DPS	Nuc
46.52	548.	8.55	0.93	6.118E-02	46.54	4.250	6.894E+00	PB210
63.28	337.	13.01	0.89	8.536E-02	63.29	3.810	2.398E+00	TH234
75.07	191.	17.46	0.76	1.024E-01				
92.58	525.	8.78	1.09	1.215E-01	92.59	5.584	1.792E+00	TH234
					93.35	5.561	6.873E+00	AC228
185.41	310.	14.26	0.87	1.072E-01	185.72	54.000	1.240E-01	U235
238.15	218.	18.63	1.11	9.401E-02	238.63	43.300	7.018E+00	PB212
294.80	103.	29.39	1.00	7.973E-02	295.09	19.300	1.560E-01	PB214
351.83	191.	18.22	1.11	6.549E-02	351.93	37.600	1.805E-01	PB214
510.66	1029.	5.35	2.66	4.546E-02	511.86	20.000	4.930E+03	RH106
582.85	118.	19.80	2.28	3.931E-02	583.02	84.500	4.637E+00	TL208
609.21	212.	16.65	1.63	3.708E-02	609.31	46.090	2.885E-01	BI214
					610.30	5.750	HL>Cutoff	RU103
1120.21	69.	19.92	1.03	1.998E-02	1120.29	15.100	5.320E-01	BI214
					1120.55	99.987	HL>Cutoff	Sc46
					1121.30	34.900	HL>Cutoff	Ta182
1460.85	139.	14.93	2.14	1.557E-02	1460.83	10.670	1.939E+00	K40
1764.91	63.	21.47	2.06	1.327E-02	1764.49	15.400	7.171E-01	BI214

***** U N I D E N T I F I E D P E A K S U M M A R Y *****								
Peak Centroid Channel Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma	FWHM %	Suspected Nuclide		
299.66 75.07	393.	191.	1.863E+03	17.46	0.755	-	s	
2041.76 510.25	272.	1029.	2.263E+04	5.35	2.657	-		

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.

 This section based on library: DET_Long Background PBC.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****								
Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	%	FWHM keV
PB-210	185.49	46.52	495.	548.	0.013	8.55		0.925s
TH-234	252.53	63.28	528.	337.	0.008	13.01		0.886s
TH-234	369.67	92.58	534.	525.	0.012	8.78		1.091s
U-235	740.91	185.41	470.	310.	0.007	14.26		0.867
PB-212	951.84	238.15	389.	218.	0.005	18.63		1.114s
PB-214	1178.37	294.80	258.	103.	0.002	29.39		0.998
PB-214	1406.47	351.83	255.	191.	0.004	18.22		1.107s
TL-208	2330.53	582.85	110.	118.	0.003	19.80		2.281s
BI-214	2435.95	609.21	200.	212.	0.005	16.65		1.633s
BI-214	4480.39	1120.21	30.	69.	0.002	19.92		1.025s
K-40	5843.64	1460.85	36.	139.	0.003	14.93		2.138
BI-214	7060.74	1764.91	20.	63.	0.001	21.47		2.061

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****									
- Nuclide -	Average	----- Peak -----		-----					
Name	Code	Activity	Energy	Activity	Code	MDA	Value		
		DPS	keV	DPS		DPS		COMMENTS	
K-40	N	1.9386E+00						4.66E+11	
			1460.83	1.939E+00	(	4.263E-01	1.49E+01	1.07E+01	G
Ta-182	F	1.5414E-44						1.14E+02	
TL-208	N	4.6370E+00						6.98E+02	
			583.02	4.637E+00	(	2.040E+00	1.98E+01	8.45E+01	G
			277.28	0.000E+00	&	1.277E+01	5.73E+02	6.31E+00	G
			860.56	0.000E+00	%	1.221E+01	2.64E+02	1.24E+01	G
PB-210	N	6.8943E+00						8.14E+03	
			46.54	6.894E+00	*(1.337E+00	8.55E+00	4.25E+00	G

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Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-212	N	7.0176E+00				6.98E+02	
			238.63	7.018E+00	(	3.052E+00	1.86E+01 4.33E+01 G
			300.03	0.000E+00	%	2.550E+01	1.00E+03 3.28E+00 GA
PB-214	N	1.7217E-01				5.84E+05	
			351.93	1.805E-01	*(	7.288E-02	1.82E+01 3.76E+01 G
			295.09	1.560E-01	(	1.172E-01	2.94E+01 1.93E+01 G
			242.00	0.000E+00	?	2.767E-01	0.00E+00 7.43E+00 GA
BI-214	N	2.8852E-01				5.84E+05	
			609.31	2.885E-01	*(	9.338E-02	1.66E+01 4.61E+01 G
			1120.29	5.320E-01	+	2.177E-01	1.99E+01 1.51E+01 G
			1764.49	7.171E-01	+	2.681E-01	2.15E+01 1.54E+01 G
TH-234	N	2.3985E+00				1.63E+12	
			63.29	2.398E+00	(	7.814E-01	1.30E+01 3.81E+00 G
			92.59	1.792E+00	-	3.768E-01	8.78E+00 5.58E+00 G
U-235	N	1.2400E-01				2.57E+11	
			185.72	1.240E-01	\$	4.149E-02	1.43E+01 5.40E+01 GA
			143.79	0.000E+00	%	1.139E-01	1.00E+03 1.10E+01 G
			205.33	0.000E+00	%	2.751E-01	8.61E+01 5.01E+00 G
			163.38	0.000E+00	%	2.545E-01	3.78E+01 5.08E+00 G

(- This peak used in the nuclide activity average.

- * - Peak is too wide, but only one peak in library.
- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction
- } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
 F - Fast Neutron Activation
 I - Fission Product
 N - Naturally Occurring Isotope

Peak Codes:

G - Gamma Ray
 X - X-Ray
 P - Positron Decay
 S - Single-Escape

P - Photon Reaction D - Double-Escape
 C - Charged Particle Reaction K - Key Line
 M - No MDA Calculation A - Not in Average
 R - Coincidence Corrected C - Coincidence Peak
 H - Half-life limit exceeded

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	Activity %
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P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count	Activity DPS	Time Corrected	Activity DPS	Uncertainty Counting	1 Sigma	MDA
BE-7			>12 Half-lives				
NA-22	<	5.8997E-02	1.1419E+00				
K-40		1.9386E+00	1.9386E+00		1.493E+01%		4.26E-01
Sc-46			>12 Half-lives				
CR-51			>12 Half-lives				
MN-54			>12 Half-lives				
FE-59			>12 Half-lives				
Co-56			>12 Half-lives				
CO-57			>12 Half-lives				
CO-58			>12 Half-lives				
CO-60	<	2.9043E-02	1.2539E-01				
ZN-65			>12 Half-lives				
NB-94	<	2.9633E-02	2.9644E-02				
ZR-95			>12 Half-lives				
NB-95			>12 Half-lives				
RU-103			>12 Half-lives				
RH-106	<	3.0209E-01	5.6693E+02				
AG-108M	<	1.6306E-02	1.6610E-02				
AG-110M			>12 Half-lives				
SN-113			>12 Half-lives				
SB-124			>12 Half-lives				
SB-125	<	5.5200E-02	9.0335E-01				
I-131			>12 Half-lives				
BA-133	<	3.5477E-02	7.3725E-02				
CS-134	<	3.1204E-02	1.3055E+00				
CS-137	<	4.2914E-02	5.5489E-02				
CE-139			>12 Half-lives				
Ba-140			>12 Half-lives				
La-140			>12 Half-lives				
CE-141			>12 Half-lives				
CE-144			>12 Half-lives				
PM-144	<	3.1813E-02	7.4387E+01				

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EU-152	<	9.2091E-02	1.6276E-01		
EU-154	<	2.2470E-01	5.5112E-01		
EU-155	<	4.9998E-02	2.3659E-01		
HF-181			>12 Halflives		
Ta-182	C	1.5414E-44	>12 Halflives	0.000E+00%	0.00E+00
Hg-203			>12 Halflives		
TL-208	#	8.1892E-02	4.6370E+00	1.980E+01%	2.04E+00
pm-146	<	7.2663E-02	2.9294E-01		
y-88			>12 Halflives		
PB-210	#	4.8791E+00	6.8943E+00	8.549E+00%	1.34E+00
PB-212	#	1.2393E-01	7.0176E+00	1.863E+01%	3.05E+00
PB-214		1.7134E-01	1.7217E-01	1.729E+01%	7.29E-02
BI-207	<	3.8614E-02	4.9059E-02		
BI-212	<	3.4154E-01	1.9339E+01		
BI-214		2.8713E-01	2.8852E-01	1.665E+01%	9.34E-02
BI-210M	<	2.8205E-02	2.8205E-02		
RA-224	<	5.3712E-01	3.0414E+01		
AC-228	<	1.1235E-01	4.2941E-01		
TH-227	<	9.2395E-02	1.3166E-01		
TH-229	<	2.9813E-01	2.9845E-01		
TH-234	#	2.3985E+00	2.3985E+00	1.301E+01%	7.81E-01
PA-231	<	8.7393E-01	8.7414E-01		
PA-233	<	3.7068E-02	3.7068E-02		
PA-234	<	7.2118E-02	7.2118E-02		
PA-234M	<	4.0247E+00	4.0247E+00		
Ra-226	<	7.3638E-01	7.3993E-01		
U-235		1.2400E-01	1.2400E-01	1.426E+01%	4.15E-02
AM-241	<	9.3776E-02	9.5462E-02		
Np-237	<	1.5506E-01	1.5526E-01		

- All peaks for activity calculation had bad shape.
 * - Activity omitted from total
 & - Activity omitted from total and all peaks had bad shape.
 < - MDA value printed.
 A - Activity printed, but activity < MDA.
 B - Activity < MDA and failed test.
 C - Area < Critical level.
 F - Failed fraction or key line test.
 H - Halflife limit exceeded

----- S U M M A R Y -----
 Total Activity (37.6 to 1999.5 keV) 1.000E+01 DPS
 Total Decayed Activity (37.6 to 1999.5 keV) 2.3470650E+01 DPS

Test America
St. Louis
Background Check

Spectrum: 16_20160709005_BGLong
Description: Background Long PBC Count
Acquired: 7/9/2016 6:23:52 PM
Detector: Detector #16

Background Evaluation Criteria:

- 1) Place instrument out of service if Countrate exceeds Control Limits.
- 2) Investigate high countrate and take corrective action as necessary if Countrate exceeds Tolerance Limits.

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results
Bkgd							
Countrate	2.68	2.51	2.56	2.60	2.80	2.86	PASS

Analyst: Aaron Schroder Reviewer:

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det16\16_20160709005_BGLong.An1

Acquisition information

Start time: 7/9/2016 6:23:52 PM
Live time: 43200
Real time: 43407
Dead time: 0.48 %
Detector ID: 16

Detector system

Ge16 SN/11012217

Calibration

Filename: 16_QC.Clb
16_QC-G_081311

Energy Calibration

Created: 2/28/2012 9:35:31 AM
Zero offset: 0.050 keV
Gain: 0.250 keV/channel
Quadratic: -2.285E-08 keV/channel^2

Efficiency Calibration

Created: 8/14/2011 1:15:14 PM
Knee Energy: 0.00 keV
Above the Knee: Interpolative Uncertainty = 0.00 %
Below the Knee: Interpolative Uncertainty = 0.00 %

Library Files

Main analysis library: DET_Long Background PBC.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters

Analysis engine: Env32 G800W064
Start channel: 150 (37.57keV)
Stop channel: 8000 (1999.64keV)
Peak rejection level: 30.000%
Peak search sensitivity: 3
Sample Size: 1.0000E+00 +/- 0.000E+00%
Activity scaling factor: 1.0000E+00/(1.0000E+00* 1.0000E+00) = 1.0000E+00
Detection limit method: Reg. Guide 4.16 Method
Random error: 4.0000000E+00
Systematic error: 4.0000000E+00
Fraction Limit: 0.000%
Background width: 3

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Half lives decay limit: 12.000
 Activity range factor: 2.000
 Min. step backg. energy 0.000
 Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	5/26/2005 8:30:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	NO	
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 20 cutoff: 5.00E+01 %
 Energy Calibration
 Normalized diff: 73.3974

***** S U M M A R Y O F P E A K S I N R A N G E *****								
Peak Energy	Area	Uncert	FWHM	Corrctn Factor	Nuclide Energy	Brnch. Ratio	Act. DPS	Nuc
46.50	980.	5.74	1.03	7.066E-02	46.54	4.250	1.067E+01	PB210
59.54	205.	19.89	0.97	8.955E-02	59.54	35.900	1.501E-01	AM241
63.34	639.	7.07	0.97	9.505E-02	63.29	3.810	4.087E+00	TH234
74.87	209.	21.67	0.69	1.117E-01				
92.68	936.	6.77	1.15	1.312E-01	92.59	5.584	2.957E+00	TH234
					93.35	5.561	1.134E+01	AC228
182.64	124.	25.89	1.08	1.138E-01				
185.72	431.	9.30	1.09	1.130E-01	185.72	54.000	1.633E-01	U235
					185.99	3.280	2.704E+00	Ra226
238.50	390.	13.23	1.03	9.906E-02	238.63	43.300	1.192E+01	PB212
295.14	227.	20.54	1.61	8.409E-02	295.09	19.300	3.258E-01	PB214
351.95	260.	20.01	1.31	6.906E-02	351.93	37.600	2.329E-01	PB214
511.15	1461.	5.32	2.04	4.932E-02	511.86	20.000	6.441E+03	RH106
583.77	179.	20.67	1.48	4.377E-02	583.02	84.500	6.331E+00	TL208
609.67	290.	13.53	1.11	4.171E-02	609.31	46.090	3.500E-01	BI214
					610.30	5.750	HL>Cutoff	RU103
802.85	117.	25.53	0.51	3.114E-02				
1460.64	285.	8.74	1.51	1.797E-02	1460.83	10.670	3.441E+00	K40
1765.33	117.	12.97	2.60	1.550E-02	1764.49	15.400	1.140E+00	BI214

***** U N I D E N T I F I E D P E A K S U M M A R Y *****								
Peak Centroid Channel Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma	FWHM %	Suspected keV	Nuclide	
299.15 74.87	688.	209.	1.867E+03	21.67	0.694	-	s	

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
728.97	182.62	410.	114.	1.000E+03	26.85	1.084	- sD
2043.69	511.15	550.	1461.	2.962E+04	5.32	2.038	- sM
3210.47	802.85	150.	117.	3.758E+03	25.53	0.505	- s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 L - Peak written from unknown list.
 C - Area < Critical level.
 M - Peak is close to a library peak.

 This section based on library: DET_Long Background PBC.lib

***** I D E N T I F I E D P E A K S U M M A R Y *****

Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	FWHM %
PB-210	185.69	46.50	656.	980.	0.023	5.74	1.031
AM-241	237.83	59.54	677.	203.	0.005	19.45	0.971D
TH-234	252.82	63.29	700.	639.	0.015	7.07	0.975D
TH-234	370.34	92.68	880.	936.	0.022	6.77	1.145
Ra-226	743.42	185.99	588.	430.	0.010	9.31	1.087D
PB-212	953.36	238.50	592.	390.	0.009	13.23	1.031
PB-214	1179.85	295.14	469.	227.	0.005	20.54	1.610s
PB-214	1407.04	351.95	506.	260.	0.006	20.01	1.308s
TL-208	2334.16	583.77	245.	179.	0.004	20.67	1.476
BI-214	2437.75	609.67	276.	290.	0.007	13.53	1.112s
K-40	5842.42	1460.64	48.	285.	0.007	8.74	1.507s
BI-214	7061.96	1765.33	17.	117.	0.003	12.97	2.599s

s - Peak fails shape tests.
 D - Peak area deconvoluted.
 A Derived peak area.

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****

Name	Code	Average Activity DPS	Energy keV	Activity DPS	Code MDA Value DPS	Comments
K-40	N	3.4412E+00	1460.83	3.441E+00	4.66E+11	4.225E-01 8.74E+00 1.07E+01 G
Ba-140	I	1.1210E-44	537.26	0.000E+00	1.28E+01	1.00E+03 2.44E+01 G
			162.66	0.000E+00		1.00E+03 6.22E+00 G
			304.85	0.000E+00		1.00E+03 4.29E+00 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments		
Ta-182	F	1.5414E-44				1.14E+02			
			1121.30	0.000E+00	%	0.000E+00	1.00E+03	3.49E+01	G
			1221.41	0.000E+00	%	0.000E+00	1.00E+03	2.70E+01	G
			1189.05	0.000E+00	%	0.000E+00	1.00E+03	1.62E+01	G
TL-208	N	6.3314E+00				6.98E+02			
			583.02	6.331E+00	&(	2.683E+00	2.07E+01	8.45E+01	G
			277.28	0.000E+00	&	1.398E+01	2.22E+02	6.31E+00	G
			860.56	0.000E+00	&	1.934E+01	1.00E+03	1.24E+01	G
PB-210	N	1.0668E+01				8.14E+03			
			46.54	1.067E+01	(	1.328E+00	5.74E+00	4.25E+00	G
PB-212	N	1.1918E+01				6.98E+02			
			238.63	1.192E+01	(	3.550E+00	1.32E+01	4.33E+01	G
			300.03	0.000E+00	%	2.569E+01	0.00E+00	3.28E+00	GA
PB-214	N	2.6441E-01				5.84E+05			
			351.93	2.329E-01	*(	9.632E-02	2.00E+01	3.76E+01	G
			295.09	3.258E-01	(	1.485E-01	2.05E+01	1.93E+01	G
			242.00	0.000E+00	?	3.364E-01	0.00E+00	7.43E+00	GA
BI-214	N	3.5000E-01				5.84E+05			
			609.31	3.500E-01	(	9.696E-02	1.35E+01	4.61E+01	G
			1120.29	0.000E+00	%	2.737E-01	4.94E+01	1.51E+01	G
			1764.49	1.140E+00	+	2.136E-01	1.30E+01	1.54E+01	G
TH-234	N	4.0867E+00				1.63E+12			
			63.29	4.087E+00	(	8.062E-01	7.07E+00	3.81E+00	G
			92.59	2.957E+00	-	4.453E-01	6.77E+00	5.58E+00	G
Ra-226		2.7024E+00				5.84E+05			
			185.99	2.702E+00	(	7.263E-01	9.31E+00	3.28E+00	G
AM-241	T	1.4871E-01				1.58E+05			
			59.54	1.487E-01	(	9.088E-02	1.95E+01	3.59E+01	G
(- This peak used in the nuclide activity average.									
* - Peak is too wide, but only one peak in library.									
! - Peak is part of a multiplet and this area went negative during deconvolution.									
? - Peak is too narrow.									
@ - Peak is too wide at FW25M, but ok at FWHM.									
% - Peak fails sensitivity test.									
\$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.									

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- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction
- } - Peak is too close to another for the activity to be found directly.

Nuclide Codes:

T - Thermal Neutron Activation
 F - Fast Neutron Activation
 I - Fission Product
 N - Naturally Occurring Isotope
 P - Photon Reaction
 C - Charged Particle Reaction
 M - No MDA Calculation
 R - Coincidence Corrected
 H - Half-life limit exceeded

Peak Codes:

G - Gamma Ray
 X - X-Ray
 P - Positron Decay
 S - Single-Escape
 D - Double-Escape
 K - Key Line
 A - Not in Average
 C - Coincidence Peak

***** D I S C A R D E D I S O T O P E P E A K S *****

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma	Activity %
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P - Peakbackground subtraction

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count		Time Corrected		Uncertainty Counting	1 Sigma	MDA
	Activity	DPS	Activity	DPS			
BE-7			>12 Halflives				
NA-22	<	5.5046E-02		1.0654E+00			
K-40	#	3.4412E+00		3.4412E+00	8.744E+00%		4.23E-01
Sc-46			>12 Halflives				
CR-51			>12 Halflives				
MN-54			>12 Halflives				
FE-59			>12 Halflives				
Co-56			>12 Halflives				
CO-57			>12 Halflives				
CO-58			>12 Halflives				
CO-60	<	4.3231E-02		1.8665E-01			
ZN-65			>12 Halflives				
NB-94	<	2.9408E-02		2.9419E-02			
ZR-95			>12 Halflives				
NB-95			>12 Halflives				
RU-103			>12 Halflives				
RH-106	<	2.2866E-01		4.2912E+02			
AG-108M	<	2.5348E-02		2.5820E-02			
AG-110M			>12 Halflives				

SN-113			>12 Halflives		
SB-124			>12 Halflives		
SB-125	<	7.7511E-02	1.2685E+00		
I-131			>12 Halflives		
BA-133	<	3.1198E-02	6.4833E-02		
CS-134	<	5.1191E-02	2.1417E+00		
CS-137	<	5.4727E-02	7.0763E-02		
CE-139			>12 Halflives		
Ba-140	C	1.1210E-44	>12 Halflives	0.000E+00%	0.00E+00
La-140			>12 Halflives		
CE-141			>12 Halflives		
CE-144			>12 Halflives		
PM-144	<	3.3884E-02	7.9229E+01		
EU-152	<	8.7882E-02	1.5532E-01		
EU-154	<	2.5965E-01	6.3685E-01		
EU-155	<	6.8362E-02	3.2349E-01		
HF-181			>12 Halflives		
Ta-182	C	1.5414E-44	>12 Halflives	0.000E+00%	0.00E+00
Hg-203			>12 Halflives		
TL-208		1.1181E-01	6.3314E+00	2.067E+01%	2.68E+00
pm-146	<	7.8034E-02	3.1460E-01		
y-88			>12 Halflives		
PB-210		7.5500E+00	1.0668E+01	5.740E+00%	1.33E+00
PB-212		2.1047E-01	1.1918E+01	1.323E+01%	3.55E+00
PB-214		2.6314E-01	2.6441E-01	1.434E+01%	9.63E-02
BI-207	<	3.5478E-02	4.5075E-02		
BI-212	<	5.4547E-01	3.0887E+01		
BI-214		3.4832E-01	3.5000E-01	1.353E+01%	9.70E-02
BI-210M	<	3.1239E-02	3.1239E-02		
RA-224	<	5.9523E-01	3.3704E+01		
AC-228	<	1.7553E-01	6.7088E-01		
TH-227	<	9.0378E-02	1.2878E-01		
TH-229	<	3.4674E-01	3.4711E-01		
TH-234		4.0867E+00	4.0867E+00	7.069E+00%	8.06E-01
PA-231	<	8.0886E-01	8.0905E-01		
PA-233	<	4.9670E-02	4.9670E-02		
PA-234	<	8.0969E-02	8.0969E-02		
PA-234M	<	4.0313E+00	4.0313E+00		
Ra-226		2.6894E+00	2.7024E+00	9.310E+00%	7.26E-01
U-235	<	1.3933E-01	1.3933E-01		
AM-241	#	1.4609E-01	1.4871E-01	1.945E+01%	9.09E-02
Np-237	<	1.8880E-01	1.8905E-01		

- All peaks for activity calculation had bad shape.
 * - Activity omitted from total
 & - Activity omitted from total and all peaks had bad shape.

< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (37.6 to 1999.6 keV) 1.885E+01 DPS
Total Decayed Activity (37.6 to 1999.6 keV) 3.9910660E+01 DPS

Run Logs

Gamma Spectroscopy Run Log

Detector: GV12

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/02/12 10:16		IC 160-13156/1		13156			JLW
10/04/12 09:10		ICV 160-13156/2		13156			JLW
01/28/16 13:28		ACVTOP 160-235885/1		235885			PS
07/09/16 18:02		ICB 160-259826/1		259826			RTM
07/12/16 01:06		CCV 160-260174/1		260174			
07/12/16 01:32		CCV 160-260174/2		260174			RTM
07/12/16 02:06		CCB 160-260174/3		260174			RTM
07/12/16 08:13	30	ZZZZZ		260174			
07/12/16 08:50	30	ZZZZZ		260174			
07/12/16 09:28	30	ZZZZZ		260174			
07/12/16 10:01	30	MB 160-257318/1-A		260174	257318	901.1	RTM
07/12/16 10:43	30	ZZZZZ		260174			
07/12/16 11:32	30	ZZZZZ		260174			
07/12/16 12:21	30	ZZZZZ		260174			
07/12/16 12:55		ZZZZZ		260174			
07/12/16 13:34	30	ZZZZZ		260174			
07/12/16 14:13	30	ZZZZZ		260174			
07/12/16 14:54	30	ZZZZZ		260174			
07/12/16 15:28	30	ZZZZZ		260174			
07/12/16 16:07	30	ZZZZZ		260174			
07/12/16 17:11	30	ZZZZZ		260174			
07/12/16 17:56	30	ZZZZZ		260174			
07/12/16 18:56	30	ZZZZZ		260174			
07/12/16 20:04	30	ZZZZZ		260174			
07/12/16 21:30	30	ZZZZZ		260174			
07/12/16 22:08	30	ZZZZZ		260174			
07/12/16 22:45	30	ZZZZZ		260174			
07/12/16 23:17	120	ZZZZZ		260174			

Detector: GV14

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
04/23/12 09:56		IC 160-12359/1		12359			JLW
04/24/12 08:12		ICV 160-12359/2		12359			JLW
01/25/16 12:29		ACVTOP 160-235877/1		235877			PS
07/09/16 18:21		ICB 160-259830/1		259830			RTM
07/12/16 01:04		CCB 160-260176/1		260176			RTM
07/12/16 02:04		CCV 160-260176/2		260176			
07/12/16 02:26		CCV 160-260176/3		260176			RTM
07/12/16 08:09	30	ZZZZZ		260176			
07/12/16 08:42	30	ZZZZZ		260176			
07/12/16 09:24	30	ZZZZZ		260176			
07/12/16 10:00	30	ZZZZZ		260176			
07/12/16 10:40	30	ZZZZZ		260176			
07/12/16 11:32	30	ZZZZZ		260176			
07/12/16 12:20	30	160-17842-1	WR111-REF-018-SS-P-01	260176	257318	901.1	RTM
07/12/16 12:56	30	ZZZZZ		260176			
07/12/16 13:35	30	ZZZZZ		260176			
07/12/16 14:15	30	ZZZZZ		260176			
07/12/16 14:55	30	ZZZZZ		260176			
07/12/16 15:29	30	ZZZZZ		260176			
07/12/16 16:06	30	ZZZZZ		260176			
07/12/16 17:05	30	ZZZZZ		260176			

Gamma Spectroscopy Run Log

Detector: GV14 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
07/12/16 17:51	30	ZZZZZ		260176			
07/12/16 18:43	30	ZZZZZ		260176			
07/12/16 19:52	30	ZZZZZ		260176			
07/12/16 21:29	30	ZZZZZ		260176			
07/12/16 22:09	30	ZZZZZ		260176			
07/12/16 22:43	30	ZZZZZ		260176			
07/12/16 23:18	120	ZZZZZ		260176			

Detector: GV16

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
07/10/12 10:35		IC 160-12382/1		12382			JLW
07/17/12 11:27		ICV 160-12382/2		12382			JLW
01/22/16 10:56		ACVTOP 160-235879/1		235879			PS
07/09/16 18:23		ICB 160-259831/1		259831			RTM
07/12/16 01:05		CCB 160-260175/1		260175			RTM
07/12/16 02:06		CCV 160-260175/2		260175			
07/12/16 02:28		CCV 160-260175/3		260175			RTM
07/12/16 08:10	30	ZZZZZ		260175			
07/12/16 08:41	30	ZZZZZ		260175			
07/12/16 09:25	30	ZZZZZ		260175			
07/12/16 09:59	30	LCS 160-257318/2-A		260175	257318	901.1	RTM
07/12/16 10:41		ZZZZZ		260175			
07/12/16 12:20	30	ZZZZZ		260175			
07/12/16 12:56	30	ZZZZZ		260175			
07/12/16 13:35	30	ZZZZZ		260175			
07/12/16 14:14	30	ZZZZZ		260175			
07/12/16 14:56	30	ZZZZZ		260175			
07/12/16 15:30	30	ZZZZZ		260175			
07/12/16 16:05	30	ZZZZZ		260175			
07/12/16 17:06	30	ZZZZZ		260175			
07/12/16 17:50	30	ZZZZZ		260175			
07/12/16 18:44	30	ZZZZZ		260175			
07/12/16 21:34	30	ZZZZZ		260175			
07/12/16 22:10	30	ZZZZZ		260175			
07/12/16 22:45	30	ZZZZZ		260175			
07/12/16 23:19	30	ZZZZZ		260175			
07/12/16 23:55	30	ZZZZZ		260175			

Radiological Pre-Preparation Data

Shipping and Receiving Documents

Login Sample Receipt Checklist

Client: EA Engineering, Science, and Technology

Job Number: 160-17842-1

Login Number: 17842

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	