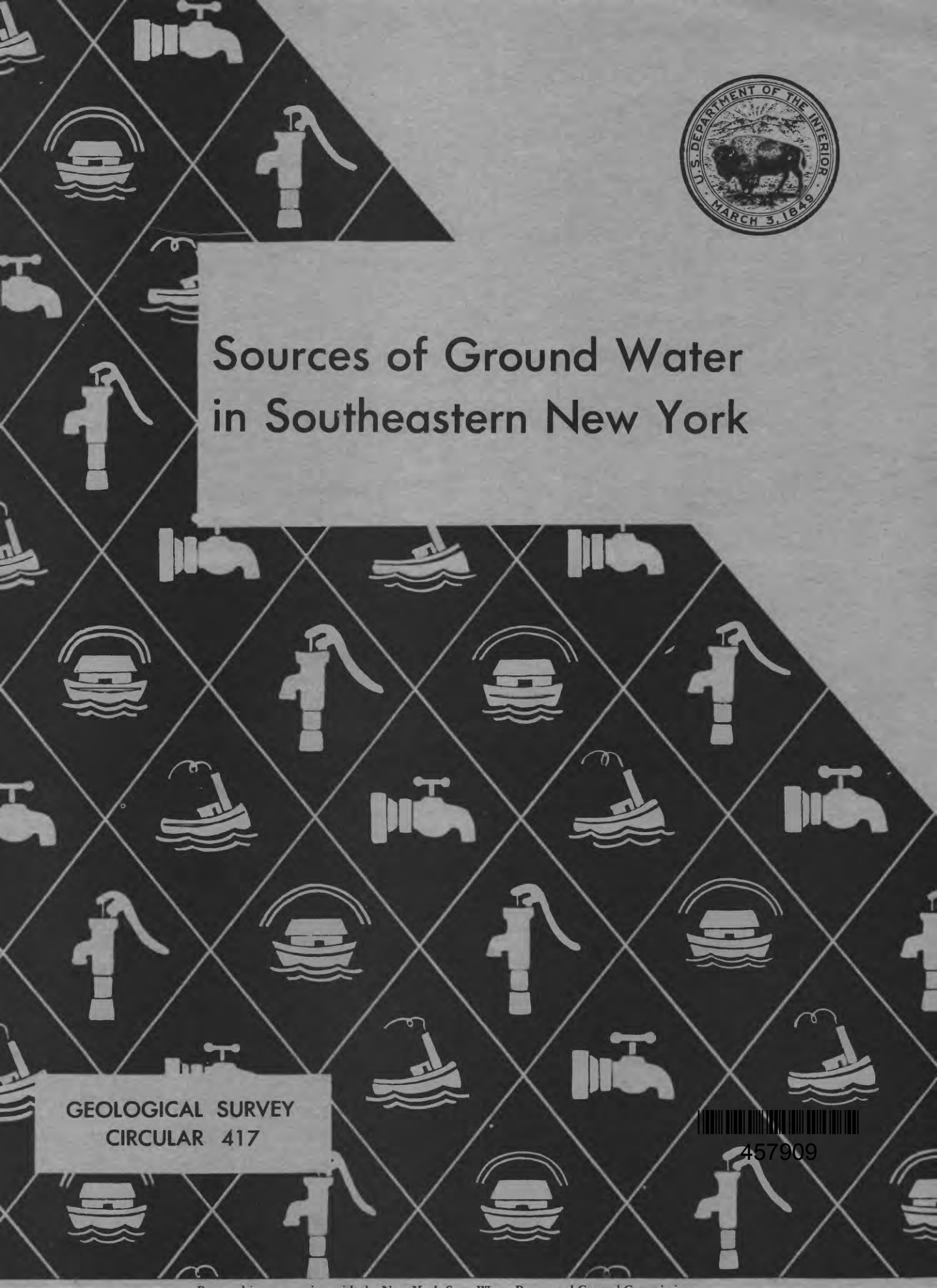

Sources of Ground Water in Southeastern New York

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Sources of Ground Water in Southeastern New York

By Nathaniel M. Perlmutter

Prepared in cooperation with the New York State Water Power and Control Commission

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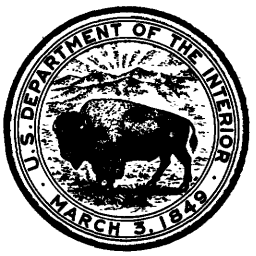

Geological Survey

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Sources of Ground Water in Southeastern New York

By Nathaniel M. Perlmutter

INTRODUCTION

This report summarizes the ground-water situation in six metropolitan counties of southeastern New York exclusive of those of New York City and Long Island. Conditions in the latter areas are covered in many published reports and are not discussed further. The six metropolitan counties of Dutchess, Orange, Putnam, Rockland, Ulster, and Westchester together include an area of about 3,600 square miles extending northward from New York City (fig. 1). Small parts of Ulster and Orange Counties lie in the Delaware River drainage basin, but the rest of the area is almost entirely in the adjoining Hudson River drainage basin. Some of the counties are densely populated and use relatively large quantities of ground water and surface water. Owing to the probable increase in population and the corresponding increase in water use, these counties are considered to be possible users of water from the Delaware River basin. Accordingly, a brief summary of the sources of ground water within these counties is pertinent to the overall investigation of the water resources of the Delaware River basin.

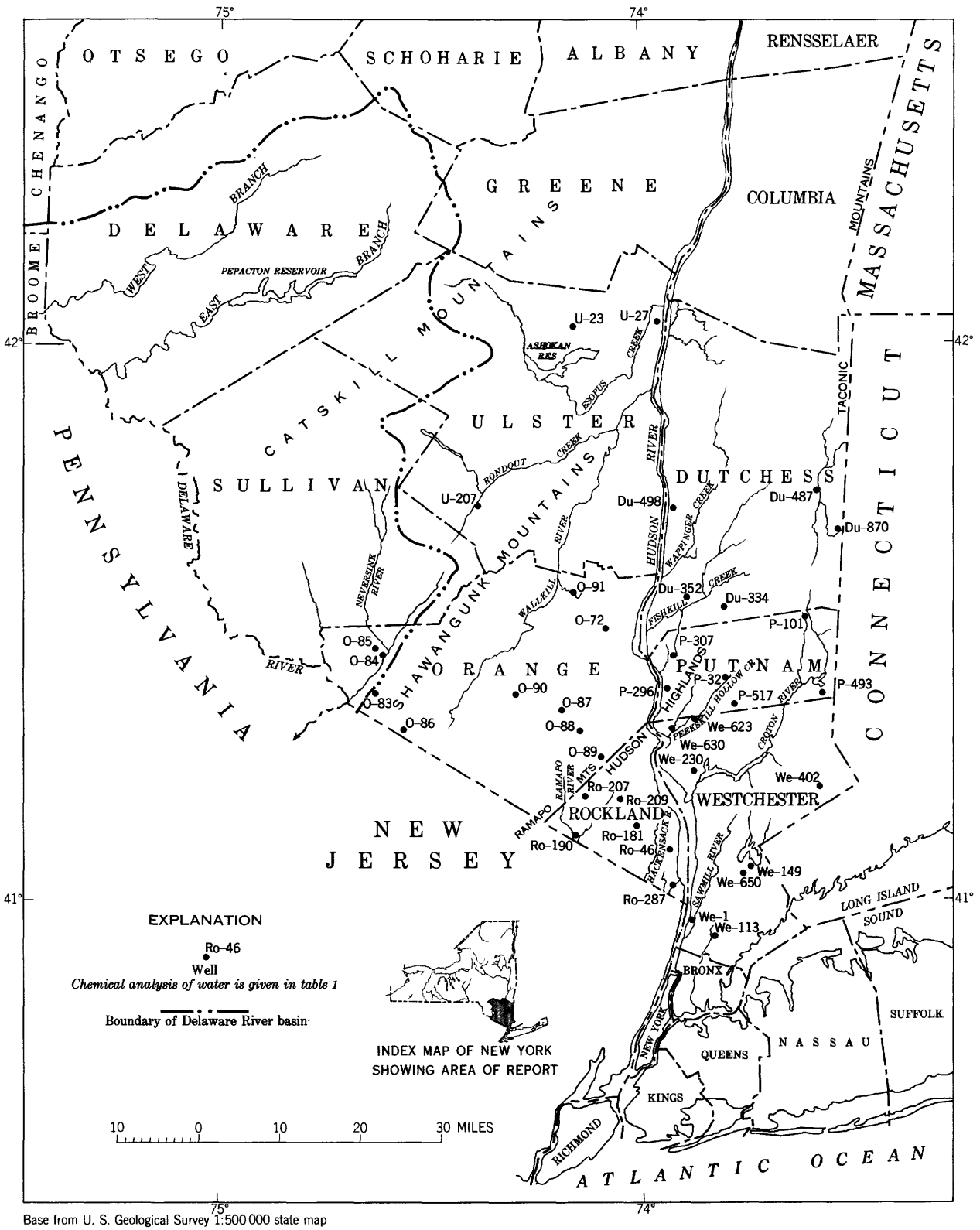
The data contained in this report were collected as part of the investigation of the ground-water resources of New York conducted by the U. S. Geological Survey in cooperation with the New York State Water Power and Control Commission. Reports on the investigations in Putnam County (Grossman, 1957) and in Westchester County (Asselstine and Grossman, 1955) have been published. At the time of publication of this circular a report on Rockland County (Perlmutter, 1959) was in press and one on Dutchess County (Simmons and others, 1959) was nearly ready for publication, but no investigations had been started in Orange and Ulster Counties. However, all the unpublished open-file data for these counties may be examined in the offices of the Geological Survey at Albany and Mineola, N. Y.

The information given in this report is based on interpretation of open-file data of the Geological Survey; published bulletins of the New York State Water Power and Control Commission, New York State Museum and New York State Department of Health, and the geologic map of New York State; and on field observations by the author, mostly in Rockland and Orange Counties. The preparation of the report was supervised by G. C. Taylor, Jr., district geologist, Ground Water Branch, Mineola District. Acknowledgment is due R. C. Heath, geologist-in-charge, subdistrict office, Albany, N. Y., for making available unpublished data.

GROUND-WATER HYDROLOGY SOUTHEASTERN NEW YORK

The source of most of the ground water in southeastern New York is the precipitation that falls directly on the area. The average annual precipitation ranges from about 50 inches in the southern part to about 42 inches in the northern part. Some ground water is derived locally by induced infiltration from lakes and streams into water-bearing deposits.

Water occurs under water-table and artesian conditions both in the unconsolidated deposits of Pleistocene and Recent age and in the consolidated bedrock which is Precambrian to Devonian and Triassic in age. The unconsolidated deposits of Pleistocene age that are composed chiefly of poorly sorted and unstratified deposits of gravel, sand, silt, clay, and boulders laid down by glaciers are called till; those composed of well-sorted and



Base from U. S. Geological Survey 1:500 000 state map

Figure 1.—Map of southeastern New York showing the metropolitan counties, location of wells for which water analyses are given, and the part of the area included in the Delaware River basin.

stratified sediments laid down by glacial melt waters are called outwash. Till covers most of the bedrock surface in the interstream areas and in minor stream valleys, and occurs also beneath outwash in the valleys of the major streams. Large bodies of outwash are distributed extensively in the valleys of the streams, shown on the map (fig. 1); numerous small, scattered bodies that occur in the valleys of minor streams and in other lowlands are not shown on the map. Thin deposits of alluvium of Recent age occur in most valleys but they are generally unimportant as sources of water.

Water in the unconsolidated deposits moves through minute openings (pores) between the constituent grains. The size, shape, and interconnection of the pores determine the permeability—the capacity of the deposits to transmit water. Owing to large differences in grain size and in sorting, the permeability ranges widely from place to place. For example, it is very high in outwash composed of well-sorted coarse sand and gravel and very small in outwash composed of silt and clay, and in till. Thus, in many places the outwash is capable of supplying more than 1,000 gpm (gallons per minute) for public supply and industrial use, whereas the yield from wells in till is generally small and sufficient for domestic use only.

The bedrock includes a large number of units of igneous, sedimentary and metamorphic rocks. In structure and composition the units range from the nearly horizontally bedded sandstone and shale of the Catskill Mountains on the west to the complexly folded and faulted granite, and gneiss, and schist of the Hudson Highlands on the east. Many of the units extend across several counties. Their distribution is on the geologic map of New York (Merrill, 1901).

Water in dense crystalline rocks, such as granite, gneiss, schist, and quartzite, occurs chiefly in openings along joints, irregular fractures, faults, and cleavage planes; water in sedimentary rocks, such as sandstone, shale, limestone, and dolomite, occurs in openings chiefly along joints, bedding planes, solution channels (restricted to limestone and dolomite), and faults. The width of the openings ranges from a hairline to several inches. The number and size of the openings and their connection with a good source of recharge largely determine the yield of wells drilled in rock. Most of the bedrock aquifers yield less than 10 gpm to individual wells; but several, such as the sandstone and shale of the Newark group of Triassic age, the Inwood limestone of Precambrian age, and the Stockbridge limestone of Cambrian and Ordovician age, commonly yield several hundred gallons per minute to individual wells.

After reaching the water table, water moves down the hydraulic gradient from areas of relatively high points on the water table to areas of relatively low points. Thus, the general pattern of movement of the ground water in bedrock is from areas of recharge in the uplands to areas of discharge on hillsides and in the bottoms of valleys. Similarly, ground water in the outwash, which is largely confined to lowlands, moves from relatively high points on the water table toward points of discharge at lower altitudes in streams and lakes. The small volume of water of many streams during the low-flow stage is furnished almost entirely by ground water issuing from springs and by direct percolation of ground water from the bedrock and outwash into the bottom of the streams.

In chemical quality, the ground water ranges from the soft, almost mineral-free water in Devonian sandstone in the Catskill Mountains to the hard, salty water in parts of the bedrock and unconsolidated deposits that border and underlie the Hudson River about as far north as Wappinger Creek in southwestern Dutchess County. The temperature of the water generally ranges between 51° and 56°F. Chemical analyses of water from selected wells tapping the principal aquifers are given in table 1.

In the following sections the general geology and water-bearing characteristics of the deposits are summarized by counties.

DUTCHESS COUNTY

Dutchess County has an area of approximately 800 square miles. The permanent population is about 145,000 (1953 census). Most of the county is a gently rolling plain ranging in altitude from about sea level along the Hudson River to about 500 feet in the central part. However, summit levels generally range from about 1,000 to 1,300 feet in the Taconic Mountains section along the eastern border and are as much as 1,600 feet in the

Table 1.—*Chemical analyses, in parts per million, of water from selected wells in Dutchess, Orange, Putnam, Rockland, Ulster, and Westchester Counties, New York*

[Asterisk (*) indicates analysis by New York State Department of Health; other analyses are by U. S. Geological Survey]

Well (fig. 1)	Location of well	Water-bearing unit	Date of collection	Depth of well (feet)	Silica (SiO_2)	Iron (Fe)		Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Specific conductance (micromhos at 25°C)	pH	Yield (gpm)	Temperature (°F)
						Total	Dissolved													Total	Noncarbonate				
	Dutchess County:																								
Du-334*	About 4 miles east of Fishkill.	Stockbridge limestone..	11- 8-1951	125	.....	0.13	.....	<0.01	.....	.....	.....	.....	299	0	29	5	.....	.....	359	220	0	.....	7.4	20	.....
Du-353*	About 1 mile north of Fishkill.	Precambrian granite and gneiss.	12-20-1949	138	.....	.2	.....	2.5	.....	.....	.....	.....	151	0	62	11	.....	.....	276	104	0	.....	6.9	3	.....
Du-487	Dover Plains.....	Pleistocene outwash.....	5-27-1949	70	8.4	.17	.....	.....	47	14	.....	.....	180	.....	20	3.5	0.1	11	209	175	27	351	8.4	250	51
Du-498	Poughkeepsie.....	Hudson River formation (of former usage).	5-27-1949	1,196	11	.97	.....	.....	100	10	.....	.....	272	0	87	26	.0	3.0	425	291	.....	639	8.1	50	53
Du-670*	About 2½ miles northeast of Wingdale.	Cheshire quartzite.....	3-31-1952	65	.....	2.4	.....	.03	.....	.....	.....	.....	22	0	9.3	.6	.....	.....	60	18	0	.....	6.1	5	.....
	Orange Connty:																								
O-72	Newburgh.....	Normanskill shale.....	9-15-1953	120	13	.03	.00	.....	42	14	.....	.....	191	0	42	3.7	.1	.5	231	162	6	385	7.6	4	.....
O-83	Lake Hawthorne	Shawangunk conglomerate.	6- 4-1957	60	8	3	.00	2.00	3.2	3.5	1.1	2.1	22	0	10	1.4	.1	.0	42	23	5	63	6.0	5	51
O-84	Goddefroy	Pleistocene outwash.....	6- 4-1957	18	5	.51	.01	.02	11.1	2.1	2.0	1.1	24	0	12	3.0	.1	5.6	56	36	17	88	6.5	.....	56
O-85	Prospect Hill	Devonian sandstone and shale.	6- 4-1957	102	9.8	.74	.01	.15	9	4.0	6.1	.8	41	0	10	7.4	.1	.5	70	39	6	113	6.6	10	56
O-86	Unionville.....	Normanskill shale.....	6- 4-1957	134	9.1	.28	.06	.01	45	5.7	7.4	.6	107	0	59	4.2	.1	.3	192	136	49	308	7.4	8	53
O-87	Schunemunk Mountain, near Monroe.	Devonian sandstone	6- 3-1957	260	5.1	.22	.01	.09	4.4	3.1	1.8	.6	6	0	16	4.6	.1	.6	48	24	19	71	5.8	30	52
O-88	Harriman	Cambrian and Ordovician limestone.	6- 3-1957	175	11	.24	.02	.01	41	16	17	1.4	223	0	19	2.2	.6	.0	206	169	0	377	7.7	10	52
O-89	Lake Tiorati	Precambrian gneiss.....	6- 3-1957	206	14	.11	.04	.01	21	5.3	4.6	1.0	69	0	19	5.5	.1	2.2	113	75	18	173	7.0	6	54
O-90	Goshen	Normanskill shale.....	6- 3-1957	422	11	.05	.02	.0	24	8.2	83	1.6	254	4	48	10	.6	.1	314	94	0	518	8.3	30	52
O-91	East Walden.....	Pleistocene outwash.....	6- 5-1957	32	8.2	.04	.00	.01	55	7.6	5.3	.8	148	0	46	5.9	1	3.9	219	169	47	356	7.5	250	51
	Putnam County:																								
P-32	Tomkins Corners	Pleistocene outwash.....	8-17-1953	36	8.1	.07	.....	.01	40	15	15	2.8	176	.....	26	14	.0	12	235	162	17	378	6.9	10	68
P-101	Patterson.....	Stockbridge limestone..	3-27-1953	137	4.5	.03	.....	.00	39	14	3.4	5.8	174	.....	18	8	.0	.6	198	155	12	317	8.1	25	.....
P-296	Garrison.....	Precambrian gneiss.....	9-14-1953	125	15	.21	.....	.01	38	10	6.9	1.2	122	.....	44	5.9	.2	1.1	190	137	37	291	7.4	3	.....
P-307	About 3 miles northeast of Cold Spring.	Pochuck gabbro gneiss..	8-17-1953	227	15	.17	.....	.02	17	5.8	9.7	.8	50	.....	26	18	.1	1.3	132	72	31	194	6.8	.....	.....
P-493	About 3 miles southeast of Brewster.	Hudson River formation (of former usage).	11-27-1953	200±	17	.17	.....	.01	35	9.5	3.8	3.2	97	.....	36	14	.1	12	200	130	51	302	7.5	15	.....
P-517*	Stillwater.....	Pleistocene till.....	5- 7-1947	24	.....	.1	.....	.....	.....	.....	6	.....	174	.....	.....	55	.....	.....	.....	269	126	.....	7.2	.....	.....
	Rockland County:																								
Ro-46	West Nyack	Palisade diabase.....	7-23-1957	291	61	.1	.06	.00	5.8	.0	52	.1	27	.....	23	8.9	.3	2.8	177	15	0	246	9.6	16	.....
Ro-181*	New City.....	Newark group.....	4-24-1950	180	.....	.3	.....	.....	.....	.....	.....	.....	35	.....	.....	5.4	.1	5.4	.....	52	23	.....	6.2	75	.....
Ro-190	Suffern.....	Pleistocene outwash.....	7-23-1957	97	28	.05	.01	.36	22	7.1	8.8	1.1	55	0	39	12	.0	3.5	141	84	39	224	6.5	1,250	55
Ro-207	Lake Sebago.....	Precambrian gneiss.....	7-23-1957	205	22	.17	.01	.08	45	10	7.4	1.9	175	0	19	3.6	.3	.0	195	154	10	318	7.5	5	.....
Ro-209	Monnt Ivy.....	Newark group.	7-24-1957	371	18	.1	.05	.00	23	13	22	.4	133	0	41	2.4	.2	4.1	166	111	2	283	7.8	33	56
Ro-287	Piermont.....	Pleistocene outwash.....	7-24-1957	69	27	2.6	.05	.00	46	15	17	.8	174	0	37	16	.1	8.7	254	177	34	404	7.2	325	53
	Ulster County:																								
U-23*	Bearsville	Devonian shale and sandstone.	8-25-1949	142	.....	.1	.....	<.01	.....	.....	.....	.....	157	18	9.6	1.6	.....	.....	203	28	0	.....	8.9	.....	.....
U-27*	Glasco	Normanskill shale.....	7-14-1949	165	.....	.5	.....	.02	.....	.....	.....	.....	161	0	10	2.4	.....	.....	220	36	0	.....	8.2	.....	.....
U-207*	Ellenville.....	Pleistocene outwash	1-23-1956	101	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.6	.....	.2	.....	92	.....	.....	7.7	150	50
	Westchester County:																								
We-1*	Yonkers.....	Pleistocene sand.....	2- 6-1952	60	.....	.1	.....	<.01	.....	.....	.....	.....	262	0	58	11	.....	.....	359	270	55	.....	7.6	100	51
We-113*	Bronxville.....	Inwood limestone.....	10-17-1951	136	.....	.15	.....	.03	.....	.....	.....	.....	173	0	60	33	.....	.....	372	300	158	.....	7.7	19	.....
We-149	Silver Lake.....	Fordham gneiss.....	6-16-1953	150	14	.19	.0	.01	38	19	3.6	3.9	177	0	25	7.9	.0	9.0	212	173	28	357	7.8	300	.....
We-230*	About 2 miles northeast of Croton-on-Hudson.	Cortlandt series	11-28-1953	81	.....	.4	.....	.03	.....	.....	.....	.....	73	0	22	.....	.....	.....	126	92	32	.....	6.7	2½	.....
We-402*	Pound Ridge.....	Manhattan schist.....	11-21-1949	304	.....	.35	.....	.....	.....	.....	.....	.....	104	0	.....	11	.....	11	.....	124	39	.....	7.9	10	.....
We-623*	About 2 miles northeast of Peekskill.	Stockbridge limestone...	11-28-1953	60	.....	.15	.....	<.01	.....	.....	.....	.....	117	.....	15	4.6	.....	.....	158	88	0	.....	7.1	.....	.....
We-630*	Peekskill.....	Hudson River formation (of former usage).	11-28-1953	85	.....	.6	.....	<.01	.....	.....	.....	.....	134	0	39	6.4	.....	.....	212	128	18	.....	6.9	2	.....
We-650	North White Plains	Pleistocene outwash.....	1-28-1952	23	13	.03	.0	.0	30	12	3.7	1.9	113	0	29	6.2	.1	1.4	158	124	32	258	7.6	170	.....

Hudson Highlands along the southern border. Several prominent lowlands, developed on relatively soft rocks, occur at altitudes of 400 to 600 feet above sea level.

GENERAL GEOLOGY

The bedrock of Dutchess County consists of igneous, metamorphic, and sedimentary rocks ranging in age from Precambrian to Ordovician. Most of the rocks are closely folded and have a northeasterly strike.

The principal bedrock units are (a) undifferentiated granite and gneiss and diorite of Precambrian age, which crop out mainly along the southern border of the county; (b) the Hudson River formation (of former usage) that, as defined in this county, includes gray and red shale, slate, phyllite, and schist of the Nassau and Schodack formations of Cambrian age and the Deepkill and Normanskill shales of Ordovician age; and (c) the Cheshire quartzite of Cambrian age and the Stockbridge limestone of Cambrian and Ordovician age, which crop out in scattered elongate belts.

The Hudson River formation (of former usage) underlies more than two-thirds of the county. Unconsolidated deposits of till and outwash of Pleistocene age cover most of the bedrock surface.

WATER-BEARING CHARACTERISTICS OF THE DEPOSITS

Ground water is obtained from all three principal rock types: till, outwash, and bedrock. Deposits of till range in thickness from less than a foot to more than 100 feet and generally are thinnest on the upland areas. Yields of wells in till average only a few gallons per minute. Deposits of outwash composed of sand and gravel yield the largest quantities of water in the county. Most of these deposits are restricted to the valleys of the major streams, Wappinger Creek, Fishkill Creek, and the Hudson River. Yields of 34 screened wells tapping outwash range from 10 to 800 gpm and average 300 gpm.

About 90 percent of the existing wells tap the Hudson River formation (of former usage) and the Stockbridge limestone. Yields of 439 wells tapping the former range from 0 to 135 gpm and average 16 gpm; yields of 153 wells tapping the Stockbridge limestone range from 0 to 220 gpm and average 22 gpm. Yields from the other bedrock units average about 10 gpm. Chemical analyses of water from 5 wells are given in table 1.

Twenty-four public-supply systems serve about half the population. Most of the water used is taken from surface sources, but 16 public-supply systems are supplied wholly or in part with ground water. Withdrawals from these systems averaged about 1 mgd (million gallons per day) in 1954. Total ground-water pumpage is about 7 mgd.

ORANGE COUNTY

Orange County has an area of about 840 square miles. The permanent population is about 159,000 (1953 census). The land surface in Orange County is of four main physiographic types: (a) a broad, gently rolling plain in the central and northeastern part of the county, ranging in altitude from a few feet above sea level along the Hudson River to about 1,000 feet in the interior; (b) a dissected highland to the southeast, where the land surface reaches an altitude of more than 1,500 feet; (c) a northeasterly trending belt of narrow ridges and valleys bordering the central plain on the northwest; and (d) a small plateau in the extreme western corner of the county.

GENERAL GEOLOGY

The bedrock of Orange County consists of igneous, metamorphic, and sedimentary rocks ranging in age from Precambrian to Devonian. The rocks are folded and most of them strike northeasterly. Dips range from gentle to steep, and major faults are numerous. The central two-thirds of the county is underlain by gray slaty shale and sandstone composing the Normanskill shale and the Snake Hill formation of Ordovician age. To the southeast the Normanskill is in contact with elongate belts of infolded and faulted beds of limestone of Precambrian, Cambrian, and Ordovician age, and sandstone, conglomerate, and shale of Devonian age. These rocks, in turn, lie on and against the complex crystalline rocks of the Hudson Highlands area, which consist mainly of Precambrian granite and

gneiss. The Normanskill shale and Snake Hill formation are overlain unconformably to the northwest by the northwesterly dipping beds of the Shawangunk conglomerate and the High Falls shale of Silurian age, which form the Shawangunk Mountains. A prominent valley that parallels the northwest flank of the Shawangunk Mountains is underlain by northwesterly dipping beds of gray limestone, shale, and sandstone divided into several formations ranging in age from Late Silurian to Middle Devonian. The plateau to the northwest of the valley is underlain by sandstone and shale of Middle to Late Devonian age.

The bedrock in most of the county is covered by a mantle of unconsolidated deposits of till and outwash of Pleistocene age.

WATER-BEARING CHARACTERISTICS OF THE DEPOSITS

Records for about 200 wells and springs are available for Orange County. Because most of the data are for the extreme northwestern part, in the Neversink River valley, a detailed appraisal of the ground-water conditions requires considerably more fieldwork in other parts of the county than has been done to date.

The principal water-bearing units are till, outwash, and bedrock. The till covers the upland areas throughout most of the county. It yields to dug wells small quantities of water sufficient for domestic use. Deposits of outwash composed of sand and gravel and ranging from a few feet to several hundred feet in thickness occur in many of the stream valleys and other lowland areas; the largest deposit is in the valley of the Neversink River, and has a maximum thickness of more than 200 feet. In 1957, total withdrawals from this deposit were only a small fraction of the recharge. Other deposits of outwash, chiefly those in the valley of the Walkill River and its tributaries, are tapped by a relatively small number of wells and represent potential sources of substantial quantities of water. The yields of 13 screened wells in outwash range from 3 to 380 gpm and average 85 gpm.

Most of the wells in the county are completed in bedrock. The chief bedrock aquifer is the Normanskill shale of Ordovician age. Yields of 16 wells in the Normanskill range from 2 to 80 gpm and average 30 gpm. Yields of 21 wells in sandstone and shale of Devonian age range from 1 to 80 gpm and average 20 gpm. Yields of wells tapping limestone of Cambrian and Ordovician age are among the largest for bedrock aquifers; for 11 wells, the yields range from 18 to 150 gpm and average 80 gpm. Wells in granite and gneiss have the lowest yields; for 10 wells, the yields range from 1 to 25 gpm and average 10 gpm. In quality the water ranges from soft to hard; locally, the iron content is excessive. Table 1 gives analyses of water from 10 wells.

About 90 percent of the water used in the county is pumped from streams and other bodies of surface water. Public-supply systems for 28 communities ranging from small real-estate developments to municipalities obtain all or part of their water from wells and springs. These systems pumped about 2 mgd in 1954, chiefly from deposits of outwash. Ground water is used also for domestic, agricultural, and some industrial purposes. Total ground-water pumpage is estimated to be about 7 mgd.

PUTNAM COUNTY

A detailed report (Grossman, 1957) on the ground-water resources of Putnam County has been published by the New York State Water Power and Control Commission. The following data are summarized from that report.

Putnam County has an area of 235 square miles. Its permanent population (1953 census) is about 22,000. The county is in the Hudson Highlands, a dissected belt of low mountains that rise from about sea level along the Hudson River to as much as 1,400 feet in the upland areas.

GENERAL GEOLOGY

The bedrock of Putnam County consists of folded and faulted igneous and metamorphic rocks ranging in age from Precambrian to Ordovician. More than 90 percent of the bedrock is composed of undifferentiated granite and gneiss of Precambrian age. The remainder consists of some scattered bodies of the Pochuck gabbro gneiss of Precambrian age and a few northeast-trending narrow

infolded and faulted beds of the Cheshire quartzite of Cambrian age, the Stockbridge limestone of Cambrian and Ordovician age, and argillaceous and schistose beds of the Hudson River formation (of former usage). The consolidated rocks are overlain by an irregular mantle of unconsolidated till and outwash of Pleistocene age. In the upland areas, the till generally is less than 30 feet thick, but in some valleys it is as much as 200 feet thick. Outwash consisting chiefly of sand and gravel is limited mostly to the valleys of the Hudson River, Peekskill Hollow Creek, Canopus Creek, and the Croton River.

WATER-BEARING CHARACTERISTICS OF THE DEPOSITS

Ground water is contained in till, outwash, and bedrock. Records of a few wells in till indicate an average yield of about 2 gpm. Many wells in till go dry during periods of low rainfall, owing to decline of the water table. Yields of 50 wells tapping outwash sand and gravel range from 1 to 450 gpm and average 33 gpm.

The yields of about 370 wells that tap bedrock, chiefly granite and gneiss, range from 0 to 120 gpm and average 12 gpm. There is little difference in the average yields of wells tapping the different bedrock units. The average hardness of all the ground-water samples collected is 70 ppm, but it is as high as 480 ppm in water from the Stockbridge limestone. Locally the water has high iron content. Chemical analyses of water from six wells are given in table 1.

About one-third of the total estimated pumpage of 1.5 mgd in 1950 came from ground-water sources. Eleven public-supply systems use ground water wholly or in part. Ground water is used also for domestic, agricultural, and some industrial purposes.

ROCKLAND COUNTY

Rockland County has an area of approximately 200 square miles. The permanent population is about 114,000 (1957). The land surface ranges in altitude from about sea level along the Hudson River in the eastern part to about 1,300 feet in the mountainous northwestern part. The eastern two-thirds of the county is a gently rolling plain which is bordered on its eastern margin by a narrow, curving ridge that rises as much as 800 feet above the plain. The plain terminates against a rugged highland, the Ramapo Mountains, in the northwestern part of the county.

GENERAL GEOLOGY

The bedrock of Rockland County includes igneous, sedimentary, and metamorphic rocks; age is Precambrian, Cambrian and Ordovician, and Triassic. The eastern two-thirds of the county is underlain by beds of conglomerate, sandstone, and shale, a part of the Newark group, and igneous rocks, all of Triassic age. The largest differentiated unit of the igneous rocks is the Palisade diabase, a sill intruded into the sedimentary rocks in the eastern part of the county. The rocks of Triassic age dip gently northwest and terminate along a major fault marking the southeastern border of a belt of crystalline rocks, mostly granite and gneiss, of Precambrian age. A small area in the northeastern part of the county is underlain by an infolded and faulted belt of rocks of Cambrian and Ordovician age consisting of beds of quartzite, limestone, and phyllite. Deposits of till and outwash of Pleistocene age cover the bedrock in most of the county; in most places their total thickness is less than 30 feet but in some it is more than 300 feet.

WATER-BEARING CHARACTERISTICS OF THE DEPOSITS

Ground water is contained in till, outwash, and bedrock. Deposits of till are tapped by a small number of domestic wells, but yields generally are less than 5 gpm. Deposits of outwash composed chiefly of sand and gravel are restricted to valleys of such major streams as the Ramapo River, the Mahwah River, the Hackensack River, and Sparkill Creek. The outwash is generally less than 100 feet thick and yields about 50 to 1,500 gpm to individual wells; at some places it is composed largely of beds of clay and silt and very fine sand which do not yield large supplies.

The source of water from most of the wells in the county is the bedrock. The main water-bearing rocks are the beds of sandstone,

conglomerate, and shale of the Newark group. Yields of 200 wells tapping these rocks range from 4 to 1,500 gpm and average about 80 gpm. Public-supply wells tapping the Newark group have an average yield of about 300 gpm and an average depth of about 400 feet. Yields of 13 wells tapping the Palisade diabase average about 11 gpm. Yields of 37 wells obtaining water from granite and gneiss average about 15 gpm but most wells yield less than 10 gpm. Yields from the other, minor bedrock units are small, commonly less than 10 gpm. On the average, the water is moderately hard and is slightly alkaline. Chemical analyses of water from six wells are given in table 1.

Most of the water used in the county is taken from ground-water sources. An average of about 10 mgd was pumped in 1956. About 80 percent of the water was pumped for public-supply and industrial use and the remainder was pumped for domestic, agricultural, and other uses. A detailed report on the ground-water resources of the county has been prepared (Perlmutter, 1959).

ULSTER COUNTY

Ulster County has an area of approximately 1,140 square miles. The permanent population is about 96,000 (1953 census). The land surface ranges in altitude from about sea level along the Hudson River to almost 4,000 feet in the northwestern part of the county. The eastern half of the county is a gently rolling, dissected lowland. The Shawangunk Mountains and some minor ridges and valleys which trend northeastward across the county separate the eastern lowland from the dissected plateau, which is a part of the Catskill Mountains, in the northwestern half of the county.

GENERAL GEOLOGY

The bedrock of Ulster County consists of folded sedimentary rocks of Ordovician to Devonian age. The rocks in the eastern half of the county have a northeasterly to northerly strike. They consist of folded beds of gray and black shale and sandstone which belong largely to the Normanskill shale of Ordovician age. Unconformably overlying the Normanskill shale in the central part of the county are the northwesterly dipping beds of the Shawangunk conglomerate of Silurian age of the Shawangunk Mountains. Minor ridges and valleys immediately west and north of the Shawangunk Mountains are underlain by folded beds, mainly of marine shale, sandstone, and limestone, that constitute several formations of Late Silurian to Middle Devonian age. The Catskill Mountains area in the northwestern half of the county is underlain by nearly horizontal beds of red and gray sandstone, shale, and conglomerate of Middle and Late Devonian age. The bedrock is overlain in most of the area by unconsolidated deposits of till and outwash of Pleistocene age. The maximum thickness of these deposits is more than 200 feet.

WATER-BEARING CHARACTERISTICS OF THE DEPOSITS

Little is known of the water-bearing characteristics of the deposits in Ulster County because only a small number of records of wells and springs have been collected in the county to date. As in other nearby counties, the main water-bearing units are till, outwash, and bedrock. The till is of irregular thickness and covers most of the upland areas. Average yields of wells in till probably are a few gallons per minute. Scattered outwash deposits of sand and gravel occur in the major stream valleys, those of Rondout Creek, Walkill River, and Esopus Creek, and probably can yield large quantities of water to individual wells. The bedrock is the source of water for most of the wells in the county. The yields of wells tapping bedrock units probably are of the same order of magnitude as the yields from wells in the same units in Orange County (p. 6). Chemical analyses of water from 3 wells are given in table 1.

Most of the ground water is used for public-supply, domestic, and agricultural purposes, but a small quantity is used for industrial and miscellaneous purposes. About 10 public-supply systems depend on ground-water sources wholly or in part. The total volume of ground water pumped by these systems averaged somewhat less than half a million gallons per day in 1954.

WESTCHESTER COUNTY

Westchester County has an area of about 450 square miles. The permanent population

is about 753,000 (1957). The altitude of the land surface ranges from about sea level along the Hudson River in the western part of the county to about 700 feet in the Hudson Highlands in the northern part. The land surface in most of the county is characterized by northeastward-trending low ridges and valleys.

GENERAL GEOLOGY

In Westchester County, bedrock consists of closely folded igneous and metamorphic rocks which range from Precambrian to Ordovician in age and form northeastward-trending belts. The principal bedrock units are (a) the Fordham gneiss, (b) the Inwood limestone, and (c) the Manhattan schist, all of Precambrian age. In addition, small areas are underlain by the Harrison diorite and the Yonkers granite, of Precambrian age, and infolded belts of the Cheshire quartzite of Cambrian age, the Stockbridge limestone, slate of the Hudson River formation, (of former usage) and miscellaneous igneous rocks such as granite, pegmatite, and the undifferentiated mafic rocks of the Cortlandt series. Outcrops of bedrock are numerous, but the bedrock surface in most of the county is covered by unconsolidated deposits of till and outwash of Pleistocene age that range in total thickness from a few feet to as much as 200 feet.

WATER-BEARING CHARACTERISTICS OF THE DEPOSITS

Ground water is obtained from till, outwash, and bedrock. Deposits of till having a wide range in thickness are extensively distributed on the uplands and in some valleys. The till has a relatively low permeability and except where it contains sandy lenses yields only a few gallons per minute to dug wells. Scattered sizable deposits of outwash occur in parts of the county; the largest and thickest are restricted to large valleys, such as those of the Hudson River, Sawmill River and Croton River. The outwash consists mostly of sand and gravel but in some places is largely composed of silt and clay. Outwash deposits of sand and gravel yield the largest supplies to wells in the county. Individual wells range in yield from about 3 to 600 gpm. The average yield is about 200 gpm.

At least 70 percent of the wells in Westchester County tap the bedrock. The average yield from these wells is less than 30 gpm. Most of the bedrock wells tap schist and gneiss, and range in yield from 1 to 400 gpm. Limestone is the most productive type of bedrock, particularly in those lowland areas where it is overlain by water-bearing deposits of outwash. Yields of individual wells penetrating limestone range from 2 to as much as 450 gpm. Yields from other minor bedrock units generally are small. Chemical analyses of water from 8 wells are given in the table.

Public-supply systems, which serve about 90 percent of the population, pump most of their water from lakes and streams. However, about 21 systems use ground-water sources wholly or in part. The estimated pumpage from public-supply wells was about 6 mgd in 1956. Wells and springs also supply domestic, agricultural, and some industrial needs but the amount supplied is unknown.

Records and logs of about 1,100 wells in Westchester County are given in Bulletin GW-35 (Asselstine and Grossman, 1955) of the New York State Water Power and Control Commission.

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TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 160-6694-1

Job Description: EPA Region 5 START 3 Contract

For:
Weston Solutions, Inc.
205 Campus Drive
Edison, NJ 08837-3939

Attention: Denise Breen

Approved for release.
Erika K Gish
Project Manager II
5/30/2014 5:03 PM

Erika K Gish, Project Manager II
13715 Rider Trail North, Earth City, MO, 63045
(314)298-8566
erika.gish@testamericainc.com
05/30/2014

The test results in this report meet NELAP requirements for parameters for which accreditation is required or available. Any exceptions to the NELAP requirements are noted. Results pertain only to samples listed in this report. Pursuant to NELAP, this report shall not be reproduced, except in full, without the written approval of the laboratory. This report is confidential and is intended for the sole use of TestAmerica and its client. All questions regarding this report should be directed to the TestAmerica Project Manager.

Louisiana Lab Certification ID (Non-Potable, Solid/Haz. Material): 106151
Florida Lab Certification ID (Drinking Water): E87689.

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Qualifiers

Metals

Qualifier	Qualifier Description
U	Indicates the analyte was analyzed for but not detected.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
F1	MS and/or MSD Recovery exceeds the control limits

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.
X	Carrier exceeds control limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	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: Weston Solutions, Inc.

Project: EPA Region 5 START 3 Contract

Report Number: 160-6694-1

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.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

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.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT
The samples were received on 5/16/2014 6:45 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were 1.1º C and 1.3º C.

TOTAL METALS (ICP)
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for total metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 05/19/2014 and analyzed on 05/22/2014.

Analytical Batch 123642
The following sample(s) was diluted due to the presence of iron which interferes with arsenic, chromium, lead, antimony, selenium, zinc. : (160-6694-1 MS), (160-6694-1 MSD), (160-6694-1 SD), 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5), 2222-SD06 (160-6694-6). Elevated reporting limits (RLs) are provided.

Zinc was detected in method blank MB 160-122752/1-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.

The matrix spike and/or matrix spike duplicate (MS/MSD) recoveries for calcium, antimony, and barium were outside control limits. Sample matrix interference are suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

Due to the high concentration of aluminum, iron, calcium, and magnesium the matrix spike / matrix spike duplicate (MS/MSD) could not be evaluated for accuracy and precision. The presence of the '4' qualifier in the data indicates analytes where the concentration in the unspiked sample exceeded four times the spiking amount. The associated laboratory control sample (LCS) met acceptance criteria.

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

TOTAL METALS (ICP)

Sample 2222-RIN-01 (160-6694-7) was analyzed for total metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 05/19/2014 and analyzed on 05/22/2014.

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

TOTAL MERCURY

Sample 2222-RIN-01 (160-6694-7) was analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 05/22/2014 and analyzed on 05/27/2014.

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

MERCURY

Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for mercury in accordance with EPA SW-846 Method 7471B. The samples were prepared on 05/27/2014 and analyzed on 05/28/2014.

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

PERCENT SOLIDS

Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 05/17/2014.

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

TOTAL ALPHA RADIUM (GFPC)

Sample 2222-RIN-01 (160-6694-7) was analyzed for Total Alpha Radium (GFPC) in accordance with SW-846 Method 9315. The samples were prepared on 05/19/2014 and analyzed on 05/21/2014.

Insufficient volume of sample 2222-RIN-01 (160-6694-7) was available to perform a sample duplicate associated with total alpha radium batch 122912. A LCSD was performed.

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

RADIUM-228 (GFPC)

Sample 2222-RIN-01 (160-6694-7) was analyzed for Radium-228 (GFPC) in accordance with SW-846 Method 9320. The samples were prepared on 05/19/2014 and analyzed on 05/23/2014.

Insufficient volume of sample 2222-RIN-01 (160-6694-7) was available to perform a sample duplicate associated with radium-228 batch 122913. A LCSD was performed.

The barium carrier recovery was outside the upper control limit of 110% (114%). The blank activity is less than the MDC. The LCS/LCSD recoveries are within limits and all other carrier recoveries are acceptable. The laboratory believes this anomaly to be isolated to the blank and not indicative of the batch.

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

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 05/19/2014, prepared on 05/21/2014 and analyzed on 05/23/2014.

Samples contain rocks and are not homogeneous. Possible matrix interference: 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5), 2222-SD06 (160-6694-6).

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

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)
Sample 2222-RIN-01 (160-6694-7) was analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE. The samples were prepared on 05/20/2014 and analyzed on 05/21/2014.

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

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with DOE. The samples were dried on 05/19/2014, prepared on 05/21/2014 and analyzed on 05/23/2014.

Samples contain rocks and are not homogeneous. Possible matrix interference: 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5), 2222-SD06 (160-6694-6).

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

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)
Sample 2222-RIN-01 (160-6694-7) was analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with DOE. The samples were prepared on 05/20/2014 and analyzed on 05/21/2014.

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

CESIUM-137 & OTHER GAMMA EMITTERS (GS)
Sample 2222-RIN-01 (160-6694-7) was analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE. The samples were prepared on 05/19/2014 and analyzed on 05/20/2014.

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

RADIUM 226 (NO INGROWTH)
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for Radium 226 (No ingrowth) in accordance with GA-01-R. The samples were dried on 05/19/2014, and prepared and analyzed on 05/21/2014.

Radium-226 by gamma spectroscopy is typically determined by inference from daughters (e.g. bismuth-214) after sealing the sample in an appropriate counting geometry/container and waiting 21 days to allow the radium-226 decay chain through radon-222 to reach secular equilibrium. Such an approach is considered to be the most reliable and representative means for establishing the true radium-226 concentration in the sample. The method requested by the client to report radium-226, using its own 186 keV gamma-ray emission, is subject to interference and potential bias due to the 185.7 keV uranium-235 gamma ray. Experience also indicates gamma spectroscopy software does not consistently assign accurate peak areas to radium-226 (186 keV), with the problem compounded by slight drift of the instrumentation. The laboratory considers radium-226 reported based upon the 186 keV gamma-ray emission to be best used by the client in a qualitative fashion.

The reporting limit for radium-226 analyzed by gamma spectroscopy was not met. The data is reported: (160-6694-1 DU), (MB 160-123290/1-A), 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5), 2222-SD06 (160-6694-6).

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

Detection Summary

Client: Weston Solutions, Inc.
Project/Site: EPA Region 5 START 3 Contract

TestAmerica Job ID: 160-6694-1

Client Sample ID: 2222-SD01 — Lab Sample ID: 160-6694-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Aluminum	10000		270	57	mg/Kg	10	☼	6010C	Total/NA
Arsenic	4.2	J	13	3.1	mg/Kg	10	☼	6010C	Total/NA
Barium	150		66	1.5	mg/Kg	10	☼	6010C	Total/NA
Cadmium	0.80	J	6.6	0.45	mg/Kg	10	☼	6010C	Total/NA
Calcium	5200		3300	89	mg/Kg	10	☼	6010C	Total/NA
Chromium	44		13	1.8	mg/Kg	10	☼	6010C	Total/NA
Cobalt	10	J	66	1.9	mg/Kg	10	☼	6010C	Total/NA
Copper	41		33	3.3	mg/Kg	10	☼	6010C	Total/NA
Iron	16000		130	26	mg/Kg	10	☼	6010C	Total/NA
Lead	120		13	1.7	mg/Kg	10	☼	6010C	Total/NA
Magnesium	5000		1300	42	mg/Kg	10	☼	6010C	Total/NA
Manganese	220		13	1.1	mg/Kg	10	☼	6010C	Total/NA
Nickel	20	J	53	1.5	mg/Kg	10	☼	6010C	Total/NA
Potassium	1100	J	6600	960	mg/Kg	10	☼	6010C	Total/NA
Sodium	150	J	1300	100	mg/Kg	10	☼	6010C	Total/NA
Vanadium	24	J	66	6.7	mg/Kg	10	☼	6010C	Total/NA
Zinc	170	B	66	7.5	mg/Kg	10	☼	6010C	Total/NA
Mercury	0.097		0.041	0.014	mg/Kg	1	☼	7471B	Total/NA

Client Sample ID: 2222-SD02 — Lab Sample ID: 160-6694-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Aluminum	5000		240	51	mg/Kg	10	☼	6010C	Total/NA
Barium	41	J	60	1.3	mg/Kg	10	☼	6010C	Total/NA
Calcium	26000		3000	80	mg/Kg	10	☼	6010C	Total/NA
Chromium	26		12	1.6	mg/Kg	10	☼	6010C	Total/NA
Cobalt	8.3	J	60	1.7	mg/Kg	10	☼	6010C	Total/NA
Copper	42		30	2.9	mg/Kg	10	☼	6010C	Total/NA
Iron	12000		120	24	mg/Kg	10	☼	6010C	Total/NA
Lead	71		12	1.5	mg/Kg	10	☼	6010C	Total/NA
Magnesium	10000		1200	38	mg/Kg	10	☼	6010C	Total/NA
Manganese	150		12	0.95	mg/Kg	10	☼	6010C	Total/NA
Nickel	16	J	48	1.4	mg/Kg	10	☼	6010C	Total/NA
Potassium	1000	J	6000	860	mg/Kg	10	☼	6010C	Total/NA
Sodium	140	J	1200	91	mg/Kg	10	☼	6010C	Total/NA
Vanadium	14	J	60	6.0	mg/Kg	10	☼	6010C	Total/NA
Zinc	140	B	60	6.7	mg/Kg	10	☼	6010C	Total/NA
Mercury	0.043	J	0.050	0.017	mg/Kg	1	☼	7471B	Total/NA

Client Sample ID: 2222-SD03 — Lab Sample ID: 160-6694-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Aluminum	11000		350	76	mg/Kg	10	☼	6010C	Total/NA
Antimony	5.7	J	18	5.5	mg/Kg	10	☼	6010C	Total/NA
Arsenic	5.7	J	18	4.2	mg/Kg	10	☼	6010C	Total/NA
Barium	100		89	1.9	mg/Kg	10	☼	6010C	Total/NA
Cadmium	1.2	J	8.9	0.60	mg/Kg	10	☼	6010C	Total/NA
Calcium	17000		4400	120	mg/Kg	10	☼	6010C	Total/NA
Chromium	610		18	2.4	mg/Kg	10	☼	6010C	Total/NA
Cobalt	16	J	89	2.6	mg/Kg	10	☼	6010C	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: 2222-SD03 (Continued) — Lab Sample ID: 160-6694-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Copper	140		44	4.3	mg/Kg	10	☼	6010C	Total/NA
Iron	23000		180	35	mg/Kg	10	☼	6010C	Total/NA
Lead	290		18	2.3	mg/Kg	10	☼	6010C	Total/NA
Magnesium	7900		1800	56	mg/Kg	10	☼	6010C	Total/NA
Manganese	300		18	1.4	mg/Kg	10	☼	6010C	Total/NA
Nickel	40	J	71	2.1	mg/Kg	10	☼	6010C	Total/NA
Potassium	1800	J	8900	1300	mg/Kg	10	☼	6010C	Total/NA
Sodium	180	J	1800	140	mg/Kg	10	☼	6010C	Total/NA
Vanadium	33	J	89	9.0	mg/Kg	10	☼	6010C	Total/NA
Zinc	430	B	89	10	mg/Kg	10	☼	6010C	Total/NA
Mercury	0.18		0.061	0.020	mg/Kg	1	☼	7471B	Total/NA

Client Sample ID: 2222-SD04 — Lab Sample ID: 160-6694-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Aluminum	9100		690	150	mg/Kg	10	☼	6010C	Total/NA
Arsenic	26	J	35	8.2	mg/Kg	10	☼	6010C	Total/NA
Barium	100	J	170	3.8	mg/Kg	10	☼	6010C	Total/NA
Cadmium	3.5	J	17	1.2	mg/Kg	10	☼	6010C	Total/NA
Calcium	17000		8600	230	mg/Kg	10	☼	6010C	Total/NA
Chromium	70		35	4.8	mg/Kg	10	☼	6010C	Total/NA
Cobalt	19	J	170	5.0	mg/Kg	10	☼	6010C	Total/NA
Copper	210		86	8.5	mg/Kg	10	☼	6010C	Total/NA
Iron	28000		350	69	mg/Kg	10	☼	6010C	Total/NA
Lead	520		35	4.5	mg/Kg	10	☼	6010C	Total/NA
Magnesium	7000		3500	110	mg/Kg	10	☼	6010C	Total/NA
Manganese	320		35	2.8	mg/Kg	10	☼	6010C	Total/NA
Nickel	58	J	140	4.0	mg/Kg	10	☼	6010C	Total/NA
Sodium	900	J	3500	260	mg/Kg	10	☼	6010C	Total/NA
Vanadium	23	J	170	18	mg/Kg	10	☼	6010C	Total/NA
Zinc	760	B	170	19	mg/Kg	10	☼	6010C	Total/NA
Mercury	0.045	J	0.10	0.035	mg/Kg	1	☼	7471B	Total/NA

Client Sample ID: 2222-SD05 — Lab Sample ID: 160-6694-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Aluminum	4200		260	55	mg/Kg	10	☼	6010C	Total/NA
Barium	16	J	65	1.4	mg/Kg	10	☼	6010C	Total/NA
Calcium	16000		3200	87	mg/Kg	10	☼	6010C	Total/NA
Chromium	18		13	1.8	mg/Kg	10	☼	6010C	Total/NA
Cobalt	9.0	J	65	1.9	mg/Kg	10	☼	6010C	Total/NA
Copper	38		32	3.2	mg/Kg	10	☼	6010C	Total/NA
Iron	15000		130	26	mg/Kg	10	☼	6010C	Total/NA
Lead	42		13	1.7	mg/Kg	10	☼	6010C	Total/NA
Magnesium	6500		1300	41	mg/Kg	10	☼	6010C	Total/NA
Manganese	130		13	1.0	mg/Kg	10	☼	6010C	Total/NA
Nickel	17	J	52	1.5	mg/Kg	10	☼	6010C	Total/NA
Sodium	110	J	1300	99	mg/Kg	10	☼	6010C	Total/NA
Vanadium	13	J	65	6.6	mg/Kg	10	☼	6010C	Total/NA
Zinc	130	B	65	7.3	mg/Kg	10	☼	6010C	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: 2222-SD05 (Continued)

Lab Sample ID: 160-6694-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Mercury	0.11		0.038	0.013	mg/Kg	1	☼	7471B	Total/NA

Client Sample ID: 2222-SD06

Lab Sample ID: 160-6694-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Aluminum	10000		310	66	mg/Kg	10	☼	6010C	Total/NA
Antimony	5.3	J	15	4.8	mg/Kg	10	☼	6010C	Total/NA
Arsenic	5.6	J	15	3.6	mg/Kg	10	☼	6010C	Total/NA
Barium	99		77	1.7	mg/Kg	10	☼	6010C	Total/NA
Cadmium	2.0	J	7.7	0.53	mg/Kg	10	☼	6010C	Total/NA
Calcium	29000		3900	100	mg/Kg	10	☼	6010C	Total/NA
Chromium	510		15	2.1	mg/Kg	10	☼	6010C	Total/NA
Cobalt	18	J	77	2.2	mg/Kg	10	☼	6010C	Total/NA
Copper	180		39	3.8	mg/Kg	10	☼	6010C	Total/NA
Iron	22000		150	31	mg/Kg	10	☼	6010C	Total/NA
Lead	390		15	2.0	mg/Kg	10	☼	6010C	Total/NA
Magnesium	8500		1500	49	mg/Kg	10	☼	6010C	Total/NA
Manganese	260		15	1.2	mg/Kg	10	☼	6010C	Total/NA
Nickel	38	J	62	1.8	mg/Kg	10	☼	6010C	Total/NA
Potassium	1600	J	7700	1100	mg/Kg	10	☼	6010C	Total/NA
Sodium	170	J	1500	120	mg/Kg	10	☼	6010C	Total/NA
Vanadium	31	J	77	7.8	mg/Kg	10	☼	6010C	Total/NA
Zinc	550	B	77	8.7	mg/Kg	10	☼	6010C	Total/NA
Mercury	0.24		0.056	0.019	mg/Kg	1	☼	7471B	Total/NA

Client Sample ID: 2222-RIN-01

Lab Sample ID: 160-6694-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Zinc	9.2	J	20	8.3	ug/L	1		6010C	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: 2222-SD01
Date Collected: 05/15/14 08:25
Date Received: 05/16/14 06:45

Lab Sample ID: 160-6694-1
Matrix: Solid
Percent Solids: 72.3

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**10000**		270	57	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Antimony	4.1	U	13	4.1	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Arsenic	**4.2**	**J**	13	3.1	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Barium	**150**		66	1.5	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Beryllium	1.0	U	6.6	1.0	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Cadmium	**0.80**	**J**	6.6	0.45	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Calcium	**5200**		3300	89	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Chromium	**44**		13	1.8	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Cobalt	**10**	**J**	66	1.9	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Copper	**41**		33	3.3	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Iron	**16000**		130	26	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Lead	**120**		13	1.7	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Magnesium	**5000**		1300	42	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Manganese	**220**		13	1.1	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Nickel	**20**	**J**	53	1.5	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Potassium	**1100**	**J**	6600	960	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Selenium	2.7	U	20	2.7	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Silver	0.93	U	13	0.93	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Sodium	**150**	**J**	1300	100	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Thallium	2.5	U	27	2.5	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Vanadium	**24**	**J**	66	6.7	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10
Zinc	**170**	**B**	66	7.5	mg/Kg	☼	05/19/14 08:37	05/22/14 15:31	10

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.097**		0.041	0.014	mg/Kg	☼	05/27/14 10:17	05/28/14 09:35	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	**0.320**		0.133	0.136	1.00	0.115	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-230	**0.578**		0.169	0.176	1.00	0.0779	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-232	**0.333**		0.127	0.130	1.00	0.0545	pCi/g	05/21/14 09:37	05/23/14 19:02	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*78.2*		*30 - 110*	*05/21/14 09:37*	*05/23/14 19:02*	*1*

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	**0.585**		0.199	0.205	1.00	0.111	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-235/236	0.0165	U	0.0413	0.0413	1.00	0.0924	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-238	**0.352**		0.153	0.156	1.00	0.0846	pCi/g	05/21/14 09:37	05/23/14 18:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*60.1*		*30 - 110*	*05/21/14 09:37*	*05/23/14 18:57*	*1*

Client Sample ID: 2222-SD01 — Lab Sample ID: 160-6694-1

Date Collected: 05/15/14 08:25 — **Matrix: Solid**
Date Received: 05/16/14 06:45

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.780	U	1.07	1.08	1.00	1.87	pCi/g	05/21/14 11:19	05/21/14 12:22	1
Radium-228	**0.628**		0.189	0.199		0.322	pCi/g	05/21/14 11:19	05/21/14 12:22	1
Lead-210	0.877	U	1.34	1.35		2.40	pCi/g	05/21/14 11:19	05/21/14 12:22	1
Lead-212	**0.586**		0.159	0.176		0.161	pCi/g	05/21/14 11:19	05/21/14 12:22	1
Lead-214	**0.451**		0.143	0.150		0.174	pCi/g	05/21/14 11:19	05/21/14 12:22	1

Client Sample ID: 2222-SD02 — Lab Sample ID: 160-6694-2

Date Collected: 05/15/14 09:45 — **Matrix: Solid**
Date Received: 05/16/14 06:45 — **Percent Solids: 71.9**

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**5000**		240	51	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Antimony	3.7	U	12	3.7	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Arsenic	2.8	U	12	2.8	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Barium	**41**	**J**	60	1.3	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Beryllium	0.89	U	6.0	0.89	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Cadmium	0.40	U	6.0	0.40	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Calcium	**26000**		3000	80	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Chromium	**26**		12	1.6	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Cobalt	**8.3**	**J**	60	1.7	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Copper	**42**		30	2.9	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Iron	**12000**		120	24	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Lead	**71**		12	1.5	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Magnesium	**10000**		1200	38	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Manganese	**150**		12	0.95	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Nickel	**16**	**J**	48	1.4	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Potassium	**1000**	**J**	6000	860	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Selenium	2.5	U	18	2.5	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Silver	0.83	U	12	0.83	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Sodium	**140**	**J**	1200	91	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Thallium	2.3	U	24	2.3	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Vanadium	**14**	**J**	60	6.0	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10
Zinc	**140**	**B**	60	6.7	mg/Kg	☼	05/19/14 08:37	05/22/14 15:54	10

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.043**	**J**	0.050	0.017	mg/Kg	☼	05/27/14 10:17	05/28/14 09:37	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	**0.314**		0.123	0.126	1.00	0.0840	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-230	**0.417**		0.139	0.143	1.00	0.0593	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-232	**0.321**		0.123	0.125	1.00	0.0693	pCi/g	05/21/14 09:37	05/23/14 19:02	1

Client Sample ID: 2222-SD02 — Lab Sample ID: 160-6694-2

Date Collected: 05/15/14 09:45 — **Matrix: Solid**
Date Received: 05/16/14 06:45

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	83.0		30 - 110	05/21/14 09:37	05/23/14 19:02	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	**0.369**		0.131	0.134	1.00	0.0647	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-235/236	0.0230	U	0.0407	0.0408	1.00	0.0735	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-238	**0.459**		0.145	0.151	1.00	0.0645	pCi/g	05/21/14 09:37	05/23/14 18:57	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	81.5		30 - 110	05/21/14 09:37	05/23/14 18:57	1

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.231	U	0.799	0.800	1.00	1.44	pCi/g	05/21/14 11:19	05/21/14 14:32	1
Radium-228	**0.647**		0.160	0.173		0.208	pCi/g	05/21/14 11:19	05/21/14 14:32	1
Lead-210	-0.270	U	1.54	1.54		1.95	pCi/g	05/21/14 11:19	05/21/14 14:32	1
Lead-212	**0.472**		0.110	0.126		0.119	pCi/g	05/21/14 11:19	05/21/14 14:32	1
Lead-214	**0.450**		0.116	0.125		0.119	pCi/g	05/21/14 11:19	05/21/14 14:32	1

Client Sample ID: 2222-SD03 — Lab Sample ID: 160-6694-3

Date Collected: 05/15/14 08:50 — **Matrix: Solid**
Date Received: 05/16/14 06:45 — **Percent Solids: 52.4**

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**11000**		350	76	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Antimony	**5.7**	**J**	18	5.5	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Arsenic	**5.7**	**J**	18	4.2	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Barium	**100**		89	1.9	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Beryllium	1.3	U	8.9	1.3	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Cadmium	**1.2**	**J**	8.9	0.60	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Calcium	**17000**		4400	120	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Chromium	**610**		18	2.4	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Cobalt	**16**	**J**	89	2.6	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Copper	**140**		44	4.3	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Iron	**23000**		180	35	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Lead	**290**		18	2.3	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Magnesium	**7900**		1800	56	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Manganese	**300**		18	1.4	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Nickel	**40**	**J**	71	2.1	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Potassium	**1800**	**J**	8900	1300	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Selenium	3.7	U	27	3.7	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Silver	1.2	U	18	1.2	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Sodium	**180**	**J**	1800	140	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Thallium	3.4	U	35	3.4	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Vanadium	**33**	**J**	89	9.0	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10
Zinc	**430**	**B**	89	10	mg/Kg	☼	05/19/14 08:37	05/22/14 15:58	10

Client Sample ID: 2222-SD03 — Lab Sample ID: 160-6694-3

Date Collected: 05/15/14 08:50 — **Matrix: Solid**
Date Received: 05/16/14 06:45 — **Percent Solids: 52.4**

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.18		0.061	0.020	mg/Kg	☼	05/27/14 10:17	05/28/14 09:39	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.07		0.235	0.251	1.00	0.0898	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-230	0.745		0.194	0.204	1.00	0.0379	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-232	0.604		0.174	0.181	1.00	0.0377	pCi/g	05/21/14 09:37	05/23/14 19:02	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*72.2*		*30 - 110*	*05/21/14 09:37*	*05/23/14 19:02*	*1*

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.666		0.172	0.181	1.00	0.0706	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-235/236	0.0110	U	0.0276	0.0276	1.00	0.0618	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-238	0.591		0.162	0.169	1.00	0.0665	pCi/g	05/21/14 09:37	05/23/14 18:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*88.0*		*30 - 110*	*05/21/14 09:37*	*05/23/14 18:57*	*1*

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	2.86		2.01	2.07	1.00	2.56	pCi/g	05/21/14 11:19	05/21/14 14:26	1
Radium-228	0.913		0.302	0.316		0.507	pCi/g	05/21/14 11:19	05/21/14 14:26	1
Lead-210	4.29		2.24	2.29		3.09	pCi/g	05/21/14 11:19	05/21/14 14:26	1
Lead-212	0.619		0.197	0.213		0.219	pCi/g	05/21/14 11:19	05/21/14 14:26	1
Lead-214	0.754		0.184	0.200		0.163	pCi/g	05/21/14 11:19	05/21/14 14:26	1

Client Sample ID: 2222-SD04 — Lab Sample ID: 160-6694-4

Date Collected: 05/15/14 09:05 — **Matrix: Solid**
Date Received: 05/16/14 06:45 — **Percent Solids: 28.6**

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	9100		690	150	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Antimony	11	U	35	11	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Arsenic	26	J	35	8.2	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Barium	100	J	170	3.8	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Beryllium	2.6	U	17	2.6	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Cadmium	3.5	J	17	1.2	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Calcium	17000		8600	230	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Chromium	70		35	4.8	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Cobalt	19	J	170	5.0	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Copper	210		86	8.5	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Iron	28000		350	69	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10

Client Sample ID: 2222-SD04 **Lab Sample ID: 160-6694-4**
Date Collected: 05/15/14 09:05 **Matrix: Solid**
Date Received: 05/16/14 06:45 **Percent Solids: 28.6**

Method: 6010C - Metals (ICP) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	520		35	4.5	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Magnesium	7000		3500	110	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Manganese	320		35	2.8	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Nickel	58	J	140	4.0	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Potassium	2500	U	17000	2500	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Selenium	7.1	U	52	7.1	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Silver	2.4	U	35	2.4	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Sodium	900	J	3500	260	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Thallium	6.6	U	69	6.6	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Vanadium	23	J	170	18	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10
Zinc	760	B	170	19	mg/Kg	☼	05/19/14 08:37	05/22/14 16:02	10

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.045	J	0.10	0.035	mg/Kg	☼	05/27/14 10:17	05/28/14 09:41	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.561		0.165	0.172	1.00	0.103	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-230	0.695		0.178	0.188	1.00	0.0520	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-232	0.445		0.143	0.148	1.00	0.0562	pCi/g	05/21/14 09:37	05/23/14 19:02	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*83.6*		*30 - 110*	*05/21/14 09:37*	*05/23/14 19:02*	*1*

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	1.15		0.234	0.253	1.00	0.0672	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-235/236	0.0854		0.0722	0.0726	1.00	0.0669	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-238	1.08		0.226	0.244	1.00	0.0537	pCi/g	05/21/14 09:37	05/23/14 18:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*83.5*		*30 - 110*	*05/21/14 09:37*	*05/23/14 18:57*	*1*

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	4.76		1.85	2.02	1.00	1.96	pCi/g	05/21/14 11:19	05/21/14 14:27	1
Radium-228	0.763		0.243	0.255		0.369	pCi/g	05/21/14 11:19	05/21/14 14:27	1
Lead-210	4.05		2.62	2.67		3.95	pCi/g	05/21/14 11:19	05/21/14 14:27	1
Lead-212	0.767		0.169	0.196		0.195	pCi/g	05/21/14 11:19	05/21/14 14:27	1
Lead-214	0.690		0.186	0.200		0.213	pCi/g	05/21/14 11:19	05/21/14 14:27	1

Client Sample ID: 2222-SD05
Date Collected: 05/15/14 09:15
Date Received: 05/16/14 06:45

Lab Sample ID: 160-6694-5
Matrix: Solid
Percent Solids: 76.9

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**4200**		260	55	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Antimony	4.0	U	13	4.0	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Arsenic	3.1	U	13	3.1	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Barium	**16**	**J**	65	1.4	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Beryllium	0.97	U	6.5	0.97	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Cadmium	0.44	U	6.5	0.44	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Calcium	**16000**		3200	87	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Chromium	**18**		13	1.8	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Cobalt	**9.0**	**J**	65	1.9	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Copper	**38**		32	3.2	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Iron	**15000**		130	26	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Lead	**42**		13	1.7	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Magnesium	**6500**		1300	41	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Manganese	**130**		13	1.0	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Nickel	**17**	**J**	52	1.5	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Potassium	940	U	6500	940	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Selenium	2.7	U	19	2.7	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Silver	0.91	U	13	0.91	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Sodium	**110**	**J**	1300	99	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Thallium	2.5	U	26	2.5	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Vanadium	**13**	**J**	65	6.6	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10
Zinc	**130**	**B**	65	7.3	mg/Kg	☼	05/19/14 08:37	05/22/14 16:06	10

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.11**		0.038	0.013	mg/Kg	☼	05/27/14 10:17	05/28/14 09:43	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	**0.296**		0.117	0.120	1.00	0.0829	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-230	**0.296**		0.115	0.118	1.00	0.0662	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-232	**0.282**		0.111	0.113	1.00	0.0523	pCi/g	05/21/14 09:37	05/23/14 19:02	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*87.9*		*30 - 110*	*05/21/14 09:37*	*05/23/14 19:02*	*1*

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	**0.289**		0.120	0.122	1.00	0.0831	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-235/236	-0.00545	U	0.00771	0.00773	1.00	0.0756	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-238	**0.243**		0.107	0.109	1.00	0.0531	pCi/g	05/21/14 09:37	05/23/14 18:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*85.0*		*30 - 110*	*05/21/14 09:37*	*05/23/14 18:57*	*1*

Client Sample ID: 2222-SD05

Lab Sample ID: 160-6694-5

Date Collected: 05/15/14 09:15

Matrix: Solid

Date Received: 05/16/14 06:45

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.109	U	1.08	1.09	1.00	2.00	pCi/g	05/21/14 11:19	05/21/14 15:46	1
Radium-228	**0.554**		0.221	0.229		0.176	pCi/g	05/21/14 11:19	05/21/14 15:46	1
Lead-210	1.53	U	1.41	1.43		2.16	pCi/g	05/21/14 11:19	05/21/14 15:46	1
Lead-212	**0.450**		0.121	0.134		0.121	pCi/g	05/21/14 11:19	05/21/14 15:46	1
Lead-214	**0.353**		0.107	0.113		0.166	pCi/g	05/21/14 11:19	05/21/14 15:46	1

Client Sample ID: 2222-SD06

Lab Sample ID: 160-6694-6

Date Collected: 05/15/14 08:45

Matrix: Solid

Date Received: 05/16/14 06:45

Percent Solids: 54.9

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**10000**		310	66	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Antimony	**5.3**	**J**	15	4.8	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Arsenic	**5.6**	**J**	15	3.6	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Barium	**99**		77	1.7	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Beryllium	1.2	U	7.7	1.2	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Cadmium	**2.0**	**J**	7.7	0.53	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Calcium	**29000**		3900	100	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Chromium	**510**		15	2.1	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Cobalt	**18**	**J**	77	2.2	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Copper	**180**		39	3.8	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Iron	**22000**		150	31	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Lead	**390**		15	2.0	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Magnesium	**8500**		1500	49	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Manganese	**260**		15	1.2	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Nickel	**38**	**J**	62	1.8	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Potassium	**1600**	**J**	7700	1100	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Selenium	3.2	U	23	3.2	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Silver	1.1	U	15	1.1	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Sodium	**170**	**J**	1500	120	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Thallium	2.9	U	31	2.9	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Vanadium	**31**	**J**	77	7.8	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10
Zinc	**550**	**B**	77	8.7	mg/Kg	☼	05/19/14 08:37	05/22/14 16:10	10

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.24**		0.056	0.019	mg/Kg	☼	05/27/14 10:17	05/28/14 09:45	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	**0.520**		0.157	0.163	1.00	0.0666	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-230	**0.548**		0.161	0.167	1.00	0.0533	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-232	**0.586**		0.166	0.173	1.00	0.0530	pCi/g	05/21/14 09:37	05/23/14 19:02	1

Client Sample ID: 2222-SD06 — Lab Sample ID: 160-6694-6

Date Collected: 05/15/14 08:45 — **Matrix: Solid**
Date Received: 05/16/14 06:45

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	81.1		30 - 110	05/21/14 09:37	05/23/14 19:02	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	**0.859**		0.198	0.211	1.00	0.0796	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-235/236	-0.00784	U	0.00906	0.00908	1.00	0.0793	pCi/g	05/21/14 09:37	05/23/14 18:57	1
Uranium-238	**0.588**		0.163	0.170	1.00	0.0581	pCi/g	05/21/14 09:37	05/23/14 18:57	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	87.3		30 - 110	05/21/14 09:37	05/23/14 18:57	1

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	**2.93**		1.63	1.71	1.00	1.92	pCi/g	05/21/14 11:19	05/21/14 15:45	1
Radium-228	**0.608**		0.220	0.229		0.434	pCi/g	05/21/14 11:19	05/21/14 15:45	1
Lead-210	**3.67**		1.60	1.66		2.17	pCi/g	05/21/14 11:19	05/21/14 15:45	1
Lead-212	**0.811**		0.204	0.229		0.194	pCi/g	05/21/14 11:19	05/21/14 15:45	1
Lead-214	**0.664**		0.159	0.174		0.155	pCi/g	05/21/14 11:19	05/21/14 15:45	1

Client Sample ID: 2222-RIN-01 — Lab Sample ID: 160-6694-7

Date Collected: 05/15/14 08:10 — **Matrix: Water**
Date Received: 05/16/14 06:45

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	22	U	200	22	ug/L		05/19/14 10:57	05/22/14 13:15	1
Antimony	3.7	U	10	3.7	ug/L		05/19/14 10:57	05/22/14 13:15	1
Arsenic	1.8	U	10	1.8	ug/L		05/19/14 10:57	05/22/14 13:15	1
Barium	2.1	U	50	2.1	ug/L		05/19/14 10:57	05/22/14 13:15	1
Beryllium	0.28	U	5.0	0.28	ug/L		05/19/14 10:57	05/22/14 13:15	1
Cadmium	0.34	U	5.0	0.34	ug/L		05/19/14 10:57	05/22/14 13:15	1
Calcium	54	U	1000	54	ug/L		05/19/14 10:57	05/22/14 13:15	1
Chromium	3.4	U	10	3.4	ug/L		05/19/14 10:57	05/22/14 13:15	1
Cobalt	2.7	U	50	2.7	ug/L		05/19/14 10:57	05/22/14 13:15	1
Copper	2.1	U	25	2.1	ug/L		05/19/14 10:57	05/22/14 13:15	1
Iron	13	U	100	13	ug/L		05/19/14 10:57	05/22/14 13:15	1
Lead	0.60	U	10	0.60	ug/L		05/19/14 10:57	05/22/14 13:15	1
Magnesium	51	U	1000	51	ug/L		05/19/14 10:57	05/22/14 13:15	1
Manganese	1.0	U	15	1.0	ug/L		05/19/14 10:57	05/22/14 13:15	1
Nickel	2.6	U	40	2.6	ug/L		05/19/14 10:57	05/22/14 13:15	1
Potassium	460	U	5000	460	ug/L		05/19/14 10:57	05/22/14 13:15	1
Selenium	2.1	U	15	2.1	ug/L		05/19/14 10:57	05/22/14 13:15	1
Silver	0.99	U	10	0.99	ug/L		05/19/14 10:57	05/22/14 13:15	1
Sodium	110	U	1000	110	ug/L		05/19/14 10:57	05/22/14 13:15	1
Thallium	2.4	U	20	2.4	ug/L		05/19/14 10:57	05/22/14 13:15	1
Vanadium	4.4	U	50	4.4	ug/L		05/19/14 10:57	05/22/14 13:15	1
Zinc	**9.2**	**J**	20	8.3	ug/L		05/19/14 10:57	05/22/14 13:15	1

Client Sample ID: 2222-RIN-01
Date Collected: 05/15/14 08:10
Date Received: 05/16/14 06:45

Lab Sample ID: 160-6694-7
Matrix: Water

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.060	U	0.20	0.060	ug/L		05/22/14 07:51	05/27/14 10:12	1

Method: 9315 - Total Apha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0991	U	0.130	0.130	1.00	0.217	pCi/L	05/19/14 13:41	05/21/14 16:16	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*91.4*		*40 - 110*	*05/19/14 13:41*	*05/21/14 16:16*	*1*

Method: 9320 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	0.0584	U	0.181	0.181	1.00	0.314	pCi/L	05/19/14 13:43	05/23/14 09:50	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*98.2*		*40 - 110*	*05/19/14 13:43*	*05/23/14 09:50*	*1*
Y Carrier	*88.2*		*40 - 110*	*05/19/14 13:43*	*05/23/14 09:50*	*1*

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0369	U	0.0789	0.0789	1.00	0.156	pCi/L	05/20/14 13:36	05/21/14 19:04	1
Thorium-230	**0.132**		0.108	0.108	1.00	0.0717	pCi/L	05/20/14 13:36	05/21/14 19:04	1
Thorium-232	-0.00817	U	0.0116	0.0116	1.00	0.113	pCi/L	05/20/14 13:36	05/21/14 19:04	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.0*		*30 - 110*	*05/20/14 13:36*	*05/21/14 19:04*	*1*

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	**0.147**		0.118	0.118	1.00	0.115	pCi/L	05/20/14 13:36	05/21/14 17:20	1
Uranium-235/236	0.0275	U	0.0551	0.0551	1.00	0.0826	pCi/L	05/20/14 13:36	05/21/14 17:20	1
Uranium-238	0.0842	U	0.0887	0.0890	1.00	0.101	pCi/L	05/20/14 13:36	05/21/14 17:20	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*88.0*		*30 - 110*	*05/20/14 13:36*	*05/21/14 17:20*	*1*

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-1.19	U	7.49	7.49	20.0	13.4	pCi/L	05/19/14 12:24	05/20/14 13:46	1

Default Detection Limits

Client: Weston Solutions, Inc.
Project/Site: EPA Region 5 START 3 Contract

TestAmerica Job ID: 160-6694-1

Method: 6010C - Metals (ICP)

Analyte	RL	MDL	Units	Method
Aluminum	20	4.3	mg/Kg	6010C
Aluminum	200	22	ug/L	6010C
Antimony	1.0	0.31	mg/Kg	6010C
Antimony	10	3.7	ug/L	6010C
Arsenic	1.0	0.24	mg/Kg	6010C
Arsenic	10	1.8	ug/L	6010C
Barium	5.0	0.11	mg/Kg	6010C
Barium	50	2.1	ug/L	6010C
Beryllium	0.50	0.075	mg/Kg	6010C
Beryllium	5.0	0.28	ug/L	6010C
Cadmium	0.50	0.034	mg/Kg	6010C
Cadmium	5.0	0.34	ug/L	6010C
Calcium	250	6.7	mg/Kg	6010C
Calcium	1000	54	ug/L	6010C
Chromium	1.0	0.14	mg/Kg	6010C
Chromium	10	3.4	ug/L	6010C
Cobalt	5.0	0.14	mg/Kg	6010C
Cobalt	50	2.7	ug/L	6010C
Copper	2.5	0.25	mg/Kg	6010C
Copper	25	2.1	ug/L	6010C
Iron	10	2.0	mg/Kg	6010C
Iron	100	13	ug/L	6010C
Lead	1.0	0.13	mg/Kg	6010C
Lead	10	0.60	ug/L	6010C
Magnesium	100	3.2	mg/Kg	6010C
Magnesium	1000	51	ug/L	6010C
Manganese	1.0	0.080	mg/Kg	6010C
Manganese	15	1.0	ug/L	6010C
Nickel	4.0	0.12	mg/Kg	6010C
Nickel	40	2.6	ug/L	6010C
Potassium	500	72	mg/Kg	6010C
Potassium	5000	460	ug/L	6010C
Selenium	1.5	0.21	mg/Kg	6010C
Selenium	15	2.1	ug/L	6010C
Silver	1.0	0.070	mg/Kg	6010C
Silver	10	0.99	ug/L	6010C
Sodium	100	7.6	mg/Kg	6010C
Sodium	1000	110	ug/L	6010C
Thallium	2.0	0.19	mg/Kg	6010C
Thallium	20	2.4	ug/L	6010C
Vanadium	5.0	0.51	mg/Kg	6010C
Vanadium	50	4.4	ug/L	6010C
Zinc	5.0	0.56	mg/Kg	6010C
Zinc	20	8.3	ug/L	6010C

Method: 7470A - Mercury (CVAA)

Analyte	RL	MDL	Units	Method
Mercury	0.20	0.060	ug/L	7470A

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Default Detection Limits

Client: Weston Solutions, Inc.
Project/Site: EPA Region 5 START 3 Contract

TestAmerica Job ID: 160-6694-1

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	RL	MDL	Units	Method
Mercury	0.033	0.011	mg/Kg	7471B

Tracer/Carrier Summary

Client: Weston Solutions, Inc.
Project/Site: EPA Region 5 START 3 Contract

TestAmerica Job ID: 160-6694-1

Method: 9315 - Total Apha Radium (GFPC)

Matrix: Water — **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
		Ba
Lab Sample ID	Client Sample ID	(40-110)
160-6694-7	2222-RIN-01	91.4
LCS 160-122912/2-A	Lab Control Sample	85.8
LCSD 160-122912/3-A	Lab Control Sample Dup	92.6
MB 160-122912/1-A	Method Blank	86.1

Tracer/Carrier Legend

Ba = Ba Carrier

Method: 9320 - Radium-228 (GFPC)

Matrix: Water — **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)	
		Ba	Y
Lab Sample ID	Client Sample ID	(40-110)	(40-110)
160-6694-7	2222-RIN-01	98.2	88.2
LCS 160-122913/2-A	Lab Control Sample	108	87.5
LCSD 160-122913/3-A	Lab Control Sample Dup	104	90.5
MB 160-122913/1-A	Method Blank	114 X	86.7

Tracer/Carrier Legend

Ba = Ba Carrier

Y = Y Carrier

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

Matrix: Solid — **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
		Th-229
Lab Sample ID	Client Sample ID	(30-110)
160-6694-1	2222-SD01	78.2
160-6694-2	2222-SD02	83.0
160-6694-3	2222-SD03	72.2
160-6694-4	2222-SD04	83.6
160-6694-5	2222-SD05	87.9
160-6694-6	2222-SD06	81.1
LCS 160-123276/2-A	Lab Control Sample	93.1
MB 160-123276/1-A	Method Blank	95.4

Tracer/Carrier Legend

Th-229 = Thorium-229

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

Matrix: Water — **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
		Th-229
Lab Sample ID	Client Sample ID	(30-110)
160-6694-7	2222-RIN-01	89.0
LCS 160-123197/2-A	Lab Control Sample	84.0
MB 160-123197/1-A	Method Blank	81.9

Tracer/Carrier Legend

Th-229 = Thorium-229

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

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
		U-232
Lab Sample ID	Client Sample ID	(30-110)
160-6694-1	2222-SD01	60.1
160-6694-2	2222-SD02	81.5
160-6694-3	2222-SD03	88.0
160-6694-4	2222-SD04	83.5
160-6694-5	2222-SD05	85.0
160-6694-6	2222-SD06	87.3
LCS 160-123278/2-A	Lab Control Sample	88.4
MB 160-123278/1-A	Method Blank	84.3

Tracer/Carrier Legend

U-232 = Uranium-232

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

Matrix: Water **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
		U-232
Lab Sample ID	Client Sample ID	(30-110)
160-6694-7	2222-RIN-01	88.0
LCS 160-123200/2-A	Lab Control Sample	79.8
MB 160-123200/1-A	Method Blank	89.8

Tracer/Carrier Legend

U-232 = Uranium-232

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 160-122752/1-A
Matrix: Solid
Analysis Batch: 123642

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 122752

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	3.8	U	18	3.8	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Antimony	0.27	U	0.88	0.27	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Arsenic	0.21	U	0.88	0.21	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Barium	0.097	U	4.4	0.097	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Beryllium	0.066	U	0.44	0.066	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Cadmium	0.030	U	0.44	0.030	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Calcium	5.9	U	220	5.9	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Chromium	0.12	U	0.88	0.12	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Cobalt	0.13	U	4.4	0.13	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Copper	0.22	U	2.2	0.22	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Iron	1.8	U	8.8	1.8	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Lead	0.11	U	0.88	0.11	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Magnesium	2.8	U	88	2.8	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Manganese	0.071	U	0.88	0.071	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Nickel	0.10	U	3.5	0.10	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Potassium	64	U	440	64	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Selenium	0.18	U	1.3	0.18	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Silver	0.062	U	0.88	0.062	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Sodium	6.7	U	88	6.7	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Thallium	0.17	U	1.8	0.17	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Vanadium	0.45	U	4.4	0.45	mg/Kg		05/19/14 08:37	05/22/14 15:24	1
Zinc	1.49	J	4.4	0.50	mg/Kg		05/19/14 08:37	05/22/14 15:24	1

Lab Sample ID: LCSSRM 160-122752/2-A
Matrix: Solid
Analysis Batch: 123642

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 122752

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	9390	6720		mg/Kg		71.6	43.5 - 156.5
Antimony	129	80.3		mg/Kg		62.2	22.4 - 249.6
Arsenic	88.4	87.7		mg/Kg		99.3	69.0 - 131.2
Barium	210	190		mg/Kg		90.7	73.3 - 126.7
Beryllium	55.8	54.0		mg/Kg		96.8	73.1 - 127.1
Cadmium	142	148		mg/Kg		104.3	73.2 - 128.2
Calcium	7530	8030		mg/Kg		106.6	74.6 - 125.4
Chromium	86.8	90.8		mg/Kg		104.6	69.1 - 131.3
Cobalt	199	217		mg/Kg		109.1	74.4 - 125.6
Copper	268	271		mg/Kg		101.2	76.1 - 123.9
Iron	12800	10400		mg/Kg		81.4	31.6 - 168.0

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: LCSSRM 160-122752/2-A
Matrix: Solid
Analysis Batch: 123642

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 122752

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec. Limits
Lead	97.9	104		mg/Kg		105.9	70.8 - 128.7
Magnesium	2850	2480		mg/Kg		86.9	65.3 - 134.7
Manganese	425	413		mg/Kg		97.1	76.2 - 123.5
Nickel	236	256		mg/Kg		108.7	74.2 - 128.0
Potassium	2570	2110		mg/Kg		82.2	61.1 - 138.9
Selenium	127	126		mg/Kg		99.4	66.6 - 133.9
Silver	66.2	65.3		mg/Kg		98.6	67.1 - 132.9
Sodium	1040	965		mg/Kg		92.8	60.4 - 139.4
Thallium	140	162		mg/Kg		115.9	68.3 - 132.1
Vanadium	156	145		mg/Kg		92.7	71.8 - 129.5
Zinc	130	130		mg/Kg		99.9	66.9 - 133.1

Lab Sample ID: 160-6694-1 MS
Matrix: Solid
Analysis Batch: 123642

Client Sample ID: 2222-SD01
Prep Type: Total/NA
Prep Batch: 122752

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	10000		1200	13800	4	mg/Kg	☼	299	75 - 125
Antimony	4.1	U	60.0	36.2	F1	mg/Kg	☼	60	75 - 125
Arsenic	4.2	J	120	127		mg/Kg	☼	103	75 - 125
Barium	150		120	236	F1	mg/Kg	☼	71	75 - 125
Beryllium	1.0	U	120	122		mg/Kg	☼	101	75 - 125
Cadmium	0.80	J	120	131		mg/Kg	☼	108	75 - 125
Calcium	5200		1200	6280	4	mg/Kg	☼	90	75 - 125
Chromium	44		120	169		mg/Kg	☼	104	75 - 125
Cobalt	10	J	120	146		mg/Kg	☼	113	75 - 125
Copper	41		120	169		mg/Kg	☼	106	75 - 125
Iron	16000		1200	17000	4	mg/Kg	☼	54	75 - 125
Lead	120		120	234		mg/Kg	☼	92	75 - 125
Magnesium	5000		1200	5850	4	mg/Kg	☼	69	75 - 125
Manganese	220		120	327		mg/Kg	☼	93	75 - 125
Nickel	20	J	120	157		mg/Kg	☼	114	75 - 125
Potassium	1100	J	1200	2450	J	mg/Kg	☼	114	75 - 125
Selenium	2.7	U	60.0	60.6		mg/Kg	☼	101	75 - 125
Silver	0.93	U	24.0	25.9		mg/Kg	☼	108	75 - 125
Sodium	150	J	1200	1380		mg/Kg	☼	102	75 - 125
Thallium	2.5	U	24.0	27.7		mg/Kg	☼	116	75 - 125
Vanadium	24	J	120	154		mg/Kg	☼	109	75 - 125
Zinc	170	B	120	267		mg/Kg	☼	80	75 - 125

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: 160-6694-1 MSD
Matrix: Solid
Analysis Batch: 123642

Client Sample ID: 2222-SD01
Prep Type: Total/NA
Prep Batch: 122752

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	10000		1360	15500	4	mg/Kg	☼	388	75 - 125	12	30
Antimony	4.1	U	68.2	41.1	F1	mg/Kg	☼	60	75 - 125	12	30
Arsenic	4.2	J	136	149		mg/Kg	☼	106	75 - 125	15	30
Barium	150		136	268		mg/Kg	☼	86	75 - 125	13	30
Beryllium	1.0	U	136	141		mg/Kg	☼	103	75 - 125	15	30
Cadmium	0.80	J	136	149		mg/Kg	☼	108	75 - 125	13	30
Calcium	5200		1360	4860	F1	mg/Kg	☼	-25	75 - 125	25	30
Chromium	44		136	184		mg/Kg	☼	103	75 - 125	8	30
Cobalt	10	J	136	164		mg/Kg	☼	112	75 - 125	11	30
Copper	41		136	184		mg/Kg	☼	105	75 - 125	9	30
Iron	16000		1360	17000	4	mg/Kg	☼	44	75 - 125	0	30
Lead	120		136	245		mg/Kg	☼	88	75 - 125	4	30
Magnesium	5000		1360	5780	F1	mg/Kg	☼	56	75 - 125	1	30
Manganese	220		136	325		mg/Kg	☼	81	75 - 125	1	30
Nickel	20	J	136	177		mg/Kg	☼	115	75 - 125	12	30
Potassium	1100	J	1360	2650	J	mg/Kg	☼	116	75 - 125	8	30
Selenium	2.7	U	68.2	72.4		mg/Kg	☼	106	75 - 125	18	30
Silver	0.93	U	27.3	28.8		mg/Kg	☼	106	75 - 125	10	30
Sodium	150	J	1360	1570		mg/Kg	☼	104	75 - 125	13	30
Thallium	2.5	U	27.3	32.6		mg/Kg	☼	120	75 - 125	16	30
Vanadium	24	J	136	173		mg/Kg	☼	110	75 - 125	12	30
Zinc	170	B	136	278		mg/Kg	☼	78	75 - 125	4	30

Lab Sample ID: MB 160-122863/1-A
Matrix: Water
Analysis Batch: 123642

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 122863

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	22	U	200	22	ug/L		05/19/14 10:57	05/22/14 12:45	1
Antimony	3.7	U	10	3.7	ug/L		05/19/14 10:57	05/22/14 12:45	1
Arsenic	1.8	U	10	1.8	ug/L		05/19/14 10:57	05/22/14 12:45	1
Barium	2.1	U	50	2.1	ug/L		05/19/14 10:57	05/22/14 12:45	1
Beryllium	0.28	U	5.0	0.28	ug/L		05/19/14 10:57	05/22/14 12:45	1
Cadmium	0.34	U	5.0	0.34	ug/L		05/19/14 10:57	05/22/14 12:45	1
Calcium	54	U	1000	54	ug/L		05/19/14 10:57	05/22/14 12:45	1
Chromium	3.4	U	10	3.4	ug/L		05/19/14 10:57	05/22/14 12:45	1
Cobalt	2.7	U	50	2.7	ug/L		05/19/14 10:57	05/22/14 12:45	1
Copper	2.1	U	25	2.1	ug/L		05/19/14 10:57	05/22/14 12:45	1
Iron	13	U	100	13	ug/L		05/19/14 10:57	05/22/14 12:45	1
Lead	0.60	U	10	0.60	ug/L		05/19/14 10:57	05/22/14 12:45	1
Magnesium	51	U	1000	51	ug/L		05/19/14 10:57	05/22/14 12:45	1
Manganese	1.0	U	15	1.0	ug/L		05/19/14 10:57	05/22/14 12:45	1
Nickel	2.6	U	40	2.6	ug/L		05/19/14 10:57	05/22/14 12:45	1
Potassium	460	U	5000	460	ug/L		05/19/14 10:57	05/22/14 12:45	1
Selenium	2.1	U	15	2.1	ug/L		05/19/14 10:57	05/22/14 12:45	1
Silver	0.99	U	10	0.99	ug/L		05/19/14 10:57	05/22/14 12:45	1
Sodium	110	U	1000	110	ug/L		05/19/14 10:57	05/22/14 12:45	1
Thallium	2.4	U	20	2.4	ug/L		05/19/14 10:57	05/22/14 12:45	1

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: MB 160-122863/1-A
Matrix: Water
Analysis Batch: 123642

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 122863

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Vanadium	4.4	U	50	4.4	ug/L		05/19/14 10:57	05/22/14 12:45	1
Zinc	8.3	U	20	8.3	ug/L		05/19/14 10:57	05/22/14 12:45	1

Lab Sample ID: LCS 160-122863/2-A
Matrix: Water
Analysis Batch: 123642

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 122863

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	10000	11000		ug/L		110	80 - 120
Antimony	500	540		ug/L		108	80 - 120
Arsenic	1000	1080		ug/L		108	80 - 120
Barium	1000	1090		ug/L		109	80 - 120
Beryllium	1000	1070		ug/L		107	80 - 120
Cadmium	1000	1110		ug/L		111	80 - 120
Calcium	10000	11100		ug/L		111	80 - 120
Chromium	1000	1110		ug/L		111	80 - 120
Cobalt	1000	1110		ug/L		111	80 - 120
Copper	1000	1150		ug/L		115	80 - 120
Iron	10000	10800		ug/L		108	80 - 120
Lead	1000	1140		ug/L		114	80 - 120
Magnesium	10000	9980		ug/L		100	80 - 120
Manganese	1000	1080		ug/L		108	80 - 120
Nickel	1000	1150		ug/L		115	80 - 120
Potassium	10000	11500		ug/L		115	80 - 120
Selenium	500	542		ug/L		108	80 - 120
Silver	200	211		ug/L		106	80 - 120
Sodium	10000	11700		ug/L		117	80 - 120
Thallium	200	238		ug/L		119	80 - 120
Vanadium	1000	1060		ug/L		106	80 - 120
Zinc	1000	1110		ug/L		111	80 - 120

Lab Sample ID: LRC 160-123642/10
Matrix: Water
Analysis Batch: 123642

Client Sample ID: Lab Control Sample

Analyte	Spike Added	LRC Result	LRC Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100000	104000		ug/L		104	90 - 110
Antimony	2000	2040		ug/L		102	90 - 110
Arsenic	10000	10100		ug/L		101	90 - 110
Barium	10000	10100		ug/L		101	90 - 110
Beryllium	10000	9940		ug/L		99	90 - 110
Cadmium	10000	10200		ug/L		102	90 - 110
Calcium	100000	98400		ug/L		98	90 - 110
Chromium	10000	9930		ug/L		99	90 - 110
Cobalt	10000	9810		ug/L		98	90 - 110
Copper	10000	10200		ug/L		102	90 - 110
Iron	100000	99000		ug/L		99	90 - 110
Lead	10000	9980		ug/L		100	90 - 110
Magnesium	100000	101000		ug/L		101	90 - 110

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: LRC 160-123642/10
Matrix: Water
Analysis Batch: 123642

Client Sample ID: Lab Control Sample

Analyte	Spike Added	LRC Result	LRC Qualifier	Unit	D	%Rec	%Rec. Limits
Manganese	10000	10000		ug/L		100	90 - 110
Nickel	10000	10000		ug/L		100	90 - 110
Potassium	100000	104000		ug/L		104	90 - 110
Selenium	2000	2030		ug/L		101	90 - 110
Silver	2000	2000		ug/L		100	90 - 110
Sodium	100000	102000		ug/L		102	90 - 110
Thallium	2000	1950		ug/L		98	90 - 110
Vanadium	10000	9870		ug/L		99	90 - 110
Zinc	10000	10000		ug/L		100	90 - 110

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 160-123407/1-A
Matrix: Water
Analysis Batch: 123936

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 123407

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.060	U	0.20	0.060	ug/L		05/22/14 07:51	05/27/14 10:12	1

Lab Sample ID: LCS 160-123407/2-A
Matrix: Water
Analysis Batch: 123936

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 123407

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	5.00	4.74		ug/L		95	80 - 120

Lab Sample ID: 160-6694-7 MS
Matrix: Water
Analysis Batch: 123936

Client Sample ID: 2222-RIN-01
Prep Type: Total/NA
Prep Batch: 123407

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.060	U	5.00	5.11		ug/L		102	80 - 120

Lab Sample ID: 160-6694-7 MSD
Matrix: Water
Analysis Batch: 123936

Client Sample ID: 2222-RIN-01
Prep Type: Total/NA
Prep Batch: 123407

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.060	U	5.00	5.05		ug/L		101	80 - 120	1	20

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Lab Sample ID: MB 160-123919/1-A
Matrix: Solid
Analysis Batch: 124146

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 123919

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.010	U	0.030	0.010	mg/Kg		05/27/14 10:17	05/28/14 09:31	1

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique) (Continued)

Lab Sample ID: LCSSRM 160-123919/2-A
Matrix: Solid
Analysis Batch: 124146

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 123919

Analyte			Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec. Limits		
Mercury			9.03	7.70		mg/Kg		85.3	51.3 - 148.4		

Lab Sample ID: 160-6694-6 MS
Matrix: Solid
Analysis Batch: 124146

Client Sample ID: 2222-SD06
Prep Type: Total/NA
Prep Batch: 123919

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Mercury	0.24		1.47	1.59		mg/Kg	☼	92	80 - 120		

Lab Sample ID: 160-6694-6 MSD
Matrix: Solid
Analysis Batch: 124146

Client Sample ID: 2222-SD06
Prep Type: Total/NA
Prep Batch: 123919

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.24		1.32	1.36		mg/Kg	☼	84	80 - 120	16	30

Method: 9315 - Total Apha Radium (GFPC)

Lab Sample ID: MB 160-122912/1-A
Matrix: Water
Analysis Batch: 123289

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 122912

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.01052	U	0.0992	0.0992	1.00	0.198	pCi/L	05/19/14 13:41	05/21/14 16:15	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*86.1*		*40 - 110*	*05/19/14 13:41*	*05/21/14 16:15*	*1*

Lab Sample ID: LCS 160-122912/2-A
Matrix: Water
Analysis Batch: 123289

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 122912

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Total Alpha Radium			11.2	11.86		1.34	1.00	0.235	pCi/L	106	67 - 133		

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*85.8*		*40 - 110*

Method: 9315 - Total Apha Radium (GFPC) (Continued)

Lab Sample ID: LCSD 160-122912/3-A
Matrix: Water
Analysis Batch: 123289

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 122912

Analyte			Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Total Alpha Radium			11.2	11.62		1.31	1.00	0.346	pCi/L	103	67 - 133	0.09	1

Carrier	*LCSD %Yield*	*LCSD Qualifier*	*Limits*
Ba Carrier	*92.6*		*40 - 110*

Method: 9320 - Radium-228 (GFPC)

Lab Sample ID: MB 160-122913/1-A
Matrix: Water
Analysis Batch: 123737

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 122913

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	0.2086	U	0.162	0.163	1.00	0.254	pCi/L	05/19/14 13:43	05/23/14 09:50	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*114*	*X*	*40 - 110*	*05/19/14 13:43*	*05/23/14 09:50*	*1*
Y Carrier	*86.7*		*40 - 110*	*05/19/14 13:43*	*05/23/14 09:50*	*1*

Lab Sample ID: LCS 160-122913/2-A
Matrix: Water
Analysis Batch: 123737

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 122913

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Radium-228			3.85	3.751		0.520	1.00	0.312	pCi/L	97	56 - 140

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*108*		*40 - 110*
Y Carrier	*87.5*		*40 - 110*

Lab Sample ID: LCSD 160-122913/3-A
Matrix: Water
Analysis Batch: 123737

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 122913

Analyte			Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Radium-228			3.85	3.208		0.462	1.00	0.276	pCi/L	83	56 - 140	0.55	1

Carrier	*LCSD %Yield*	*LCSD Qualifier*	*Limits*
Ba Carrier	*104*		*40 - 110*
Y Carrier	*90.5*		*40 - 110*

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

Lab Sample ID: MB 160-123197/1-A — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 123332 — **Prep Batch: 123197**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.02379	U	0.0476	0.0476	1.00	0.0714	pCi/L	05/20/14 13:36	05/21/14 19:04	1
Thorium-230	0.2388		0.151	0.152	1.00	0.0714	pCi/L	05/20/14 13:36	05/21/14 19:04	1
Thorium-232	0.04293	U	0.0676	0.0677	1.00	0.108	pCi/L	05/20/14 13:36	05/21/14 19:04	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*81.9*		*30 - 110*	*05/20/14 13:36*	*05/21/14 19:04*	*1*

Lab Sample ID: LCS 160-123197/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 123333 — **Prep Batch: 123197**

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			8.64	9.421		1.22	1.00	0.103	pCi/L	109	81 - 125		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*84.0*		*30 - 110*

Lab Sample ID: MB 160-123276/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 123806 — **Prep Batch: 123276**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.01892	U	0.0362	0.0362	1.00	0.0686	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-230	0.04828		0.0452	0.0454	1.00	0.0460	pCi/g	05/21/14 09:37	05/23/14 19:02	1
Thorium-232	0.008162	U	0.0204	0.0205	1.00	0.0457	pCi/g	05/21/14 09:37	05/23/14 19:02	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.4*		*30 - 110*	*05/21/14 09:37*	*05/23/14 19:02*	*1*

Lab Sample ID: LCS 160-123276/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 123807 — **Prep Batch: 123276**

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	23.35		2.39	1.00	0.115	pCi/g	95	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*93.1*		*30 - 110*

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

Lab Sample ID: MB 160-123200/1-A
Matrix: Water
Analysis Batch: 123362

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 123200

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.01901	U	0.0646	0.0646	1.00	0.148	pCi/L	05/20/14 13:36	05/21/14 17:20	1
Uranium-235/236	0.0000	U	0.0101	0.0101	1.00	0.0811	pCi/L	05/20/14 13:36	05/21/14 17:20	1
Uranium-238	0.1301		0.106	0.107	1.00	0.0650	pCi/L	05/20/14 13:36	05/21/14 17:20	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*89.8*		*30 - 110*	*05/20/14 13:36*	*05/21/14 17:20*	*1*

Lab Sample ID: LCS 160-123200/2-A
Matrix: Water
Analysis Batch: 123363

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 123200

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Uranium-233/234			12.7	13.22		1.57	1.00	0.150	pCi/L	104	84 - 120		
Uranium-238			13.0	13.79		1.62	1.00	0.0696	pCi/L	106	83 - 121		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Uranium-232	*79.8*		*30 - 110*

Lab Sample ID: MB 160-123278/1-A
Matrix: Solid
Analysis Batch: 124262

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 123278

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.004946	U	0.0488	0.0488	1.00	0.110	pCi/g	05/21/14 09:37	05/28/14 15:45	1
Uranium-235/236	-0.01407	U	0.0450	0.0451	1.00	0.130	pCi/g	05/21/14 09:37	05/28/14 15:45	1
Uranium-238	0.01551	U	0.0478	0.0478	1.00	0.0994	pCi/g	05/21/14 09:37	05/28/14 15:45	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*84.3*		*30 - 110*	*05/21/14 09:37*	*05/28/14 15:45*	*1*

Lab Sample ID: LCS 160-123278/2-A
Matrix: Solid
Analysis Batch: 123762

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 123278

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Uranium-233/234			6.37	6.226		0.733	1.00	0.0683	pCi/g	98	84 - 120		
Uranium-238			6.51	6.834		0.786	1.00	0.0681	pCi/g	105	82 - 122		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Uranium-232	*88.4*		*30 - 110*

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-122895/1-A
Matrix: Water
Analysis Batch: 123127

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 122895

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	1.139	U	6.53	6.53	20.0	12.3	pCi/L	05/19/14 12:24	05/20/14 15:18	1

Lab Sample ID: LCS 160-122895/2-A
Matrix: Water
Analysis Batch: 123145

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 122895

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	137000	134000		15500		489	pCi/L	98	90 - 111
Cesium-137	50100	50940		5060	20.0	167	pCi/L	102	90 - 111
Cobalt-60	57100	56820		5610		89.8	pCi/L	100	89 - 110

Lab Sample ID: 160-6694-7 DU
Matrix: Water
Analysis Batch: 123147

Client Sample ID: 2222-RIN-01
Prep Type: Total/NA
Prep Batch: 122895

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Cesium-137	-1.19	U	-0.2213	U	5.10	20.0	9.54	pCi/L	0.08	1

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-123290/1-A
Matrix: Solid
Analysis Batch: 123298

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 123290

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.3399	U	0.705	0.707	1.00	1.23	pCi/g	05/21/14 11:19	05/21/14 12:20	1
Radium-228	0.0000	U	0.0468	0.0468		0.173	pCi/g	05/21/14 11:19	05/21/14 12:20	1
Lead-210	0.8642	U	0.905	0.911		1.57	pCi/g	05/21/14 11:19	05/21/14 12:20	1
Lead-212	-0.007971	U	0.0561	0.0561		0.110	pCi/g	05/21/14 11:19	05/21/14 12:20	1
Lead-214	-0.04299	U	1.29	1.29		0.192	pCi/g	05/21/14 11:19	05/21/14 12:20	1

Lab Sample ID: LCS 160-123290/2-A
Matrix: Solid
Analysis Batch: 123327

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 123290

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.4	103.6		11.0		1.44	pCi/g	106	87 - 116
Cesium-137	31.1	30.03		3.29		0.382	pCi/g	97	87 - 120
Cobalt-60	22.4	22.05		2.33		0.0869	pCi/g	98	87 - 115

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: 160-6694-1 DU
Matrix: Solid
Analysis Batch: 123245

Client Sample ID: 2222-SD01
Prep Type: Total/NA
Prep Batch: 123290

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Radium-226	0.780	U	1.162	U	0.852	1.00	1.29	pCi/g	0.20	1
Radium-228	0.628		0.7152		0.192		0.0811	pCi/g	0.22	1
Lead-210	0.877	U	0.4692	U	0.968		1.64	pCi/g	0.18	1
Lead-212	0.586		0.5914		0.131		0.0950	pCi/g	0.02	1
Lead-214	0.451		0.5125		0.135		0.121	pCi/g	0.22	1

Metals

Prep Batch: 122752

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	3050B	
160-6694-1 MS	2222-SD01	Total/NA	Solid	3050B	
160-6694-1 MSD	2222-SD01	Total/NA	Solid	3050B	
160-6694-1 SD	2222-SD01	Total/NA	Solid	3050B	
160-6694-2	2222-SD02	Total/NA	Solid	3050B	
160-6694-3	2222-SD03	Total/NA	Solid	3050B	
160-6694-4	2222-SD04	Total/NA	Solid	3050B	
160-6694-5	2222-SD05	Total/NA	Solid	3050B	
160-6694-6	2222-SD06	Total/NA	Solid	3050B	
LCSSRM 160-122752/2-A	Lab Control Sample	Total/NA	Solid	3050B	
MB 160-122752/1-A	Method Blank	Total/NA	Solid	3050B	

Prep Batch: 122863

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-7	2222-RIN-01	Total/NA	Water	3010A	
LCS 160-122863/2-A	Lab Control Sample	Total/NA	Water	3010A	
MB 160-122863/1-A	Method Blank	Total/NA	Water	3010A	

Prep Batch: 123407

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-7	2222-RIN-01	Total/NA	Water	7470A	
160-6694-7 MS	2222-RIN-01	Total/NA	Water	7470A	
160-6694-7 MSD	2222-RIN-01	Total/NA	Water	7470A	
160-6694-7 SD	2222-RIN-01	Total/NA	Water	7470A	
LCS 160-123407/2-A	Lab Control Sample	Total/NA	Water	7470A	
MB 160-123407/1-A	Method Blank	Total/NA	Water	7470A	

Analysis Batch: 123642

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	6010C	122752
160-6694-1 MS	2222-SD01	Total/NA	Solid	6010C	122752
160-6694-1 MSD	2222-SD01	Total/NA	Solid	6010C	122752
160-6694-1 SD	2222-SD01	Total/NA	Solid	6010C	122752
160-6694-2	2222-SD02	Total/NA	Solid	6010C	122752
160-6694-3	2222-SD03	Total/NA	Solid	6010C	122752
160-6694-4	2222-SD04	Total/NA	Solid	6010C	122752
160-6694-5	2222-SD05	Total/NA	Solid	6010C	122752
160-6694-6	2222-SD06	Total/NA	Solid	6010C	122752
160-6694-7	2222-RIN-01	Total/NA	Water	6010C	122863
CRI 160-123642/7	DL		Water	6010C	
ICSA 160-123642/8	ICS		Water	6010C	
ICSAB 160-123642/9	ICS		Water	6010C	
LCS 160-122863/2-A	Lab Control Sample	Total/NA	Water	6010C	122863
LCSSRM 160-122752/2-A	Lab Control Sample	Total/NA	Solid	6010C	122752
LRC 160-123642/10	Lab Control Sample		Water	6010C	
MB 160-122752/1-A	Method Blank	Total/NA	Solid	6010C	122752
MB 160-122863/1-A	Method Blank	Total/NA	Water	6010C	122863

Prep Batch: 123919

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	7471B	

Metals (Continued)

Prep Batch: 123919 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-2	2222-SD02	Total/NA	Solid	7471B	
160-6694-3	2222-SD03	Total/NA	Solid	7471B	
160-6694-4	2222-SD04	Total/NA	Solid	7471B	
160-6694-5	2222-SD05	Total/NA	Solid	7471B	
160-6694-6	2222-SD06	Total/NA	Solid	7471B	
160-6694-6 MS	2222-SD06	Total/NA	Solid	7471B	
160-6694-6 MSD	2222-SD06	Total/NA	Solid	7471B	
160-6694-6 SD	2222-SD06	Total/NA	Solid	7471B	
LCSSRM 160-123919/2-A	Lab Control Sample	Total/NA	Solid	7471B	
MB 160-123919/1-A	Method Blank	Total/NA	Solid	7471B	

Analysis Batch: 123936

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-7	2222-RIN-01	Total/NA	Water	7470A	123407
160-6694-7 MS	2222-RIN-01	Total/NA	Water	7470A	123407
160-6694-7 MSD	2222-RIN-01	Total/NA	Water	7470A	123407
160-6694-7 SD	2222-RIN-01	Total/NA	Water	7470A	123407
LCS 160-123407/2-A	Lab Control Sample	Total/NA	Water	7470A	123407
MB 160-123407/1-A	Method Blank	Total/NA	Water	7470A	123407

Analysis Batch: 124146

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	7471B	123919
160-6694-2	2222-SD02	Total/NA	Solid	7471B	123919
160-6694-3	2222-SD03	Total/NA	Solid	7471B	123919
160-6694-4	2222-SD04	Total/NA	Solid	7471B	123919
160-6694-5	2222-SD05	Total/NA	Solid	7471B	123919
160-6694-6	2222-SD06	Total/NA	Solid	7471B	123919
160-6694-6 MS	2222-SD06	Total/NA	Solid	7471B	123919
160-6694-6 MSD	2222-SD06	Total/NA	Solid	7471B	123919
160-6694-6 SD	2222-SD06	Total/NA	Solid	7471B	123919
LCSSRM 160-123919/2-A	Lab Control Sample	Total/NA	Solid	7471B	123919
MB 160-123919/1-A	Method Blank	Total/NA	Solid	7471B	123919

General Chemistry

Analysis Batch: 122677

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	Moisture	
160-6694-2	2222-SD02	Total/NA	Solid	Moisture	
160-6694-3	2222-SD03	Total/NA	Solid	Moisture	
160-6694-4	2222-SD04	Total/NA	Solid	Moisture	
160-6694-5	2222-SD05	Total/NA	Solid	Moisture	
160-6694-6	2222-SD06	Total/NA	Solid	Moisture	

Rad

Leach Batch: 122857

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	Dry and Grind	

Rad (Continued)

Leach Batch: 122857 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1 DU	2222-SD01	Total/NA	Solid	Dry and Grind	
160-6694-2	2222-SD02	Total/NA	Solid	Dry and Grind	
160-6694-3	2222-SD03	Total/NA	Solid	Dry and Grind	
160-6694-4	2222-SD04	Total/NA	Solid	Dry and Grind	
160-6694-5	2222-SD05	Total/NA	Solid	Dry and Grind	
160-6694-6	2222-SD06	Total/NA	Solid	Dry and Grind	

Prep Batch: 122895

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-7	2222-RIN-01	Total/NA	Water	Fill_Geo-0	
160-6694-7 DU	2222-RIN-01	Total/NA	Water	Fill_Geo-0	
LCS 160-122895/2-A	Lab Control Sample	Total/NA	Water	Fill_Geo-0	
MB 160-122895/1-A	Method Blank	Total/NA	Water	Fill_Geo-0	

Prep Batch: 122912

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-7	2222-RIN-01	Total/NA	Water	PrecSep_0	
LCS 160-122912/2-A	Lab Control Sample	Total/NA	Water	PrecSep_0	
LCSD 160-122912/3-A	Lab Control Sample Dup	Total/NA	Water	PrecSep_0	
MB 160-122912/1-A	Method Blank	Total/NA	Water	PrecSep_0	

Prep Batch: 122913

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-7	2222-RIN-01	Total/NA	Water	PrecSep_0	
LCS 160-122913/2-A	Lab Control Sample	Total/NA	Water	PrecSep_0	
LCSD 160-122913/3-A	Lab Control Sample Dup	Total/NA	Water	PrecSep_0	
MB 160-122913/1-A	Method Blank	Total/NA	Water	PrecSep_0	

Prep Batch: 123197

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-7	2222-RIN-01	Total/NA	Water	ExtChrom	
LCS 160-123197/2-A	Lab Control Sample	Total/NA	Water	ExtChrom	
MB 160-123197/1-A	Method Blank	Total/NA	Water	ExtChrom	

Prep Batch: 123200

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-7	2222-RIN-01	Total/NA	Water	ExtChrom	
LCS 160-123200/2-A	Lab Control Sample	Total/NA	Water	ExtChrom	
MB 160-123200/1-A	Method Blank	Total/NA	Water	ExtChrom	

Prep Batch: 123276

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	ExtChrom	122857
160-6694-2	2222-SD02	Total/NA	Solid	ExtChrom	122857
160-6694-3	2222-SD03	Total/NA	Solid	ExtChrom	122857
160-6694-4	2222-SD04	Total/NA	Solid	ExtChrom	122857
160-6694-5	2222-SD05	Total/NA	Solid	ExtChrom	122857
160-6694-6	2222-SD06	Total/NA	Solid	ExtChrom	122857
LCS 160-123276/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-123276/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Rad (Continued)

Prep Batch: 123278

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	ExtChrom	122857
160-6694-2	2222-SD02	Total/NA	Solid	ExtChrom	122857
160-6694-3	2222-SD03	Total/NA	Solid	ExtChrom	122857
160-6694-4	2222-SD04	Total/NA	Solid	ExtChrom	122857
160-6694-5	2222-SD05	Total/NA	Solid	ExtChrom	122857
160-6694-6	2222-SD06	Total/NA	Solid	ExtChrom	122857
LCS 160-123278/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-123278/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 123290

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6694-1	2222-SD01	Total/NA	Solid	Fill_Geo-0	122857
160-6694-1 DU	2222-SD01	Total/NA	Solid	Fill_Geo-0	122857
160-6694-2	2222-SD02	Total/NA	Solid	Fill_Geo-0	122857
160-6694-3	2222-SD03	Total/NA	Solid	Fill_Geo-0	122857
160-6694-4	2222-SD04	Total/NA	Solid	Fill_Geo-0	122857
160-6694-5	2222-SD05	Total/NA	Solid	Fill_Geo-0	122857
160-6694-6	2222-SD06	Total/NA	Solid	Fill_Geo-0	122857
LCS 160-123290/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-123290/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

Client Sample ID: 2222-SD01

Lab Sample ID: 160-6694-1

Date Collected: 05/15/14 08:25
Matrix: Solid
Date Received: 05/16/14 06:45
Percent Solids: 72.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			122752	05/19/14 08:37	LJT	TAL SL
Total/NA	Analysis	6010C		10	123642	05/22/14 15:31	FLC	TAL SL
Total/NA	Prep	7471B			123919	05/27/14 10:17	MTS	TAL SL
Total/NA	Analysis	7471B		1	124146	05/28/14 09:35	FLC	TAL SL
Total/NA	Analysis	Moisture		1	122677	05/17/14 08:15	SDB	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123278	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123793	05/23/14 18:57	MLK	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123276	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123811	05/23/14 19:02	RTM	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	Fill_Geo-0			123290	05/21/14 11:19	JDL	TAL SL
Total/NA	Analysis	GA-01-R		1	123296	05/21/14 12:22	SMP	TAL SL

Client Sample ID: 2222-SD02

Lab Sample ID: 160-6694-2

Date Collected: 05/15/14 09:45
Matrix: Solid
Date Received: 05/16/14 06:45
Percent Solids: 71.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			122752	05/19/14 08:37	LJT	TAL SL
Total/NA	Analysis	6010C		10	123642	05/22/14 15:54	FLC	TAL SL
Total/NA	Prep	7471B			123919	05/27/14 10:17	MTS	TAL SL
Total/NA	Analysis	7471B		1	124146	05/28/14 09:37	FLC	TAL SL
Total/NA	Analysis	Moisture		1	122677	05/17/14 08:15	SDB	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123278	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123794	05/23/14 18:57	MLK	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123276	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123812	05/23/14 19:02	RTM	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	Fill_Geo-0			123290	05/21/14 11:19	JDL	TAL SL
Total/NA	Analysis	GA-01-R		1	123247	05/21/14 14:32	SMP	TAL SL

Client Sample ID: 2222-SD03

Lab Sample ID: 160-6694-3

Date Collected: 05/15/14 08:50
Matrix: Solid
Date Received: 05/16/14 06:45
Percent Solids: 52.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			122752	05/19/14 08:37	LJT	TAL SL
Total/NA	Analysis	6010C		10	123642	05/22/14 15:58	FLC	TAL SL
Total/NA	Prep	7471B			123919	05/27/14 10:17	MTS	TAL SL
Total/NA	Analysis	7471B		1	124146	05/28/14 09:39	FLC	TAL SL

Client Sample ID: 2222-SD03

Lab Sample ID: 160-6694-3

Date Collected: 05/15/14 08:50

Matrix: Solid

Date Received: 05/16/14 06:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1	122677	05/17/14 08:15	SDB	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123278	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123795	05/23/14 18:57	MLK	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123276	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123813	05/23/14 19:02	RTM	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	Fill_Geo-0			123290	05/21/14 11:19	JDL	TAL SL
Total/NA	Analysis	GA-01-R		1	123296	05/21/14 14:26	SMP	TAL SL

Client Sample ID: 2222-SD04

Lab Sample ID: 160-6694-4

Date Collected: 05/15/14 09:05

Matrix: Solid

Date Received: 05/16/14 06:45

Percent Solids: 28.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			122752	05/19/14 08:37	LJT	TAL SL
Total/NA	Analysis	6010C		10	123642	05/22/14 16:02	FLC	TAL SL
Total/NA	Prep	7471B			123919	05/27/14 10:17	MTS	TAL SL
Total/NA	Analysis	7471B		1	124146	05/28/14 09:41	FLC	TAL SL
Total/NA	Analysis	Moisture		1	122677	05/17/14 08:15	SDB	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123278	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123796	05/23/14 18:57	MLK	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123276	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123815	05/23/14 19:02	RTM	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	Fill_Geo-0			123290	05/21/14 11:19	JDL	TAL SL
Total/NA	Analysis	GA-01-R		1	123294	05/21/14 14:27	EMN	TAL SL

Client Sample ID: 2222-SD05

Lab Sample ID: 160-6694-5

Date Collected: 05/15/14 09:15

Matrix: Solid

Date Received: 05/16/14 06:45

Percent Solids: 76.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			122752	05/19/14 08:37	LJT	TAL SL
Total/NA	Analysis	6010C		10	123642	05/22/14 16:06	FLC	TAL SL
Total/NA	Prep	7471B			123919	05/27/14 10:17	MTS	TAL SL
Total/NA	Analysis	7471B		1	124146	05/28/14 09:43	FLC	TAL SL
Total/NA	Analysis	Moisture		1	122677	05/17/14 08:15	SDB	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123278	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123797	05/23/14 18:57	MLK	TAL SL

Client Sample ID: 2222-SD05

Lab Sample ID: 160-6694-5

Date Collected: 05/15/14 09:15

Matrix: Solid

Date Received: 05/16/14 06:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123276	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123816	05/23/14 19:02	RTM	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	Fill_Geo-0			123290	05/21/14 11:19	JDL	TAL SL
Total/NA	Analysis	GA-01-R		1	123327	05/21/14 15:46	SMP	TAL SL

Client Sample ID: 2222-SD06

Lab Sample ID: 160-6694-6

Date Collected: 05/15/14 08:45

Matrix: Solid

Date Received: 05/16/14 06:45

Percent Solids: 54.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			122752	05/19/14 08:37	LJT	TAL SL
Total/NA	Analysis	6010C		10	123642	05/22/14 16:10	FLC	TAL SL
Total/NA	Prep	7471B			123919	05/27/14 10:17	MTS	TAL SL
Total/NA	Analysis	7471B		1	124146	05/28/14 09:45	FLC	TAL SL
Total/NA	Analysis	Moisture		1	122677	05/17/14 08:15	SDB	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123278	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123798	05/23/14 18:57	MLK	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	ExtChrom			123276	05/21/14 09:37	MLM	TAL SL
Total/NA	Analysis	A-01-R		1	123817	05/23/14 19:02	RTM	TAL SL
Total/NA	Leach	Dry and Grind			122857	05/19/14 10:39	DRO	TAL SL
Total/NA	Prep	Fill_Geo-0			123290	05/21/14 11:19	JDL	TAL SL
Total/NA	Analysis	GA-01-R		1	123299	05/21/14 15:45	SMP	TAL SL

Client Sample ID: 2222-RIN-01

Lab Sample ID: 160-6694-7

Date Collected: 05/15/14 08:10

Matrix: Water

Date Received: 05/16/14 06:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3010A			122863	05/19/14 10:57	LJT	TAL SL
Total/NA	Analysis	6010C		1	123642	05/22/14 13:15	FLC	TAL SL
Total/NA	Prep	7470A			123407	05/22/14 07:51	MTS	TAL SL
Total/NA	Analysis	7470A		1	123936	05/27/14 10:12	MTS	TAL SL
Total/NA	Prep	PrecSep_0			122912	05/19/14 13:41	LEM	TAL SL
Total/NA	Analysis	9315		1	123289	05/21/14 16:16	MLK	TAL SL
Total/NA	Prep	PrecSep_0			122913	05/19/14 13:43	LEM	TAL SL
Total/NA	Analysis	9320		1	123737	05/23/14 09:50	SMP	TAL SL
Total/NA	Prep	ExtChrom			123200	05/20/14 13:36	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	123366	05/21/14 17:20	RTM	TAL SL
Total/NA	Prep	ExtChrom			123197	05/20/14 13:36	SCB	TAL SL
Total/NA	Analysis	A-01-R		1	123337	05/21/14 19:04	RTM	TAL SL

Lab Chronicle

Client: Weston Solutions, Inc.
Project/Site: EPA Region 5 START 3 Contract

TestAmerica Job ID: 160-6694-1

Client Sample ID: 2222-RIN-01
Date Collected: 05/15/14 08:10
Date Received: 05/16/14 06:45

Lab Sample ID: 160-6694-7
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Fill_Geo-0			122895	05/19/14 12:24	JDL	TAL SL
Total/NA	Analysis	GA-01-R		1	123230	05/20/14 13:46	SMP	TAL SL

Laboratory References:

MCL = Materials and Chemistry Laboratory Inc, PO BOX 5808, Oak Ridge, TN 37831

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

Certification Summary

Client: Weston Solutions, Inc.
Project/Site: EPA Region 5 START 3 Contract

TestAmerica Job ID: 160-6694-1

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	06-30-14 *
California	NELAP	9	09266CA	03-31-14 *
Connecticut	State Program	1	PH-0241	03-31-15
Florida	NELAP	4	E87689	06-30-14 *
Illinois	NELAP	5	200023	11-30-14
Iowa	State Program	7	373	12-01-14
Kansas	NELAP	7	E-10236	10-31-14
Kentucky (DW)	State Program	4	90125	12-31-14
L-A-B	DoD ELAP		L2305	01-10-16
Louisiana	NELAP	6	LA140007	12-31-14
Maryland	State Program	3	310	09-30-14
Missouri	State Program	7	780	06-30-14 *
Nevada	State Program	9	MO000542013-1	07-31-14
New Jersey	NELAP	2	MO002	06-30-14 *
New Mexico	State Program	6		06-30-10 *
New York	NELAP	2	11616	03-31-15
North Dakota	State Program	8	R207	06-30-14 *
NRC	NRC		24-24817-01	12-31-22
Oklahoma	State Program	6	2013-049	08-31-14
Pennsylvania	NELAP	3	68-00540	02-28-15
South Carolina	State Program	4	85002001	06-30-14 *
Texas	NELAP	6	T104704193-13-6	07-31-14
USDA	Federal		P330-07-00122	01-09-17
USEPA Reg V SDWA	Federal	1	WG-15J	08-30-14
Utah	NELAP	8	MO000542013-5	07-31-14
Virginia	NELAP	3	2236	06-14-14 *
Washington	State Program	10	C592	08-30-14
West Virginia DEP	State Program	3	381	08-30-14

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: Weston Solutions, Inc. TestAmerica Job ID: 160-6694-1
Project/Site: EPA Region 5 START 3 Contract

Method	Method Description	Protocol	Laboratory
6010C	Metals (ICP)	SW846	TAL SL
7470A	Mercury (CVAA)	SW846	TAL SL
7471B	Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)	SW846	TAL SL
Moisture	Percent Moisture	EPA	TAL SL
9315	Total Apha Radium (GFPC)	SW846	TAL SL
9320	Radium-228 (GFPC)	SW846	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL
GA-01-R	Radium-226 & Other Gamma Emitters (GS)	DOE	TAL SL
Lead sub to MCL	General Sub Contract Method	NONE	MCL
Lead to MCL	General Sub Contract Method	NONE	MCL

Protocol References:

DOE = U.S. Department of Energy

EPA = US Environmental Protection Agency

NONE = NONE

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

MCL = Materials and Chemistry Laboratory Inc, PO BOX 5808, Oak Ridge, TN 37831

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

Sample Summary

Client: Weston Solutions, Inc.
Project/Site: EPA Region 5 START 3 Contract

TestAmerica Job ID: 160-6694-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-6694-1	2222-SD01	Solid	05/15/14 08:25	05/16/14 06:45
160-6694-2	2222-SD02	Solid	05/15/14 09:45	05/16/14 06:45
160-6694-3	2222-SD03	Solid	05/15/14 08:50	05/16/14 06:45
160-6694-4	2222-SD04	Solid	05/15/14 09:05	05/16/14 06:45
160-6694-5	2222-SD05	Solid	05/15/14 09:15	05/16/14 06:45
160-6694-6	2222-SD06	Solid	05/15/14 08:45	05/16/14 06:45
160-6694-7	2222-RIN-01	Water	05/15/14 08:10	05/16/14 06:45

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
1L Marn_00002	03/02/16		Eckert & Ziegler, Lot 83924-334		(Purchased Reagent)		Americium-241	5097.5 pCi/L
							Ce-139	2399.2 pCi/L
							Cesium-137	2003.5 pCi/L
							Co-57	1564.3 pCi/L
							Cobalt-60	3293.9 pCi/L
							Mn-54	3083.6 pCi/L
							Sn-113	4248.4 pCi/L
							Y-88	6929.6 pCi/L
1L Marn_00003	02/09/17		Eckert & Ziegler, Lot 90062		(Purchased Reagent)		Americium-241	5072.4 Bq
							Cd-109	72078 Bq
							Ce-139	2418 Bq
							Cesium-137	2056.4 Bq
							Co-57	1593.5 Bq
							Cobalt-60	3233.8 Bq
							Hg-203	5155.9 Bq
							Mn-54	3114.6 Bq
							Sn-113	4253.1 Bq
							Y-88	7000 Bq
1L Marn_00004	02/15/14		Eckert & Ziegler, Lot 83924-334		(Purchased Reagent)		Americium-241	5097.5 pCi/L
							Ce-139	2399.2 pCi/L
							Cesium-137	2003.5 pCi/L
							Co-57	1564.3 pCi/L
							Cobalt-60	3293.9 pCi/L
							Mn-54	3083.6 pCi/L
							Sn-113	4248.4 pCi/L
							Y-88	6929.6 pCi/L
1L Marn_00007	03/02/16		Eckert & Ziegler, Lot 81592-334		(Purchased Reagent)		Americium-241	5373.3 pCi/L
							Cesium-137	2145.7 pCi/L
							Cobalt-60	3426.5 pCi/L
1L Marn_00008	11/22/14		Eckert & Ziegler, Lot 83924-334		(Purchased Reagent)		Americium-241	305.85 dpm/g
							Cesium-137	120.21 dpm/g
							Cobalt-60	197.61 dpm/g
82232-334_00001	06/03/60		Eckert & Ziegler, Lot 82232-334		(Purchased Reagent)		Americium-241	7.281 Bq
							Pu-239	7.137 Bq
							Pulser	
							Thorium-230	7.63 Bq
							U	
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
82235-334_00001	06/04/60		Eckert & Ziegler, Lot 82235-334		(Purchased Reagent)		Americium-241	7.466 Bq
							Pu-239	6.897 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Thorium-230	7.167 Bq
82236-334_00001	06/02/60	Eckert & Ziegler, Lot 82236-334			(Purchased Reagent)		Americium-241	6.891 Bq
							Pu-239	6.664 Bq
							Pulser	
							Thorium-230	7.107 Bq
							U	
82237-334_00003							Pulser	
							U	
82240-334_00001	06/08/60	Eckert & Ziegler, Lot 82240-334			(Purchased Reagent)		Americium-241	8.298 Bq
							Pu-239	7.163 Bq
							Thorium-230	6.304 Bq
82241-334_00001	06/08/60	Eckert & Ziegler, Lot 82241-334			(Purchased Reagent)		Americium-241	6.638 Bq
							Pu-239	6.797 Bq
							Thorium-230	6.629 Bq
82242-334_00001	06/08/60	Eckert & Ziegler, Lot 82242-334			(Purchased Reagent)		Americium-241	7.145 Bq
							Pu-239	6.414 Bq
							Thorium-230	6.583 Bq
82243-334_00001	06/09/60	Eckert & Ziegler, Lot 82243-334			(Purchased Reagent)		Americium-241	6.39 Bq
							Pu-239	5.979 Bq
							Thorium-230	5.856 Bq
82244-334_00001	06/09/60	Eckert & Zigler, Lot 82244-334			(Purchased Reagent)		Americium-241	6.897 Bq
							Pu-239	6.717 Bq
							Pulser	
							Thorium-230	7.352 Bq
							U	
82245-334_00001	06/09/60	Eckert & Ziegler, Lot 82245-334			(Purchased Reagent)		Americium-241	5.528 Bq
							Pu-239	5.437 Bq
							Pulser	
							Thorium-230	6.727 Bq
							U	
82246-334_00001	06/09/60	Eckert & Ziegler, Lot 82246-334			(Purchased Reagent)		Americium-241	6.002 Bq
							Pu-239	5.353 Bq
							Thorium-230	5.57 Bq
82247-334_00001	06/10/60	Eckert & Ziegler, Lot 82247-334			(Purchased Reagent)		Americium-241	6.291 Bq
							Pu-239	5.746 Bq
							Thorium-230	6.251 Bq
Ba Carrier_00008	12/16/14	CPI, Lot 13L009			(Purchased Reagent)		Ba Carrier	20000 ug/mL
Hg Curve Int._00401	05/22/14	05/21/14	2% Nitric Acid, Lot 309914	100 mL	HG CAL_00006	0.1 mL	Mercury	0.1 ug/mL
.HG CAL_00006	08/30/14	Spex, Lot 18-136HGY			(Purchased Reagent)		Mercury	100 ug/mL
Hg Curve Int._00403	05/23/14	05/22/14	2% Nitric Acid, Lot 309914	100 mL	HG CAL_00006	0.1 mL	Mercury	0.1 ug/mL
.HG CAL_00006	08/30/14	Spex, Lot 18-136HGY			(Purchased Reagent)		Mercury	100 ug/mL

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
Hg Curve Int._00404	05/23/14	05/22/14	2% Nitric Acid, Lot 309914	100 mL	HG CAL_00006	0.1 mL	Mercury	0.1 ug/mL
.HG CAL_00006	08/30/14		Spex, Lot 18-136HGY		(Purchased Reagent)		Mercury	100 ug/mL
Hg Curve Int._00405	05/28/14	05/27/14	2% Nitric Acid, Lot 309914	100 mL	HG CAL_00006	0.1 mL	Mercury	0.1 ug/mL
.HG CAL_00006	08/30/14		Spex, Lot 18-136HGY		(Purchased Reagent)		Mercury	100 ug/mL
Hg QC Int._00388	05/28/14	05/27/14	2% Nitric Acid, Lot 309914	100 mL	HG QC_00004	0.1 mL	Mercury	0.1 ug/mL
.HG QC_00004	09/01/14		Leeman Labs, Lot 1323201		(Purchased Reagent)		Mercury	100 ug/mL
ICP CAL1/LLC_00012	06/12/14	05/12/14	5% HCl/5%HN03, Lot 336380	1000 mL	ICPC13 LLC A_00002	2 mL	Aluminum	0.2 ug/mL
							Arsenic	0.01 ug/mL
							Ba Carrier	0.05 ug/mL
							Beryllium	0.005 ug/mL
							Cadmium	0.005 ug/mL
							Calcium	1 ug/mL
							Chromium	0.01 ug/mL
							Cobalt	0.05 ug/mL
							Copper	0.025 ug/mL
							Iron	0.1 ug/mL
							Lead	0.01 ug/mL
							Magnesium	1 ug/mL
							Manganese	0.015 ug/mL
							Nickel	0.04 ug/mL
							Potassium	5 ug/mL
							Selenium	0.015 ug/mL
							Sodium	1 ug/mL
							Thallium	0.02 ug/mL
							Vanadium	0.05 ug/mL
							Zinc	0.02 ug/mL
					ICPC13 LLC B_00001	2 mL	Antimony	0.01 ug/mL
							Silver	0.01 ug/mL
.ICPC13 LLC A_00002	09/10/14		AccuScience, Lot 1050477		(Purchased Reagent)		Aluminum	100 ug/mL
							Arsenic	5 ug/mL
							Ba Carrier	25 ug/mL
							Beryllium	2.5 ug/mL
							Cadmium	2.5 ug/mL
							Calcium	500 ug/mL
							Chromium	5 ug/mL
							Cobalt	25 ug/mL
							Copper	12.5 ug/mL
							Iron	50 ug/mL
							Lead	5 ug/mL
							Magnesium	500 ug/mL
							Manganese	7.5 ug/mL
							Nickel	20 ug/mL
							Potassium	2500 ug/mL

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Selenium	7.5 ug/mL
							Sodium	500 ug/mL
							Thallium	10 ug/mL
							Vanadium	25 ug/mL
							Zinc	10 ug/mL
.ICPC13 LLC B_00001	09/10/14		AccuScience, Lot 1050477		(Purchased Reagent)		Antimony	5 ug/mL
							Silver	5 ug/mL
ICP CAL2/CCV_00018	06/12/14	05/12/14	5% HCl/5@HN03, Lot 363689	1000 mL	ICPC13 CAL A_00001	5 mL	Antimony	1 ug/mL
							Silver	1 ug/mL
					ICPC13 CAL B_00001	5 mL	Potassium	50 ug/mL
							Sodium	50 ug/mL
					ICPC13 CAL C_00001	5 mL	Aluminum	50 ug/mL
							Calcium	50 ug/mL
							Iron	50 ug/mL
							Magnesium	50 ug/mL
					ICPC13 CAL D_00001	5 mL	Ba Carrier	5 ug/mL
							Lead	5 ug/mL
							Vanadium	5 ug/mL
							Zinc	5 ug/mL
					ICPC13 CAL E_00001	5 mL	Arsenic	5 ug/mL
							Beryllium	5 ug/mL
							Cadmium	5 ug/mL
							Chromium	5 ug/mL
							Cobalt	5 ug/mL
							Copper	5 ug/mL
							Manganese	5 ug/mL
							Nickel	5 ug/mL
							Selenium	1 ug/mL
							Thallium	1 ug/mL
.ICPC13 CAL A_00001	09/16/14		AccuScience, Lot 1050679		(Purchased Reagent)		Antimony	200 ug/mL
							Silver	200 ug/mL
.ICPC13 CAL B_00001	09/16/14		AccuScience, Lot 1050680		(Purchased Reagent)		Potassium	10000 ug/mL
							Sodium	10000 ug/mL
.ICPC13 CAL C_00001	09/16/14		AccuScience, Lot 1050681		(Purchased Reagent)		Aluminum	10000 ug/mL
							Calcium	10000 ug/mL
							Iron	10000 ug/mL
							Magnesium	10000 ug/mL
.ICPC13 CAL D_00001	09/16/14		AccuScience, Lot 1050682		(Purchased Reagent)		Ba Carrier	1000 ug/mL
							Lead	1000 ug/mL
							Vanadium	1000 ug/mL
							Zinc	1000 ug/mL
.ICPC13 CAL E_00001	09/16/14		AccuScience, Lot 1050696		(Purchased Reagent)		Arsenic	1000 ug/mL
							Beryllium	1000 ug/mL
							Cadmium	1000 ug/mL
							Chromium	1000 ug/mL
							Cobalt	1000 ug/mL
							Copper	1000 ug/mL

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Manganese	1000 ug/mL
							Nickel	1000 ug/mL
							Selenium	200 ug/mL
							Thallium	200 ug/mL
ICP CAL3\LRC_00010	06/12/14	05/12/14	5% HCl /5%HN03, Lot 363689	1000 mL	ICPC13 CAL A_00001	10 mL	Antimony	2 ug/mL
							Silver	2 ug/mL
					ICPC13 CAL B_00001	10 mL	Potassium	100 ug/mL
							Sodium	100 ug/mL
					ICPC13 CAL C_00001	10 mL	Aluminum	100 ug/mL
							Calcium	100 ug/mL
							Iron	100 ug/mL
							Magnesium	100 ug/mL
					ICPC13 CAL D_00001	10 mL	Ba Carrier	10 ug/mL
							Lead	10 ug/mL
							Vanadium	10 ug/mL
							Zinc	10 ug/mL
					ICPC13 CAL E_00001	10 mL	Arsenic	10 ug/mL
							Beryllium	10 ug/mL
							Cadmium	10 ug/mL
							Chromium	10 ug/mL
							Cobalt	10 ug/mL
							Copper	10 ug/mL
							Manganese	10 ug/mL
							Nickel	10 ug/mL
							Selenium	2 ug/mL
							Thallium	2 ug/mL
.ICPC13 CAL A_00001	09/16/14		AccuScience, Lot 1050679		(Purchased Reagent)		Antimony	200 ug/mL
							Silver	200 ug/mL
.ICPC13 CAL B_00001	09/16/14		AccuScience, Lot 1050680		(Purchased Reagent)		Potassium	10000 ug/mL
							Sodium	10000 ug/mL
.ICPC13 CAL C_00001	09/16/14		AccuScience, Lot 1050681		(Purchased Reagent)		Aluminum	10000 ug/mL
							Calcium	10000 ug/mL
							Iron	10000 ug/mL
							Magnesium	10000 ug/mL
.ICPC13 CAL D_00001	09/16/14		AccuScience, Lot 1050682		(Purchased Reagent)		Ba Carrier	1000 ug/mL
							Lead	1000 ug/mL
							Vanadium	1000 ug/mL
							Zinc	1000 ug/mL
.ICPC13 CAL E_00001	09/16/14		AccuScience, Lot 1050696		(Purchased Reagent)		Arsenic	1000 ug/mL
							Beryllium	1000 ug/mL
							Cadmium	1000 ug/mL
							Chromium	1000 ug/mL
							Cobalt	1000 ug/mL
							Copper	1000 ug/mL
							Manganese	1000 ug/mL
							Nickel	1000 ug/mL
							Selenium	200 ug/mL

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Thallium	200 ug/mL
ICP ICV_00008	06/12/14	05/12/14	5% Nitric Acid, Lot 363689	1000 mL	ICPC ICV 1_00001	5 mL	Antimony	1 ug/mL
					ICPC ICV 3_00001	5 mL	Aluminum	50 ug/mL
							Calcium	50 ug/mL
							Iron	50 ug/mL
							Sodium	50 ug/mL
					ICPC ICV 4_00001	5 mL	Arsenic	5 ug/mL
							Ba Carrier	5 ug/mL
							Beryllium	5 ug/mL
							Cadmium	5 ug/mL
							Chromium	5 ug/mL
							Cobalt	5 ug/mL
							Copper	5 ug/mL
							Lead	5 ug/mL
							Manganese	5 ug/mL
							Nickel	5 ug/mL
							Selenium	1 ug/mL
							Silver	1 ug/mL
							Thallium	1 ug/mL
							Vanadium	5 ug/mL
							Zinc	5 ug/mL
					ICPC ICV2_00001	5 mL	Magnesium	50 ug/mL
							Potassium	50 ug/mL
.ICPC ICV 1_00001	11/01/14	Inorganic Venures, Lot G2-MEB499048			(Purchased Reagent)		Antimony	200 ug/mL
.ICPC ICV 3_00001	10/24/14	Inorganic Ventures, Lot G2-MEB499049			(Purchased Reagent)		Aluminum	10000 ug/mL
							Calcium	10000 ug/mL
							Iron	10000 ug/mL
							Sodium	10000 ug/mL
.ICPC ICV 4_00001	11/01/14	Inorganic Ventures, Lot G2-MEB499047			(Purchased Reagent)		Arsenic	1000 ug/mL
							Ba Carrier	1000 ug/mL
							Beryllium	1000 ug/mL
							Cadmium	1000 ug/mL
							Chromium	1000 ug/mL
							Cobalt	1000 ug/mL
							Copper	1000 ug/mL
							Lead	1000 ug/mL
							Manganese	1000 ug/mL
							Nickel	1000 ug/mL
							Selenium	200 ug/mL
							Silver	200 ug/mL
							Thallium	200 ug/mL
							Vanadium	1000 ug/mL
							Zinc	1000 ug/mL
.ICPC ICV2_00001	11/01/14	Inorganic Ventures, Lot G2-MEB499050			(Purchased Reagent)		Magnesium	10000 ug/mL
							Potassium	10000 ug/mL

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
ICPC MIX AB_00041	06/12/14	05/12/14	5% HCl /5%HN03, Lot 363689	1000 mL	ICPC13 AB 1_00001	5 mL	Arsenic	2.5 ug/mL
							Ba Carrier	2.5 ug/mL
							Beryllium	2.5 ug/mL
							Lead	2.5 ug/mL
							Selenium	0.5 ug/mL
							Vanadium	2.5 ug/mL
							Zinc	2.5 ug/mL
					ICPC13 AB 2_00001	5 mL	Antimony	0.5 ug/mL
							Cadmium	2.5 ug/mL
							Chromium	2.5 ug/mL
							Cobalt	2.5 ug/mL
							Copper	2.5 ug/mL
							Manganese	2.5 ug/mL
							Nickel	2.5 ug/mL
							Silver	0.5 ug/mL
							Thallium	0.5 ug/mL
					ICPC13 ICSA 1_00001	5 mL	Potassium	100 ug/mL
							Sodium	100 ug/mL
					ICPC13 ICSA 2_00001	5 mL	Aluminum	100 ug/mL
							Calcium	100 ug/mL
							Iron	100 ug/mL
							Magnesium	100 ug/mL
.ICPC13 AB 1_00001	09/10/14		AccuScience, Lot 105480		(Purchased Reagent)		Arsenic	500 ug/mL
							Ba Carrier	500 ug/mL
							Beryllium	500 ug/mL
							Lead	500 ug/mL
							Selenium	100 ug/mL
							Vanadium	500 ug/mL
							Zinc	500 ug/mL
.ICPC13 AB 2_00001	09/10/14		AccuScience, Lot 105048		(Purchased Reagent)		Antimony	100 ug/mL
							Cadmium	500 ug/mL
							Chromium	500 ug/mL
							Cobalt	500 ug/mL
							Copper	500 ug/mL
							Manganese	500 ug/mL
							Nickel	500 ug/mL
							Silver	100 ug/mL
							Thallium	100 ug/mL
.ICPC13 ICSA 1_00001	09/20/14		AccuScience, Lot 1050486		(Purchased Reagent)		Potassium	20000 ug/mL
							Sodium	20000 ug/mL
.ICPC13 ICSA 2_00001	09/20/14		AccuScience, Lot 1050486		(Purchased Reagent)		Aluminum	20000 ug/mL
							Calcium	20000 ug/mL
							Iron	20000 ug/mL
							Magnesium	20000 ug/mL
ICPC MIX ICSA_00037	06/12/14	05/12/14	5% HCl/5%HN03, Lot 363689	1000 mL	ICPC13 ICSA 1_00001	5 mL	Potassium	100 ug/mL
							Sodium	100 ug/mL

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
					ICPC13 ICSA 2_00001	5 mL	Aluminum	100 ug/mL
							Calcium	100 ug/mL
							Iron	100 ug/mL
							Magnesium	100 ug/mL
.ICPC13 ICSA 1_00001	09/20/14	AccuScience, Lot 1050486			(Purchased Reagent)		Potassium	20000 ug/mL
							Sodium	20000 ug/mL
.ICPC13 ICSA 2_00001	09/20/14	AccuScience, Lot 1050486			(Purchased Reagent)		Aluminum	20000 ug/mL
							Calcium	20000 ug/mL
							Iron	20000 ug/mL
							Magnesium	20000 ug/mL
Marn Soil_00002	03/01/16	Eckert & Ziegler, Lot 83814-334			(Purchased Reagent)		Americium-241	2870 Bq
							Cd-109	39231 Bq
							Ce-139	1302 Bq
							Cesium-137	1087 Bq
							Co-57	849 Bq
							Cobalt-60	1788 Bq
							Hg-203	2820 Bq
							Lead-210	35040 Bq
							Sn-113	2306 Bq
							Y-88	3762 Bq
MarnSolid_00002	02/09/17	Eckert & Ziegler, Lot 90099			(Purchased Reagent)		Americium-241	2797 Bq
							Cd-109	39337 Bq
							Ce-139	1320 Bq
							Cesium-137	1122 Bq
							Co-57	870 Bq
							Hg-203	2814 Bq
							Lead-210	35883 Bq
							Sn-113	2322 Bq
							Y-88	3821 Bq
PR_LCSSRM_00004	10/31/16	ERA, Lot DO81-540			(Purchased Reagent)		Aluminum	9390 mg/Kg
							Antimony	129 mg/Kg
							Arsenic	88.4 mg/Kg
							B	101 mg/Kg
							Ba Carrier	210 mg/Kg
							Beryllium	55.8 mg/Kg
							Cadmium	142 mg/Kg
							Calcium	7530 mg/Kg
							Chromium	86.8 mg/Kg
							Cobalt	199 mg/Kg
							Copper	268 mg/Kg
							Iron	12800 mg/Kg
							Lead	97.9 mg/Kg
							Magnesium	2850 mg/Kg
							Manganese	425 mg/Kg
							Mercury	9.03 mg/Kg
							Mo	103 mg/Kg
							Nickel	236 mg/Kg

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Potassium	2570 mg/Kg
							Selenium	127 mg/Kg
							Silver	66.2 mg/Kg
							Sn	149 mg/Kg
							Sodium	1040 mg/Kg
							Sr	167 mg/Kg
							Thallium	140 mg/Kg
							Ti	215 mg/Kg
							Vanadium	156 mg/Kg
							Zinc	130 mg/Kg
PR_LCSSRM_00006	10/31/16		ERA, Lot DO81-540		(Purchased Reagent)		Aluminum	9390 mg/Kg
							Antimony	129 mg/Kg
							Arsenic	88.4 mg/Kg
							B	101 mg/Kg
							Ba Carrier	210 mg/Kg
							Beryllium	55.8 mg/Kg
							Cadmium	142 mg/Kg
							Calcium	7530 mg/Kg
							Chromium	86.8 mg/Kg
							Cobalt	199 mg/Kg
							Copper	268 mg/Kg
							Iron	12800 mg/Kg
							Lead	97.9 mg/Kg
							Magnesium	2850 mg/Kg
							Manganese	425 mg/Kg
							Mercury	9.03 mg/Kg
							Mo	103 mg/Kg
							Nickel	236 mg/Kg
							Potassium	2570 mg/Kg
							Selenium	127 mg/Kg
							Silver	66.2 mg/Kg
							Sn	149 mg/Kg
							Sodium	1040 mg/Kg
							Sr	167 mg/Kg
							Thallium	140 mg/Kg
							Ti	215 mg/Kg
							Vanadium	156 mg/Kg
							Zinc	130 mg/Kg
PREP 1 and 2_00002	01/30/15		AccuScience, Lot 1055262		(Purchased Reagent)		Aluminum	2000 mg/L
							Antimony	100 mg/L
							Arsenic	200 mg/L
							B	400 mg/L
							Ba Carrier	200 mg/L
							Beryllium	200 mg/L
							Bi	200 mg/L
							Cadmium	200 mg/L
							Calcium	2000 mg/L

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Chromium	200 mg/L
							Cobalt	200 mg/L
							Copper	200 mg/L
							Iron	2000 mg/L
							Lead	200 mg/L
							Li	200 mg/L
							Magnesium	2000 mg/L
							Manganese	200 mg/L
							Mo	100 mg/L
							Nb	100 mg/L
							Nickel	200 mg/L
							P	200 mg/L
							Potassium	2000 mg/L
							Selenium	100 mg/L
							Silver	40 mg/L
							Sm	200 mg/L
							Sn	200 mg/L
							Sodium	2000 mg/L
							Sr	200 mg/L
							Sulfur	2000 mg/L
							Th	200 mg/L
							Thallium	40 mg/L
							Ti	200 mg/L
							U	200 mg/L
							Vanadium	200 mg/L
							W	200 mg/L
							Zinc	200 mg/L
							Zr	200 mg/L
Ra-226_00008	09/21/13	08/28/12	1M HNO3, Lot 0	1000 mL	Ra-226_00003	3 mL	Ra	25.0433 dpm/mL
							Radium-226	25.0433 dpm/mL
							Total Alpha Radium	25.0433 dpm/mL
.Ra-226_00003	09/09/41	03/07/03	1M HNO3, Lot 0	100 mL	Ra-226_00001	5.0931 g	Ra	8347.78 dpm/mL
							Radium-226	8347.78 dpm/mL
							Total Alpha Radium	8347.78 dpm/mL
..Ra-226_00001	09/09/41	NIST, Lot SRM 4967			(Purchased Reagent)		Ra	2729 Bq/g
							Radium-226	2729 Bq/g
							Total Alpha Radium	2729 Bq/g
Ra-228_00007	07/16/14	06/18/12	0.5M HCL, Lot 0	500 mL	Ra-228_00003	2 mL	Radium-228	23.2417 dpm/mL
.Ra-228_00003	02/03/34	09/01/06	0.5M HCL, Lot 0	200 mL	Ra-228_00002	4.9582 g	Radium-228	5810.43 dpm/mL
..Ra-228_00002	02/03/34	Analytics, Lot 72287-334			(Purchased Reagent)		Radium-228	3906.28 Bq/g

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
Ra226 Cal_00001	10/06/52	10/06/03	0.5M HNO3, Lot 10/06/2003	100 mL	Th-230 Ra226_00001	5.1498 g	Thorium-230	4567.94 dpm/g
.Th-230 Ra226_00001	12/19/52	Analytics, Lot 65090-334			(Purchased Reagent)		Thorium-230	88701.2 dpm/g
RA22609A120_00003	05/16/14	Eckert & Ziegler, Lot 1388-74			(Purchased Reagent)		Ra	100.02 dpm/mL
							Radium-226	100.02 dpm/mL
							Total Alpha Radium	100.02 dpm/mL
Source A_00001	04/01/59	02/23/11	water, Lot 79670-334	0.9986 Source	Gamma Ampuole_00001	0.9986 g	Americium-241	9.4429 Bq
							Cd-109	132.909 Bq
							Ce-139	4.4538 Bq
							Cesium-137	3.7296 Bq
							Co-57	2.9513 Bq
							Cobalt-60	6.2002 Bq
							Hg-203	9.6996 Bq
							Sn-113	7.6266 Bq
							Y-88	12.712 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 C_00001	04/01/59	02/23/12	water, Lot 79670-334	1.0148 g	Gamma Ampuole_00001	1.0148 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 D_00001	04/01/59	02/23/11	water, Lot 79670-334	0.9781 g	Gamma Ampuole_00001	0.9781 g	Americium-241	9442.9 Bq
							Cd-109	132909 Bq
							Ce-139	4453.8 Bq
							Cesium-137	3729.6 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							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 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 F_00001	01/01/61	02/23/11	water, Lot 83725-334	10 mL	Gamma Ampuole_00003	2.0327 mL	Americium-241	1846.42 Bq
							Cd-109	26819.3 Bq
							Ce-139	890.424 Bq
							Cesium-137	743.562 Bq
							Co-57	580.6 Bq
							Cobalt-60	1222.38 Bq
							Hg-203	1926.02 Bq
							Sn-113	1576.93 Bq
							Y-88	2572.87 Bq
.Gamma Ampuole_00003	01/19/61		Analytics, Lot 83725-334		(Purchased Reagent)		Americium-241	9083.6 Bq
							Cd-109	131939 Bq
							Ce-139	4380.5 Bq
							Cesium-137	3658 Bq
							Co-57	2856.3 Bq

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Cobalt-60	6013.6 Bq
							Hg-203	9475.2 Bq
							Sn-113	7757.8 Bq
							Y-88	12657.4 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
							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
							Y-88	2681.34 Bq
.Gamma Ampuole_00003	01/19/61		Analytics, Lot 83725-334		(Purchased Reagent)		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
							Sn-113	7757.8 Bq
							Y-88	12657.4 Bq
Sr-90_00004	09/17/59	06/21/11	0.1M HCL, Lot 0	100 mL	Sr-90_00001	5.0139 g	Gross Beta	45120.6 dpm/mL
							Sr	22560.3 dpm/mL
							Sr-90	22560.3 dpm/mL
.Sr-90_00001	09/17/59		Eckert & Ziegler, Lot 80573-334		(Purchased Reagent)		Gross Beta	14998.5 Bq/g

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Sr	7499.25 Bq/g
							Sr-90	7499.25 Bq/g
Sr-90_00018	11/29/62	11/28/12	0.1M HCL, Lot 0	100 mL	Sr-90_00017	4.9997 g	Gross Beta	44774.2 dpm/mL
							Sr-90	22387.1 dpm/mL
.Sr-90_00017	11/29/62	Analytics, Lot 92352			(Purchased Reagent)		Gross Beta	14925.6 Bq/g
							Sr-90	7462.82 Bq/g
Th-229_00012	12/26/14	12/23/13	0.1M HNO3, Lot L0022	500 mL	Th-229_00004	15 mL	Thorium-229	67.9293 dpm/mL
.Th-229_00004	07/14/60	01/26/11	0.1M HNO3, Lot 0	100 mL	Th-229_00002	5.0613 g	Thorium-229	2264.31 dpm/mL
..Th-229_00002	07/14/60	Eckert & Ziegler, Lot 82832-334			(Purchased Reagent)		Thorium-229	745.63 Bq/g
Th-230_00003	04/11/61	06/24/11	1M HNO3, Lot 0	100 mL	Th-230_00001	5.0878 g	Gross Alpha	2397.01 dpm/mL
							Thorium-230	2397.01 dpm/mL
.Th-230_00001	04/11/61	Eckert & Ziegler, Lot 84460-334			(Purchased Reagent)		Gross Alpha	785.217 Bq/g
							Thorium-230	785.217 Bq/g
Th-230_00016	11/29/62	11/28/12	0.5M HNO3, Lot 0	100 mL	Th-230_00015	5.0489 g	Gross Alpha	2374.49 dpm/mL
							Thorium-230	2374.49 dpm/mL
.Th-230_00015	11/29/62	Analytics, Lot 92523			(Purchased Reagent)		Gross Alpha	783.829 Bq/g
							Thorium-230	783.829 Bq/g
Th-230_00023	01/28/15	02/04/13	1M HNO3, Lot 0	200 mL	Th-230_00006	4 mL	Thorium-230	47.9403 dpm/mL
.Th-230_00006	04/11/61	06/24/11	1M HNO3, Lot 0	100 mL	Th-230_00002	5.0878 g	Thorium-230	2397.01 dpm/mL
..Th-230_00002	04/11/61	Eckert & Ziegler, Lot 84460-334			(Purchased Reagent)		Thorium-230	785.217 Bq/g
TRM-2_00001	03/20/50	DOE, Lot TRM-2			(Purchased Reagent)		Lead-210	22.1 pCi/g
							Radium-226	25.4 pCi/g
							Thorium-230	24.5 pCi/g
							Uranium-233/234	6.2 pCi/g
							Uranium-238	6 pCi/g
Tuna Can LCS_00002	01/22/14	Analytics, Lot 74139-334			(Purchased Reagent)		Americium-241	219 dpm/g
							Cesium-137	82.3 dpm/g
							Cobalt-60	136 dpm/g
Tuna Can LCS_00003	10/31/14	Analytics, Lot 74139-334			(Purchased Reagent)		Americium-241	219 dpm/g
							Cesium-137	82.3 dpm/g
							Cobalt-60	136 dpm/g
Tuna Can_00002	02/03/15	Eckert & Ziegler, Lot 81427-334			(Purchased Reagent)		Americium-241	1164 Bq
							Cd-109	16063 Bq
							Ce-139	546 Bq
							Cesium-137	465 Bq
							Co-57	357 Bq

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Cobalt-60	742 Bq
							Hg-203	1208 Bq
							Lead-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
							Lead-210	14936 Bq
							Sn-113	967 Bq
							Y-88	1590 Bq
Tuna Can_00006	03/01/16	Eckert & Ziegler, Lot 83814-334			(Purchased Reagent)		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
							Lead-210	14606 Bq
							Sn-113	961 Bq
							Y-88	1568 Bq
U-232_00025	05/11/15	05/07/14	DI Water, Lot 0	250 mL	U-232_00009	2 mL	Uranium-232	82.2457 dpm/mL
.U-232_00009	08/25/61	08/29/11	1M HNO3, Lot 0	100 mL	U-232_00003	5.1609 g	Uranium-232	10280.7 dpm/mL
..U-232_00003	08/25/61	Eckert & Ziegler, Lot 85539-334			(Purchased Reagent)		Uranium-232	3320.07 Bq/g
U-232_00026	05/06/15	06/13/13	2M HNO3, Lot n/a	1000 mL	U-232_00009	8 mL	Uranium-232	82.2457 dpm/mL
.U-232_00009	08/25/61	08/29/11	1M HNO3, Lot 0	100 mL	U-232_00003	5.1609 g	Uranium-232	10280.7 dpm/mL
..U-232_00003	08/25/61	Eckert & Ziegler, Lot 85539-334			(Purchased Reagent)		Uranium-232	3320.07 Bq/g
UNAT Spike_00001	11/13/14	11/11/13	1M HNO3, Lot n/a	200 mL	UNAT Parent_00001	20 mL	Uranium-233/234	70.6912 dpm/mL
							Uranium-235/236	3.37064 dpm/mL
							Uranium-238	72.265 dpm/mL
.UNAT Parent_00001	03/30/58	05/03/13	1M HNO3, Lot n/a	200 mL	UNAT Ampoule_00001	19.2509 g	Uranium-233/234	706.912 dpm/mL
							Uranium-235/236	33.7064 dpm/mL
							Uranium-238	722.65 dpm/mL
..UNAT Ampoule_00001	03/30/58	New Brunswick Lab, Lot CRM 145			(Purchased Reagent)		Uranium-233/234	7344.2 dpm/g
							Uranium-235/236	350.18 dpm/g

REAGENT TRACEABILITY SUMMARY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Reagent ID	Exp Date	Prep Date	Dilutant Used	Reagent Final Volume	Parent Reagent		Analyte	Concentration
					Reagent ID	Volume Added		
							Uranium-238	7507.7 dpm/g
Y Carrier_00008	09/28/15	CPI, Lot 1058681			(Purchased Reagent)		Y Carrier	50000 mg/L

Reagent

1L Marn_00002

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

83924-334

1.0 Liter Solid in 130G GA-MA Beaker

Customer: Test America St. Louis
P.O. No.: 2401509, Item 1
Reference Date: 01-Jan-2011 12:00 PM EST **Grams of Master Source:** 0.015372

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. Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty , % Type u_A	u_B	U	Calibration Method
Am-241	59.5	1.580E+05	———	1.830E+03	0.1	1.7	3.5	4π LS
Cd-109	88.0	4.626E+02	1.697E+05	2.609E+03	0.8	2.3	4.9	HPGe
Co-57	122.1	2.718E+02	8.711E+04	1.339E+03	0.5	2.0	4.1	HPGe
Ce-139	165.9	1.376E+02	1.247E+05	1.917E+03	0.5	1.9	3.9	HPGe
Hg-203	279.2	4.661E+01	2.753E+05	4.232E+03	0.4	1.9	3.9	HPGe
Sn-113	391.7	1.151E+02	1.769E+05	2.719E+03	0.5	1.9	3.9	HPGe
Cs-137	661.7	1.098E+04	1.109E+05	1.705E+03	0.7	1.9	4.0	HPGe
Mn-54	834.9	3.121E+02	———	3.083E+03	0.1	1.7	3.3	IC
Y-88	898.0	1.066E+02	4.224E+05	6.493E+03	0.5	1.9	3.9	HPGe
Zn-65	1115.6	2.441E+02	———	3.181E+03	0.1	1.7	3.5	IC
Co-60	1173.2	1.925E+03	2.142E+05	3.293E+03	0.6	1.9	4.0	HPGe
Co-60	1332.5	1.925E+03	2.143E+05	3.294E+03	0.6	1.9	4.0	HPGe
Y-88	1836.1	1.066E+02	4.472E+05	6.874E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1956

6675
ID: 1L Marn_00002
Exp: 03/02/16 Prpd: JW Opn: 03/02/11
Mixed Gamma 1L Marn 2011

91608
ID: 1L Marn_00004
Exp:02/15/14 Prpd:JW Opn:03/
Mixed Gamma 1L Marn

ANA Form005 Rev. —

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

This standard will expire one year after the reference date.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ Date: 2/23/11
J. D. McCorvey, QA Manager Alternate

Reagent

1L Marn_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

90062
1.0 Liter Solid in 130G GA-MA Beaker

Customer: TestAmerica St. Louis
P.O. No.: 2455298, Item 1
Reference Date: 01-Jan-2012 12:00 PM EST **Grams of Master Source:** 0.015513

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.
Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty* , % Type u_A	u_B	U	Calibration Method*
Am-241	59.5	1.580E+05	———	1.821E+03	0.1	1.7	3.5	4π LS
Cd-109	88.0	4.626E+02	1.677E+05	2.602E+03	0.5	2.3	4.7	HPGe
Co-57	122.1	2.718E+02	8.795E+04	1.364E+03	0.4	2.0	4.1	HPGe
Ce-139	165.9	1.376E+02	1.245E+05	1.932E+03	0.4	1.9	3.9	HPGe
Hg-203	279.2	4.661E+01	2.707E+05	4.200E+03	0.3	1.9	3.8	HPGe
Sn-113	391.7	1.151E+02	1.755E+05	2.722E+03	0.4	1.9	3.9	HPGe
Cs-137	661.7	1.098E+04	1.128E+05	1.750E+03	0.7	1.9	4.0	HPGe
Mn-54	834.9	3.121E+02	———	3.114E+03	0.1	1.7	3.3	IC
Y-88	898.0	1.066E+02	4.228E+05	6.559E+03	0.5	1.9	3.9	HPGe
Zn-65	1115.6	2.441E+02	———	3.134E+03	0.1	1.7	3.5	IC
Co-60	1173.2	1.925E+03	2.084E+05	3.233E+03	0.6	1.9	4.0	HPGe
Co-60	1332.5	1.925E+03	2.084E+05	3.233E+03	0.7	1.9	4.0	HPGe
Y-88	1836.1	1.066E+02	4.476E+05	6.944E+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)

This standard will expire one year after the reference date.

Source Prepared by: M Williford
M. Williford, Radiochemist

QA Approved: L. Mc
J.D. McCorvey, Counting Room Manager

Date: 26 Jan 12

Reagent

1L Marn_00004

St. Louis Radiological Standard Reverification Form

Standard ID Number: 1L Marn_6675
True Value = 5097.5 Bq/Sample
Date Analyzed: 2/15/2013

Radionuclide: Am-241

	Replicates	
#1	4993	Bq/Sample
#2	5086	Bq/Sample
#3	4995	Bq/Sample

Mean = 5024.667

1 sigma = 53.12564 1.96 sigma = 104.1262

True Value minus 5% = 4842.625 (True Value - 5%)
True Value plus 5% = 5352.375 (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: JW 2/20/13

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: 1L Marn_6675
True Value = 3294.5 Bq/Sample
Date Analyzed: 2/15/2013

Radionuclide: Co-60 1L

	Replicates	
#1	3157	Bq/Sample
#2	3243	Bq/Sample
#3	3135	Bq/Sample

Mean = 3178.333

1 sigma = 57.07305 1.96 sigma = 111.8632

True Value minus 5% = 3129.775 (True Value - 5%)
True Value plus 5% = 3459.225 (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: JW 2/20/13

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: 1l Marn_6675
True Value = 2003.5 Bq/Sample
Date Analyzed: 2/15/2013

Radionuclide: Cs-137

	Replicates	
#1	1933	Bq/Sample
#2	1961	Bq/Sample
#3	1949	Bq/Sample

Mean = 1947.667

1 sigma = 14.04754 1.96 sigma = 27.53318

True Value minus 5% = 1903.325 (True Value - 5%)
True Value plus 5% = 2103.675 (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: JW 4/12/11

SOP Reference: STL-QA-0002, Current Revision

Test America St. Louis Spectrum ID: 12_1LMarn_20130204

Sample Description: 12_1LMarn_6675_re-ver
Detector: Ge12 S/N10034336
Batch ID: 12
Work Order Number: 1LMarn
Lot Number: 6675_re-ver

Decay to Time: 1/1/2011 11:00 Live Time: 7200 sec
Acquisition Time: 2/15/2013 03:32:29 Real Time: 7597 sec
Analysis Time: 2/20/2013 09:54 Dead Time: 5.23 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 12_Liquid_Marinelli 1L.Clb
Efficiency Cal Desc: Ge12_Marn1LCal_90062_032612
Efficiency Cal Date: 4/2/2012 17:17
Energy Cal Date: 2/28/2012 13:26
Library: DET_EnergyStandardMix & Mn, Zn.l
Bkgd Correction File: 12_2013-02-02_0428.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
AM-241	4.993E+03	0.2	8.575E+00	3.142E+02	1.328E+01
CD-109	6.962E+04	0.2	1.672E+02	4.406E+03	2.479E+02
CO-57	1.616E+03	0.6	1.035E+01	9.820E+01	1.838E+01
Ce-139	2.398E+03	2.7	6.538E+01	2.331E+02	1.366E+02
SN-113	4.125E+03	5.4	2.209E+02	3.294E+02	4.796E+02
CS-137	1.933E+03	0.3	5.094E+00	9.761E+01	5.422E+00
Mn-54	2.982E+03	0.7	2.108E+01	1.487E+02	2.977E+01
Y-898	7.047E+03	5.8	4.103E+02	5.371E+02	8.058E+02
Zn-65	6.569E+03	1.2	7.682E+01	3.282E+02	1.117E+02
Co-1173	3.101E+03	0.3	8.067E+00	1.510E+02	7.041E+00
Co-1332	3.157E+03	0.2	7.828E+00	1.560E+02	4.920E+00
Y-1836	7.692E+03	3.1	2.377E+02	5.012E+02	3.034E+02
Total	1.152E+05				

Analyst: Jody Watson

TestAmerica, Inc Spectrum name: 12_1LMarn_20130204.An1

Sample description
12_1LMarn_6675_re-ver

Spectrum Filename: C:\User\SPC\Det12\12_1LMarn_20130204.An1

Acquisition information

Start time:	2/15/2013 3:32:29 AM
Live time:	7200
Real time:	7597
Dead time:	5.23 %
Detector ID:	12

Detector system
Ge12 S/N10034336

Calibration
Filename: 12_Liquid_Marinelli 1L.Clb
Ge12_Marn1LCal_90062_032612

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:	4/2/2012 5:17:10 PM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 2.18 %
Log(Eff):	-2.771167E+00 + (4.009767E-01*Log(E)) + (-8.911171E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.25 %
Log(Eff):	-1.324587E+01 + (4.570937E+00*Log(E)) + (-5.039442E-01*Log(E)^2)

Library Files

Main analysis library:	DET_EnergyStandardMix & Mn, Zn.l
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:	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

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	1/1/2011 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	12_2013-02-02_0428.PBC 2/2/2013 4:28:50 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0584

***** 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
36.76	5138.	7.55	0.84	3.624E-02				
43.53	616.	56.59	0.85	4.187E-02				
48.69	11606.	4.22	0.89	4.530E-02				
49.86	18202.	2.91	0.89	4.600E-02				
59.54	648225.	0.17	0.91	5.068E-02	59.54	35.700	4.993E+03	AM241
88.03	316880.	0.24	0.96	5.599E-02	88.03	3.610	6.962E+04	CD109
102.95	456.	45.02	1.11	5.581E-02				
122.10	74467.	0.64	1.01	5.407E-02	122.06	85.600	1.615E+03	CO57
136.49	8641.	3.11	1.00	5.213E-02				
140.88	250.	68.28	0.46	5.147E-02				
154.79	170.	80.90	0.57	4.927E-02				
165.91	13146.	2.73	1.00	4.737E-02	165.85	79.900	2.398E+03	Ce139
194.47	428.	51.24	0.33	4.358E-02				
263.92	325.	73.81	0.38	3.667E-02				
344.31	944.	21.10	1.38	3.113E-02				
391.58	5189.	3.36	1.21	2.862E-02	391.69	64.000	4.205E+03	SN113
395.19	381.	39.22	1.22	2.845E-02				
455.45	273.	54.35	1.27	2.584E-02				
459.06	280.	53.16	1.27	2.570E-02				
510.93	3274.	8.35	2.36	2.384E-02				
579.94	138.	70.65	0.52	2.176E-02				
602.40	379.	50.83	0.44	2.116E-02				
613.62	470.	50.91	0.40	2.087E-02				
661.61	222792.	0.26	1.43	1.973E-02	661.66	85.210	1.933E+03	CS137
690.22	165.	83.10	0.50	1.910E-02				
816.21	109.	83.32	0.33	1.676E-02				
834.77	63184.	0.71	1.62	1.647E-02	834.85	99.980	2.982E+03	Mn54
876.46	229.	53.88	0.48	1.583E-02				

885.61	187.	61.97	0.31	1.570E-02				
897.98	4761.	5.82	1.72	1.553E-02	898.02	93.700	7.047E+03	Y898
918.14	272.	56.40	1.67	1.525E-02				
919.93	319.	48.16	1.67	1.523E-02				
948.57	744.	29.95	0.29	1.485E-02				
1015.37	371.	48.30	0.36	1.404E-02				
1089.44	434.	39.48	0.49	1.323E-02				
1115.38	34358.	1.17	1.81	1.297E-02	1115.55	50.600	6.569E+03	Zn65
1173.10	209549.	0.26	1.82	1.242E-02	1173.24	99.900	3.101E+03	Co1173
1203.75	205.	30.79	1.89	1.215E-02				
1208.51	159.	45.21	1.90	1.211E-02				
1249.20	248.	46.34	0.36	1.177E-02				
1270.02	63.	67.58	0.45	1.160E-02				
1332.36	191117.	0.25	1.91	1.112E-02	1332.50	99.982	3.157E+03	Co1332
1405.23	14.	126.57	0.46	1.061E-02				
1606.84	145.	38.49	0.67	9.398E-03				
1626.74	92.	41.34	0.33	9.293E-03				
1686.46	98.	41.34	0.53	8.990E-03				
1778.89	137.	39.94	0.34	8.555E-03				
1835.71	2943.	3.09	2.07	8.307E-03	1836.01	99.200	7.692E+03	Y1836
1883.88	168.	27.97	0.82	8.107E-03				
1897.64	66.	36.27	0.50	8.052E-03				
1956.93	68.	35.28	0.70	7.821E-03				

********** 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
146.70	36.76	43650.	5138.	1.418E+05	7.55	0.837	- s
173.77	43.53	48366.	616.	1.471E+04	56.59	0.850	- s
194.41	48.63	113899.	11606.	2.562E+05	4.22	0.891	- D

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected	
199.07	49.79	130727.	18202.	3.957E+05	2.91	0.892	-	D
411.27	102.95	15657.	456.	8.177E+03	45.02	1.110	-	s
545.32	136.49	19063.	8641.	1.658E+05	3.11	1.004	-	
562.86	140.88	11602.	250.	4.867E+03	68.28	0.458	-	c
618.48	154.79	8685.	170.	3.457E+03	80.90	0.573	-	c
777.08	194.47	15890.	428.	9.820E+03	51.24	0.326	-	s
1054.68	263.92	16350.	325.	8.862E+03	73.81	0.375	-	s
1376.06	344.31	11620.	944.	3.033E+04	21.10	1.382	-	
1579.53	395.20	7807.	269.	9.467E+03	53.92	0.786	-	sM
1820.40	455.44	5006.	139.	5.378E+03	72.48	0.538	-	sc
1834.82	459.04	10946.	240.	9.337E+03	77.84	0.480	-	sc
2042.29	510.93	14793.	3274.	1.373E+05	8.35	2.357	-	s
2318.27	579.94	4035.	138.	6.357E+03	70.65	0.520	-	sc
2408.11	602.40	9183.	379.	1.791E+04	50.83	0.439	-	s
2452.99	613.62	11757.	470.	2.253E+04	50.91	0.399	-	s
2759.35	690.22	5567.	165.	8.620E+03	83.10	0.505	-	sc
3263.32	816.21	3488.	109.	6.502E+03	83.32	0.327	-	sc
3504.38	876.46	5276.	229.	1.444E+04	53.88	0.484	-	s
3540.98	885.61	4965.	187.	1.191E+04	61.97	0.305	-	s
3671.10	918.13	11618.	272.	1.783E+04	56.40	1.666	-	D
3678.29	919.93	11672.	319.	2.098E+04	48.16	1.667	-	D
3792.86	948.57	11290.	744.	5.011E+04	29.95	0.287	-	s
4060.14	1015.37	7632.	371.	2.646E+04	48.30	0.356	-	s
4356.55	1089.44	6938.	434.	3.279E+04	39.48	0.485	-	s
4813.99	1203.74	2058.	250.	2.055E+04	37.63	0.717	-	s
4833.06	1208.50	1794.	168.	1.383E+04	50.10	0.460	-	s
4995.96	1249.20	1986.	248.	2.104E+04	46.34	0.358	-	s
5079.30	1270.02	614.	63.	5.418E+03	67.58	0.447	-	s
5620.52	1405.23	150.	14.	1.320E+03	126.57	0.457	-	sc
6427.77	1606.84	495.	145.	1.543E+04	38.49	0.668	-	s
6507.48	1626.74	301.	92.	9.900E+03	41.34	0.325	-	s
6746.62	1686.46	318.	98.	1.088E+04	41.34	0.533	-	s
7116.83	1778.89	431.	137.	1.605E+04	39.94	0.344	-	s
7537.37	1883.88	306.	168.	2.072E+04	27.97	0.818	-	s
7592.48	1897.64	142.	66.	8.135E+03	36.27	0.501	-	s
7830.00	1956.93	145.	68.	8.695E+03	35.28	0.696	-	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 & Mn, Zn.l

********** 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	237.76	59.54	136413.	648225.	90.031	0.17	0.907
CD-109	351.61	88.03	58352.	316880.	44.011	0.24	0.963
CO-57	487.80	122.10	32850.	74467.	10.343	0.64	1.009
Ce-139	662.90	165.91	25630.	13146.	1.826	2.73	1.002
Hg-203	1114.99	279.00	22973.	-66.	-0.009	324.64	1.109s
SN-113	1565.09	391.59	15977.	5089.	0.707	5.36	1.252
CS-137	2644.90	661.61	17821.	222792.	30.943	0.26	1.432
Mn-54	3337.58	834.77	18168.	63184.	8.776	0.71	1.620
Y-898	3590.46	897.98	13511.	4761.	0.661	5.82	1.720s
Zn-65	4460.38	1115.38	15559.	34358.	4.772	1.17	1.808
Co-1173	4691.36	1173.10	10305.	209549.	29.104	0.26	1.819
Co-1332	5328.82	1332.36	4011.	191117.	26.544	0.25	1.913
Y-1836	7344.42	1835.71	592.	2943.	0.409	3.09	2.074

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
AM-241		4.9933E+03				1.58E+05		
			59.54	4.993E+03	(	1.328E+01	1.72E-01 3.57E+01 G	
CD-109		6.9615E+04				4.63E+02		
			88.03	6.962E+04	(	2.479E+02	2.40E-01 3.61E+00 G	
CO-57		1.6155E+03				2.72E+02		
			122.06	1.615E+03	(	1.838E+01	6.41E-01 8.56E+01 G	
Ce-139		2.3981E+03				1.38E+02		
			165.85	2.398E+03	(	1.366E+02	2.73E+00 7.99E+01 G	
Hg-203		-3.1754E-01				4.66E+01		
			279.17	-3.175E-01	?(	3.407E+00	3.25E+02 8.15E+01 G	
SN-113		4.1246E+03				1.15E+02		
			391.69	4.125E+03	(	4.796E+02	5.36E+00 6.40E+01 G	
CS-137		1.9333E+03				1.10E+04		
			661.66	1.933E+03	(	5.422E+00	2.63E-01 8.52E+01 G	

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Mn-54		2.9820E+03					3.12E+02	
			834.85	2.982E+03	(	2.977E+01	7.07E-01	1.00E+02 G
Y-898		7.0471E+03					1.07E+02	
			898.02	7.047E+03	@(	8.058E+02	5.82E+00	9.37E+01 G
Zn-65	F	6.5691E+03					2.44E+02	
			1115.55	6.569E+03	(	1.117E+02	1.17E+00	5.06E+01 G
Co-1173		3.1012E+03					1.93E+03	
			1173.24	3.101E+03	(	7.041E+00	2.60E-01	9.99E+01 G
Co-1332		3.1570E+03					1.93E+03	
			1332.50	3.157E+03	(	4.920E+00	2.48E-01	1.00E+02 G
Y-1836		7.6919E+03					1.07E+02	
			1836.01	7.692E+03	(	3.034E+02	3.09E+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.
@ - 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	279.00	22973.	-66.	-0.009	324.64	0.000E+00

P - Peakbackground subtraction

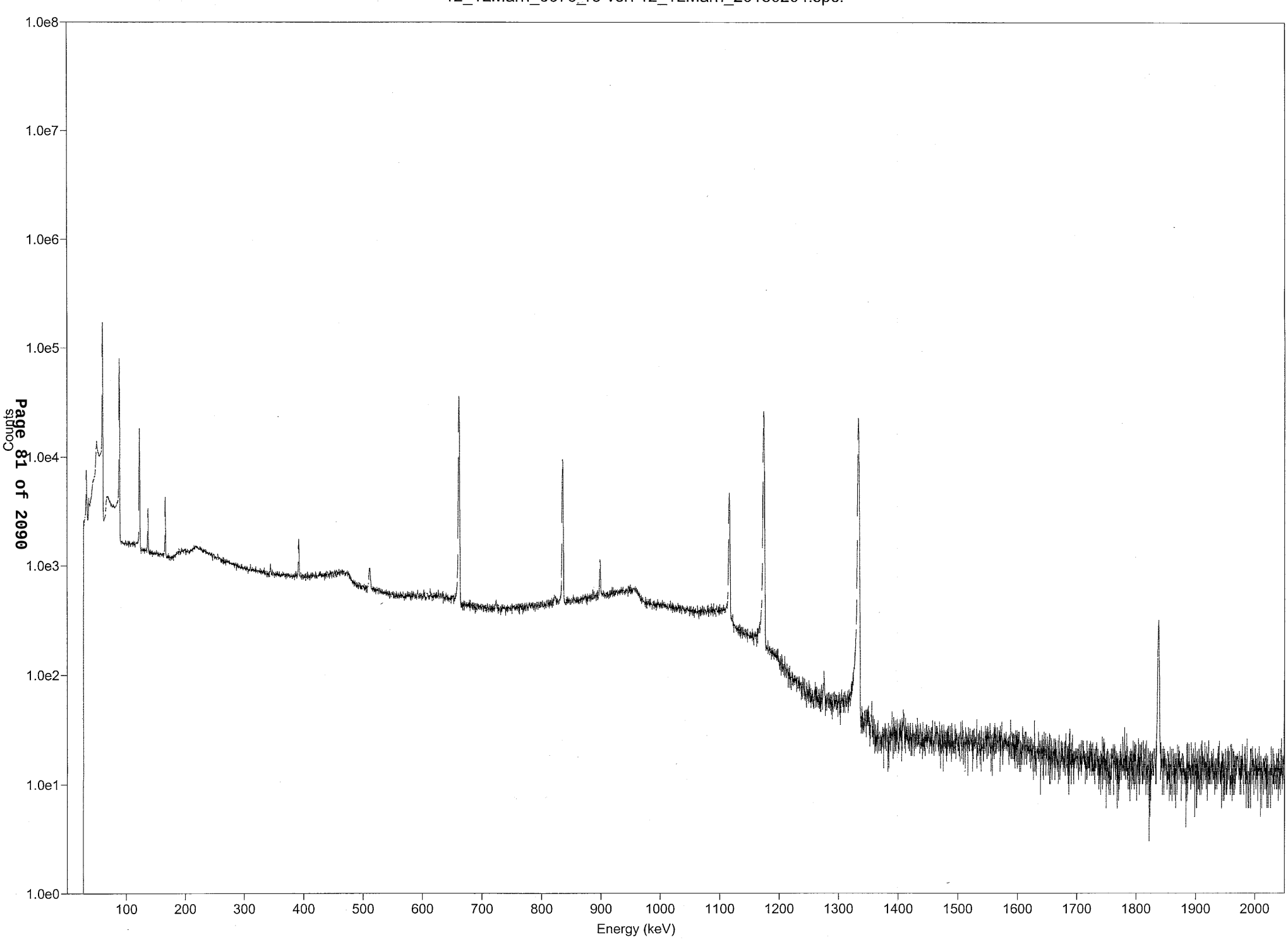
***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting		MDA Bq/Sample
AM-241	4.9763E+03	4.9933E+03	1.717E-01%		1.33E+01
CD-109	2.1774E+04	6.9615E+04	2.402E-01%		2.48E+02
CO-57	2.2346E+02	1.6155E+03	6.409E-01%		1.84E+01
Ce-139	4.8235E+01	2.3981E+03	2.727E+00%		1.37E+02
Hg-203 #A	-3.1754E-01	>12 Halflives	3.2464E+02%	3.4074E+00	
SN-113	3.8591E+01	4.1246E+03	5.357E+00%		4.80E+02
CS-137	1.8409E+03	1.9333E+03	2.635E-01%		5.42E+00
Mn-54	5.3310E+02	2.9820E+03	7.068E-01%		2.98E+01
Y-898 #	4.5449E+01	7.0471E+03	5.822E+00%		8.06E+02
Zn-65	7.2726E+02	6.5691E+03	1.169E+00%		1.12E+02
Co-1173	2.3455E+03	3.1012E+03	2.601E-01%		7.04E+00
Co-1332	2.3877E+03	3.1570E+03	2.479E-01%		4.92E+00
Y-1836	4.9607E+01	7.6919E+03	3.090E+00%		3.03E+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 (948.4 to 1999.4 keV) 3.499E+04 Bq/Sample
Total Decayed Activity (948.4 to 1999.4 keV) 1.1522832E+05 Bq/Sample


12_1LMarn_6675_re-ver. 12_1LMarn_20130204.spc.
1.0e8
1.0e7
1.0e6
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Counts
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Energy (keV)

Test America St. Louis Spectrum ID: 15_1LMarn_20130225

Sample Description: 15_1LMarn_6675_re-ver
Detector: Ge15 SN/11012216
Batch ID: 15
Work Order Number: 1LMarn
Lot Number: 6675_re-ver

Decay to Time: 1/1/2011 11:00 Live Time: 7200 sec
Acquisition Time: 2/19/2013 21:03:28 Real Time: 7487 sec
Analysis Time: 2/20/2013 07:54 Dead Time: 3.84 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 15_Liquid_Marinelli 1L.Clb
Efficiency Cal Desc: 15_1LMarinelli_90062_030512
Efficiency Cal Date: 3/14/2012 17:18
Energy Cal Date: 2/28/2012 16:29
Library: DET_EnergyStandardMix & Mn, Zn.l
Bkgd Correction File: 15_2013-02-02_0428.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
AM-241	5.086E+03	0.2	1.011E+01	3.201E+02	1.571E+01
CD-109	7.057E+04	0.3	2.093E+02	4.469E+03	3.174E+02
CO-57	1.609E+03	0.7	1.171E+01	9.794E+01	2.150E+01
Ce-139	2.385E+03	3.2	7.640E+01	2.353E+02	1.655E+02
SN-113	4.642E+03	5.9	2.758E+02	3.895E+02	6.198E+02
CS-137	1.961E+03	0.3	6.690E+00	9.909E+01	7.312E+00
Mn-54	3.011E+03	0.9	2.768E+01	1.512E+02	4.059E+01
Y-898	7.964E+03	8.3	6.571E+02	7.650E+02	1.244E+03
Zn-65	6.522E+03	1.3	8.535E+01	3.281E+02	1.353E+02
Co-1173	3.195E+03	0.3	1.021E+01	1.557E+02	8.479E+00
Co-1332	3.243E+03	0.3	1.025E+01	1.603E+02	5.804E+00
Y-1836	7.187E+03	3.6	2.616E+02	4.883E+02	3.454E+02
Total	1.174E+05				

Analyst: Jody Watson

TestAmerica, Inc. Spectrum name: 15_1LMarn_20130225.An1

Sample description
15_1LMarn_6675_re-ver

Spectrum Filename: C:\User\SPC\Det15\15_1LMarn_20130225.An1

Acquisition information
Start time: 2/19/2013 9:03:28 PM
Live time: 7200
Real time: 7487
Dead time: 3.84 %
Detector ID: 15

Detector system
Ge15 SN/11012216

Calibration
Filename: 15_Liquid_Marinelli 1L.Clb
15_1LMarinelli_90062_030512

Energy Calibration
Created: 2/28/2012 4:29:17 PM
Zero offset: 0.044 keV
Gain: 0.250 keV/channel
Quadratic: -3.267E-08 keV/channel^2

Efficiency Calibration
Created: 3/14/2012 5:18:02 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.47 %
Log(Eff): -1.572527E+00 + (-4.580173E-02*Log(E)) + (-6.063230E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.05 %
Log(Eff): -1.327166E+01 + (4.478511E+00*Log(E)) + (-4.979721E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix & Mn, Zn.l
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.57keV)
Stop channel: 8000 (1999.52keV)
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

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	1/1/2011 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	15_2013-02-02_0428.PBC 2/2/2013 4:28:03 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0535

***** 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
36.48	2825.	10.89	0.91	2.717E-02				
42.57	608.	49.87	0.60	3.083E-02				
49.55	21252.	3.12	1.86	3.412E-02				
59.58	487285.	0.20	0.95	3.741E-02	59.54	35.700	5.086E+03	AM241
66.42	63.	398.25	0.77	3.888E-02				
88.11	231633.	0.30	0.98	4.066E-02	88.03	3.610	7.057E+04	CD109
103.26	462.	39.69	0.44	4.027E-02				
122.16	52563.	0.73	1.04	3.879E-02	122.06	85.600	1.609E+03	CO57
128.83	200.	57.27	0.37	3.810E-02				
136.53	6618.	3.95	1.08	3.725E-02				
165.96	9080.	3.20	1.09	3.368E-02	165.85	79.900	2.385E+03	Ce139
184.19	174.	79.03	1.07	3.142E-02				
186.87	356.	46.85	1.07	3.112E-02				
215.85	223.	57.70	0.65	2.815E-02				
255.26	394.	44.34	0.49	2.500E-02				
278.40	126.	143.74	1.16	2.343E-02	279.17	81.500	HL>Cutoff	Hg203
310.34	456.	44.10	0.40	2.168E-02				
344.08	422.	42.50	0.83	2.007E-02				
391.75	3537.	5.94	1.27	1.818E-02	391.69	64.000	4.642E+03	SN113
463.90	281.	67.27	0.57	1.593E-02				
623.89	190.	65.05	0.72	1.254E-02				
661.74	135608.	0.29	1.47	1.194E-02	661.66	85.210	1.944E+03	CS137
666.97	106.	105.63	1.48	1.186E-02				
672.06	141.	77.32	1.48	1.179E-02				
796.20	392.	39.17	0.80	1.021E-02				
834.93	37602.	0.92	1.59	9.807E-03	834.85	99.980	3.011E+03	Mn54
875.76	104.	63.24	0.46	9.410E-03				
885.01	208.	59.12	0.45	9.325E-03				
898.25	3094.	8.25	1.28	9.205E-03	898.02	93.700	7.964E+03	Y898
926.17	194.	65.73	0.51	8.963E-03				

1115.57	19728.	1.31	1.77	7.601E-03	1115.55	50.600	6.521E+03	Zn65
1173.26	126035.	0.32	1.80	7.264E-03	1173.24	99.900	3.195E+03	Co1173
1186.58	94.	68.35	0.46	7.190E-03				
1213.78	62.	61.82	0.45	7.044E-03				
1321.38	155.	32.46	0.83	6.519E-03				
1332.53	114010.	0.32	1.89	6.469E-03	1332.50	99.982	3.242E+03	Co1332
1415.02	139.	29.65	0.35	6.121E-03				
1836.04	1538.	3.64	2.23	4.790E-03	1836.01	99.200	7.187E+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 keV	Suspected Nuclide	
145.63	36.48	30600.	2825.	1.040E+05	10.89	0.914	-	
169.96	42.57	36525.	608.	1.972E+04	49.87	0.605	-	s

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
197.88	49.55	119732.	21252.	6.228E+05	3.12	1.864	- s
265.30	66.42	25155.	63.	1.620E+03	398.25	0.774	- sc
412.55	103.26	12418.	462.	1.146E+04	39.69	0.444	- s
514.77	128.83	6460.	200.	5.249E+03	57.27	0.373	- s
545.55	136.53	16853.	6618.	1.776E+05	3.95	1.077	- s
736.09	183.97	9389.	174.	5.543E+03	79.03	1.072	- sc
746.78	186.65	13737.	356.	1.144E+04	46.85	1.074	- D
862.65	215.85	7526.	223.	7.915E+03	57.70	0.654	- s
1020.21	255.26	10044.	394.	1.576E+04	44.34	0.491	- s
1240.43	310.34	10923.	456.	2.105E+04	44.10	0.399	- s
1375.30	344.08	9092.	422.	2.105E+04	42.50	0.832	- s
1854.40	463.90	9645.	281.	1.761E+04	67.27	0.567	- s
2494.23	623.89	4738.	190.	1.511E+04	65.05	0.719	- s
2666.38	666.93	1799.	70.	5.900E+03	86.52	0.448	- sc
2686.75	672.02	4425.	185.	1.569E+04	67.67	0.520	- s
3183.47	796.20	5554.	392.	3.834E+04	39.17	0.795	- s
3501.72	875.76	2111.	104.	1.105E+04	63.24	0.460	- sc
3538.74	885.01	4717.	208.	2.232E+04	59.12	0.451	- s
3703.39	926.17	5092.	194.	2.168E+04	65.73	0.508	- s
4745.38	1186.58	1274.	94.	1.307E+04	68.35	0.465	- s
4854.23	1213.78	554.	62.	8.731E+03	61.82	0.451	- s
5284.84	1321.38	594.	155.	2.378E+04	32.46	0.826	- s
5659.64	1415.02	260.	139.	2.271E+04	29.65	0.352	- 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: DET_EnergyStandardMix & Mn, Zn.l

********** 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	237.95	59.58	103990.	487285.	67.678	0.20	0.951
CD-109	352.01	88.11	49711.	231633.	32.171	0.30	0.976
CO-57	488.11	122.16	22553.	52563.	7.300	0.73	1.044
Ce-139	663.19	165.96	18123.	9080.	1.261	3.20	1.087
Hg-203	1112.69	278.40	16344.	126.	0.018	143.74	1.156
SN-113	1565.92	391.75	10152.	3537.	0.491	5.94	1.270s
CS-137	2645.47	661.70	11853.	136770.	18.996	0.34	1.451
Mn-54	3338.37	834.93	11706.	37602.	5.222	0.92	1.588
Y-898	3591.68	898.25	10638.	3094.	0.430	8.25	1.284
Zn-65	4461.20	1115.57	7610.	19728.	2.740	1.31	1.767
Co-1173	4692.08	1173.26	5069.	126035.	17.505	0.32	1.801
Co-1332	5329.49	1332.53	1868.	114010.	15.835	0.32	1.891

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Y-1836	7345.28	1836.04	233.	1538.	0.214	3.64	2.228

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample			COMMENTS
AM-241		5.0860E+03				1.58E+05			
			59.54	5.086E+03	(	1.571E+01	1.99E-01	3.57E+01	G
CD-109		7.0570E+04				4.63E+02			
			88.03	7.057E+04	(	3.174E+02	2.97E-01	3.61E+00	G
CO-57		1.6086E+03				2.72E+02			
			122.06	1.609E+03	(	2.150E+01	7.28E-01	8.56E+01	G
Ce-139		2.3853E+03				1.38E+02			
			165.85	2.385E+03	(	1.655E+02	3.20E+00	7.99E+01	G
Hg-203		9.1644E-01				4.66E+01			
			279.17	9.164E-01	(	4.352E+00	1.44E+02	8.15E+01	G
SN-113		4.6424E+03				1.15E+02			
			391.69	4.642E+03	@(	6.198E+02	5.94E+00	6.40E+01	G
CS-137		1.9608E+03				1.10E+04			
			661.66	1.961E+03	(	7.312E+00	3.41E-01	8.52E+01	G
Mn-54		3.0107E+03				3.12E+02			
			834.85	3.011E+03	(	4.059E+01	9.20E-01	1.00E+02	G
Y-898		7.9643E+03				1.07E+02			
			898.02	7.964E+03	(	1.244E+03	8.25E+00	9.37E+01	G
Zn-65	F	6.5215E+03				2.44E+02			
			1115.55	6.521E+03	(	1.353E+02	1.31E+00	5.06E+01	G
Co-1173		3.1948E+03				1.93E+03			
			1173.24	3.195E+03	(	8.479E+00	3.20E-01	9.99E+01	G
Co-1332		3.2425E+03				1.93E+03			
			1332.50	3.242E+03	(	5.804E+00	3.16E-01	1.00E+02	G

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
Y-1836	7.1870E+03				1.07E+02	
		1836.01	7.187E+03	(3.454E+02	3.64E+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.
@ - 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	278.40	16344.	126.	0.018	143.74	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 1 Sigma Counting		MDA Bq/Sample
AM-241	5.0686E+03	5.0860E+03	1.987E-01%		1.57E+01
CD-109	2.1917E+04	7.0570E+04	2.966E-01%		3.17E+02
CO-57	2.1983E+02	1.6086E+03	7.283E-01%		2.15E+01
Ce-139	4.6849E+01	2.3853E+03	3.203E+00%		1.66E+02
Hg-203 #A	9.1644E-01	>12 Halflives	1.4374E+02%	4.3521E+00	
SN-113 #	4.2216E+01	4.6424E+03	5.940E+00%		6.20E+02
CS-137	1.8665E+03	1.9608E+03	3.412E-01%		7.31E+00
Mn-54	5.3261E+02	3.0107E+03	9.195E-01%		4.06E+01
Y-898	4.9809E+01	7.9643E+03	8.250E+00%		1.24E+03
Zn-65	7.1237E+02	6.5215E+03	1.309E+00%		1.35E+02
Co-1173	2.4122E+03	3.1948E+03	3.197E-01%		8.48E+00
Co-1332	2.4482E+03	3.2425E+03	3.161E-01%		5.80E+00
Y-1836	4.4948E+01	7.1870E+03	3.640E+00%		3.45E+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 (215.7 to 1999.5 keV) 3.536E+04 Bq/Sample
Total Decayed Activity (215.7 to 1999.5 keV) 1.1737398E+05 Bq/Sample

Test America St. Louis Spectrum ID: 16_1lmarn_20130150

Sample Description: 16_1lmarn_6675_re-ver
Detector: Ge16 SN/11012217
Batch ID: 16
Work Order Number: 1lmarn
Lot Number: 6675_re-ver

Decay to Time: 1/1/2011 11:00 Live Time: 7200 sec
Acquisition Time: 2/20/2013 07:07:02 Real Time: 7664 sec
Analysis Time: 2/20/2013 09:16 Dead Time: 6.06 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 16_Liquid_Marinelli 1L.Clb
Efficiency Cal Desc: 16_1Lmarn_90062_032712
Efficiency Cal Date: 4/2/2012 18:09
Energy Cal Date: 2/28/2012 09:35
Library: DET_EnergyStandardMix & Mn, Zn.l
Bkgd Correction File: 16_2013-02-02_0437.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
AM-241	4.995E+03	0.2	7.945E+00	3.143E+02	1.209E+01
CD-109	6.962E+04	0.2	1.615E+02	4.406E+03	2.381E+02
CO-57	1.581E+03	0.6	9.705E+00	9.609E+01	1.738E+01
Ce-139	2.334E+03	2.4	5.500E+01	2.246E+02	1.222E+02
SN-113	4.452E+03	5.0	2.245E+02	3.464E+02	4.866E+02
CS-137	1.949E+03	0.2	4.602E+00	9.837E+01	4.488E+00
Mn-54	2.998E+03	0.7	2.042E+01	1.494E+02	2.919E+01
Y-898	6.786E+03	6.7	4.568E+02	5.658E+02	8.765E+02
Zn-65	6.656E+03	1.1	7.303E+01	3.315E+02	1.081E+02
Co-1173	3.100E+03	0.2	7.705E+00	1.510E+02	6.398E+00
Co-1332	3.135E+03	0.2	7.399E+00	1.549E+02	3.628E+00
Y-1836	7.386E+03	2.9	2.152E+02	4.752E+02	2.898E+02
Total	1.150E+05				

Analyst: Jody Watson

TestAmerica, Inc. Spectrum name: 16_1lmarn_20130150.An1

Sample description
16_1lmarn_6675_re-ver

Spectrum Filename: C:\User\SPC\Det16\16_1lmarn_20130150.An1

Acquisition information
Start time: 2/20/2013 7:07:02 AM
Live time: 7200
Real time: 7664
Dead time: 6.06 %
Detector ID: 16

Detector system
Ge16 SN/11012217

Calibration
Filename: 16_Liquid_Marinelli 1L.Clb
16_1Lmarn_90062_032712

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: 4/2/2012 6:09:24 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.42 %
Log(Eff): -2.314705E+00 + (2.848008E-01*Log(E)) + (-8.114986E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.26 %
Log(Eff): -1.260350E+01 + (4.382261E+00*Log(E)) + (-4.889120E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix & Mn, Zn.l
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: 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

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	1/1/2011 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	16_2013-02-02_0437.PBC 2/2/2013 4:37:12 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0764

***** 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
36.64	6554.	6.16	1.13	4.231E-02				
43.27	3917.	12.59	1.41	4.817E-02				
49.55	29490.	2.63	1.90	5.248E-02				
59.57	732872.	0.16	0.96	5.728E-02	59.54	35.700	4.995E+03	AM241
66.98	5569.	8.82	3.12	5.953E-02				
84.75	4830.	6.57	0.99	6.176E-02				
88.11	350640.	0.19	1.00	6.181E-02	88.03	3.610	7.032E+04	CD109
105.60	486.	43.69	0.51	6.086E-02				
122.16	78162.	0.61	1.05	5.873E-02	122.06	85.600	1.581E+03	CO57
136.58	9264.	3.31	1.03	5.634E-02				
159.49	188.	76.63	0.44	5.213E-02				
165.95	13383.	2.36	1.09	5.083E-02	165.85	79.900	2.334E+03	Ce139
179.75	417.	44.01	0.40	4.864E-02				
214.45	512.	68.00	0.45	4.397E-02				
221.76	425.	63.14	0.67	4.311E-02				
288.24	223.	62.62	0.54	3.671E-02				
310.48	648.	43.36	0.39	3.500E-02				
344.31	1070.	27.39	0.97	3.271E-02				
387.01	233.	66.59	1.27	3.023E-02				
391.68	5449.	3.33	1.27	2.999E-02	391.69	64.000	4.348E+03	SN113
450.79	474.	51.20	0.32	2.719E-02				
460.40	436.	41.52	0.36	2.679E-02				
514.67	99.	90.85	0.28	2.473E-02				
661.77	233169.	0.24	1.49	2.048E-02	661.66	85.210	1.949E+03	CS137
705.25	101.	79.96	0.47	1.950E-02				

821.67	1060.	21.99	0.83	1.728E-02				
834.98	65043.	0.68	1.61	1.705E-02	834.85	99.980	2.997E+03	Mn54
898.26	4589.	6.73	1.72	1.607E-02	898.02	93.700	6.786E+03	Y898
919.13	570.	36.10	0.52	1.577E-02				
980.41	96.	79.78	0.36	1.495E-02				
1000.96	342.	45.57	0.37	1.469E-02				
1010.03	69.	93.75	0.32	1.458E-02				
1022.53	145.	69.20	0.34	1.443E-02				
1037.21	438.	46.06	0.39	1.426E-02				
1115.71	35468.	1.10	1.85	1.340E-02	1115.55	50.600	6.656E+03	Zn65
1173.42	216115.	0.25	1.88	1.284E-02	1173.24	99.900	3.100E+03	Co1173
1278.68	23.	214.64	2.04	1.192E-02				
1281.65	148.	42.62	2.04	1.189E-02				
1313.27	148.	39.70	0.53	1.164E-02				
1332.70	195742.	0.24	1.99	1.149E-02	1332.50	99.982	3.135E+03	Co1332
1785.14	34.	52.89	0.48	8.813E-03				
1836.18	2825.	2.91	2.45	8.585E-03	1836.01	99.200	7.386E+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	
146.27	36.64	46940.	6554.	1.549E+05	6.16	1.125	-	s
172.81	43.27	75556.	3917.	8.131E+04	12.59	1.413	-	s
197.92	49.55	163115.	29490.	5.619E+05	2.63	1.901	-	s

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
267.58	66.98	64240.	5569.	9.354E+04	8.82	3.116	- s
338.56	84.73	43714.	487.	7.885E+03	72.41	0.396	- sc
422.01	105.60	16698.	486.	7.980E+03	43.69	0.505	- s
545.88	136.58	23085.	9264.	1.644E+05	3.31	1.033	-
637.48	159.49	9492.	188.	3.606E+03	76.63	0.441	- c
718.46	179.75	12492.	417.	8.580E+03	44.01	0.398	- s
857.23	214.45	28991.	512.	1.165E+04	68.00	0.453	- s
886.44	221.76	21443.	425.	9.851E+03	63.14	0.673	- s
1152.29	288.24	8287.	223.	6.084E+03	62.62	0.539	- s
1241.22	310.48	18762.	648.	1.850E+04	43.36	0.388	- s
1376.50	344.31	18844.	1070.	3.271E+04	27.39	0.974	-
1547.21	387.00	10130.	297.	9.823E+03	58.98	0.485	- sM
1802.30	450.79	15274.	474.	1.745E+04	51.20	0.323	- s
1840.74	460.40	10780.	436.	1.627E+04	41.52	0.357	- s
2057.79	514.67	3995.	99.	4.004E+03	90.85	0.275	- sc
2820.07	705.25	2974.	101.	5.189E+03	79.96	0.474	- sc
3285.74	821.67	11021.	1060.	6.137E+04	21.99	0.829	- s
3675.65	919.13	10443.	570.	3.615E+04	36.10	0.523	- s
3920.78	980.41	2885.	96.	6.422E+03	79.78	0.363	- sc
4003.00	1000.96	6862.	342.	2.331E+04	45.57	0.367	- s
4039.32	1010.03	2256.	69.	4.743E+03	93.75	0.318	- sc
4089.32	1022.53	3969.	145.	1.005E+04	69.20	0.342	- sc
4148.05	1037.21	8928.	438.	3.068E+04	46.06	0.391	- s
5114.23	1278.33	1227.	23.	1.946E+03	214.64	2.037	- sc
5126.14	1281.31	1922.	148.	1.247E+04	42.62	2.040	- D
5252.64	1313.27	938.	148.	1.267E+04	39.70	0.535	- s
7141.29	1785.14	124.	34.	3.858E+03	52.89	0.478	- 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 & Mn, Zn.l

********** 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	237.95	59.57	144475.	732814.	101.780	0.16	0.962
CD-109	351.98	88.09	64599.	347155.	48.216	0.23	0.987
CO-57	488.19	122.16	33758.	78162.	10.856	0.61	1.051
Ce-139	663.30	165.95	22443.	13383.	1.859	2.36	1.088
Hg-203	1116.50	279.29	25583.	-102.	-0.014	220.98	1.173s
SN-113	1565.89	391.67	16977.	5580.	0.775	5.04	1.355
CS-137	2646.15	661.77	13142.	233148.	32.382	0.24	1.485

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Mn-54	3338.98	834.98	18315.	65043.	9.034	0.68	1.610
Y-898	3592.14	898.26	16035.	4589.	0.637	6.73	1.721
Zn-65	4462.14	1115.71	15127.	35468.	4.926	1.10	1.846
Co-1173	4693.02	1173.42	9051.	216115.	30.016	0.25	1.884
Co-1332	5330.40	1332.70	2307.	195742.	27.186	0.24	1.990
Y-1836	7345.61	1836.18	538.	2825.	0.392	2.91	2.445

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
AM-241		4.9949E+03				1.58E+05	
			59.54	4.995E+03	(P	1.209E+01 1.59E-01 3.57E+01	G
CD-109		6.9618E+04				4.63E+02	
			88.03	6.962E+04	(	2.381E+02 2.32E-01 3.61E+00	G
CO-57		1.5814E+03				2.72E+02	
			122.06	1.581E+03	(	1.738E+01 6.14E-01 8.56E+01	G
Ce-139		2.3344E+03				1.38E+02	
			165.85	2.334E+03	(	1.222E+02 2.36E+00 7.99E+01	G
Hg-203		-4.6620E-01				4.66E+01	
			279.17	-4.662E-01	&(	3.404E+00 2.21E+02 8.15E+01	G
SN-113		4.4524E+03				1.15E+02	
			391.69	4.452E+03	(	4.866E+02 5.04E+00 6.40E+01	G
CS-137		1.9488E+03				1.10E+04	
			661.66	1.949E+03	(P	4.488E+00 2.36E-01 8.52E+01	G
Mn-54		2.9975E+03				3.12E+02	
			834.85	2.997E+03	(	2.919E+01 6.81E-01 1.00E+02	G
Y-898		6.7857E+03				1.07E+02	
			898.02	6.786E+03	(	8.765E+02 6.73E+00 9.37E+01	G
Zn-65	F	6.6559E+03				2.44E+02	
			1115.55	6.656E+03	(	1.081E+02 1.10E+00 5.06E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
Co-1173	3.1000E+03				1.93E+03	
		1173.24	3.100E+03	(	6.398E+00 2.49E-01	9.99E+01 G
Co-1332	3.1350E+03				1.93E+03	
		1332.50	3.135E+03	(	3.628E+00 2.36E-01	1.00E+02 G
Y-1836	7.3858E+03				1.07E+02	
		1836.01	7.386E+03	(	2.898E+02 2.91E+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.
@ - 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	279.29	25583.	-102.	-0.014	220.98	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 1 Sigma Counting		MDA Bq/Sample
AM-241	4.9778E+03	4.9949E+03	1.591E-01%		1.21E+01
CD-109	2.1607E+04	6.9618E+04	2.320E-01%		2.38E+02
CO-57	2.1589E+02	1.5814E+03	6.137E-01%		1.74E+01
Ce-139	4.5753E+01	2.3344E+03	2.356E+00%		1.22E+02
Hg-203 #A	-4.6620E-01	>12 Halflives	2.2098E+02%	3.4036E+00	
SN-113	4.0386E+01	4.4524E+03	5.041E+00%		4.87E+02
CS-137	1.8551E+03	1.9488E+03	2.362E-01%		4.49E+00
Mn-54	5.2978E+02	2.9975E+03	6.812E-01%		2.92E+01
Y-898	4.2322E+01	6.7857E+03	6.732E+00%		8.76E+02
Zn-65	7.2618E+02	6.6559E+03	1.097E+00%		1.08E+02
Co-1173	2.3403E+03	3.1000E+03	2.485E-01%		6.40E+00
Co-1332	2.3667E+03	3.1350E+03	2.360E-01%		3.63E+00
Y-1836	4.6065E+01	7.3858E+03	2.913E+00%		2.90E+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 (1313.1 to 1999.6 keV) 3.479E+04 Bq/Sample
Total Decayed Activity (1313.1 to 1999.6 keV) 1.1498970E+05 Bq/Sample

2013 1L Marn Re-Verification per geometry

Geometry: 1L Marn

Reference date 1/1/2011

Calibration Standard: 83925-334

Standard volume g / vial: 1

Standard volume transferred in g / geometry: 1

lab ID# of cal standard: Rad11-0032 / TALS#6675

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	abundance	Activity Bq/sample
Am-241	1830	1830	0.359	**5097.5**
Cs-137	1705	1705	0.851	**2003.5**
Co-60	3294	3294	0.99986	**3294.5**

Reviewed By: Jody Watson

Date: 1/20/2013

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Reagent ID: 1L Marn_00002

Type:	ASTD	Expiration Date:	03/02/2016
Description:	Mixed Gamma 1L Marn 2011	Laboratory:	TestAmerica St. Louis
No. of Bottles:	1	Prepared By:	Watson, Jody
Storage Location:	RAD STDs Cabinet in Gamma	Vendor:	Eckert & Ziegler
Reagent Volume:	1.000 L	Vendor Lot #:	83924-334
Creation Date:	02/25/2011	Vendor Cat #:	
Container(s):	6675		
Comment:			

Reagent Analyte Information

Analyte	Source ID	Source Expiration Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
Am-241					5097.50000	pCi/L
Ce-139					2399.20000	pCi/L
Co-57					1564.30000	pCi/L
Co-60					3293.90000	pCi/L
Cs-137					2003.50000	pCi/L
Mn-54					3083.60000	pCi/L
Sn-113					4248.40000	pCi/L
Y-88					6929.60000	pCi/L

TestAmerica St. Louis

Standards Preparation Logbook Record

Feb-20-2013

Logbook: \\Qstlmo01\Stdslog\RAD_STD.std

RAD11-0032, Mixed Gamma 1L Marn

Analyst: watsonj

Vendor: Eckert & Ziegler Lot No.: 83924-334
Solvent: None
Date Prep./Opened: 03-02-2011 Date Received: 02-25-2011
Date Expires(1): 03-02-2016 (5 Years)
Date Expires(2): 03-02-2016 (5 Years)
1L Marn 2011 Calibration Source 83924-334 Ref Date 1/1/2011

Component	Initial Conc (Bq/sample)	Final Conc (Bq/sample)
Am-241	5,097.5	5,097.5
Cd-109	72,272	72,272
Ce-139	2,399.2	2,399.2
Co-57	1,564.3	1,564.3
Co-60	3,293.9	3,293.9
Co-60	3,294.5	3,294.5
Cs-137	2,003.5	2,003.5
Hg-203	5,195.2	5,195.2
Mn-54	3,083.6	3,083.6
Sn-113	4,248.4	4,248.4
Y-88	6,929.6	6,929.6
Y-88	6,929.4	6,929.4

Reviewed By: _____

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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

83924-334

1.0 Liter Solid in 130G GA-MA Beaker

Customer: Test America St. Louis
P.O. No.: 2401509, Item 1
Reference Date: 01-Jan-2011 12:00 PM EST **Grams of Master Source:** 0.015372

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. Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
Am-241	59.5	1.580E+05	———	1.830E+03	0.1	1.7	3.5	4π LS
Cd-109	88.0	4.626E+02	1.697E+05	2.609E+03	0.8	2.3	4.9	HPGe
Co-57	122.1	2.718E+02	8.711E+04	1.339E+03	0.5	2.0	4.1	HPGe
Ce-139	165.9	1.376E+02	1.247E+05	1.917E+03	0.5	1.9	3.9	HPGe
Hg-203	279.2	4.661E+01	2.753E+05	4.232E+03	0.4	1.9	3.9	HPGe
Sn-113	391.7	1.151E+02	1.769E+05	2.719E+03	0.5	1.9	3.9	HPGe
Cs-137	661.7	1.098E+04	1.109E+05	1.705E+03	0.7	1.9	4.0	HPGe
Mn-54	834.9	3.121E+02	———	3.083E+03	0.1	1.7	3.3	IC
Y-88	898.0	1.066E+02	4.224E+05	6.493E+03	0.5	1.9	3.9	HPGe
Zn-65	1115.6	2.441E+02	———	3.181E+03	0.1	1.7	3.5	IC
Co-60	1173.2	1.925E+03	2.142E+05	3.293E+03	0.6	1.9	4.0	HPGe
Co-60	1332.5	1.925E+03	2.143E+05	3.294E+03	0.6	1.9	4.0	HPGe
Y-88	1836.1	1.066E+02	4.472E+05	6.874E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS FOUNDED 1956

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Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318

This standard will expire one year after the reference date.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ Date: 2/23/14
J. D. McCorvey, QA Manager Alternate

Reagent

1L Marn_00007

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

81592-334

1.0 Liter Solid in 130G GA-MA Beaker

Customer: Test America/Earth City, MO
P.O. No.: 2344874, Item 1
Reference Date: 01-Jan-2010 12:00 PM EST **Grams of Master Source:** 0.016663

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. Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
Am-241	59.5	1.580E+05	———	1.929E+03	0.1	1.7	3.5	4π LS
Cd-109	88.0	4.626E+02	1.606E+05	2.676E+03	0.4	2.3	4.7	HPGe
Co-57	122.1	2.718E+02	8.471E+04	1.412E+03	0.5	2.0	4.1	HPGe
Ce-139	165.9	1.376E+02	1.209E+05	2.015E+03	0.4	1.9	3.9	HPGe
Hg-203	279.2	4.661E+01	2.726E+05	4.542E+03	0.4	1.9	3.9	HPGe
Sn-113	391.7	1.151E+02	1.672E+05	2.786E+03	0.5	1.9	3.9	HPGe
Cs-137	661.7	1.098E+04	1.096E+05	1.826E+03	0.6	1.9	4.0	HPGe
Mn-54	834.9	3.121E+02	———	3.069E+03	0.1	1.7	3.3	IC
Y-88	898.0	1.066E+02	4.077E+05	6.794E+03	0.4	1.9	3.9	HPGe
Zn-65	1115.6	2.441E+02	———	2.105E+03	0.1	1.7	3.5	IC
Co-60	1173.2	1.925E+03	2.055E+05	3.424E+03	0.5	1.9	3.9	HPGe
Co-60	1332.5	1.925E+03	2.056E+05	3.426E+03	0.7	1.9	4.0	HPGe
Y-88	1836.1	1.066E+02	4.308E+05	7.178E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY — HEALTH PHYSICS SOCIETY — FOUNDED 1956

This standard will expire one year after the reference date.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ for Date: 3-22-10
J. D. McCorvey, QA Manager Alternate

Reagent

1L Marn_00008

St. Louis Radiological Standard Reverification Form

Standard ID Number: 1L Marn_00008 (255911)
True Value = 5097.49 Bq/Sample
Date Analyzed: 11/22/2013

Radionuclide: Am-241

	Replicates	
#1	5038	Bq/Sample
#2	5045	Bq/Sample
#3	5140	Bq/Sample

Mean = 5074.333

1 sigma = 56.9766

1.96 sigma = 111.6741

True Value minus 5% = 4842.6155 (True Value - 5%)
True Value plus 5% = 5352.3645 (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 11/22/13

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: 1L Marn_00008 (255911)
True Value = 2003.53 Bq/Sample
Date Analyzed: 11/22/2013

Radionuclide: Cs-137

	Replicates	
#1	1974	Bq/Sample
#2	1972	Bq/Sample
#3	2010	Bq/Sample

Mean = 1985.333

1 sigma = 21.38535

1.96 sigma = 41.91529

True Value minus 5% = 1903.3535 (True Value - 5%)
True Value plus 5% = 2103.7065 (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 11/22/13

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: 1L Marn_00008 (255911)
True Value = 3293.47 Bq/Sample
Date Analyzed: 11/22/2013

Radionuclide: Co-60

Replicates		
#1	3211	Bq/Sample
#2	3238	Bq/Sample
#3	3226	Bq/Sample

Mean = 3225

1 sigma = 13.52775

1.96 sigma = 26.51439

True Value minus 5% = 3128.7965 (True Value - 5%)
True Value plus 5% = 3458.1435 (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 11/22/13

SOP Reference: STL-QA-0002, Current Revision

Gamma LCS per Geometry - 1L Marn

Reagent ID: 1L Marn_00008
Container: 255911
Reference date 1/1/2011
Calibration Standard: 83924-334
Standard volume: 1000 g/vial
Standard volume transferred: 1000 g/geometry

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	γ abundance	dpm/g	Bq/sample
Am-241	1830	1830.0	0.359	305.85	5097.49
Cs-137	1705	1705.0	0.851	120.21	2003.53
Co-60	3293	3293.0	0.999856	197.61	3293.47

Reviewed By: Jody Watson

Date: 12/1/2013

SOP Reference: ST-RD-0102, Current Rev **Form:** RAD-0080 **Revised:** 11/27/2013

Test America St. Louis Spectrum ID: 14_83924-334_20131712

Sample Description: 1L Marn_83924-334_2011Cal
Detector: Ge14 SN/11080670
Batch ID: 1L Marn
Work Order Number: 83924-334
Lot Number: 2011Cal

Decay to Time: 1/1/2011 12:00 Live Time: 3600 sec
Acquisition Time: 11/22/2013 10:57:47 Real Time: 3750 sec
Analysis Time: 11/22/2013 12:00 Dead Time: 4.00 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 14_Liquid_Marinelli 1L.Clb
Efficiency Cal Desc: 14_1LMarinelli_90062_030612
Efficiency Cal Date: 3/14/2012 16:58
Energy Cal Date: 2/28/2012 10:48
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 14_2013-11-02_0117.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
K-40	8.495E-01	867.9	7.373E+00	7.373E+00	2.543E+01
CO-60	3.211E+03	0.3	9.328E+00	1.587E+02	5.759E+00
CS-134	1.470E+00	297.5	4.373E+00	4.374E+00	1.532E+01
CS-137	1.974E+03	0.4	7.651E+00	9.898E+01	7.115E+00
EU-152	2.481E+01	24.1	5.967E+00	6.105E+00	1.499E+01
EU-154	2.075E+01	28.9	5.993E+00	6.079E+00	8.480E+01
EU-155	5.806E+00	97.3	5.651E+00	5.661E+00	1.866E+01
TL-208	5.627E+00	97.5	5.485E+00	5.493E+00	1.814E+01
PB-210	-2.937E+02	20.7	6.071E+01	6.626E+01	1.896E+02
PB-212	3.881E+00	199.5	7.744E+00	7.747E+00	2.564E+01
PB-214	3.309E+00	90.8	3.005E+00	3.009E+00	1.100E+01
BI-212	-5.834E+01	102.9	6.003E+01	6.010E+01	1.986E+02
BI-214	-6.621E+00	68.1	4.506E+00	4.518E+00	1.185E+01
AC-228	1.083E+01	106.8	1.157E+01	1.158E+01	4.440E+01
Pa-234	4.849E+00	113.3	5.493E+00	5.499E+00	1.510E+01
TH-234	-3.063E+01	126.3	3.867E+01	3.871E+01	9.050E+01
PA-234M	-4.729E+02	69.8	3.300E+02	3.308E+02	1.088E+03
U-235	3.923E+00	230.0	9.021E+00	9.024E+00	2.438E+01
AM-241	5.038E+03	0.2	1.150E+01	2.911E+02	1.662E+01
Total	1.031E+04				

Analyst: Jody Watson

TestAmerica, Inc. Spectrum name: 14_83924-334_20131712.An1

Sample description
1L Marn_83924-334_2011Cal

Spectrum Filename: C:\User\SPC\Det14\14_83924-334_20131712.An1

Acquisition information
Start time: 11/22/2013 10:57:47 AM
Live time: 3600
Real time: 3750
Dead time: 4.00 %
Detector ID: 14

Detector system
Ge14 SN/11080670

Calibration
Filename: 14_Liquid_Marinelli 1L.Clb
14_1LMarinelli_90062_030612

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: 3/14/2012 4:58:47 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.64 %
Log(Eff): -1.428037E+00 + (-4.136370E-02*Log(E)) + (-5.958012E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.07 %
Log(Eff): -1.383299E+01 + (4.786779E+00*Log(E)) + (-5.293738E-01*Log(E)^2)

Library Files
Main analysis library: Client_Routine Short Rev1.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: 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

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	1/1/2011 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	14_2013-11-02_0117.PBC 11/2/2013 1:17:51 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 21 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0644

***** 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
36.62	2067.	10.16	0.85	3.141E-02				
48.93	5047.	6.05	0.75	3.983E-02				
49.91	6988.	4.67	0.75	4.035E-02				
59.62	288463.	0.23	0.79	4.454E-02	59.54	35.900	5.038E+03	AM241
66.52	278.	54.43	0.40	4.654E-02				
87.99	93420.	0.43	0.85	4.914E-02				
92.32	109.	87.47	0.80	4.919E-02				
103.02	264.	50.15	0.66	4.885E-02				
105.29	144.	97.33	0.81	4.871E-02	105.31	21.200	PBC<MDA	EU155
122.02	16652.	1.43	0.90	4.715E-02	121.78	28.580	3.978E+02	EU152
123.10	38.	398.99	0.83	4.702E-02	123.10	40.790	PBC<MDA	EU154
					123.10	40.790	6.870E-01	EU154
136.42	1797.	9.14	0.86	4.530E-02				
143.34	31.	408.02	0.85	4.425E-02	143.79	10.960	PBC<MDA	U235
163.38	30.	495.12	0.87	4.129E-02	163.38	5.080	PBC<MDA	U235
165.81	1590.	9.60	0.91	4.092E-02				
195.69	118.	74.72	0.49	3.670E-02				
205.52	55.	253.55	0.91	3.553E-02	205.33	5.010	PBC<MDA	U235
212.94	110.	82.72	0.66	3.466E-02				
239.03	68.	152.55	0.94	3.205E-02	238.63	43.300	PBC<MDA	PB212
294.37	95.	105.71	1.00	2.759E-02	295.09	19.300	PBC<MDA	PB214
					295.09	19.300	PBC<MDA	PB214
339.70	50.	218.91	1.04	2.498E-02	338.32	12.010	PBC<MDA	AC228
344.43	500.	24.05	1.05	2.465E-02	344.29	26.500	2.463E+01	EU152
351.19	80.	108.49	1.06	2.426E-02	351.93	37.600	PBC<MDA	PB214
					351.93	37.600	PBC<MDA	PB214
391.65	390.	38.33	1.09	2.240E-02				
447.44	117.	58.20	0.65	2.024E-02				

501.44	266.	38.69	0.53	1.853E-02				
559.23	281.	36.01	0.52	1.700E-02				
562.49	32.	297.50	1.25	1.691E-02	563.24	8.350	PBC<MDA	CS134
					563.24	8.350	1.641E+01	CS134
579.75	161.	49.44	0.43	1.652E-02				
583.07	99.	87.84	1.27	1.645E-02	583.02	84.500	PBC<MDA	TL208
661.67	84081.	0.39	1.34	1.485E-02	661.66	85.210	1.974E+03	CS137
723.29	262.	36.98	0.64	1.380E-02	723.36	20.220	3.287E+01	EU154
					723.36	20.220	3.287E+01	EU154
733.78	74.	76.93	0.65	1.364E-02				
768.83	122.	49.99	0.49	1.312E-02				
784.84	80.	66.85	0.37	1.290E-02				
834.84	12806.	1.53	1.48	1.224E-02				
852.33	357.	28.82	0.50	1.203E-02				
872.61	107.	99.19	1.52	1.179E-02	873.23	12.270	PBC<MDA	EU154
					873.23	12.270	2.587E+01	EU154
880.43	72.	150.13	1.53	1.171E-02	880.53	6.000	PBC<MDA	Pa234
					880.53	6.000	2.835E+01	Pa234
898.11	293.	38.52	0.96	1.151E-02				
911.72	105.	106.79	1.55	1.137E-02	911.07	29.000	PBC<MDA	AC228
946.23	33.	354.85	1.58	1.101E-02	946.02	13.400	PBC<MDA	Pa234
					946.02	13.400	6.256E+00	Pa234
964.08	91.	123.19	1.60	1.083E-02	964.11	14.605	PBC<MDA	EU152

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
995.88	162.	62.98	1.62	1.053E-02	996.33	10.600	PBC<MDA	EU154
					996.33	10.600	5.080E+01	EU154
1005.09	327.	35.42	0.31	1.045E-02				
1005.35	123.	84.31	1.63	1.045E-02	1004.77	18.010	PBC<MDA	EU154
					1004.77	18.010	2.284E+01	EU154
1015.27	118.	60.67	1.64	1.036E-02				
1018.03	267.	27.40	1.64	1.033E-02				
1047.15	108.	47.96	0.40	1.008E-02				
1067.52	210.	40.07	0.73	9.917E-03				
1085.97	118.	67.40	0.32	9.770E-03				
1112.06	129.	68.42	1.71	9.569E-03	1112.07	13.644	PBC<MDA	EU152
1115.55	5835.	3.20	1.62	9.543E-03				
1130.70	122.	52.90	0.54	9.430E-03				
1160.81	153.	46.10	0.54	9.214E-03				
1173.20	72050.	0.42	1.74	9.128E-03	1173.24	99.900	3.210E+03	CO60
1274.48	133.	28.88	1.83	8.481E-03	1274.54	35.190	1.565E+01	EU154
					1274.54	35.190	1.565E+01	EU154
1332.44	64400.	0.41	1.84	8.150E-03	1332.50	99.980	3.211E+03	CO60
1408.09	61.	38.96	1.92	7.754E-03	1408.00	21.005	PBC<MDA	EU152
1460.60	2.	176.54	1.96	7.499E-03	1460.83	10.670	PBC<MDA	K40
1764.44	5.	303.05	2.14	6.302E-03	1764.49	15.400	PBC<MDA	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 keV		Suspected Nuclide
145.92	36.62	14850.	2067.	6.581E+04	10.16	0.845	-	
195.15	48.90	44158.	5047.	1.267E+05	6.05	0.750	-	D
199.05	49.87	49696.	6988.	1.732E+05	4.67	0.751	-	D
265.45	66.52	9692.	278.	5.974E+03	54.43	0.398	-	s
351.34	87.99	16882.	93420.	1.901E+06	0.43	0.854	-	
411.43	103.02	6094.	264.	5.400E+03	42.30	0.659	-	s
544.98	136.42	7551.	1797.	3.968E+04	9.14	0.863	-	
662.54	165.81	6516.	1589.	3.884E+04	7.61	0.912	-	s
782.02	195.69	3554.	118.	3.225E+03	74.72	0.494	-	sc
850.98	212.94	3747.	110.	3.164E+03	82.72	0.664	-	sc
1565.75	391.65	5490.	390.	1.741E+04	38.33	1.091	-	s
1788.86	447.44	2092.	117.	5.789E+03	58.20	0.647	-	s
2004.87	501.44	3089.	266.	1.434E+04	38.69	0.525	-	s
2236.02	559.23	2710.	280.	1.648E+04	26.95	0.517	-	s
2318.13	579.75	2059.	160.	9.670E+03	40.94	0.429	-	sM
2892.32	723.29	2440.	193.	1.395E+04	36.99	0.638	-	s
2934.30	733.78	1250.	74.	5.389E+03	76.93	0.653	-	sc
3074.48	768.83	1357.	122.	9.308E+03	43.61	0.491	-	s
3138.57	784.84	1180.	81.	6.281E+03	60.99	0.367	-	s
3338.60	834.84	4513.	12806.	1.046E+06	1.53	1.477	-	
3408.54	852.33	2666.	357.	2.966E+04	28.82	0.502	-	s
3591.73	898.11	3247.	293.	2.546E+04	38.52	0.963	-	sM
4019.78	1005.09	3149.	205.	1.959E+04	39.39	0.311	-	s
4060.50	1015.42	2516.	118.	1.142E+04	60.67	1.637	-	D
4071.52	1018.17	2547.	267.	2.586E+04	27.40	1.639	-	D
4188.05	1047.15	1111.	108.	1.074E+04	47.96	0.402	-	s
4269.57	1067.52	1972.	210.	2.123E+04	40.07	0.735	-	s
4343.41	1085.97	1862.	118.	1.208E+04	67.40	0.320	-	s
4461.66	1115.55	2816.	5870.	6.152E+05	1.83	1.714	-	D
4522.39	1130.70	1206.	122.	1.290E+04	52.90	0.541	-	s

4642.86	1160.81	1258.	153.	1.660E+04	46.10	0.536	- 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: Client_Routine Short Rev1.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	190.08	47.67	47682.	-1581.	-0.439	20.18	0.750s
AM-241	237.90	59.62	41475.	288463.	80.129	0.23	0.788
TH-234	252.24	63.21	14671.	-192.	-0.053	107.83	0.765s
TH-234	368.65	92.32	9376.	109.	0.030	87.47	0.796s
AC-228	372.76	93.35	5008.	-280.	-0.078	36.29	0.797D
U-235	372.76	93.35	5008.	-280.	-0.078	36.29	0.797D
EU-155	420.51	105.29	9765.	144.	0.040	97.33	0.809
EU-152	487.40	122.02	10014.	16652.	4.626	1.43	0.900s
EU-154	491.73	123.10	11217.	38.	0.010	398.99	0.827s
Pa-234	524.25	131.23	9215.	-120.	-0.033	113.29	0.836s
U-235	572.69	143.34	8234.	31.	0.009	408.02	0.849s
U-235	652.80	163.38	10716.	30.	0.008	495.12	0.869s
U-235	821.34	205.52	9656.	55.	0.015	253.55	0.911s
PB-212	955.36	239.03	9156.	68.	0.019	152.55	0.945s
I-131	1134.10	283.73	7784.	-68.	-0.019	184.27	0.990s
PB-214	1176.66	294.37	6597.	95.	0.027	105.71	1.001s
AC-228	1357.97	339.70	6064.	50.	0.014	218.91	1.043s
EU-152	1376.89	344.43	4181.	500.	0.139	24.05	1.048
PB-214	1403.91	351.19	5901.	80.	0.022	108.49	1.056s
I-131	1458.60	364.86	6548.	-36.	-0.010	316.70	1.069s
BE-7	1909.70	477.65	6947.	-83.	-0.023	141.66	1.176s
CS-134	2249.06	562.49	4404.	32.	0.009	297.50	1.255s
CS-134	2275.09	568.99	4739.	-41.	-0.011	238.49	1.260s
Pa-234	2276.09	569.24	4723.	-33.	-0.009	290.80	1.261s
TL-208	2331.39	583.07	4575.	99.	0.027	87.84	1.273s
BI-214	2431.71	608.15	4397.	-174.	-0.048	61.13	1.296s
I-131	2548.68	637.39	4868.	-95.	-0.026	104.34	1.321s
CS-137	2645.83	661.67	4156.	84081.	23.356	0.39	1.336
EU-154	2892.98	723.46	4315.	71.	0.020	131.53	1.397s
BI-212	2897.16	724.50	3044.	-76.	-0.021	102.90	1.400s
CS-134	3178.79	794.90	4240.	-63.	-0.017	147.55	1.459s
CS-134	3208.91	802.43	4567.	-32.	-0.009	295.73	1.464s
TL-208	3450.30	862.76	4635.	-71.	-0.020	135.94	1.513s
EU-154	3489.71	872.61	5545.	107.	0.030	99.19	1.523s
Pa-234	3520.99	880.43	5756.	72.	0.020	150.13	1.529s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Pa-234	3538.19	884.73	5396.	-45.	-0.012	231.95	1.531s
AC-228	3646.19	911.72	6279.	105.	0.029	106.79	1.554s
Pa-234	3784.26	946.23	6934.	33.	0.009	354.85	1.582s
EU-152	3855.67	964.08	6226.	91.	0.025	123.19	1.597
AC-228	3873.07	968.43	5841.	-121.	-0.034	89.48	1.601s
EU-154	3982.92	995.88	5101.	162.	0.045	62.98	1.622s
PA-234M	3999.68	1000.07	5362.	-149.	-0.042	69.78	1.626s
EU-154	4020.79	1005.35	5281.	123.	0.034	84.31	1.629s
EU-152	4447.85	1112.07	3851.	129.	0.036	68.42	1.712D
BI-214	4475.74	1119.05	7013.	-1033.	-0.287	11.92	1.718s
CO-60	4692.43	1173.20	2424.	72050.	20.014	0.42	1.737
EU-154	5097.75	1274.48	673.	133.	0.037	28.88	1.831s
CO-60	5329.70	1332.44	586.	64400.	17.889	0.41	1.845
EU-152	5632.46	1408.09	256.	61.	0.017	38.96	1.923s
K-40	5842.63	1460.60	229.	2.	0.001	176.54	1.958s
BI-214	7058.84	1764.44	126.	5.	0.001	303.05	2.145s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	Peak MDA Value Bq/Sample	COMMENTS
BE-7	C	-1.1450E+01				5.31E+01	
			477.60	-1.145E+01	&(	5.366E+01 1.42E+02 1.05E+01	G
K-40	N	8.4954E-01				4.66E+11	
			1460.83	8.495E-01	(P	2.543E+01 1.77E+02 1.07E+01	G
CO-60	F	3.2106E+03				1.93E+03	
			1332.50	3.211E+03	(	5.759E+00 4.07E-01 1.00E+02	G
			1173.24	3.210E+03	(	1.034E+01 4.15E-01 9.99E+01	G
I-131	I	-5.2049E-01				8.02E+00	
			364.48	-5.205E-01	?(	5.463E+00 3.17E+02 8.17E+01	G
			284.30	-1.083E+01	&	6.608E+01 1.84E+02 6.14E+00	G
			636.97	-2.404E+01	+	8.294E+01 1.04E+02 7.17E+00	G
CS-134	I	1.4699E+00				7.54E+02	
			604.71	1.916E-01	&(	1.532E+01 2.41E+03 9.76E+01	G
			795.87	-4.212E+00	&	2.059E+01 1.48E+02 8.55E+01	G
			569.32	-1.164E+01	&	9.201E+01 2.38E+02 1.54E+01	G
			801.95	-2.156E+01	+	2.116E+02 2.96E+02 8.69E+00	G
			563.24	1.641E+01	&(	1.620E+02 2.98E+02 8.35E+00	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CS-137	I 1.9735E+03					1.10E+04	
		661.66	1.974E+03	(	7.115E+00	3.88E-01	8.52E+01 G
EU-152	F 2.4812E+01					4.94E+03	
		344.29	2.463E+01	(	1.499E+01	2.40E+01	2.65E+01 G
		121.78	3.978E+02	+	1.121E+01	1.43E+00	2.86E+01 G
		778.92	-1.272E+00	&	6.017E+01	1.42E+03	1.29E+01 G
		964.11	1.851E+01	(	7.542E+01	1.23E+02	1.46E+01 G
		1112.07	3.191E+01	(	7.201E+01	6.84E+01	1.36E+01 G
		1408.00	1.215E+01	-	1.528E+01	3.90E+01	2.10E+01 G
EU-154	I 2.0752E+01					3.14E+03	
		873.23	2.587E+01	?(	8.480E+01	9.92E+01	1.23E+01 G
		123.10	6.870E-01	-	9.075E+00	3.99E+02	4.08E+01 G
		1274.54	1.565E+01	*(	1.452E+01	2.89E+01	3.52E+01 G
		723.36	8.913E+00	?(	3.881E+01	1.32E+02	2.02E+01 G
		1004.77	2.284E+01	?(	6.360E+01	8.43E+01	1.80E+01 G
		996.33	5.080E+01	*(	1.054E+02	6.30E+01	1.06E+01 G
EU-155	I 5.8061E+00					1.81E+03	
		105.31	5.806E+00	(	1.866E+01	9.73E+01	2.12E+01 G
		86.54	0.000E+00	-	1.144E+01	1.00E+03	3.07E+01 G
TL-208	N 5.6266E+00					6.98E+02	
		583.02	5.627E+00	?(P	1.814E+01	8.78E+01	8.45E+01 G
		277.28	-1.556E+00	% P	1.736E+02	3.71E+03	6.31E+00 G
		860.56	-3.804E+01	&	1.712E+02	1.36E+02	1.24E+01 G
PB-210	N -2.9373E+02					8.14E+03	
		46.54	-2.937E+02	?(P	1.896E+02	2.02E+01	4.25E+00 G
PB-212	N 3.8808E+00					6.98E+02	
		238.63	3.881E+00	@(P	2.564E+01	1.53E+02	4.33E+01 G
		300.03	-3.236E+00	&	3.278E+02	3.05E+03	3.28E+00 G
PB-214	N 3.3085E+00					5.84E+05	
		351.93	2.446E+00	(P	1.100E+01	1.08E+02	3.76E+01 G
		295.09	4.989E+00	@(P	1.991E+01	1.06E+02	1.93E+01 G
		242.00	-1.187E+00	% P	5.298E+01	2.20E+03	7.43E+00 G
BI-212	N -5.8339E+01					6.98E+02	
		727.17	-5.834E+01	&(	1.986E+02	1.03E+02	7.55E+00 G
		785.42	-1.313E+01	%	1.527E+03	3.50E+03	1.28E+00 G
BI-214	N -6.6206E+00					5.84E+05	
		609.31	-6.621E+00	&(P	1.185E+01	6.11E+01	4.61E+01 G
		1120.29	-2.002E+02	& P	7.613E+01	1.19E+01	1.51E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
		1764.49	1.403E+00	+ P	1.577E+01	3.03E+02	1.54E+01 G
AC-228	N 1.0832E+01					2.10E+03	
		911.07	1.258E+01	(	4.440E+01	1.07E+02	2.90E+01 G
		968.97-2.538E+01		&	7.501E+01	8.95E+01	1.75E+01 G
		338.32	6.615E+00	?(	4.797E+01	2.19E+02	1.20E+01 G
						Energy duplication	
		93.35-4.024E+01		&	4.785E+01	3.63E+01	5.56E+00 XA
Pa-234	N 4.8490E+00					1.63E+12	
		131.29-4.034E+00		?(	1.510E+01	1.13E+02	1.80E+01 G
		569.47-6.768E+00		+	6.529E+01	2.91E+02	8.20E+00 G
		946.02	6.256E+00	?(	7.357E+01	3.55E+02	1.34E+01 G
		883.24-1.112E+01		+	8.551E+01	2.32E+02	9.60E+00 G
		880.53	2.835E+01	*(	1.409E+02	1.50E+02	6.00E+00 G
TH-234	N -3.0627E+01					1.63E+12	
		63.29-3.063E+01		?(P	9.050E+01	1.08E+02	3.81E+00 G
		92.59	1.099E+01	+ P	4.591E+01	8.75E+01	5.58E+00 G
PA-234M	N -4.7291E+02					1.63E+12	
		1001.00-4.729E+02		?(	1.088E+03	6.98E+01	8.37E-01 G
		766.41	2.233E+00	%	1.641E+03	2.20E+04	2.94E-01 G
U-235	N 3.9231E+00					2.57E+11	
		143.79	1.803E+00	&(	2.438E+01	4.08E+02	1.10E+01 G
		205.33	8.566E+00	?(	7.189E+01	2.54E+02	5.01E+00 G
		163.38	3.918E+00	?(	6.424E+01	4.95E+02	5.08E+00 G
						Energy duplication	
		93.35-2.718E+01		&	3.232E+01	3.63E+01	5.81E+00 X
AM-241	T 5.0379E+03					1.58E+05	
		59.54	5.038E+03	(	1.662E+01	2.28E-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.
+ - 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	47.67	47682.	-1581.	-0.439	20.18	-2.937E+02	P
TH-234	63.21	14671.	-192.	-0.053	107.83	-3.063E+01	P
TH-234	92.32	9376.	109.	0.030	87.47	1.099E+01	P
AC-228	93.35	5008.	-280.	-0.078	36.29	-4.024E+01	
U-235	93.35	5008.	-280.	-0.078	36.29	-2.718E+01	
EU-155	105.29	9765.	144.	0.040	97.33	5.806E+00	
EU-154	123.10	11217.	38.	0.010	398.99	6.870E-01	
Pa-234	131.23	9215.	-120.	-0.033	113.29	-4.034E+00	
U-235	143.34	8234.	31.	0.009	408.02	1.803E+00	
U-235	163.38	10716.	30.	0.008	495.12	3.918E+00	
U-235	205.52	9656.	55.	0.015	253.55	8.566E+00	
PB-212	239.03	9156.	68.	0.019	152.55	3.881E+00	P
I-131	283.73	7784.	-68.	-0.019	184.27	0.000E+00	
PB-214	294.37	6597.	95.	0.027	105.71	4.989E+00	P
AC-228	339.70	6064.	50.	0.014	218.91	6.615E+00	
PB-214	351.19	5901.	80.	0.022	108.49	2.446E+00	P
I-131	364.86	6548.	-36.	-0.010	316.70	0.000E+00	
BE-7	477.65	6947.	-83.	-0.023	141.66	0.000E+00	
CS-134	562.49	4404.	32.	0.009	297.50	1.641E+01	
CS-134	568.99	4739.	-41.	-0.011	238.49	-1.164E+01	
Pa-234	569.24	4723.	-33.	-0.009	290.80	-6.768E+00	
BI-214	608.15	4397.	-174.	-0.048	61.13	-6.621E+00	P
I-131	637.39	4868.	-95.	-0.026	104.34	0.000E+00	
EU-154	723.46	4315.	71.	0.020	131.53	8.913E+00	
BI-212	724.50	3044.	-76.	-0.021	102.90	-5.834E+01	
CS-134	794.90	4240.	-63.	-0.017	147.55	-4.212E+00	
CS-134	802.43	4567.	-32.	-0.009	295.73	-2.156E+01	
EU-154	872.61	5545.	107.	0.030	99.19	2.587E+01	
Pa-234	880.43	5756.	72.	0.020	150.13	2.835E+01	
Pa-234	884.73	5396.	-45.	-0.012	231.95	-1.112E+01	
AC-228	911.72	6279.	105.	0.029	106.79	1.258E+01	
Pa-234	946.23	6934.	33.	0.009	354.85	6.256E+00	
AC-228	968.43	5841.	-121.	-0.034	89.48	-2.538E+01	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
EU-154	995.88	5101.	162.	0.045	62.98	5.080E+01		
PA-234M	1000.07	5362.	-149.	-0.042	69.78	-4.729E+02		
EU-154	1005.35	5281.	123.	0.034	84.31	2.284E+01		
BI-214	1119.05	7013.	-1033.	-0.287	11.92	-2.002E+02		P
EU-154	1274.48	673.	133.	0.037	28.88	1.565E+01		
K-40	1460.60	229.	2.	0.001	176.54	8.495E-01		P
BI-214	1764.44	126.	5.	0.001	303.05	1.403E+00		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 *****

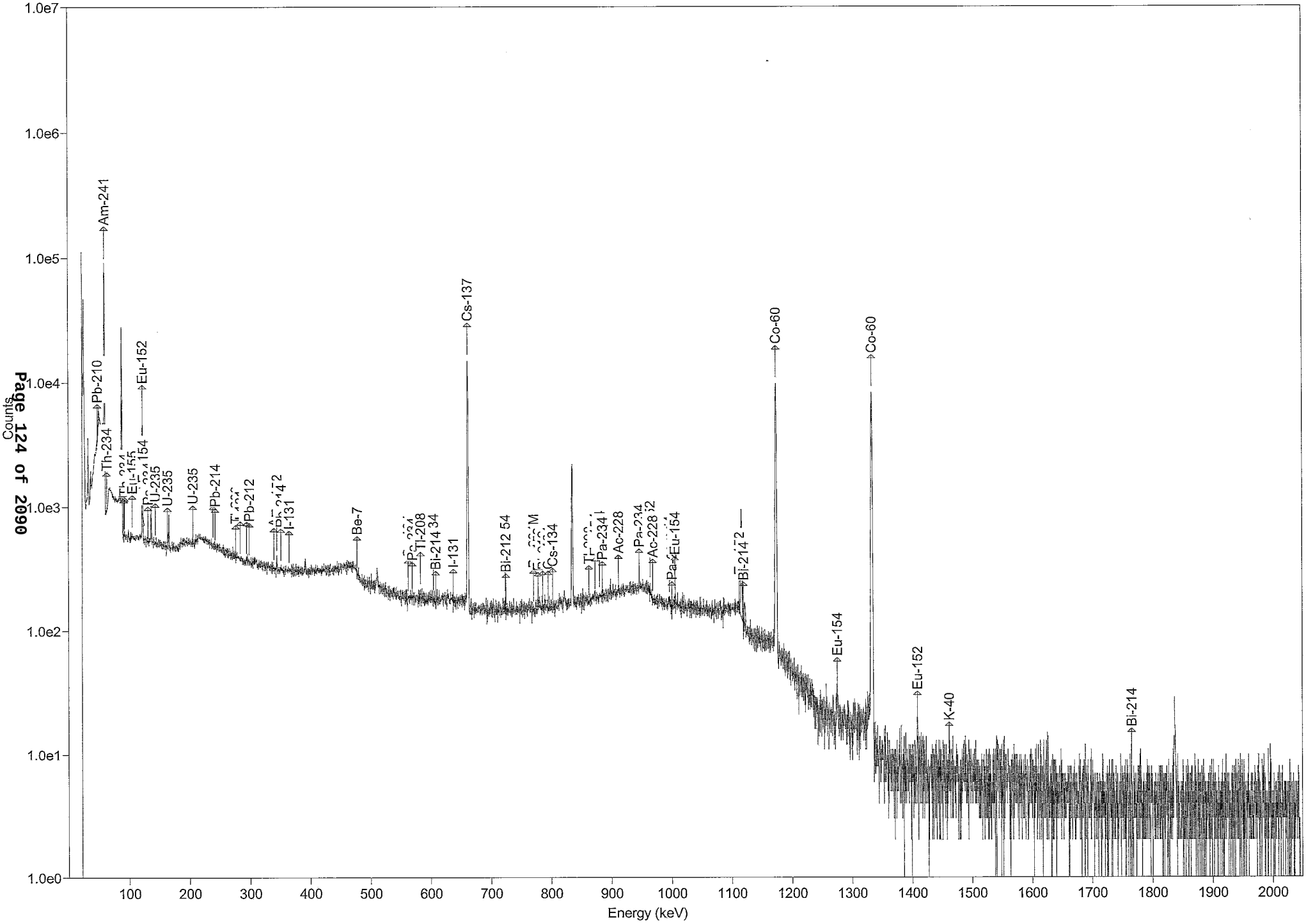
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting		MDA Bq/Sample
BE-7	#A	-1.1450E+01	>12 Halflives	1.4166E+02%	5.3658E+01	
K-40	#A	8.4954E-01	8.4954E-01	8.679E+02%		2.54E+01
CO-60		2.1952E+03	3.2106E+03	2.905E-01%		5.76E+00
I-131	#A	-5.2049E-01	>12 Halflives	3.1670E+02%	5.4632E+00	
CS-134	#A	5.5691E-01	1.4699E+00	2.975E+02%		1.53E+01
CS-137		1.8460E+03	1.9735E+03	3.877E-01%		7.11E+00
EU-152		2.1398E+01	2.4812E+01	2.405E+01%		1.50E+01
EU-154	#A	1.6435E+01	2.0752E+01	2.888E+01%		8.48E+01
EU-155	#A	3.8763E+00	5.8061E+00	9.733E+01%		1.87E+01
TL-208	#A	1.9705E+00	5.6266E+00	9.749E+01%		1.81E+01
PB-210	#A	-2.6848E+02	-2.9373E+02	2.067E+01%		1.90E+02
PB-212	#A	1.3591E+00	3.8808E+00	1.995E+02%		2.56E+01
PB-214	#A	3.3044E+00	3.3085E+00	9.081E+01%		1.10E+01
BI-212	#A	-2.0431E+01	-5.8339E+01	1.029E+02%		1.99E+02
BI-214	#A	-6.6123E+00	-6.6206E+00	6.806E+01%		1.19E+01
AC-228	#A	7.6446E+00	1.0832E+01	1.068E+02%		4.44E+01
Pa-234	#A	4.8490E+00	4.8490E+00	1.133E+02%		1.51E+01
TH-234	#A	-3.0627E+01	-3.0627E+01	1.263E+02%		9.05E+01
PA-234M	#A	-4.7291E+02	-4.7291E+02	6.978E+01%		1.09E+03
U-235	#A	3.9231E+00	3.9231E+00	2.300E+02%		2.44E+01
AM-241		5.0146E+03	5.0379E+03	2.283E-01%		1.66E+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 (1130.6 to 1999.5 keV) 9.077E+03 Bq/Sample
Total Decayed Activity (1130.6 to 1999.5 keV) 1.0246803E+04 Bq/Sample

The library has energies which are not separable.


1L Marn_83924-334_2011Cal. 14_83924-334_20131712.spc.
Counts
Energy (keV)
Am-241
Pb-210
Th-234
Eu-155
Eu-152
U-235
Pb-214
Pb-212
I-131
Be-7
Cs-137
Bi-212 54
Cs-134
Pa-234
Ac-228
Co-60
Eu-154
K-40
Bi-214

Sample Description: 1L Marn_83924-334_2011Cal
Detector: Ge15 SN/11012216
Batch ID: 1L Marn
Work Order Number: 83924-334
Lot Number: 2011Cal

Decay to Time: 1/1/2011 12:00 Live Time: 3600 sec
Acquisition Time: 11/22/2013 09:53:42 Real Time: 3712 sec
Analysis Time: 11/22/2013 10:55 Dead Time: 3.02 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 15_Liquid_Marinelli 1L.Clb
Efficiency Cal Desc: 15_1LMarinelli_90062_030512
Efficiency Cal Date: 3/14/2012 17:18
Energy Cal Date: 2/28/2012 16:29
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 15_2013-11-02_0115.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
K-40	5.431E+00	148.7	8.076E+00	8.081E+00	2.766E+01
CO-60	3.238E+03	0.3	1.066E+01	1.601E+02	7.520E+00
CS-134	3.363E+00	90.4	3.040E+00	3.045E+00	1.827E+01
CS-137	1.972E+03	0.5	9.082E+00	9.900E+01	9.211E+00
EU-152	2.791E+01	31.6	8.812E+00	8.931E+00	2.006E+01
EU-154	1.508E+02	1.4	2.110E+00	7.714E+00	1.032E+02
EU-155	1.475E+00	408.5	6.028E+00	6.028E+00	1.997E+01
TL-208	7.526E-01	322.4	2.426E+00	2.426E+00	2.057E+01
PB-210	-3.725E+02	21.6	8.027E+01	8.703E+01	2.479E+02
PB-212	9.094E+00	92.4	8.405E+00	8.425E+00	2.778E+01
PB-214	6.813E-01	633.2	4.314E+00	4.314E+00	1.431E+01
BI-212	-7.353E+01	106.0	7.797E+01	7.805E+01	2.580E+02
BI-214	3.390E+00	73.9	2.506E+00	2.511E+00	8.575E+00
AC-228	3.106E+01	39.1	1.215E+01	1.225E+01	3.982E+01
Pa-234	4.721E+00	138.6	6.543E+00	6.548E+00	1.836E+01
TH-234	-1.958E+02	20.5	4.007E+01	4.149E+01	1.233E+02
PA-234M	-1.282E+02	148.9	1.908E+02	1.909E+02	1.306E+03
U-235	2.806E+00	202.7	5.687E+00	5.689E+00	3.026E+01
AM-241	5.045E+03	0.3	1.387E+01	2.916E+02	2.099E+01
Total	1.050E+04				

Analyst: Jody Watson

TestAmerica, Inc. Spectrum name: 15_83924-334_20131458.An1

Sample description
1L Marn_83924-334_2011Cal

Spectrum Filename: C:\User\SPC\Det15\15_83924-334_20131458.An1

Acquisition information
Start time: 11/22/2013 9:53:42 AM
Live time: 3600
Real time: 3712
Dead time: 3.02 %
Detector ID: 15

Detector system
Ge15 SN/11012216

Calibration
Filename: 15_Liquid_Marinelli 1L.Clb
15_1LMarinelli_90062_030512

Energy Calibration
Created: 2/28/2012 4:29:17 PM
Zero offset: 0.044 keV
Gain: 0.250 keV/channel
Quadratic: -3.267E-08 keV/channel^2

Efficiency Calibration
Created: 3/14/2012 5:18:02 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.47 %
Log(Eff): -1.572527E+00 + (-4.580173E-02*Log(E)) + (-6.063230E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.05 %
Log(Eff): -1.327166E+01 + (4.478511E+00*Log(E)) + (-4.979721E-01*Log(E)^2)

Library Files
Main analysis library: Client_Routine Short Rev1.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 (1999.52keV)
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

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	1/1/2011 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	15_2013-11-02_0115.PBC 11/2/2013 1:15:02 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 23 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.1414

***** 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
36.57	1998.	12.38	0.95	2.723E-02				
49.53	9830.	4.71	1.74	3.411E-02				
59.52	242718.	0.27	0.96	3.740E-02	59.54	35.900	5.045E+03	AM241
88.07	78275.	0.48	1.01	4.066E-02				
98.91	219.	51.58	0.70	4.048E-02				
103.81	30.	408.53	1.00	4.015E-02	105.31	21.200	PBC<MDA	EU155
122.14	13524.	1.79	1.05	3.879E-02	121.78	28.580	3.926E+02	EU152
					123.10	40.790	3.005E+02	EU154
					123.10	40.790	3.005E+02	EU154
136.63	1806.	8.80	1.04	3.724E-02				
166.01	1118.	12.64	1.02	3.367E-02				
182.81	104.	65.78	0.38	3.156E-02				
206.21	68.	202.67	1.09	2.915E-02	205.33	5.010	PBC<MDA	U235
					205.33	5.010	1.302E+01	U235
240.87	130.	80.09	1.12	2.623E-02	238.63	43.300	PBC<MDA	PB212
247.76	169.	80.17	0.51	2.554E-02				
276.80	39.	322.36	1.15	2.355E-02	277.28	6.310	PBC<MDA	TL208
					277.28	6.310	2.056E+01	TL208
284.47	95.	127.51	1.16	2.312E-02	284.30	6.140	HL>Cutoff	I131
					284.30	6.140	HL>Cutoff	I131
307.11	153.	62.71	0.66	2.185E-02				
344.79	461.	31.57	0.84	2.004E-02	344.29	26.500	2.791E+01	EU152
351.84	18.	633.21	1.22	1.973E-02	351.93	37.600	PBC<MDA	PB214
364.48	27.	414.99	1.23	1.921E-02	364.48	81.700	HL>Cutoff	I131
					364.48	81.700	HL>Cutoff	I131
391.80	406.	33.58	0.93	1.818E-02				
418.37	75.	72.58	0.41	1.728E-02				
426.56	128.	58.93	0.39	1.702E-02				

609.58	65.	64.61	1.43	1.279E-02	609.31	46.090	PBC<MDA	BI214
612.27	86.	65.88	0.38	1.274E-02				
612.53	71.	90.87	1.43	1.274E-02				
661.73	67564.	0.46	1.45	1.194E-02	661.66	85.210	1.972E+03	CS137
722.46	69.	122.38	1.52	1.108E-02	723.36	20.220	PBC<MDA	EU154
					723.36	20.220	1.077E+01	EU154
723.01	230.	45.74	0.72	1.109E-02				
768.46	29.	283.18	1.55	1.055E-02	766.41	0.294	PBC<MDA	PA234M
785.08	174.	54.07	0.33	1.034E-02				
801.97	98.	92.72	1.58	1.015E-02	801.95	8.690	PBC<MDA	CS134
					801.95	8.690	8.106E+01	CS134
834.98	10366.	1.55	1.58	9.806E-03				
873.73	27.	384.70	1.63	9.434E-03	873.23	12.270	PBC<MDA	EU154
					873.23	12.270	8.086E+00	EU154
884.50	39.	263.61	1.64	9.341E-03	883.24	9.600	PBC<MDA	Pa234
					883.24	9.600	1.206E+01	Pa234
907.74	271.	37.23	0.37	9.121E-03				
910.96	208.	39.14	1.66	9.092E-03	911.07	29.000	PBC<MDA	AC228
946.13	42.	264.01	1.68	8.798E-03	946.02	13.400	PBC<MDA	Pa234
					946.02	13.400	9.867E+00	Pa234
953.11	161.	65.10	0.53	8.740E-03				
981.21	184.	50.75	0.50	8.520E-03				
995.94	94.	104.12	1.72	8.406E-03	996.33	10.600	PBC<MDA	EU154
					996.33	10.600	3.691E+01	EU154

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
1004.35	119.	82.72	1.72	8.343E-03	1004.77	18.010	PBC<MDA	EU154
					1004.77	18.010	2.768E+01	EU154
1029.71	247.	42.92	0.24	8.164E-03				
1115.54	5012.	3.88	1.85	7.601E-03				
1144.14	137.	44.72	0.66	7.430E-03				
1173.36	57410.	0.47	1.79	7.263E-03	1173.24	99.900	3.214E+03	CO60
1195.51	87.	59.49	0.34	7.142E-03				
1236.75	66.	45.61	0.40	6.925E-03				
1274.27	228.	21.30	0.61	6.739E-03	1274.54	35.190	3.373E+01	EU154
1274.84	104.	32.18	1.90	6.738E-03	1274.54	35.190	PBC<MDA	EU154
1332.66	51930.	0.46	1.92	6.468E-03	1332.50	99.980	3.262E+03	CO60
1408.51	60.	32.31	1.98	6.149E-03	1408.00	21.005	PBC<MDA	EU152
1461.17	12.	87.17	2.02	5.942E-03	1460.83	10.670	PBC<MDA	K40
1764.99	12.	78.94	2.18	4.975E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV		Suspected Nuclide
145.97	36.57	16912.	1998.	7.336E+04	12.38	0.946	-	sM
197.81	49.53	58866.	10188.	2.986E+05	3.51	1.744	-	sM
351.84	88.07	15162.	78716.	1.936E+06	0.42	1.008	-	
395.18	98.91	4717.	219.	5.419E+03	51.58	0.703	-	s
545.94	136.63	6698.	1806.	4.851E+04	8.80	1.038	-	s
663.39	166.01	5669.	1127.	3.347E+04	9.91	1.020	-	
730.57	182.81	2288.	104.	3.296E+03	65.78	0.379	-	c
990.22	247.76	5434.	169.	6.604E+03	80.17	0.512	-	c
1227.49	307.11	3188.	153.	6.995E+03	62.71	0.662	-	s
1566.13	391.80	4545.	406.	2.233E+04	33.58	0.928	-	s
1672.36	418.37	1444.	75.	4.341E+03	72.58	0.410	-	sc
1705.09	426.56	2242.	128.	7.550E+03	58.93	0.391	-	s
2448.81	612.27	2040.	71.	5.567E+03	90.87	1.433	-	sc
2890.69	723.01	2487.	162.	1.458E+04	44.33	0.723	-	sM
3138.98	785.08	2177.	166.	1.602E+04	40.60	0.330	-	s
3338.60	834.98	3216.	10366.	1.057E+06	1.55	1.584	-	
3629.21	907.74	2592.	260.	2.854E+04	28.34	1.656	-	D
3811.18	953.11	2952.	161.	1.842E+04	65.10	0.534	-	s
3923.59	981.21	2227.	184.	2.160E+04	50.75	0.500	-	sM
4117.66	1029.71	2443.	247.	3.025E+04	42.92	0.240	-	sM
4461.10	1115.54	3719.	6784.	8.925E+05	1.76	1.850	-	sM
4575.55	1144.14	981.	137.	1.839E+04	44.72	0.657	-	s
4781.09	1195.51	648.	87.	1.218E+04	59.49	0.339	-	s
4946.16	1236.75	240.	66.	9.530E+03	45.61	0.399	-	s
5096.32	1274.27	459.	124.	1.839E+04	26.05	0.605	-	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: Client_Routine Short Rev1.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	189.26	47.39	59326.	-1709.	-0.475	20.92	0.946
AM-241	237.72	59.52	46727.	242718.	67.422	0.27	0.964
TH-234	251.82	63.05	19122.	-1028.	-0.286	19.86	0.962s
EU-155	353.93	88.59	23344.	-442.	-0.123	49.16	0.983s
EU-155	414.75	103.81	7589.	30.	0.008	408.53	1.000
EU-152	488.02	122.14	10000.	13524.	3.757	1.79	1.049
EU-154	487.94	122.12	9037.	12494.	3.471	1.40	1.017s
Pa-234	523.79	131.09	9221.	-74.	-0.021	183.58	1.024s
U-235	654.06	163.67	9720.	-334.	-0.093	42.49	1.053s
U-235	824.09	206.21	9593.	68.	0.019	202.67	1.091s
PB-212	962.67	240.87	7190.	130.	0.036	80.09	1.120s
PB-214	970.14	242.74	9363.	-215.	-0.060	64.13	1.123s
TL-208	1106.33	276.80	7688.	39.	0.011	322.36	1.154s
I-131	1136.98	284.47	7359.	95.	0.027	127.51	1.160
PB-214	1179.66	295.14	7165.	-57.	-0.016	210.36	1.170s
PB-212	1204.54	301.37	6660.	-51.	-0.014	225.11	1.174s
AC-228	1352.26	338.31	6910.	-62.	-0.017	191.28	1.207s
EU-152	1378.13	344.79	4965.	461.	0.128	31.57	0.836s
PB-214	1406.32	351.84	6612.	18.	0.005	633.21	1.219s
I-131	1456.90	364.48	6489.	27.	0.008	414.99	1.229s
CS-134	2249.00	562.57	4075.	-101.	-0.028	90.21	1.394s
CS-134	2279.06	570.09	4740.	-95.	-0.026	103.23	1.399s
Pa-234	2279.05	570.08	4731.	-93.	-0.026	105.09	1.399s
CS-134	2420.41	605.43	4434.	-61.	-0.017	155.21	1.427s
BI-214	2435.94	609.31	1475.	65.	0.018	64.61	1.431D
CS-137	2645.57	661.73	4510.	67564.	18.768	0.46	1.451
EU-154	2888.51	722.46	3512.	69.	0.019	122.38	1.519s
BI-212	2900.45	725.45	3315.	-77.	-0.021	106.03	1.522s
PA-234M	3072.47	768.46	3405.	29.	0.008	283.18	1.552s
CS-134	3183.03	796.09	4114.	-74.	-0.021	122.79	1.574s
CS-134	3206.53	801.97	4041.	98.	0.027	92.72	1.578s
EU-154	3493.61	873.73	5257.	27.	0.007	384.70	1.631s
Pa-234	3536.70	884.50	5245.	39.	0.011	263.61	1.638s
AC-228	3642.99	911.07	3211.	208.	0.058	39.14	1.658D
Pa-234	3783.27	946.13	6090.	42.	0.012	264.01	1.683s
EU-152	3853.95	963.80	5838.	-72.	-0.020	150.48	1.696s
AC-228	3875.45	969.17	5165.	-118.	-0.033	86.29	1.699s
EU-154	3982.53	995.94	4719.	94.	0.026	104.12	1.718s
PA-234M	4001.90	1000.78	4919.	-67.	-0.019	148.87	1.722s
EU-154	4016.18	1004.35	4751.	119.	0.033	82.72	1.724s
EU-152	4447.58	1112.16	6928.	-654.	-0.182	18.43	1.797
BI-214	4472.17	1118.31	7236.	-1129.	-0.314	11.10	1.803
CO-60	4692.47	1173.36	2276.	57410.	15.947	0.47	1.788
EU-154	5098.60	1274.84	510.	104.	0.029	32.18	1.902s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
CO-60	5329.98	1332.66	630.	51930.	14.425	0.46	1.919
EU-152	5633.60	1408.51	159.	60.	0.017	32.31	1.984s
K-40	5844.41	1461.17	168.	12.	0.003	87.17	2.015s
BI-214	7060.78	1764.99	106.	12.	0.003	78.94	2.180

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	-1.0130E+00				5.31E+01	
			477.60-1.013E+00	&(6.332E+01		1.88E+03 1.05E+01	G
K-40	N	5.4314E+00				4.66E+11	
			1460.83 5.431E+00	?(P 2.766E+01		8.72E+01 1.07E+01	G
CO-60	F	3.2379E+03				1.93E+03	
			1332.50 3.262E+03	(7.520E+00		4.58E-01 1.00E+02	G
			1173.24 3.214E+03	(1.260E+01		4.73E-01 9.99E+01	G
I-131	I	1.7576E+00				8.02E+00	
			364.48 4.863E-01	?(6.691E+00		4.15E+02 8.17E+01	G
			284.30 1.867E+01	?(7.874E+01		1.28E+02 6.14E+00	G
			636.97 5.576E-01	& 9.345E+01		5.04E+03 7.17E+00	G
CS-134	I	3.3633E+00				7.54E+02	
			604.71-3.553E+00	?(1.827E+01		1.55E+02 9.76E+01	G
			795.87-6.224E+00	+ 2.530E+01		1.23E+02 8.55E+01	G
			569.32-3.343E+01	& 1.141E+02		1.03E+02 1.54E+01	G
			801.95 8.106E+01	(2.484E+02		9.27E+01 8.69E+00	G
			563.24-6.483E+01	+ 1.933E+02		9.02E+01 8.35E+00	G
CS-137	I	1.9715E+03				1.10E+04	
			661.66 1.972E+03	(9.211E+00		4.61E-01 8.52E+01	G
EU-152	F	2.7912E+01				4.94E+03	
			344.29 2.791E+01	(2.006E+01		3.16E+01 2.65E+01	G
			121.78 3.926E+02	+ 1.361E+01		1.79E+00 2.86E+01	G
			778.92 1.414E+00	% 7.177E+01		1.53E+03 1.29E+01	G
			964.11-1.836E+01	& 9.145E+01		1.50E+02 1.46E+01	G
			1112.07-2.024E+02	- 1.210E+02		1.84E+01 1.36E+01	G
			1408.00 1.499E+01	& 1.531E+01		3.23E+01 2.10E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
EU-154	I 1.5078E+02					3.14E+03	
		873.23	8.086E+00	?(	1.032E+02	3.85E+02	1.23E+01 G
		123.10	2.777E+02	?(	9.905E+00	1.40E+00	4.08E+01 G
		1274.54	1.541E+01	-	1.597E+01	3.22E+01	3.52E+01 G
		723.36	1.077E+01	-	4.365E+01	1.22E+02	2.02E+01 G
		1004.77	2.768E+01	?(	7.561E+01	8.27E+01	1.80E+01 G
		996.33	3.691E+01	(	1.271E+02	1.04E+02	1.06E+01 G
EU-155	I 1.4754E+00					1.81E+03	
		105.31	1.475E+00	(	1.997E+01	4.09E+02	2.12E+01 G
		86.54	-1.473E+01	+	2.383E+01	4.92E+01	3.07E+01 G
TL-208	N 7.5256E-01					6.98E+02	
		583.02	-7.263E-01	&(P	2.057E+01	1.00E+05	8.45E+01 G
		277.28	2.056E+01	&(	2.195E+02	3.22E+02	6.31E+00 G
		860.56	-3.685E+00	%	2.138E+02	1.75E+03	1.24E+01 G
PB-210	N -3.7246E+02					8.14E+03	
		46.54	-3.725E+02	(P	2.479E+02	2.09E+01	4.25E+00 G
PB-212	N 9.0935E+00					6.98E+02	
		238.63	9.093E+00	(P	2.778E+01	8.01E+01	4.33E+01 G
		300.03	-5.588E+01	+	4.166E+02	2.25E+02	3.28E+00 G
PB-214	N 6.8131E-01					5.84E+05	
		351.93	6.813E-01	?(	1.431E+01	6.33E+02	3.76E+01 G
		295.09	-3.652E+00	+	2.544E+01	2.10E+02	1.93E+01 G
		242.00	-3.093E+01	+	6.538E+01	6.41E+01	7.43E+00 G
BI-212	N -7.3531E+01					6.98E+02	
		727.17	-7.353E+01	?(	2.580E+02	1.06E+02	7.55E+00 G
		785.42	5.041E+01	%	1.733E+03	1.03E+03	1.28E+00 G
BI-214	N 3.3896E+00					5.84E+05	
		609.31	3.048E+00	(P	8.575E+00	6.46E+01	4.61E+01 G
		1120.29	-2.747E+02	+ P	9.708E+01	1.11E+01	1.51E+01 G
		1764.49	4.413E+00	(P	1.837E+01	7.89E+01	1.54E+01 G
AC-228	N 3.1056E+01					2.10E+03	
		911.07	3.106E+01	(	3.982E+01	3.91E+01	2.90E+01 G
		968.97	-3.100E+01	-	8.835E+01	8.63E+01	1.75E+01 G
		338.32	-9.932E+00	-	6.290E+01	1.91E+02	1.20E+01 G
						Energy duplication	
		93.35	5.734E-01	%	8.128E+01	4.28E+03	5.56E+00 XA
Pa-234	N 4.7207E+00					1.63E+12	
		131.29	-3.023E+00	?(	1.836E+01	1.84E+02	1.80E+01 G
		569.47	-2.331E+01	+	8.102E+01	1.05E+02	8.20E+00 G

Nuclide	Ave	activity	Energy	Activity	Code	Peak	MDA	Comments
			946.02	9.867E+00	?(	8.633E+01	2.64E+02	1.34E+01 G
			883.24	1.206E+01	&(	1.054E+02	2.64E+02	9.60E+00 G
			880.53	-1.580E+00	%	1.694E+02	3.23E+03	6.00E+00 G
TH-234	N	-1.9578E+02					1.63E+12	
			63.29	-1.958E+02	&(P	1.233E+02	1.99E+01	3.81E+00 G
			92.59	-5.213E+00	& P	5.839E+01	1.46E+03	5.58E+00 G
PA-234M	N	-1.2816E+02					1.63E+12	
			1001.00	-2.650E+02	?(	1.306E+03	1.49E+02	8.37E-01 G
			766.41	2.615E+02	&(	2.459E+03	2.83E+02	2.94E-01 G
U-235	N	2.8061E+00					2.57E+11	
			143.79	-1.865E+00	%(P	3.026E+01	7.92E+02	1.10E+01 G
			205.33	1.302E+01	&(	8.734E+01	2.03E+02	5.01E+00 G
			163.38	-5.375E+01	+ P	7.430E+01	4.25E+01	5.08E+00 G
							Energy	duplication
			93.35	3.873E-01	%	5.490E+01	4.28E+03	5.81E+00 X
AM-241	T	5.0447E+03					1.58E+05	
			59.54	5.045E+03	(	2.099E+01	2.75E-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.
+ - 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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape
K - Key Line
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	
PB-210	47.39	59326.	-1709.	-0.475	20.92	-3.725E+02	P
TH-234	63.05	19122.	-1028.	-0.286	19.86	-1.958E+02	P
EU-155	88.59	23344.	-442.	-0.123	49.16	-1.473E+01	
EU-155	103.81	7589.	30.	0.008	408.53	1.475E+00	
EU-154	122.12	9037.	12494.	3.471	1.40	2.777E+02	
Pa-234	131.09	9221.	-74.	-0.021	183.58	-3.023E+00	
U-235	163.67	9720.	-334.	-0.093	42.49	-5.375E+01	P
U-235	206.21	9593.	68.	0.019	202.67	1.302E+01	
PB-212	240.87	7190.	130.	0.036	80.09	9.093E+00	P
PB-214	242.74	9363.	-215.	-0.060	64.13	-3.093E+01	
TL-208	276.80	7688.	39.	0.011	322.36	2.056E+01	
I-131	284.47	7359.	95.	0.027	127.51	0.000E+00	
PB-214	295.14	7165.	-57.	-0.016	210.36	-3.652E+00	
PB-212	301.37	6660.	-51.	-0.014	225.11	-5.588E+01	
PB-214	351.84	6612.	18.	0.005	633.21	6.813E-01	
I-131	364.48	6489.	27.	0.008	414.99	0.000E+00	
CS-134	562.57	4075.	-101.	-0.028	90.21	-6.483E+01	
CS-134	570.09	4740.	-95.	-0.026	103.23	-3.343E+01	
Pa-234	570.08	4731.	-93.	-0.026	105.09	-2.331E+01	
CS-134	605.43	4434.	-61.	-0.017	155.21	-3.553E+00	
EU-154	722.46	3512.	69.	0.019	122.38	1.077E+01	
BI-212	725.45	3315.	-77.	-0.021	106.03	-7.353E+01	
PA-234M	768.46	3405.	29.	0.008	283.18	2.615E+02	
CS-134	796.09	4114.	-74.	-0.021	122.79	-6.224E+00	
CS-134	801.97	4041.	98.	0.027	92.72	8.106E+01	
EU-154	873.73	5257.	27.	0.007	384.70	8.086E+00	
Pa-234	884.50	5245.	39.	0.011	263.61	1.206E+01	
Pa-234	946.13	6090.	42.	0.012	264.01	9.867E+00	
EU-154	995.94	4719.	94.	0.026	104.12	3.691E+01	
PA-234M	1000.78	4919.	-67.	-0.019	148.87	-2.650E+02	
EU-154	1004.35	4751.	119.	0.033	82.72	2.768E+01	
EU-154	1274.84	510.	104.	0.029	32.18	1.541E+01	
K-40	1461.17	168.	12.	0.003	87.17	5.431E+00	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 *****

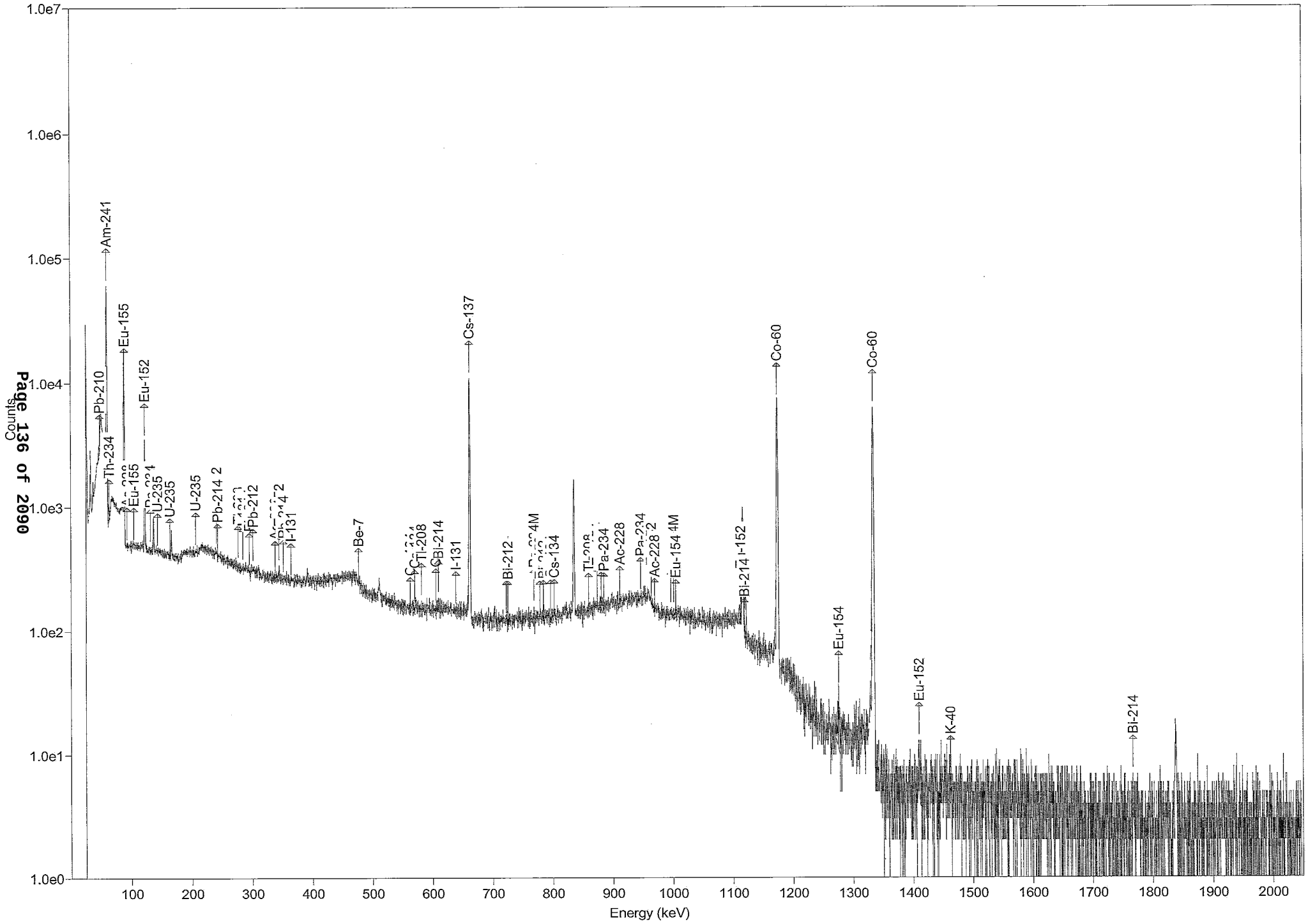
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting		MDA Bq/Sample
BE-7	#A	-1.0130E+00	>12 Halflives	1.8836E+03%	6.3317E+01	
K-40	#A	5.4314E+00	5.4314E+00	1.487E+02%		2.77E+01
CO-60		2.2139E+03	3.2379E+03	3.293E-01%		7.52E+00
I-131	#A	1.7576E+00	>12 Halflives	1.2751E+02%	6.6912E+00	
CS-134	#A	1.2743E+00	3.3633E+00	9.040E+01%		1.83E+01
CS-137		1.8441E+03	1.9715E+03	4.607E-01%		9.21E+00
EU-152		2.4072E+01	2.7912E+01	3.157E+01%		2.01E+01
EU-154	#C	1.1942E+02	1.5078E+02	1.399E+00%		1.03E+02
EU-155	#A	9.8505E-01	1.4754E+00	4.085E+02%		2.00E+01
TL-208	#A	2.6357E-01	7.5256E-01	3.224E+02%		2.06E+01
PB-210	#A	-3.4045E+02	-3.7246E+02	2.155E+01%		2.48E+02
PB-212	#A	3.1848E+00	9.0935E+00	9.243E+01%		2.78E+01
PB-214	#A	6.8045E-01	6.8131E-01	6.332E+02%		1.43E+01
BI-212	#A	-2.5753E+01	-7.3531E+01	1.060E+02%		2.58E+02
BI-214	A	3.3853E+00	3.3896E+00	7.392E+01%		8.57E+00
AC-228	A	2.1918E+01	3.1056E+01	3.914E+01%		3.98E+01
Pa-234	#A	4.7207E+00	4.7207E+00	1.386E+02%		1.84E+01
TH-234	#A	-1.9578E+02	-1.9578E+02	2.047E+01%		1.23E+02
PA-234M	#A	-1.2816E+02	-1.2816E+02	1.489E+02%		1.31E+03
U-235	#A	2.8061E+00	2.8061E+00	2.027E+02%		3.03E+01
AM-241		5.0214E+03	5.0447E+03	2.749E-01%		2.10E+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 (953.1 to 1999.5 keV) 9.125E+03 Bq/Sample
Total Decayed Activity (953.1 to 1999.5 keV) 1.0313123E+04 Bq/Sample

The library has energies which are not separable.


1L Marn_83924-334_2011Cal. 15_83924-334_20131458.spc.
Counts
Energy (keV)
1.0e7
1.0e6
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Am-241
Pb-210
Th-234
Eu-155
Eu-152
U-235
U-235
U-235
Pb-214
Pb-212
I-131
Be-7
Tl-208
Bi-214
I-131
Cs-137
Bi-212
Cs-134
Pa-234
Ac-228
Ac-228
Eu-154
Bi-214
I-152
Co-60
Co-60
Eu-154
Eu-152
K-40
Bi-214

Test America St. Louis Spectrum ID: 18_83924-334_20130931

Sample Description: 1L Marn_83924-334_2011Cal
Detector: Ge18 SN/11164036
Batch ID: 1L Marn
Work Order Number: 83924-334
Lot Number: 2011Cal

Decay to Time: 1/1/2011 12:00 Live Time: 3600 sec
Acquisition Time: 11/22/2013 08:29:35 Real Time: 3758 sec
Analysis Time: 11/22/2013 09:32 Dead Time: 4.21 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 18_1LMarinelli.Clb
Efficiency Cal Desc: 18_1Lmarn_83924-334_120711
Efficiency Cal Date: 12/8/2011 10:14
Energy Cal Date: 3/1/2012 13:27
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 18_2013-11-02_0120.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
K-40	4.025E+01	23.9	9.618E+00	9.830E+00	1.819E+01
CO-60	3.226E+03	0.3	8.914E+00	1.593E+02	7.263E+00
CS-134	4.627E+00	97.1	4.493E+00	4.499E+00	1.334E+01
CS-137	2.010E+03	0.4	7.710E+00	1.001E+02	7.902E+00
EU-152	1.338E+01	36.6	4.889E+00	4.947E+00	1.905E+01
EU-154	2.242E+02	1.1	2.535E+00	1.137E+01	7.933E+01
EU-155	1.533E+03	0.4	5.520E+00	8.917E+01	1.807E+01
TL-208	-2.664E+00	232.6	6.197E+00	6.198E+00	1.790E+01
PB-210	-3.870E+02	17.6	6.800E+01	7.641E+01	2.130E+02
PB-212	-1.820E-01	4773.0	8.687E+00	8.687E+00	2.351E+01
PB-214	4.260E+00	82.8	3.529E+00	3.537E+00	1.166E+01
BI-212	-1.079E+02	62.8	6.771E+01	6.792E+01	2.231E+02
BI-214	-2.768E-02	60.2	1.665E-02	1.670E-02	1.191E+01
AC-228	6.535E+00	191.9	1.254E+01	1.254E+01	4.150E+01
Pa-234	1.506E+00	67.0	1.009E+00	1.012E+00	1.566E+01
TH-234	-1.603E+02	21.3	3.416E+01	3.528E+01	1.017E+02
PA-234M	1.349E+01	2211.0	2.982E+02	2.982E+02	9.895E+02
U-235	3.412E+00	228.3	7.791E+00	7.793E+00	2.577E+01
AM-241	5.140E+03	0.2	1.213E+01	2.970E+02	1.820E+01
Total	1.222E+04				

Analyst: Jody Watson

Test America Spectrum name: 18_83924-334_20130931.An1

Sample description
1L Marn_83924-334_2011Cal

Spectrum Filename: C:\User\SPC\Det18\18_83924-334_20130931.An1

Acquisition information

Start time:	11/22/2013 8:29:35 AM
Live time:	3600
Real time:	3758
Dead time:	4.21 %
Detector ID:	18

Detector system
Ge18 SN/11164036

Calibration
Filename: 18_1LMarinelli.Clb
18_1Lmarn_83924-334_120711

Energy Calibration

Created:	3/1/2012 1:27:55 PM
Zero offset:	0.007 keV
Gain:	0.250 keV/channel
Quadratic:	-3.202E-08 keV/channel^2

Efficiency Calibration

Created:	12/8/2011 10:14:04 AM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 2.55 %
Log(Eff):	-1.645931E+00 + (3.227669E-02*Log(E)) + (-6.187585E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.90 %
Log(Eff):	-1.318185E+01 + (4.538566E+00*Log(E)) + (-5.017483E-01*Log(E)^2)

Library Files

Main analysis library:	Client_Routine Short Rev1.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 (1999.55keV)
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

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	1/1/2011 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	18_2013-11-02_0120.PBC 11/2/2013 1:20:35 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 22 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 179.3500

***** 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
36.41	2725.	9.39	0.92	3.507E-02				
42.28	528.	43.96	0.17	3.985E-02				
49.45	13420.	3.85	1.81	4.449E-02				
55.21	180.	133.43	0.40	4.737E-02				
59.43	324650.	0.24	0.95	4.906E-02	59.54	35.900	5.140E+03	AM241
87.92	104101.	0.41	1.01	5.396E-02	86.54	30.700	2.617E+03	EU155
122.03	18305.	1.39	1.04	5.191E-02	121.78	28.580	3.972E+02	EU152
					123.10	40.790	3.040E+02	EU154
					121.78	28.580	3.972E+02	EU152
136.39	2134.	8.35	1.00	4.999E-02				
144.00	66.	228.33	1.05	4.890E-02	143.79	10.960	PBC<MDA	U235
149.02	129.	76.92	0.52	4.809E-02				
165.89	1654.	10.21	1.18	4.516E-02				
240.71	-4.	439.57	1.15	3.601E-02	238.63	43.300	PBC<MDA	PB212
					238.63	43.300	PBC<MDA	PB212
344.29	286.	46.97	1.25	2.819E-02	344.29	26.500	PBC<MDA	EU152
					344.29	26.500	1.233E+01	EU152
352.08	160.	71.55	1.26	2.777E-02	351.93	37.600	PBC<MDA	PB214
391.60	615.	17.97	1.27	2.577E-02				
520.46	42.	127.38	0.50	2.097E-02				
564.05	63.	174.57	1.45	1.977E-02	563.24	8.350	PBC<MDA	CS134
					563.24	8.350	2.795E+01	CS134
569.31	113.	97.12	1.46	1.961E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	1.957E+01	Pa234
					569.32	15.380	2.753E+01	CS134
					569.47	8.200	1.957E+01	Pa234
569.33	103.	107.15	1.46	1.960E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	1.778E+01	Pa234

602.95	20.	497.78	1.49	1.873E-02	604.71	97.620	PBC<MDA	CS134
					604.71	97.620	8.077E-01	CS134
635.92	25.	435.48	1.51	1.801E-02	636.97	7.170	HL>Cutoff	I131
661.68	100873.	0.38	1.47	1.749E-02	661.66	85.210	2.010E+03	CS137
723.21	305.	33.05	1.59	1.632E-02	723.36	20.220	PBC<MDA	EU154
					723.36	20.220	3.240E+01	EU154
778.97	278.	35.82	0.55	1.539E-02	778.92	12.940	4.501E+01	EU152
					778.92	12.940	4.501E+01	EU152
785.20	50.	212.42	1.64	1.529E-02	785.42	1.280	PBC<MDA	BI212
795.81	46.	235.56	1.64	1.513E-02	795.87	85.530	PBC<MDA	CS134
					795.87	85.530	2.590E+00	CS134
804.95	346.	41.31	0.37	1.500E-02				
834.89	15686.	1.55	1.60	1.457E-02				
860.56	12.	975.06	1.70	1.422E-02	860.56	12.420	PBC<MDA	TL208

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
874.57	48.	244.94	1.70	1.405E-02	873.23	12.270	PBC<MDA	EU154
					873.23	12.270	9.777E+00	EU154
911.14	65.	191.85	1.73	1.358E-02	911.07	29.000	PBC<MDA	AC228
927.30	120.	55.25	0.42	1.338E-02				
948.53	472.	39.16	0.41	1.314E-02				
963.71	58.	223.34	1.77	1.296E-02	964.11	14.605	PBC<MDA	EU152
					964.11	14.605	9.797E+00	EU152
972.86	138.	56.31	0.37	1.287E-02				
998.18	27.	410.08	1.80	1.262E-02	996.33	10.600	PBC<MDA	EU154
					996.33	10.600	7.131E+00	EU154
1004.81	133.	85.58	1.80	1.253E-02	1004.77	18.010	PBC<MDA	EU154
					1004.77	18.010	2.063E+01	EU154
1115.48	7455.	2.93	1.73	1.149E-02				
1173.31	86649.	0.40	1.86	1.101E-02	1173.24	99.900	3.199E+03	CO60
1202.37	192.	32.00	0.41	1.079E-02				
1274.66	182.	25.93	1.98	1.027E-02	1274.54	35.190	1.768E+01	EU154
					1274.54	35.190	1.768E+01	EU154
1332.61	79149.	0.38	1.93	9.884E-03	1332.50	99.980	3.253E+03	CO60
1408.32	77.	36.55	2.06	9.427E-03	1408.00	21.005	PBC<MDA	EU152
					1408.00	21.005	1.255E+01	EU152
1460.73	141.	21.30	0.59	9.130E-03	1460.83	10.670	4.025E+01	K40
1528.95	113.	32.88	0.63	8.774E-03				
1762.55	35.	60.06	2.23	7.731E-03	1764.49	15.400	PBC<MDA	BI214
					1764.49	15.400	PBC<MDA	BI214
1835.68	314.	12.52	1.06	7.462E-03				

********** 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
145.51	36.41	18849.	2725.	7.771E+04	9.39	0.922	-	s
168.94	42.28	21376.	528.	1.326E+04	43.96	0.165	-	s
197.63	49.45	72749.	13916.	3.128E+05	2.87	1.810	-	s
220.65	55.21	28753.	180.	3.800E+03	133.43	0.400	-	sc
351.38	87.92	121935.	887.	1.643E+04	55.79	1.006	-	M
545.13	136.39	8468.	2134.	4.267E+04	8.35	0.995	-	
595.61	149.02	4164.	129.	2.682E+03	76.92	0.524	-	c
663.05	165.89	7674.	1655.	3.664E+04	7.88	1.179	-	M
1565.44	391.60	3868.	615.	2.387E+04	17.97	1.275	-	M
2080.70	520.46	1410.	42.	2.003E+03	127.38	0.498	-	c
3114.63	778.97	2763.	150.	9.721E+03	50.35	0.553	-	s
3218.54	804.95	4063.	393.	2.619E+04	23.50	0.372	-	s
3338.31	834.89	6306.	15686.	1.077E+06	1.55	1.598	-	
3707.99	927.30	1843.	120.	8.992E+03	55.25	0.424	-	s
3792.90	948.53	6349.	495.	3.766E+04	23.21	0.407	-	s
3890.26	972.86	2077.	138.	1.071E+04	47.53	0.367	-	s
4460.89	1115.48	5090.	9524.	8.288E+05	1.47	1.726	-	s
4808.59	1202.37	858.	192.	1.778E+04	32.00	0.414	-	s
6115.71	1528.95	187.	113.	1.292E+04	32.88	0.629	-	s
7343.76	1835.68	157.	314.	4.206E+04	12.52	1.057	-	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: Client_Routine Short Rev1.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	189.27	47.36	74417.	-2314.	-0.643	17.18	0.947s
AM-241	237.50	59.43	60537.	324650.	90.181	0.24	0.954
TH-234	252.01	63.06	22527.	-1107.	-0.307	20.35	0.965s
EU-155	351.47	87.94	17487.	103216.	28.671	0.36	0.989s
TH-234	369.15	92.36	13364.	-156.	-0.043	223.18	0.996s
AC-228	373.09	93.35	10787.	-92.	-0.025	160.48	0.997D
U-235	373.09	93.35	10787.	-92.	-0.025	160.48	0.997D
EU-155	417.47	104.45	11065.	-140.	-0.039	106.41	1.009
EU-152	487.65	122.01	13083.	17462.	4.851	1.20	1.026
EU-154	487.66	122.01	10631.	17385.	4.829	1.13	1.028s
Pa-234	526.58	131.75	12069.	-194.	-0.054	80.34	1.036s
U-235	575.55	144.00	11262.	66.	0.018	228.33	1.049s
U-235	651.23	162.93	11857.	-123.	-0.034	125.49	1.070
U-235	823.60	206.05	13175.	-105.	-0.029	154.40	1.112s
PB-214	967.35	242.01	12423.	-158.	-0.044	104.73	1.149s
I-131	1135.61	284.09	10742.	-134.	-0.037	109.37	1.191
PB-214	1182.37	295.79	10204.	-135.	-0.038	114.33	1.202s
PB-212	1198.06	299.72	10181.	-68.	-0.019	210.18	1.207s
EU-152	1376.27	344.29	8880.	286.	0.079	46.97	1.249s
PB-214	1407.44	352.08	8707.	160.	0.044	71.55	1.257s
I-131	1460.05	365.24	8793.	-95.	-0.026	139.51	1.269
CS-134	2255.02	564.05	6001.	63.	0.017	174.57	1.451s
CS-134	2276.07	569.31	5993.	113.	0.031	97.12	1.456s
Pa-234	2276.14	569.33	6027.	103.	0.029	107.15	1.456s
TL-208	2331.23	583.10	6124.	-79.	-0.022	186.43	1.468s
CS-134	2410.59	602.95	5020.	20.	0.006	497.78	1.487s
BI-214	2436.33	609.38	6131.	-86.	-0.024	164.39	1.491s
I-131	2542.48	635.92	5834.	25.	0.007	435.48	1.514
CS-137	2645.49	661.68	7140.	100873.	28.020	0.38	1.465
EU-154	2891.57	723.21	4923.	305.	0.085	33.05	1.587s
BI-212	2907.52	727.19	5401.	-167.	-0.046	62.76	1.590s
PA-234M	3055.06	764.08	4431.	-97.	-0.027	97.75	1.622s
EU-152	3113.65	778.73	5737.	129.	0.036	83.29	1.631s
BI-212	3139.54	785.20	5669.	50.	0.014	212.42	1.637s
CS-134	3181.98	795.81	5777.	46.	0.013	235.56	1.645s
CS-134	3208.23	802.37	6068.	-101.	-0.028	109.13	1.650s
TL-208	3441.01	860.56	6875.	12.	0.003	975.06	1.695s
EU-154	3497.02	874.57	6904.	48.	0.013	244.94	1.705s
AC-228	3643.35	911.14	7833.	65.	0.018	191.85	1.734s
Pa-234	3782.59	945.95	9079.	-137.	-0.038	98.92	1.759s
EU-152	3853.66	963.71	8244.	58.	0.016	223.34	1.773s
AC-228	3870.55	967.93	7239.	-127.	-0.035	95.08	1.776
EU-154	3991.54	998.18	6206.	27.	0.008	410.08	1.796s
EU-154	4018.08	1004.81	6388.	133.	0.037	85.58	1.802s

Test America Spectrum name: 18_83924-334_20130931.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
EU-152	4447.22	1112.06	9810.	-770.	-0.214	18.55	1.876s
BI-214	4473.83	1118.71	10780.	-1869.	-0.519	8.22	1.882s
CO-60	4692.29	1173.31	4158.	86649.	24.069	0.40	1.856
EU-154	5097.87	1274.66	1024.	182.	0.051	25.93	1.980
CO-60	5329.83	1332.61	1394.	79149.	21.986	0.38	1.927
EU-152	5632.82	1408.32	359.	77.	0.021	36.55	2.058s
K-40	5842.61	1460.73	172.	141.	0.039	21.30	0.593s
BI-214	7050.92	1762.55	207.	35.	0.010	60.06	2.234s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	Peak MDA Value Bq/Sample		COMMENTS
BE-7	C	2.6868E-02					5.31E+01	
			477.60	2.687E-02	&(	5.263E+01	5.91E+04 1.05E+01	G
K-40	N	4.0251E+01					4.66E+11	
			1460.83	4.025E+01	*(P	1.819E+01	2.13E+01 1.07E+01	G
CO-60	F	3.2262E+03					1.93E+03	
			1332.50	3.253E+03	(	7.263E+00	3.79E-01 1.00E+02	G
			1173.24	3.199E+03	(	1.119E+01	4.02E-01 9.99E+01	G
I-131	I	-6.6842E-01					8.02E+00	
			364.48	-1.196E+00	(	5.517E+00	1.40E+02 8.17E+01	G
			284.30	-1.895E+01	+	6.845E+01	1.09E+02 6.14E+00	G
			636.97	5.343E+00	(	7.717E+01	4.35E+02 7.17E+00	G
CS-134	I	4.6266E+00					7.54E+02	
			604.71	8.077E-01	?(	1.334E+01	4.98E+02 9.76E+01	G
			795.87	2.590E+00	?(	2.022E+01	2.36E+02 8.55E+01	G
			569.32	2.753E+01	*(	8.835E+01	9.71E+01 1.54E+01	G
			801.95	-5.686E+01	+	2.051E+02	1.09E+02 8.69E+00	G
			563.24	2.795E+01	&(	1.615E+02	1.75E+02 8.35E+00	G
CS-137	I	2.0104E+03					1.10E+04	
			661.66	2.010E+03	(	7.902E+00	3.84E-01 8.52E+01	G
EU-152	F	1.3378E+01					4.94E+03	
			344.29	1.233E+01	*(	1.905E+01	4.70E+01 2.65E+01	G
			121.78	3.789E+02	+	1.162E+01	1.20E+00 2.86E+01	G
			778.92	2.091E+01	(	5.752E+01	8.33E+01 1.29E+01	G
			964.11	9.797E+00	&(	7.243E+01	2.23E+02 1.46E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
		1112.07-1.577E+02	&	9.513E+01	1.85E+01	1.36E+01 G
		1408.00 1.255E+01	@(	1.480E+01	3.65E+01	2.10E+01 G
EU-154	I 2.2418E+02					3.14E+03
		873.23 9.777E+00	?(	7.933E+01	2.45E+02	1.23E+01 G
		123.10 2.887E+02	?(	8.023E+00	1.13E+00	4.08E+01 G
		1274.54 1.768E+01	-	1.474E+01	2.59E+01	3.52E+01 G
		723.36 3.240E+01	-	3.505E+01	3.31E+01	2.02E+01 G
		1004.77 2.063E+01	-	5.829E+01	8.56E+01	1.80E+01 G
		996.33 7.131E+00	-	9.696E+01	4.10E+02	1.06E+01 G
EU-155	I 1.5326E+03					1.81E+03
		105.31-5.142E+00	?(	1.807E+01	1.06E+02	2.12E+01 G
		86.54 2.595E+03	?(	1.556E+01	3.60E-01	3.07E+01 G
TL-208	N -2.6637E+00					6.98E+02
		583.02-3.850E+00	?(P	1.790E+01	1.86E+02	8.45E+01 G
		277.28 4.872E+00	%	1.819E+02	1.13E+03	6.31E+00 G
		860.56 5.404E+00	?(	1.748E+02	9.75E+02	1.24E+01 G
PB-210	N -3.8697E+02					8.14E+03
		46.54-3.870E+02	?(P	2.130E+02	1.72E+01	4.25E+00 G
PB-212	N -1.8200E-01					6.98E+02
		238.63-1.820E-01	%(P	2.351E+01	4.40E+02	4.33E+01 G
		300.03-5.310E+01	+	3.693E+02	2.10E+02	3.28E+00 G
PB-214	N 4.2599E+00					5.84E+05
		351.93 4.260E+00	(P	1.166E+01	7.15E+01	3.76E+01 G
		295.09-6.236E+00	& P	2.179E+01	1.14E+02	1.93E+01 G
		242.00-1.656E+01	+ P	5.477E+01	1.05E+02	7.43E+00 G
BI-212	N -1.0788E+02					6.98E+02
		727.17-1.079E+02	?(	2.231E+02	6.28E+01	7.55E+00 G
		785.42 2.035E+02	&	1.433E+03	2.12E+02	1.28E+00 G
BI-214	N -2.7676E-02					5.84E+05
		609.31-2.786E+00	?(P	1.191E+01	1.64E+02	4.61E+01 G
		1120.29-3.006E+02	+ P	7.827E+01	8.22E+00	1.51E+01 G
		1764.49 8.228E+00	?(P	1.629E+01	6.01E+01	1.54E+01 G
AC-228	N 6.5354E+00					2.10E+03
		911.07 6.535E+00	?(	4.150E+01	1.92E+02	2.90E+01 G
		968.97-2.219E+01	&	6.970E+01	9.51E+01	1.75E+01 G
		338.32-2.027E-01	%	5.132E+01	7.64E+03	1.20E+01 G
						Energy duplication
		93.35-1.202E+01	&	6.378E+01	1.60E+02	5.56E+00 XA

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Pa-234	N 1.5062E+00					1.63E+12	
		131.29-5.908E+00		?(	1.566E+01	8.03E+01	1.80E+01 G
		569.47 1.778E+01		*(	6.298E+01	1.07E+02	8.20E+00 G
		946.02-2.153E+01		+	7.033E+01	9.89E+01	1.34E+01 G
		883.24-1.063E+00		%	8.378E+01	2.38E+03	9.60E+00 G
		880.53-3.528E-01		%	1.338E+02	1.14E+04	6.00E+00 G
TH-234	N -1.6028E+02					1.63E+12	
		63.29-1.603E+02		&(P	1.017E+02	2.03E+01	3.81E+00 G
		92.59-1.437E+01		+ P	4.986E+01	2.23E+02	5.58E+00 G
PA-234M	N 1.3485E+01					1.63E+12	
		1001.00 1.349E+01		%(	9.895E+02	2.21E+03	8.37E-01 G
		766.41-5.868E+02		+	1.896E+03	9.77E+01	2.94E-01 G
U-235	N 3.4121E+00					2.57E+11	
		143.79 3.412E+00		?(	2.577E+01	2.28E+02	1.10E+01 G
		205.33-1.474E+01		+	7.523E+01	1.54E+02	5.01E+00 G
		163.38-1.469E+01		+	6.090E+01	1.25E+02	5.08E+00 G
							Energy duplication
		93.35-8.119E+00		+	4.308E+01	1.60E+02	5.81E+00 X
AM-241	T 5.1398E+03					1.58E+05	
		59.54 5.140E+03		(	1.820E+01	2.36E-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.
+ - 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
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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	47.36	74417.	-2314.	-0.643	17.18	-3.870E+02	P
TH-234	63.06	22527.	-1107.	-0.307	20.35	-1.603E+02	P
EU-155	87.94	17487.	103216.	28.671	0.36	2.595E+03	
TH-234	92.36	13364.	-156.	-0.043	223.18	-1.437E+01	P
AC-228	93.35	10787.	-92.	-0.025	160.48	-1.202E+01	
EU-155	104.45	11065.	-140.	-0.039	106.41	-5.142E+00	
EU-152	122.01	13083.	17462.	4.851	1.20	3.789E+02	
EU-154	122.01	10631.	17385.	4.829	1.13	2.887E+02	
Pa-234	131.75	12069.	-194.	-0.054	80.34	-5.908E+00	
PB-214	242.01	12423.	-158.	-0.044	104.73	-1.656E+01	P
PB-214	295.79	10204.	-135.	-0.038	114.33	-6.236E+00	P
PB-212	299.72	10181.	-68.	-0.019	210.18	-5.310E+01	
EU-152	344.29	8880.	286.	0.079	46.97	1.233E+01	
PB-214	352.08	8707.	160.	0.044	71.55	4.260E+00	P
CS-134	564.05	6001.	63.	0.017	174.57	2.795E+01	
CS-134	569.31	5993.	113.	0.031	97.12	2.753E+01	
Pa-234	569.33	6027.	103.	0.029	107.15	1.778E+01	
TL-208	583.10	6124.	-79.	-0.022	186.43	-3.850E+00	P
CS-134	602.95	5020.	20.	0.006	497.78	8.077E-01	
BI-214	609.38	6131.	-86.	-0.024	164.39	-2.786E+00	P
EU-154	723.21	4923.	305.	0.085	33.05	3.240E+01	
BI-212	727.19	5401.	-167.	-0.046	62.76	-1.079E+02	
PA-234M	764.08	4431.	-97.	-0.027	97.75	-5.868E+02	
EU-152	778.73	5737.	129.	0.036	83.29	2.091E+01	
BI-212	785.20	5669.	50.	0.014	212.42	2.035E+02	
CS-134	795.81	5777.	46.	0.013	235.56	2.590E+00	
CS-134	802.37	6068.	-101.	-0.028	109.13	-5.686E+01	
TL-208	860.56	6875.	12.	0.003	975.06	5.404E+00	
EU-154	874.57	6904.	48.	0.013	244.94	9.777E+00	
AC-228	911.14	7833.	65.	0.018	191.85	6.535E+00	
Pa-234	945.95	9079.	-137.	-0.038	98.92	-2.153E+01	
EU-152	963.71	8244.	58.	0.016	223.34	9.797E+00	
AC-228	967.93	7239.	-127.	-0.035	95.08	-2.219E+01	
EU-154	998.18	6206.	27.	0.008	410.08	7.131E+00	
EU-154	1004.81	6388.	133.	0.037	85.58	2.063E+01	
EU-152	1112.06	9810.	-770.	-0.214	18.55	-1.577E+02	
BI-214	1118.71	10780.	-1869.	-0.519	8.22	-3.006E+02	P
EU-154	1274.66	1024.	182.	0.051	25.93	1.768E+01	
EU-152	1408.32	359.	77.	0.021	36.55	1.255E+01	
BI-214	1762.55	207.	35.	0.010	60.06	8.228E+00	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 *****

Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting		MDA Bq/Sample
BE-7	#A	2.6868E-02	>12 Halflives	5.9081E+04%	5.2627E+01	
K-40	#	4.0251E+01	4.0251E+01	2.390E+01%		1.82E+01
CO-60		2.2060E+03	3.2262E+03	2.763E-01%		7.26E+00
I-131	A	-6.6842E-01	>12 Halflives	1.3951E+02%	5.5170E+00	
CS-134	#A	1.7531E+00	4.6266E+00	9.712E+01%		1.33E+01
CS-137		1.8805E+03	2.0104E+03	3.835E-01%		7.90E+00
EU-152	#A	1.1537E+01	1.3378E+01	3.655E+01%		1.91E+01
EU-154	#C	1.7755E+02	2.2418E+02	1.131E+00%		7.93E+01
EU-155	#C	1.0233E+03	1.5326E+03	3.602E-01%		1.81E+01
TL-208	#A	-9.3296E-01	-2.6637E+00	2.326E+02%		1.79E+01
PB-210	#A	-3.5372E+02	-3.8697E+02	1.757E+01%		2.13E+02
PB-212	#A	-6.3745E-02	-1.8200E-01	4.773E+03%		2.35E+01
PB-214	#A	4.2546E+00	4.2599E+00	8.284E+01%		1.17E+01
BI-212	#A	-3.7784E+01	-1.0788E+02	6.276E+01%		2.23E+02
BI-214	#A	-2.7642E-02	-2.7676E-02	6.015E+01%		1.19E+01
AC-228	#A	4.6124E+00	6.5354E+00	1.919E+02%		4.15E+01
Pa-234	#A	1.5062E+00	1.5062E+00	6.696E+01%		1.57E+01
TH-234	#A	-1.6028E+02	-1.6028E+02	2.131E+01%		1.02E+02
PA-234M	#A	1.3485E+01	1.3485E+01	2.211E+03%		9.89E+02
U-235	#A	3.4121E+00	3.4121E+00	2.283E+02%		2.58E+01
AM-241		5.1161E+03	5.1398E+03	2.360E-01%		1.82E+01

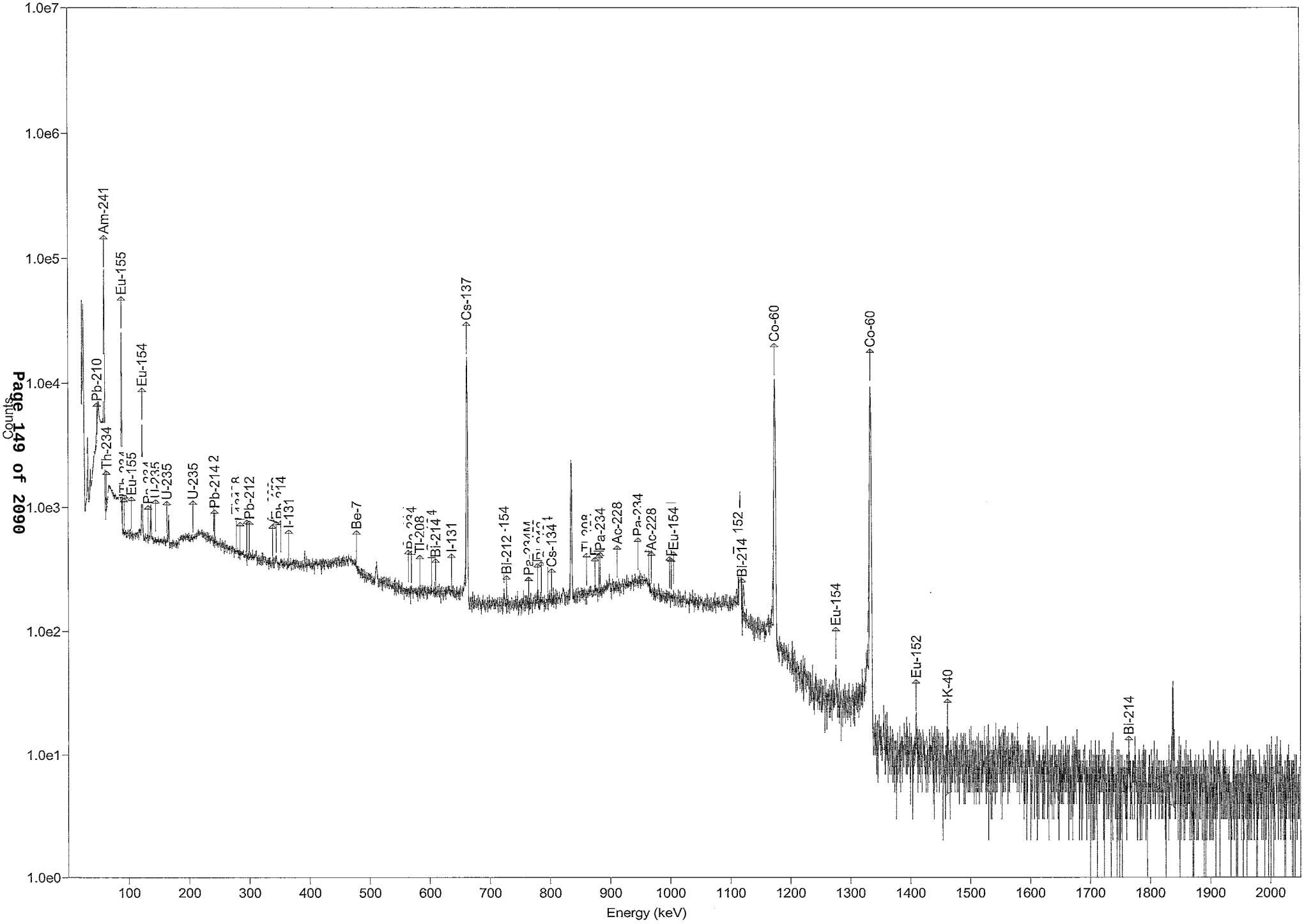
\# - All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key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

---------- S U M M A R Y ----------

Total Activity (37.5 to 1999.5 keV) 9.243E+03 Bq/Sample
Total Decayed Activity (37.5 to 1999.5 keV) 1.0416781E+04 Bq/Sample

The library has energies which are not separable.

1L Marn_83924-334_2011Cal. 18_83924-334_20130931.spc.



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

83924-334

1.0 Liter Solid in 130G GA-MA Beaker

Customer: Test America St. Louis
P.O. No.: 2401509, Item 1
Reference Date: 01-Jan-2011 12:00 PM EST **Grams of Master Source:** 0.015372

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. Density of solid matrix 1.15 g/cc.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty , % Type u_A	u_B	U	Calibration Method
Am-241	59.5	1.580E+05	———	1.830E+03	0.1	1.7	3.5	4π LS
Cd-109	88.0	4.626E+02	1.697E+05	2.609E+03	0.8	2.3	4.9	HPGe
Co-57	122.1	2.718E+02	8.711E+04	1.339E+03	0.5	2.0	4.1	HPGe
Ce-139	165.9	1.376E+02	1.247E+05	1.917E+03	0.5	1.9	3.9	HPGe
Hg-203	279.2	4.661E+01	2.753E+05	4.232E+03	0.4	1.9	3.9	HPGe
Sn-113	391.7	1.151E+02	1.769E+05	2.719E+03	0.5	1.9	3.9	HPGe
Cs-137	661.7	1.098E+04	1.109E+05	1.705E+03	0.7	1.9	4.0	HPGe
Mn-54	834.9	3.121E+02	———	3.083E+03	0.1	1.7	3.3	IC
Y-88	898.0	1.066E+02	4.224E+05	6.493E+03	0.5	1.9	3.9	HPGe
Zn-65	1115.6	2.441E+02	———	3.181E+03	0.1	1.7	3.5	IC
Co-60	1173.2	1.925E+03	2.142E+05	3.293E+03	0.6	1.9	4.0	HPGe
Co-60	1332.5	1.925E+03	2.143E+05	3.294E+03	0.6	1.9	4.0	HPGe
Y-88	1836.1	1.066E+02	4.472E+05	6.874E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1956

6675
ID: 1L Marn_00002
Exp: 03/02/18 Prpd: JW Opn: 03/02/11
Mixed Gamma 1L Marn 2011

91608
ID: 1L Marn_00004
Exp:02/15/14 Prpd:JW Opn:03/
Mixed Gamma 1L Marn

ANA Form005 Rev. —

This standard will expire one year after the reference date.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ Date: 2/23/11
J. D. McCorvey, QA Manager Alternate

Reagent

82232-334_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

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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1956

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82233-334_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

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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1956

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82234-334_00001

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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

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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1956

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82235-334_00001

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404•352•8677
Fax 404•352•2837
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

82235-334

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: 4-Jun-2010 12:00 PM EST

Isotope	Activity (Bq)	Energy Range (keV)	Half-Life, years	Uncertainty* Type (%) u_A	u_B	U
Th-230	7.167E+00	4420-4800	7.540E+04	0.8	1.1	2.7
Pu-239	6.897E+00	4950-5240	2.410E+04	0.8	1.1	2.7
Am-241	7.466E+00	5280-5600	4.326E+02	0.8	1.1	2.7
Total Activity	2.161E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY
HEALTH PHYSICS SOCIETY
FOUNDED 1958

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82236-334_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

82236-334

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	7.107E+00	4420-4800	7.540E+04	0.7	1.1	2.6
Pu-239	6.664E+00	4950-5240	2.410E+04	0.8	1.1	2.7
Am-241	6.891E+00	5280-5600	4.326E+02	0.7	1.1	2.6
Total Activity	2.071E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1958

Comments:
Diameter of active area: 19 mm. Disk mounted on customer supplied disk 31.8 mm diameter x 0.46 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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82237-334_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

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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1958

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82240-334_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

82240-334

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	6.304E+00	4420-4800	7.540E+04	0.9	1.1	2.8
Pu-239	7.163E+00	4950-5240	2.410E+04	0.8	1.1	2.7
Am-241	8.298E+00	5280-5600	4.326E+02	0.8	1.1	2.7
Total Activity	2.182E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1958

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82241-334_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

82241-334

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	6.629E+00	4420-4800	7.540E+04	0.8	1.1	2.7
Pu-239	6.797E+00	4950-5240	2.410E+04	0.8	1.1	2.7
Am-241	6.638E+00	5280-5600	4.326E+02	0.8	1.1	2.7
Total Activity	2.011E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY — HEALTH PHYSICS SOCIETY — FOUNDED 1956

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82242-334_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

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)

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1958

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82243-334_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

82243-334

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	5.856E+00	4420-4800	7.540E+04	0.8	1.1	2.7
Pu-239	5.979E+00	4950-5240	2.410E+04	0.8	1.1	2.7
Am-241	6.390E+00	5280-5600	4.326E+02	0.8	1.1	2.7
Total Activity	1.827E+01	3000-8000		0.3	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)

ACCREDITED SOURCE CALIBRATION LABORATORY
HEALTH PHYSICS SOCIETY
FOUNDED 1966

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82244-334_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

82244-334

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	7.352E+00	4420-4800	7.540E+04	0.8	1.1	2.7
Pu-239	6.717E+00	4950-5240	2.410E+04	0.9	1.1	2.8
Am-241	6.897E+00	5280-5600	4.326E+02	0.9	1.1	2.8
Total Activity	2.101E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY — HEALTH PHYSICS SOCIETY — FOUNDED 1956

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82245-334_00001

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Analytics

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Atlanta, Georgia 30318
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Fax 404•352•2837
www.analyticsinc.com

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)

ACCREDITED SOURCE CALIBRATION LABORATORY — HEALTH PHYSICS SOCIETY — FOUNDED 1956

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

82246-334_00001

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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

82246-334

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	5.570E+00	4420-4800	7.540E+04	1.0	1.1	3.0
Pu-239	5.353E+00	4950-5240	2.410E+04	1.0	1.1	3.0
Am-241	6.002E+00	5280-5600	4.326E+02	1.0	1.1	3.0
Total Activity	1.696E+01	3000-8000		0.7	1.1	2.6

***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)

ACCREDITED SOURCE CALIBRATION LABORATORY
HEALTH PHYSICS SOCIETY
FOUNDED 1956

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: _____ Date: 06.24.2010
E. A. Taskaev, QA Manager Alternate

Reagent

82247-334_00001

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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

82247-334

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: 10-Jun-2010 12:00 PM EST

Isotope	Activity (Bq)	Energy Range (keV)	Half-Life, years	Uncertainty* Type (%) u_A	u_B	U
Th-230	6.251E+00	4420-4800	7.540E+04	0.9	1.1	2.8
Pu-239	5.746E+00	4950-5240	2.410E+04	0.9	1.1	2.8
Am-241	6.291E+00	5280-5600	4.326E+02	0.9	1.1	2.8
Total Activity	1.832E+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)

ACCREDITED SOURCE CALIBRATION LABORATORY — HEALTH PHYSICS SOCIETY — FOUNDED 1956

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: _____ Date: 06-24-2010
E. A. Taskaev, QA Manager Alternate

Reagent

Gamma Ampuole_00001

Eckert & Ziegler
Analytics

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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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
Am-241	59.5	157860	———	3.390E+03	0.1	0.9	1.8	4π 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
Co-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: 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:
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: [signature] for
W. Mao, Radiochemist

QA Approved: [signature] Date: 5-13-09
D. M. Montgomery, QA Manager

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Reagent

Gamma Ampuole_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

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, % Type u_A	u_B	U	Calibration Method
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: MITaskaeva
M. I. Taskaeva, Radiochemist

QA Approved: _____ Date: 13 JAN 11
J. D. McCorvey, QA Manager Alternate

Reagent

ICPC ICV 1_00001

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

232147
ID: ICPC ICV 1_00001
Exp 11/01/14 Prpd Opn 10/24/13
ICP ICV 1

1.0 **INORGANIC VENTURES** is an ISO Guide 34 "General Requirements for the Competence of Reference Material Producers" and ISO 9001 registered manufacturer. Our manufacturing laboratory is accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Custom Solution**

Catalog No.: TA-64

Lot Number: **G2-MEB499048**

Matrix: 5% HNO3(v/v), 2.5% HF(v/v)

1,000 µg/mL ea:
Si, Sn, Ti,

200 µg/mL ea:
Mo, Sb

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Antimony, Sb	200.0 ± 1.5 µg/mL	Molybdenum, Mo	200.0 ± 1.0 µg/mL	Silicon, Si	1,000 ± 7 µg/mL
Tin, Sn	1,000 ± 7 µg/mL	Titanium, Ti	1,000 ± 7 µg/mL		

Certified Density: 1.041 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEBILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

4.1 ASSAY INFORMATION

ELEMENT	METHOD	NIST SRM#	SRM LOT#
Mo	Calculated		See Sec. 4.2
Mo	ICP Assay	3134	891307
Sb	Calculated		See Sec. 4.2
Sb	ICP Assay	3102A	061229
Si	Calculated		See Sec. 4.2
Si	ICP Assay	3150	071204
Sn	Calculated		See Sec. 4.2
Sn	ICP Assay	3161a	070330
Ti	ICP Assay	3162a	060808

4.2 BALANCE CALIBRATION - All analytical balances are calibrated yearly by an accredited calibration laboratory and are traceable to a class E 2 analytical weight set with NIST Traceability. All balances are checked daily using an in-house procedure. The weights used for testing are annually compared to master weights and are traceable to the National Institute of Standards and Technology (NIST).

4.3 THERMOMETER CALIBRATION - All thermometers are NIST traceable through thermometers that are calibrated by an A2LA accredited calibration laboratory.

4.4 GLASSWARE CALIBRATION - An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM's.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES IN µg/mL - N/A

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
HPLC, IC, TLC, ISE, IR, NMR, UV/VIS, MS, Capillary Electrophoresis, Potentiometry, Wet Chemistry and Voltammetry
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact Technical Staff

This CRM was manufactured using 18 megohm doubly deionized water that has been filtered through a 0.2 micron filter.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep **Tightly** sealed when not in use. Store and use at 20 ± 4ºC. **Do Not** pipette from the container. **Do Not** return portions removed from pipetting to container.

Element Specific Information - For specific information regarding any element: Contact technical staff.

Uranium Note: If uranium is present in this standard, it is natural abundance unless specified in Section 3.0.

HF Note: This standard should not be prepared or stored in glass.

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous.

Inorganic Ventures homogeneity data indicate that the end user should take a minimum sample size of 0.2mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration
- SAI Global File Number 010105

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration"
- Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 "General Requirements for the Competence of Reference Material Producers"
- Reference Materials Production - Accredited A2LA Certificate Number 883.02

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission
- Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission
- Reporting Defects and Non-Compliance

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies of chemically-stable solutions performed at the manufacturer's facility show a CRM shelf-life of twenty one months for solutions packaged in 125-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Manufacturer concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

11.3 Chemical Stability - Studies have been conducted on this or similar CRMs and it has been demonstrated that this CRM is chemically stable for a period of not less than two years provided the "Storage & Handling" conditions are followed that are described in section 7.0.

Certification Date: October 16, 2013

Expiration Date: 01 NOV 2014

Stability Testing Note: This solution is a newly designed product undergoing stability testing. You will be notified if any chemical instability is observed.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Donna Senn
Product Documentation Technician

Certificate Approved By: Brian Alexander
PhD., Technical Process Director

Certifying Officer: Paul Gaines
PhD., Senior Technical Director

Reagent

ICPC ICV 3_00001

INORGANIC VENTURES
300 Technology Drive
Christiansburg VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

232149
ID. ICPC ICV 3_00001
Exp 10/24/14 Prpd Opn 10/24/13
ICPC ICV 3

1.0 **INORGANIC VENTURES** is an ISO Guide 34 "General Requirements for the Competence of Reference Material Producers" and ISO 9001 registered manufacturer. Our manufacturing laboratory is accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Custom Solution**

Catalog No.: TA-65

Lot Number: **G2-MEB499049**

Matrix: 5% HNO3(v/v)

10,000 µg/mL ea:
Al, Ca, Fe, Na

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Aluminum, Al	10,000.0 ± 60.0 µg/mL	Calcium, Ca	10,000.0 ± 40.0 µg/mL	Iron, Fe	10,000.0 ± 60.0 µg/mL
Sodium, Na	10,000.0 ± 40.0 µg/mL				

Certified Density: 1.147 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 TRACEBILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

4.1 ASSAY INFORMATION

ELEMENT	METHOD	NIST SRM#	SRM LOT#
Al	ICP Assay	3101a	060502
Al	EDTA	928	928
Ca	ICP Assay	3109a	050825
Ca	EDTA	928	928
Fe	ICP Assay	3126a	051031
Fe	EDTA	928	928
Na	Gravimetric		See Sec. 4.2
Na	ICP Assay	3152a	120715

4.2 BALANCE CALIBRATION - All analytical balances are calibrated yearly by an accredited calibration laboratory and are traceable to a class E 2 analytical weight set with NIST Traceability. All balances are checked daily using an in-house procedure. The weights used for testing are annually compared to master weights and are traceable to the National Institute of Standards and Technology (NIST).

4.3 THERMOMETER CALIBRATION - All thermometers are NIST traceable through thermometers that are calibrated by an A2LA accredited calibration laboratory.

4.4 GLASSWARE CALIBRATION - An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM's.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES IN µg/mL - N/A

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
HPLC, IC, TLC, ISE, IR, NMR, UV/VIS, MS, Capillary Electrophoresis, Potentiometry, Wet Chemistry and Voltammetry
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact Technical Staff

This CRM was manufactured using 18 megohm doubly deionized water that has been filtered through a 0.2 micron filter.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep **Tightly** sealed when not in use. Store and use at 20 ± 4°C. **Do Not** pipette from the container. **Do Not** return portions removed from pipetting to container.

Element Specific Information - For specific information regarding any element: Contact technical staff.

Uranium Note: If uranium is present in this standard, it is natural abundance unless specified in Section 3.0.

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous.

Inorganic Ventures homogeneity data indicate that the end user should take a minimum sample size of 0.2mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration
- SAI Global File Number 010105

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration"
- Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 "General Requirements for the Competence of Reference Material Producers"
- Reference Materials Production - Accredited A2LA Certificate Number 883.02

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission
- Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission
- Reporting Defects and Non-Compliance

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies of chemically-stable solutions performed at the manufacturer's facility show a CRM shelf-life of twenty one months for solutions packaged in 125-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Manufacturer concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

11.3 Chemical Stability - Studies have been conducted on this or similar CRMs and it has been demonstrated that this CRM is chemically stable for a period of not less than two years provided the "Storage & Handling" conditions are followed that are described in section 7.0.

Certification Date: October 16, 2013

Expiration Date: 01 NOV 2014

Stability Testing Note: This solution is a newly designed product undergoing stability testing. You will be notified if any chemical instability is observed.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Donna Senn
Product Documentation Technician

Certificate Approved By: Brian Alexander
PhD., Technical Process Director

Certifying Officer: Paul Gaines
PhD., Senior Technical Director

Reagent

ICPC ICV 4_00001

INORGANIC VENTURES™
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

232150
ID ICPC ICV 4_00001
Exp 11/01/14 Prpd Opn 10/24/13
ICPC ICV 4

1.0 **INORGANIC VENTURES** is an ISO Guide 34 "General Requirements for the Competence of Reference Material Producers" and ISO 9001 registered manufacturer. Our manufacturing laboratory is accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Custom Solution**

Catalog No.: TA-63

Lot Number: **G2-MEB499047**

Matrix: 7% HNO3(v/v)

1,000 µg/mL ea:

As, B, Ba, Be, Bi, Cd, Co, Cr3, Cu,
Li, Mn, Ni, P, Pb, Sr, Th, U, V,
Zn,

200 µg/mL ea:

Ag, Se, Tl

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Arsenic, As	1,000 ± 7 µg/mL	Barium, Ba	1,000 ± 7 µg/mL	Beryllium, Be	1,000 ± 6 µg/mL
Bismuth, Bi	1,000 ± 7 µg/mL	Boron, B	1,000 ± 7 µg/mL	Cadmium, Cd	1,000 ± 6 µg/mL
Chromium+3, Cr3	1,000 ± 6 µg/mL	Cobalt, Co	1,000 ± 7 µg/mL	Copper, Cu	1,000 ± 7 µg/mL
Lead, Pb	1,000 ± 7 µg/mL	Lithium, Li	1,000 ± 7 µg/mL	Manganese, Mn	1,000 ± 6 µg/mL
Nickel, Ni	1,000 ± 7 µg/mL	Phosphorus, P	1,000 ± 5 µg/mL	Selenium, Se	200.0 ± 1.3 µg/mL
Silver, Ag	200.0 ± 1.3 µg/mL	Strontium, Sr	1,000 ± 6 µg/mL	Thallium, Tl	200.0 ± 1.3 µg/mL
Thorium, Th	1,000 ± 7 µg/mL	Uranium, U	1,000 ± 7 µg/mL	Vanadium, V	1,000 ± 7 µg/mL
Zinc, Zn	1,000 ± 6 µg/mL				

Certified Density: 1.109 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded

4.2 **BALANCE CALIBRATION -** All analytical balances are calibrated yearly by an accredited calibration laboratory and are traceable to a class E 2 analytical weight set with NIST Traceability. All balances are checked daily using an in-house procedure. The weights used for testing are annually compared to master weights and are traceable to the National Institute of Standards and Technology (NIST).

4.3 **THERMOMETER CALIBRATION -** All thermometers are NIST traceable through thermometers that are calibrated by an A2LA accredited calibration laboratory.

4.4 **GLASSWARE CALIBRATION -** An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM's.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES IN µg/mL - N/A

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
HPLC, IC, TLC, ISE, IR, NMR, UV/VIS, MS, Capillary Electrophoresis, Potentiometry, Wet Chemistry and Voltammetry
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact Technical Staff

This CRM was manufactured using 18 megohm doubly deionized water that has been filtered through a 0.2 micron filter.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep **Tightly** sealed when not in use. Store and use at 20 ± 4°C. **Do Not** pipette from the container. **Do Not** return portions removed from pipetting to container.

Element Specific Information - For specific information regarding any element: Contact technical staff.

Uranium Note: If uranium is present in this standard, it is natural abundance unless specified in Section 3.0.

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous.

Inorganic Ventures homogeneity data indicate that the end user should take a minimum sample size of 0.2mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 **ISO 9001 Quality Management System Registration**
- SAI Global File Number 010105

10.2 **ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration"**
- Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 **ISO/IEC Guide 34 "General Requirements for the Competence of Reference Material Producers"**
- Reference Materials Production - Accredited A2LA Certificate Number 883.02

10.4 **10CFR50 Appendix B - Nuclear Regulatory Commission**
- Domestic Licensing of Production and Utilization Facilities

10.5 **10CFR21 - Nuclear Regulatory Commission**
- Reporting Defects and Non-Compliance

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies of chemically-stable solutions performed at the manufacturer's facility show a CRM shelf-life of twenty one months for solutions packaged in 125-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Manufacturer concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

11.3 Chemical Stability - Studies have been conducted on this or similar CRMs and it has been demonstrated that this CRM is chemically stable for a period of not less than two years provided the "Storage & Handling" conditions are followed that are described in section 7.0.

Certification Date: October 16, 2013

Expiration Date: 01 NOV 2014

Stability Testing Note: This solution is a newly designed product undergoing stability testing. You will be notified if any chemical instability is observed.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Donna Senn
Product Documentation Technician

Certificate Approved By: Brian Alexander
PhD., Technical Process Director

Certifying Officer: Paul Gaines
PhD., Senior Technical Director

Reagent

ICPC ICV2_00001

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 - USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

232148
ID ICPC ICV2_00001
Exp 11/01/14 Prpd Opn 10/24/13
ICPC ICV2

1.0 **INORGANIC VENTURES** is an ISO Guide 34 "General Requirements for the Competence of Reference Material Producers" and ISO 9001 registered manufacturer. Our manufacturing laboratory is accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 DESCRIPTION OF CRM **Custom Solution**

Catalog No.: TA-66

Lot Number: **G2-MEB499050**

Matrix: 1% HNO3(v/v)

10,000 µg/mL ea:
K, Mg, S

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Magnesium, Mg	10,000.0 ± 60.0 µg/mL	Potassium, K	10,000.0 ± 40.0 µg/mL	Sulfur, S	10,000.0 ± 60.0 µg/mL

Certified Density: 1.080 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$$

2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 TRACEBILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

4.1 ASSAY INFORMATION

ELEMENT	METHOD	NIST SRM#	SRM LOT#
K	Gravimetric		See Sec. 4.2
K	ICP Assay	3141a	051220
Mg	ICP Assay	3131a	050302
Mg	EDTA	928	928
S	ICP Assay	3154	892205
S	Acidimetric	84k	84k

4.2 BALANCE CALIBRATION - All analytical balances are calibrated yearly by an accredited calibration laboratory and are traceable to a class E 2 analytical weight set with NIST Traceability. All balances are checked daily using an in-house procedure. The weights used for testing are annually compared to master weights and are traceable to the National Institute of Standards and Technology (NIST).

4.3 THERMOMETER CALIBRATION - All thermometers are NIST traceable through thermometers that are calibrated by an A2LA accredited calibration laboratory.

4.4 GLASSWARE CALIBRATION - An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM's.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES IN µg/mL - N/A

6.0 INTENDED USE

For the calibration of analytical instruments including but not limited to the following:
HPLC, IC, TLC, ISE, IR, NMR, UV/VIS, MS, Capillary Electrophoresis, Potentiometry, Wet Chemistry and Voltammetry
For the validation of analytical methods
For the preparation of "working reference samples"
For interference studies and the determination of correction coefficients
For detection limit and linearity studies
For additional intended uses, contact Technical Staff

This CRM was manufactured using 18 megohm doubly deionized water that has been filtered through a 0.2 micron filter.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

Storage & Handling - Keep **Tightly** sealed when not in use. Store and use at 20 ± 4ºC. **Do Not** pipette from the container. **Do Not** return portions removed from pipetting to container.

Element Specific Information - For specific information regarding any element: Contact technical staff.

Uranium Note: If uranium is present in this standard, it is natural abundance unless specified in Section 3.0.

8.0 HAZARDOUS INFORMATION - Please refer to the enclosed Material Safety Data sheet for information regarding this CRM.

9.0 HOMOGENEITY - This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous.

Inorganic Ventures homogeneity data indicate that the end user should take a minimum sample size of 0.2mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration
- SAI Global File Number 010105

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration"
- Chemical Testing - Accredited A2LA Certificate Number 883.01

10.3 ISO/IEC Guide 34 "General Requirements for the Competence of Reference Material Producers"
- Reference Materials Production - Accredited A2LA Certificate Number 883.02

10.4 10CFR50 Appendix B - Nuclear Regulatory Commission
- Domestic Licensing of Production and Utilization Facilities

10.5 10CFR21 - Nuclear Regulatory Commission
- Reporting Defects and Non-Compliance

11.0 DATE OF CERTIFICATION AND PERIOD OF VALIDITY

11.1 Shelf Life - The period of time during which the concentration of the analyte(s) in a properly packaged, unopened, and unused standard stored under environmentally controlled and monitored conditions will remain within the specified uncertainty range. Shelf life is limited primarily by transpiration (loss of water from the solution) and infrequently, by chemical instability. Transpiration studies of chemically-stable solutions performed at the manufacturer's facility show a CRM shelf-life of twenty one months for solutions packaged in 125-mL low density polyethylene bottles. When stored under special conditions that minimize transpiration and instability, the shelf life can be extended past this limit.

11.2 Expiration Date - The date after which a CRM should not be used. Routine laboratory use of a CRM increases transpiration losses and the chance of contamination which affect the integrity of the CRM and limit its useful life. Manufacturer concurs with state and federal regulatory agencies' recommendations that solution standards be assigned a one-year expiration date.

11.3 Chemical Stability - Studies have been conducted on this or similar CRMs and it has been demonstrated that this CRM is chemically stable for a period of not less than two years provided the "Storage & Handling" conditions are followed that are described in section 7.0.

Certification Date: October 16, 2013

Expiration Date: 01 NOV 2014

Stability Testing Note: This solution is a newly designed product undergoing stability testing. You will be notified if any chemical instability is observed.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Prepared By: Donna Senn
Product Documentation Technician

Certificate Approved By: Brian Alexander
PhD., Technical Process Director

Certifying Officer: Paul Gaines
PhD., Senior Technical Director

Reagent

ICPC13 AB 1_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

199808
AB ID: ICPC13 AB 1_00001
Exp:09/10/14 Prpd:CDS Opn:09/10/13
ICPC 2013 AB 1

199815
ID: ICPC13 AB 2_00001
Exp 09/10/14 Prpd CDS Opn:09/10/13
ICPC 2013 AB 2

Certificate of Analysis

Rev 0

Description: Custom 26 Element Mix, #2368, 250 mL
mg/L ± 2% in 5% HNO_3
Ag, Mo, Sb, Tl, Bi, Cd, Co, Cr, Cu, Mn, Ni, Si, Sn, Ti shipped separately.

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2368-01-250ML	5% HNO3 + Tr HF	1050480	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Selenium	Se	7782-49-2	99.999	7027.46.4	100
Arsenic	As	7440-38-2	99.9999	7002.46.5	500
Boron	B	7440-42-8	99.999	7003.46.5	500
Barium	Ba	7440-39-3	99.997	7004.29.2	500
Beryllium	Be	7440-41-7	99.999	7005.46.5	500
Lithium	Li	7439-93-2	99.999	7015.46.5	500
Lead	Pb	7439-92-1	99.999	7023.29.2	500
Strontium	Sr	7440-24-6	99.998	7030.46.4	500
Thorium	Th	7440-29-1	99.99	7031.46.3	500
Uranium	U	7440-61-1	99.8	7035.330.1	500
Vanadium	V	7440-62-2	99.99	7036.46.5	500
Zinc	Zn	7440-66-6	99.9995	7037.46.5	500
Silver	Ag	7440-22-4	99.999	7000.29.1	100
Molybdenum	Mo	7439-98-7	99.999	7018.29.3	100
Antimony	Sb	7440-36-0	99.999	7026.46.3	100
Thallium	Tl	7440-28-0	99.999	7236.46.1	100
Bismuth	Bi	7440-69-9	99.999	7040.46.2	500
Cadmium	Cd	7440-43-9	99.9999	7007.29.3	500
Cobalt	Co	7440-48-4	99.999	7008.46.8	500
Chromium	Cr	7440-47-3	99.998	7009.46.3	500
Copper	Cu	7440-50-8	99.9995	7011.46.5	500
Manganese	Mn	7439-96-5	99.95	7017.46.4	500
Nickel	Ni	7440-02-0	99.995	7021.46.8	500
Silicon	Si	7440-21-3	99.999	7028.46.12	500
Tin	Sn	7440-31-5	99.999	7029.46.4	500
Titanium	Ti	7440-32-6	99.995	7033.38.2	500

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricllly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 AB 2_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

199808
AB ID: ICPC13 AB 1_00001
Exp:09/10/14 Prpd:CDS Opn:09/10/13
ICPC 2013 AB 1

199815
ID: ICPC13 AB 2_00001
Exp 09/10/14 Prpd CDS Opn:09/10/13
ICPC 2013 AB 2

Certificate of Analysis

Rev 0

Description: Custom 26 Element Mix, #2368, 250 mL
mg/L ± 2% in 5% HNO_3
Ag, Mo, Sb, Tl, Bi, Cd, Co, Cr, Cu, Mn, Ni, Si, Sn, Ti shipped separately.

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2368-01-250ML	5% HNO3 + Tr HF	1050480	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Selenium	Se	7782-49-2	99.999	7027.46.4	100
Arsenic	As	7440-38-2	99.9999	7002.46.5	500
Boron	B	7440-42-8	99.999	7003.46.5	500
Barium	Ba	7440-39-3	99.997	7004.29.2	500
Beryllium	Be	7440-41-7	99.999	7005.46.5	500
Lithium	Li	7439-93-2	99.999	7015.46.5	500
Lead	Pb	7439-92-1	99.999	7023.29.2	500
Strontium	Sr	7440-24-6	99.998	7030.46.4	500
Thorium	Th	7440-29-1	99.99	7031.46.3	500
Uranium	U	7440-61-1	99.8	7035.330.1	500
Vanadium	V	7440-62-2	99.99	7036.46.5	500
Zinc	Zn	7440-66-6	99.9995	7037.46.5	500
Silver	Ag	7440-22-4	99.999	7000.29.1	100
Molybdenum	Mo	7439-98-7	99.999	7018.29.3	100
Antimony	Sb	7440-36-0	99.999	7026.46.3	100
Thallium	Tl	7440-28-0	99.999	7236.46.1	100
Bismuth	Bi	7440-69-9	99.999	7040.46.2	500
Cadmium	Cd	7440-43-9	99.9999	7007.29.3	500
Cobalt	Co	7440-48-4	99.999	7008.46.8	500
Chromium	Cr	7440-47-3	99.998	7009.46.3	500
Copper	Cu	7440-50-8	99.9995	7011.46.5	500
Manganese	Mn	7439-96-5	99.95	7017.46.4	500
Nickel	Ni	7440-02-0	99.995	7021.46.8	500
Silicon	Si	7440-21-3	99.999	7028.46.12	500
Tin	Sn	7440-31-5	99.999	7029.46.4	500
Titanium	Ti	7440-32-6	99.995	7033.38.2	500

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricllly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 CAL A_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

203129
ID: ICPC13 CAL A_00001
Exp 09/16/14 Prpd Opn 09/16/13
ICPC 2013 CAL 2,3 A

Certificate of Analysis

Rev 0

Description: Custom 34 Element Mix (ICPC- 2013- Cal 2,3), #2366, 500 mL
mg/L ± 2% in 10% HNO_3 + Tr HF

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2366-01-500ml-A	10% HNO3 + Tr HF	1050679	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Silver	Ag	7440-22-4	99.999	7000.29.1	200
Molybdenum	Mo	7439-98-7	99.999	7018.29.3	200
Antimony	Sb	7440-36-0	99.999	7026.46.3	200
Silicon	Si	7440-21-3	99.999	7028.46.12	1000
Tin	Sn	7440-31-5	99.999	7029.46.4	1000
Titanium	Ti	7440-32-6	99.995	7033.38.2	1000
Sulfur	S	7704-34-9	95.9	7025.43.5	10000

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 CAL B_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

203132
ID: ICPC13 CAL B_00001
Exp:09/16/14 Prpd: Opn:09/16/13
ICPC 2013 CAL 2,3 B

Certificate of Analysis

Rev 0

Description: Custom 34 Element Mix (ICPC- 2013- Cal 2,3), #2366, 500 mL
mg/L ± 2% in 5% HNO_3

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2366-01-500ml-B	10% HNO_3 + Tr HF	1050680	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Potassium	K	7440-09-7	99.999	7013.46.9	10000
Sodium	Na	7440-23-5	99.999	7020.46.6	10000
Phosphorus	P	7723-14-0	99.995	7022.46.11	10000

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
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Reagent

ICPC13 CAL C_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

203133
ID ICPC13 CAL C_00001
Exp: 09/16/14 Prpd
ICPC 2013 CAL 2,3 C

Certificate of Analysis

Rev 0

Description: Custom 34 Element Mix (ICPC- 2013- Cal 2,3), #2366, 500 mL
mg/L ± 2% in 10% HNO_3

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2366-01-500ml-C	10% HNO_3	1050681	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Aluminum	Al	7429-90-5	99.9995	7001.46.7	10000
Calcium	Ca	7440-70-2	99.999	7006.46.12	10000
Iron	Fe	7439-89-6	99.99	7012.46.13	10000
Magnesium	Mg	7439-95-4	99.99	7016.46.4	10000

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricllly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 CAL D_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

203134
ID ICPC13 CAL D_00001
Exp 09/16/14 Prpd Opn 09/16/13
ICPC 2013 CAL 2,3 D

Certificate of Analysis

Rev 0

Description: Custom 34 Element Mix (ICPC- 2013- Cal 2,3), #2366, 500 mL
mg/L ± 2% in 10% HNO_3

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2366-01-500ml-D	10% HNO_3	1050682	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Boron	B	7440-42-8	99.999	7003.46.5	1000
Barium	Ba	7440-39-3	99.999	7004.29.1	1000
Lithium	Li	7439-93-2	99.999	7015.46.5	1000
Lead	Pb	7439-92-1	99.999	7023.29.2	1000
Strontium	Sr	7440-24-6	99.998	7030.46.4	1000
Thorium	Th	7440-29-1	99.99	7031.46.3	1000
Uranium	U	7440-61-1	99.8	7035.330.1	1000
Vanadium	V	7440-62-2	99.99	7036.46.5	1000
Zinc	Zn	7440-66-6	99.9995	7037.46.5	1000

Certified By: Mark Filla

Mark Filla

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 CAL E_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

203135
ID ICPC13 CAL E_00001
Exp 09/16/14 Prpd: Opn:09/16/13
ICPC 2013 CAL 2,3 E

Certificate of Analysis

Rev 0

Description: Custom 34 Element Mix (ICPC- 2013- Cal 2,3), #2366, 500 mL
mg/L ± 2% in 10% HNO_3

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2366-01-500ml-E	10% HNO_3 + Tr HF	1050696	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Thallium	Tl	7440-28-0	99.999	7034.29.3	200
Selenium	Se	7782-49-2	99.999	7027.46.4	200
Arsenic	As	7440-38-2	99.9999	7002.46.5	1000
Beryllium	Be	7440-41-7	99.999	7005.46.5	1000
Bismuth	Bi	7440-69-9	99.999	7040.46.2	1000
Cadmium	Cd	7440-43-9	99.9999	7007.29.3	1000
Cobalt	Co	7440-48-4	99.999	7008.46.8	1000
Chromium	Cr	7440-47-3	99.998	7009.46.3	1000
Copper	Cu	7440-50-8	99.9995	7011.46.5	1000
Manganese	Mn	7439-96-5	99.95	7017.46.4	1000
Nickel	Ni	7440-02-0	99.995	7021.46.8	1000

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 ICSA 1_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

206501
ID ICPC13 ICSA 1_00001
Exp 09/20/14 Prpd CDS Opn 09/20/13
ICPC 2013 ICSA 1

206502
ID ICPC13 ICSA 2_00001
Exp 09/20/14 Prpd Opn 09/20/13
ICPC 2013 ICSA 2

Certificate of Analysis

Rev 0

Description: Custom 8 Element Mix, #2367, 500 mL
20,000 mg/L ± 2% in 5% HNO_3
Al, Ca, Fe, Mg shipped separately in 10% HNO_3.

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2367-01-500ml	5% HNO3	1050486	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Potassium	K	7440-09-7	99.999	7013.46.9	20000
Sodium	Na	7440-23-5	99.999	7020.46.6	20000
Phosphorus	P	7723-14-0	99.995	7022.46.11	20000
Sulfur	S	7704-34-9	95.9	7025.43.5	20000
Aluminum	Al	7429-90-5	99.9995	7001.46.7	20000
Calcium	Ca	7440-70-2	99.999	7006.46.12	20000
Iron	Fe	7439-89-6	99.99	7012.46.13	20000
Magnesium	Mg	7439-95-4	99.99	7016.46.5	20000

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 ICSA 2_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

206501
ID ICPC13 ICSA 1_00001
Exp 09/20/14 Prpd CDS Opn 09/20/13
ICPC 2013 ICSA 1

206502
ID ICPC13 ICSA 2_00001
Exp 09/20/14 Prpd Opn 09/20/13
ICPC 2013 ICSA 2

Certificate of Analysis

Rev 0

Description: Custom 8 Element Mix, #2367, 500 mL
20,000 mg/L ± 2% in 5% HNO_3
Al, Ca, Fe, Mg shipped separately in 10% HNO_3.

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2367-01-500ml	5% HNO3	1050486	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Potassium	K	7440-09-7	99.999	7013.46.9	20000
Sodium	Na	7440-23-5	99.999	7020.46.6	20000
Phosphorus	P	7723-14-0	99.995	7022.46.11	20000
Sulfur	S	7704-34-9	95.9	7025.43.5	20000
Aluminum	Al	7429-90-5	99.9995	7001.46.7	20000
Calcium	Ca	7440-70-2	99.999	7006.46.12	20000
Iron	Fe	7439-89-6	99.99	7012.46.13	20000
Magnesium	Mg	7439-95-4	99.99	7016.46.5	20000

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 LLC A_00002

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

199804
ID ICPC13 LLC A_00001
Exp 09/10/14 Prpd:CDS Opn:09/10/13
ICPC LLC 2013 solution A

LLC

199805
ID ICPC13 LLC B_00001
Exp 09/10/14 Prpd:CDS Opn:09/10/13
ICPC 2013 LLC B

Certificate of Analysis

Rev 0

Description: Custom 34 Element Mix, #2365, 250 mL
mg/L ± 2% in 2% HNO_3
Ag, Sb, Ti, Mo, Sn, Si, S shipped separately.

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2365-01-250ML	2% HNO3 + Tr HF	1050477	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Beryllium	Be	7440-41-7	99.999	7005.46.4	2.5
Cadmium	Cd	7440-43-9	99.9999	7007.29.3	2.5
Strontium	Sr	7440-24-6	99.999	7030.46.2	2.5
Arsenic	As	7440-38-2	99.9999	7002.46.5	5.0
Chromium	Cr	7440-47-3	99.998	7009.46.3	5.0
Lead	Pb	7439-92-1	99.999	7023.29.1	5.0
Selenium	Se	7782-49-2	99.999	7027.46.4	7.5
Manganese	Mn	7439-96-5	99.95	7017.46.4	7.5
Thallium	Tl	7440-28-0	99.999	7236.46.1	10.0
Zinc	Zn	7440-66-6	99.9995	7037.46.5	10.0
Copper	Cu	7440-50-8	99.9999	7011.46.4	12.5
Nickel	Ni	7440-02-0	99.995	7021.46.8	20.0
Boron	B	7440-42-8	99.999	7003.46.5	25.0
Barium	Ba	7440-39-3	99.997	7004.29.2	25.0
Cobalt	Co	7440-48-4	99.999	7008.46.8	25.0
Lithium	Li	7439-93-2	99.999	7015.46.5	25.0
Vanadium	V	7440-62-2	99.99	7036.46.5	25.0
Iron	Fe	7439-89-6	99.99	7012.46.13	50.0
Aluminum	Al	7429-90-5	99.9995	7001.46.7	100.0
Bismuth	Bi	7440-69-9	99.999	7040.46.2	100.0
Thorium	Th	7440-29-1	99.99	7031.46.3	100.0
Phosphorus	P	7723-14-0	99.995	7022.46.11	125.0
Uranium	U	7440-61-1	99.8	7035.330.1	250.0
Calcium	Ca	7440-70-2	99.999	7006.46.12	500.0
Magnesium	Mg	7439-95-4	99.99	7016.46.5	500.0
Sodium	Na	7440-23-5	99.999	7020.46.6	500.0
Potassium	K	7440-09-7	99.999	7013.46.9	2500.0
Silver	Ag	7440-22-4	99.999	7000.29.1	5.0

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
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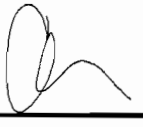
Antimony	Sb	7440-36-0	99.999	7026.46.3	5
Titanium	Ti	7440-32-6	99.995	7033.38.2	10
Molybdenum	Mo	7439-98-7	99.999	7018.29.3	20
Tin	Sn	7440-31-5	99.999	7029.46.4	50
Silicon	Si	7440-21-3	99.999	7028.46.12	200
Sulfur	S	7704-34-9	95.9	7025.43.5	2500

Certified By:  Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

ICPC13 LLC B_00001

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

199804
ID ICPC13 LLC A_00001
Exp:09/10/14 Prpd:CDS Opn:09/10/13
ICPC LLC 2013 solution A

LLC

199805
ID ICPC13 LLC B_00001
Exp:09/10/14 Prpd:CDS Opn:09/10/13
ICPC 2013 LLC B

Certificate of Analysis

Rev 0

Description: Custom 34 Element Mix, #2365, 250 mL
mg/L ± 2% in 2% HNO_3
Ag, Sb, Ti, Mo, Sn, Si, S shipped separately.

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2365-01-250ML	2% HNO3 + Tr HF	1050477	Ambient	10/1/2014	

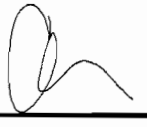
Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Beryllium	Be	7440-41-7	99.999	7005.46.4	2.5
Cadmium	Cd	7440-43-9	99.9999	7007.29.3	2.5
Strontium	Sr	7440-24-6	99.999	7030.46.2	2.5
Arsenic	As	7440-38-2	99.9999	7002.46.5	5.0
Chromium	Cr	7440-47-3	99.998	7009.46.3	5.0
Lead	Pb	7439-92-1	99.999	7023.29.1	5.0
Selenium	Se	7782-49-2	99.999	7027.46.4	7.5
Manganese	Mn	7439-96-5	99.95	7017.46.4	7.5
Thallium	Tl	7440-28-0	99.999	7236.46.1	10.0
Zinc	Zn	7440-66-6	99.9995	7037.46.5	10.0
Copper	Cu	7440-50-8	99.9999	7011.46.4	12.5
Nickel	Ni	7440-02-0	99.995	7021.46.8	20.0
Boron	B	7440-42-8	99.999	7003.46.5	25.0
Barium	Ba	7440-39-3	99.997	7004.29.2	25.0
Cobalt	Co	7440-48-4	99.999	7008.46.8	25.0
Lithium	Li	7439-93-2	99.999	7015.46.5	25.0
Vanadium	V	7440-62-2	99.99	7036.46.5	25.0
Iron	Fe	7439-89-6	99.99	7012.46.13	50.0
Aluminum	Al	7429-90-5	99.9995	7001.46.7	100.0
Bismuth	Bi	7440-69-9	99.999	7040.46.2	100.0
Thorium	Th	7440-29-1	99.99	7031.46.3	100.0
Phosphorus	P	7723-14-0	99.995	7022.46.11	125.0
Uranium	U	7440-61-1	99.8	7035.330.1	250.0
Calcium	Ca	7440-70-2	99.999	7006.46.12	500.0
Magnesium	Mg	7439-95-4	99.99	7016.46.5	500.0
Sodium	Na	7440-23-5	99.999	7020.46.6	500.0
Potassium	K	7440-09-7	99.999	7013.46.9	2500.0
Silver	Ag	7440-22-4	99.999	7000.29.1	5.0

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Antimony	Sb	7440-36-0	99.999	7026.46.3	5
Titanium	Ti	7440-32-6	99.995	7033.38.2	10
Molybdenum	Mo	7439-98-7	99.999	7018.29.3	20
Tin	Sn	7440-31-5	99.999	7029.46.4	50
Silicon	Si	7440-21-3	99.999	7028.46.12	200
Sulfur	S	7704-34-9	95.9	7025.43.5	2500

Certified By:  Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

199804
ID ICPC13 LLC A_00001
Exp:09/10/14 Prpd:CDS Opn:09/10/13
ICPC LLC 2013 solution A

LLC

199805
ID ICPC13 LLC B_00001
Exp:09/10/14 Prpd:CDS Opn:09/10/13
ICPC 2013 LLC B

Certificate of Analysis

Rev 0

Description: Custom 34 Element Mix, #2365, 250 mL
mg/L ± 2% in 2% HNO_3
Ag, Sb, Ti, Mo, Sn, Si, S shipped separately.

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2365-01-250ML	2% HNO3 + Tr HF	1050477	Ambient	10/1/2014	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Beryllium	Be	7440-41-7	99.999	7005.46.4	2.5
Cadmium	Cd	7440-43-9	99.9999	7007.29.3	2.5
Strontium	Sr	7440-24-6	99.999	7030.46.2	2.5
Arsenic	As	7440-38-2	99.9999	7002.46.5	5.0
Chromium	Cr	7440-47-3	99.998	7009.46.3	5.0
Lead	Pb	7439-92-1	99.999	7023.29.1	5.0
Selenium	Se	7782-49-2	99.999	7027.46.4	7.5
Manganese	Mn	7439-96-5	99.95	7017.46.4	7.5
Thallium	Tl	7440-28-0	99.999	7236.46.1	10.0
Zinc	Zn	7440-66-6	99.9995	7037.46.5	10.0
Copper	Cu	7440-50-8	99.9999	7011.46.4	12.5
Nickel	Ni	7440-02-0	99.995	7021.46.8	20.0
Boron	B	7440-42-8	99.999	7003.46.5	25.0
Barium	Ba	7440-39-3	99.997	7004.29.2	25.0
Cobalt	Co	7440-48-4	99.999	7008.46.8	25.0
Lithium	Li	7439-93-2	99.999	7015.46.5	25.0
Vanadium	V	7440-62-2	99.99	7036.46.5	25.0
Iron	Fe	7439-89-6	99.99	7012.46.13	50.0
Aluminum	Al	7429-90-5	99.9995	7001.46.7	100.0
Bismuth	Bi	7440-69-9	99.999	7040.46.2	100.0
Thorium	Th	7440-29-1	99.99	7031.46.3	100.0
Phosphorus	P	7723-14-0	99.995	7022.46.11	125.0
Uranium	U	7440-61-1	99.8	7035.330.1	250.0
Calcium	Ca	7440-70-2	99.999	7006.46.12	500.0
Magnesium	Mg	7439-95-4	99.99	7016.46.5	500.0
Sodium	Na	7440-23-5	99.999	7020.46.6	500.0
Potassium	K	7440-09-7	99.999	7013.46.9	2500.0
Silver	Ag	7440-22-4	99.999	7000.29.1	5.0

Certified By: Carrie Bibbins

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

Marn Soil_00002

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

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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
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)

Corporate Office
Laboratory

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, Radiochemist

QA Approved: _____ Date: 2/11/11
J. D. McCorvey, QA Manager Alternate

Reagent

MarnSolid_00002

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* γps/gram	This Source γps	Uncertainty* , % Type u_A	u_B	U	Calibration Method*
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)

Corporate Office

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: _____ Date: 30 JAN 12
J.D. McCorvey, Counting Room Manager

Reagent

PREP 1 and 2_00002

304576
ID PREP 1 and 2_00002
Exp 01/30/15 Prpd REV Opn 01/30/14
Spike 1 and 2

AccuScience
15520 Oakwood Street
Pierrefonds QC Canada H9H1Y2
877-723-2220
www.accuscience.com

Certificate of Analysis

Rev 0

Description: Custom 37 Element Mix, Prep Spike 1, 500 mL
mg/L ± 2% in 10% HNO_3
Ag, Mo, Nb, Sb, Bi, Sn, Ti, W, Zr and S Shipped Separately.

Catalog No:	Matrix:	Lot No:	Storage:	Exp. Date:	Date Received:
ACSM2381-01-500ML	10% HNO3	1055262	Ambient	2/1/2015	

Element	Symbol	CAS No	Purity %	Source Lot No	Concentration mg/L
Aluminum	Al	7429-90-5	99.9995	7001.46.7	2000
Calcium	Ca	7440-70-2	99.999	7006.29.2	2000
Iron	Fe	7439-89-6	99.99	7012.46.13	2000
Potassium	K	7440-09-7	99.999	7013.46.9	2000
Magnesium	Mg	7439-95-4	99.99	7016.46.5	2000
Sodium	Na	7440-23-5	99.999	7020.46.7	2000
Arsenic	As	7440-38-2	99.9999	7002.46.5	200
Barium	Ba	7440-39-3	99.997	7004.29.3	200
Beryllium	Be	7440-41-7	99.999	7005.46.5	200
Cadmium	Cd	7440-43-9	99.9999	7007.46.3	200
Cobalt	Co	7440-48-4	99.995	7008.46.8	200
Chromium	Cr	7440-47-3	99.998	7009.46.3	200
Copper	Cu	7440-50-8	99.9995	7011.46.5	200
Lithium	Li	7439-93-2	99.999	7015.46.5	200
Manganese	Mn	7439-96-5	99.95	7017.46.5	200
Nickel	Ni	7440-02-0	99.995	7021.46.8	200
Phosphorus	P	7723-14-0	99.995	7022.46.11	200
Lead	Pb	7439-92-1	99.999	7023.29.2	200
Samarium	Sm	7440-19-9	99.999	7066.46.1	200
Strontium	Sr	7440-24-6	99.998	7030.46.4	200
Thorium	Th	7440-29-1	99.98	7031.46.4	200
Uranium	U	7440-61-1	99.8	7035.330.1	200
Vanadium	V	7440-62-2	99.995	7036.46.6	200
Zinc	Zn	7440-66-6	99.9995	7037.46.5	200
Boron	B	7440-42-8	99.999	7003.46.5	400
Selenium	Se	7782-49-2	99.999	7027.46.4	100
Thallium	Tl	7440-28-0	99.99	7034.29.4	40
Sulfur	S	7704-34-9	95.9	7025.43.5	2000

Certified By: Zachary Spinelli

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Bismuth	Bi	7440-69-9	99.999	7040.117.1	200
Tin	Sn	7440-31-5	99.999	7029.46.4	200
Titanium	Ti	7440-32-6	99.995	7033.38.3	200
Tungsten	W	7440-33-7	99.99	7072.46.2	200
Zirconium	Zr	7440-67-7	99.95	7038.29.2	200
Molybdenum	Mo	7439-98-7	99.999	7018.29.3	100
Niobium	Nb	7440-03-1	99.995	7108.46.3	100
Antimony	Sb	7440-36-0	99.999	7026.46.3	100
Silver	Ag	7440-22-4	99.999	7000.29.1	40

Certified By: Zachary Spinelli

All weights are traceable through N. I. S. T. Test No. 822/264157-00.
Concentration (correct for purity) and uncertainty (95% confidence) values listed are determined gravimetricly.

Manufacturer's Quality System
Audited & Registered
by NSF-ISR to ISO 9001:2008

Reagent

Ra-226_00001

National Institute of Standards & Technology

Certificate

Standard Reference Material 4967
Radioactivity Standard

Radionuclide	Radium-226 (1)*
Source identification	SRM 4967
Source description	Liquid in a 5-mL, flame-sealed NIST borosilicate-glass ampoule (2)
Solution composition	Approximately 1.4 mol•L^{-1} HCl(3) containing 1.74 mg $BaCl_2$ per gram of solution(4) and Ra^{+2} (5)
Solution density	1.019 ± 0.001 g•mL^{-1} at 22 °C (6)
Solution mass	5.1167 ± 0.0027 g (7)
Radium-226 activity concentration	2729 Bq•g^{-1} (8)
Reference time	1200 EST 9 September 1991
Overall uncertainty	1.18 percent (9)
Half life	1600 ± 7 years (10)
Calibration method	NIST pressurized "4π"γ ionization chamber "A" calibrated with the national radium standards(11); and confirmatory measurements (12)

This standard reference material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD
January 1992

William P. Reed, Chief
Standard Reference Materials Program

*Notes on back

NOTES

(1) This standard was prepared by gravimetric dilutions of the "1947 series" of ^{226}Ra standards which were recalibrated at NIST (NBS) in 1967. The "age" of the radium, with accompanying in-growth of ^{210}Pb, is at least 44.3 years.

(2) Approximately five milliliters of solution. Ampoule specifications:

body diameter	16.5 ± 0.5 mm
wall thickness	0.60 ± 0.04 mm
barium content	less than 2.5 percent
lead oxide content	less than 0.02 percent
other heavy elements	trace quantities

(3) Corresponding to a 14.9% (by weight) solution of NIST, high-purity, vacuum-distilled hydrochloric acid (nominal 10 $mol \cdot L^{-1}$) in doubly-distilled water.

(4) The $BaCl_2$ reagent used to prepare the carrier solution was measured in a NaI(Tl) well counter and found to contain ≤ 0.01 Bq ^{226}Ra per gram of $BaCl_2$.

(5) The atom ratio of barium carrier to radium in the solution is approximately 2.5×10^4.

(6) The uncertainty in the density is three times the standard deviation of the mean for three independent gravimetric determinations. Confirmatory measurements based on the total master solution mass and individually dispensed masses in known volumes were in agreement.

(7) Mean mass of the dispensed solution in the ampoule. The uncertainty is three times the standard deviation of 19 individually weighed masses of solution from which the mean mass was calculated.

(8) Corresponding to 7.461×10^{-8} g ^{226}Ra per gram of solution assuming a conversion factor of 36.576 $kBq \cdot \mu g^{-1}$.

(9) The overall uncertainty, 1.18 percent, was formed by taking three times the quadratic combination of the standard deviation of the mean, or approximations thereof, for the following component uncertainties:

a) four ion chamber "A" measurements on samples of 2 dilutions	0.051 percent
b) twenty-two comparative ion chamber "A" measurements on 8 "1947(1967 recalibrated) series" of ^{226}Ra standards	0.040 percent
c) ion chamber calibration for the "1947(1967 recalibrated) series" [with respect to the "radiation balance" primary measurements on the "1957 series" and national radium standards (see note 11)]	0.34 percent
d) gravimetric dilution factor	0.1 percent
e) half-life correction	0.0046 percent
f) ^{226}Ra mass to activity conversion	0.16 percent

(10) NCRP Report No. 58, 2nd ed., Appendix A3 (Feb. 1985).

(11) For further details on NIST (NBS) radium series calibrations see W.B. Mann, et al., J. Res. NBS 62, 21-26 (1959). The 1967 recalibration of the "1947 series" and "1957 series" intercomparisons were made with chamber "A".

(12) For confirmation, this ^{226}Ra standard series was also directly compared against preparations of the "1947" (1967 recalibration)", "1978", and "1984" ^{226}Ra series by ^{222}Rn analyses with the NIST pulse-ionization-chamber Primary Radon Measurement System [R. Collé, et al., J. Res. NIST 95 155-165 (1990); J.M.R. Hutchinson, et al., Appl. Rad. Isot. 43, 175-189 (1992)], by liquid scintillation counting, and by NaI(Tl) well-crystal and Ge γ-spectrometry.

For further information please contact R. Collé, (301) 975-5527.

Reagent

Ra-228_00002

ANALYTICS

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

72287-334

Ra-228 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with a germanium gamma spectrometer system.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

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

ISOTOPE:	Ra-228
ACTIVITY (dps):	1.958 E4
HALF-LIFE:	5.75 years
CALIBRATION DATE:	February 3, 2006 12:00 EST
RELATIIVE EXPANDED UNCERTAINTY (k=2):	4.0%

Impurities: γ-impurities (other than decay products) <0.1%

5.01244 grams 0.1M HCl solution with 50 µg/g Ba carrier.

P O NUMBER 2135125, Item 1

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

Q A APPROVED: 2-6-06

Reagent

Ra-228_00007

TestAmerica St. Louis

Standards Preparation Logbook Record

Jul-17-2013

Logbook: \\Qstlmo01\Stdslog\RAD_STD.std

RAD06-0055, Ra-228 Ampoule

Analyst: kempemaj

Vendor: Analytics
Vendor's Expiration Date: 02-03-2031
Solvent: 0.1 M HCl
Date Prep./Opened: 09-01-2006 Date Received: 02-09-2006 Date Consumed: 04-22-2008
Date Expires(1): 02-03-2034 (25 Years)
Date Expires(2): 02-03-2034 (25 Years)
19580 dps/5.01244g, grams entered as mL to make dilution calculations work.

Component	Initial Conc (dpm/mL)	Final Conc (dpm/mL)
Ra-228	234,377	234,377

RAD06-0056, Ra-228 Parent

Analyst: kempemaj

Solvent: 0.5M HCl
Volume (ml): 200.00
Date Prep./Opened: 09-01-2006
Date Expires(1): 02-03-2034 (25 Years)
Date Expires(2): 02-03-2034 (25 Years)
grams transferred are entered as mL for the program to calculate correctly.

Parent Std No.: RAD06-0055, Ra-228 Ampoule
Aliquot Amount (ml): 4.9582
Parent Date Expires(1): 02-03-2034 Parent Date Expires(2): 02-03-2034

Component	Initial Conc (dpm/mL)	Final Conc (dpm/mL)
Ra-228	234,377	5,810.4

RAD12-0030, Ra-228 Spike

#15973
Ra-228-00007

Analyst: hursts

Solvent: 0.5M HCl
Volume (ml): 1,000.0
Date Prep./Opened: 06-18-2012
Date Expires(1): 07-16-2014 (1 Year)
Date Expires(2): 07-16-2014 (1 Year)

Parent Std No.: RAD06-0056, Ra-228 Parent
Aliquot Amount (ml): 4.0000
Parent Date Expires(1): 02-03-2034 Parent Date Expires(2): 02-03-2034

Component	Initial Conc (dpm/mL)	Final Conc (dpm/mL)
Ra-228	5,810.4	23.242

Reviewed By: SLB

Page 1 of 1

Ra-228 Spike

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Reagent ID: Ra-228_00007

		Expiration Date:	07/16/2014
Description:	Ra-228 Spike	Laboratory:	TestAmerica St. Louis
No. of Bottles:	1	Prepared By:	Hurst, Sarah
Storage Location:	RAD Separations Reagents -	Solvent:	0.5M HCL
Reagent Volume:	500.000 mL	Solvent Lot:	0
Creation Date:	06/18/2012		
Container(s):	15973		
Comment:	Rad12-0030 1L created and split into 2 bottles (Bottle A and Bottle B). Bottle B- re-verified 7/16/13. Prior to using bottle A, please re-verify by gamma spec.		

Reagent Analyte Information

Analyte	Source ID	Source Expiration Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
Ra-228	Ra-228_00003	02/03/2034	5810.431	dpm/mL	23.24172	dpm/mL

Source Reagents

Reagent	Description	Type	Expiration	Vendor	Vendor Lot #	Vendor Cat Lot #	Volume Used	Volume Units
Ra-228_00003	Ra-228 Parent		02/03/34				2.00000	mL

St. Louis Radiological Standard Reverification Form

Standard ID Number: Rad12-0030
True Value = 10470 DPM/L or g
Date Analyzed: 7/16/2013

Radionuclide: Radium-228

	Replicates	
#1	10260	DPM/L or g
#2	10710	DPM/L or g
#3	10750	DPM/L or g

Mean = 10573.33

1 sigma = 272.0907 1.96 sigma = 533.2977

True Value minus 5% = 9946.5 (True Value - 5%)
True Value plus 5% = 10993.5 (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: EMH 07/17/2013

SOP Reference: STL-QA-0002, Current Revision

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Analysis Report for Gamma Spectroscopy

Batch: M132730 **Operator:** 403135

SampID	WRKNO	Aliquot	Sigma	Instrument	Detector	CountDateTime	CountDuration
Verification 1	M1AFF1AC	500.00mL	2.00	GammaVision	GV07	7 / 16 / 13 17:54	60

Analyte	Cmpnd#	Activity	TotalUnc	CountUnc	MDA	MLCC	Act/MDA
RA-228	579	1.026E+004pCi/L	1.107E+003	4.955E+002	2.174E+002	9.560E+001	47.18

SampID	WRKNO	Aliquot	Sigma	Instrument	Detector	CountDateTime	CountDuration
Verification 2	M1AFF1AC	500.00mL	2.00	GammaVision	GV08	7 / 16 / 13 14:30	60

Analyte	Cmpnd#	Activity	TotalUnc	CountUnc	MDA	MLCC	Act/MDA
RA-228	579	1.071E+004pCi/L	1.144E+003	4.896E+002	2.321E+002	1.033E+002	46.14

SampID	WRKNO	Aliquot	Sigma	Instrument	Detector	CountDateTime	CountDuration
Verification 3	M1AFF1AC	500.00mL	2.00	GammaVision	GV11	7 / 16 / 13 19:01	60

Analyte	Cmpnd#	Activity	TotalUnc	CountUnc	MDA	MLCC	Act/MDA
RA-228	579	1.075E+004pCi/L	1.135E+003	4.432E+002	1.498E+002	6.641E+001	71.76

Laboratory Control Sample Information

Sample ID	WRKNO	Analyte	Activity		StdAdded	Recovery	ZFactor
Verification 1	M1AFF1AC	RA-228	1.026E+004	pCi/L	1.047E+004	97.97%	-0.2689
Verification 2		RA-228	1.071E+004	pCi/L	1.047E+004	102.32%	0.3040
Verification 3		RA-228	1.075E+004	pCi/L	1.047E+004	102.69%	0.3554

Sample Duplicate Information

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

Blanks Information

SampID	WRKNO	Analyte	Activity	UncTotal	ZFactor

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gamma Barcode Report

Sample Description: M132730_NA_1
Instrument Operator: **Sample ID #:** NA **Sample Title:** 1
Sample Type: water **Batch ID:** M132730 **Geometry:** Marinelli, 0.5L

8

Sample Description: M132730_NA_2
Instrument Operator: **Sample ID #:** NA **Sample Title:** 2
Sample Type: water **Batch ID:** M132730 **Geometry:** Marinelli, 0.5L

7

Sample Description: M132730_NA_3
Instrument Operator: **Sample ID #:** NA **Sample Title:** 3
Sample Type: water **Batch ID:** M132730 **Geometry:** Marinelli, 0.5L

11

228 verification in 0.5C Marn
- I put '228ver1' for Sample ID
Short 1hr

-RS

Rad 12-0030 Ra 228 verification

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Prep Report for Gamma Spectroscopy

Batch: M132730 **Prep Analyst:** 260

SampID	WRKNO	Aliquot	Dilution	Adjusted Aliquot	GeometryDesc
1	NA	5.0000E+002 mL	1.00	5.0000E+002 mL	Marinelli, 0.5L
2	NA	5.0000E+002 mL	1.00	5.0000E+002 mL	Marinelli, 0.5L
3	NA	5.0000E+002 mL	1.00	5.0000E+002 mL	Marinelli, 0.5L

(8)

Spike Information

Sample ID	Standard ID	Analyte	Std Conc	Aliquot	Ref Date	StdAdded

Spiked By | Spike Verified By | Spike Date

Standard Operating Procedures

SOPNumber	Title	Revision
☑ ST.PC.0025	Gamma Spec Prep	

EMH — Reviewed By; 7/17/13 — Review Date

Analyst/Relenquished By; 7.16.13 — Release Date; EMH — Received By; 7/16/13 EMH 7/16/13 — Receipt Date

Test America St. Louis Spectrum ID: 8__20130913

Sample Description: M132730_NA_1
Detector: Ge 8 SN/174
Batch ID: M132730
Work Order Number: NA
Lot Number: 1

Decay to Time: 2/3/2006 12:00 Live Time: 3600 sec
Acquisition Time: 7/16/2013 14:30:42 Real Time: 3611 sec
Analysis Time: 7/17/2013 08:38 Dead Time: 0.30 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 8_Liquid_Marinelli 0.5L.Clb
Efficiency Cal Desc: 8_0.5Lmarn_90101_032612
Efficiency Cal Date: 3/28/2012 10:24
Energy Cal Date: 2/28/2012 10:34
Library: Client_Routine Long_Rev4.lib
Bkgd Correction File: 8_2013-07-06_0316.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
NA-22	2.778E-01	441.1	1.225E+00	1.225E+00	4.513E+00
K-40	1.516E+00	122.5	1.857E+00	1.859E+00	7.261E+00
MN-54	1.743E+02	42.4	7.381E+01	7.429E+01	2.314E+02
CO-57	1.087E+02	87.7	9.539E+01	9.555E+01	7.534E+02
CO-60	-1.104E-02	5179.0	5.715E-01	5.715E-01	2.251E+00
ZN-65	7.318E+01	1100.0	8.049E+02	8.049E+02	2.935E+03
NB-94	-2.732E-01	108.7	2.968E-01	2.971E-01	9.979E-01
RH-106	5.366E+02	58.0	3.112E+02	3.123E+02	1.020E+03
AG-108M	8.481E-02	209.3	1.775E-01	1.776E-01	7.027E-01
AG-110M	6.141E+02	94.3	5.791E+02	5.799E+02	1.591E+03
SB-125	4.288E+01	9.1	3.894E+00	4.407E+00	1.456E+01
Gd-153	-1.023E+03	181.2	1.854E+03	1.855E+03	6.195E+03
BA-133	-3.473E-01	152.4	5.295E-01	5.298E-01	1.785E+00
CS-134	2.385E+01	10.4	2.476E+00	2.734E+00	1.083E+01
CS-137	-3.138E-01	875.6	2.748E+00	2.748E+00	1.351E+00
CE-144	-1.996E+03	66.2	1.321E+03	1.325E+03	4.360E+03
PM-144	2.997E+01	95.6	2.865E+01	2.869E+01	1.130E+02
EU-152	-1.761E-01	100.7	1.774E-01	1.776E-01	3.904E+00
EU-154	-2.899E-01	100.3	2.907E-01	2.910E-01	1.027E+01
EU-155	1.729E+01	21.0	3.635E+00	3.745E+00	8.248E+00
TL-208	2.871E+02	3.6	1.048E+01	1.745E+01	1.308E+01
pm-146	1.027E+00	83.0	8.523E-01	8.537E-01	7.717E+00
Cd-109	4.361E+02	118.7	5.178E+02	5.183E+02	1.720E+03
PB-210	1.480E+01	119.1	1.763E+01	1.765E+01	5.874E+01
PB-212	9.046E+02	1.8	1.588E+01	5.121E+01	1.944E+01
PB-214	4.790E-01	96.0	4.599E-01	4.605E-01	1.795E+00
BI-207	4.414E-01	51.4	2.269E-01	2.280E-01	9.831E-01
BI-212	8.963E+02	7.3	6.524E+01	7.847E+01	1.254E+02
BI-214	8.300E-01	64.8	5.380E-01	5.395E-01	1.776E+00
BI-210M	1.770E-02	1983.0	3.509E-01	3.509E-01	1.196E+00
RA-224	9.650E+02	14.1	1.365E+02	1.459E+02	4.254E+02
AC-228	1.982E+02	2.3	4.529E+00	1.058E+01	4.295E+00
TH-227	-3.823E+01	5.1	1.943E+00	2.838E+00	3.504E+00
TH-229	1.229E-01	2901.0	3.564E+00	3.564E+00	1.211E+01
TH-234	2.246E+01	51.1	1.148E+01	1.153E+01	2.950E+01
PA-231	-1.584E+01	58.0	9.181E+00	9.214E+00	3.020E+01
PA-233	3.980E+00	14.2	5.668E-01	5.997E-01	1.962E+00
PA-234	-2.293E+00	54.8	1.258E+00	1.263E+00	4.134E+00
PA-234M	-1.515E+01	2000.0	3.029E+02	3.029E+02	1.029E+02
U-235	9.133E-01	162.7	1.486E+00	1.487E+00	4.459E+00
AM-241	7.894E-02	1568.0	1.238E+00	1.238E+00	4.183E+00
Np-237	0.000E+00	0.0	2.077E+00	2.077E+00	6.975E+00

Total 5.355E+03

Analyst: Micha Korrinhizer

TestAmerica Spectrum name: 8__20130913.An1

Sample description
M132730_NA_1

Spectrum Filename: C:\User\SPC\Det8\8__20130913.An1

Acquisition information

Start time:	7/16/2013 2:30:42 PM
Live time:	3600
Real time:	3611
Dead time:	0.30 %
Detector ID:	8

Detector system
Ge 8 SN/174

Calibration

Filename:	8_Liquid_Marinelli 0.5L.Clb

8_0.5Lmarn_90101_032612

Energy Calibration

Created:	2/28/2012 10:34:41 AM
Zero offset:	0.052 keV
Gain:	0.250 keV/channel
Quadratic:	5.282E-10 keV/channel^2

Efficiency Calibration

Created:	3/28/2012 10:24:47 AM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 1.34 %
Log(Eff):	-1.169253E+00 + (-3.875994E-02*Log(E)) + (-6.194504E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.74 %
Log(Eff):	-2.783617E+01 + (1.016917E+01*Log(E)) + (-1.038451E+00*Log(E)^2)

Library Files

Main analysis library:	Client_Routine Long_Rev4.lib
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters

Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.55keV)
Stop channel:	8000 (1999.96keV)
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

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	2/3/2006 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	8_2013-07-06_0316.PBC 7/6/2013 3:16:34 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 51 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 129.8629

***** 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
36.74	49.	65.02	0.59	9.328E-03				
46.65	30.	119.14	1.01	1.660E-02	46.54	4.250	PBC<MDA	PB210
57.44	35.	87.66	0.46	2.515E-02				
59.68	3.	150.08	1.02	2.675E-02	59.54	35.900	PBC<MDA	AM241
63.39	91.	32.87	0.58	2.953E-02	63.29	3.810	PBC<MDA	TH234
74.77	850.	5.78	1.03	3.717E-02				
77.15	1351.	3.71	1.04	3.856E-02				
80.91	43.	90.78	1.04	4.068E-02	80.99	34.060	PBC<MDA	BA133
87.15	510.	7.76	1.04	4.364E-02	86.54	30.700	3.009E+01	EU155
88.09	41.	118.73	1.04	4.405E-02	88.04	3.790	PBC<MDA	Cd109
89.94	542.	7.10	1.05	4.484E-02				
92.59	45.	30.77	1.05	4.591E-02	92.59	5.584	PBC<MDA	TH234
93.27	557.	7.18	1.05	4.614E-02	93.35	5.561	1.467E+02	AC228
99.38	121.	30.73	1.05	4.824E-02	99.50	15.000	HL>Cutoff	Np239
105.26	232.	21.03	0.79	4.978E-02	105.31	21.200	1.729E+01	EU155
					106.13	22.700	HL>Cutoff	Np239
123.47	16.	214.01	1.07	5.246E-02	123.10	40.790	PBC<MDA	EU154
					122.06	85.600	1.019E+02	CO57
129.14	398.	14.75	1.18	5.277E-02				
135.50	15.	215.22	1.08	5.282E-02	136.30	5.850	HL>Cutoff	HF181
					136.30	5.850	HL>Cutoff	HF181
					136.47	10.680	7.651E+02	CO57
136.90	40.	87.73	1.08	5.282E-02	136.47	10.680	PBC<MDA	CO57
140.38	15.	252.24	1.08	5.271E-02	140.51	89.300	HL>Cutoff	Tc99m
143.72	8.	132.27	1.09	5.256E-02	143.79	10.960	PBC<MDA	U235
145.23	38.	55.50	0.36	5.248E-02				
165.97	10.	329.41	1.10	5.051E-02	165.85	79.900	HL>Cutoff	CE139
205.86	16.	121.84	0.62	4.364E-02	205.33	5.010	PBC<MDA	U235
209.33	556.	8.87	0.96	4.305E-02				
238.65	3722.	1.75	1.16	3.923E-02	238.63	43.300	9.045E+02	PB212
240.96	370.	14.21	1.16	3.896E-02	240.99	4.100	9.609E+02	RA224
					242.00	7.430	3.576E+01	PB214
270.23	389.	10.63	1.05	3.585E-02				
277.43	191.	21.53	1.24	3.517E-02	277.28	6.310	3.566E+02	TL208

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					279.20	81.460	HL>Cutoff	Hg203
294.05	7.	307.28	1.20	3.360E-02	295.09	19.300	PBC<MDA	PB214
					295.95	30.160	HL>Cutoff	Ir192
					295.09	19.300	3.220E-01	PB214
300.28	239.	13.85	0.87	3.316E-02	300.03	3.280	9.071E+02	PB212
					300.07	2.460	8.140E+01	PA231
					300.18	6.200	3.230E+01	PA233
					300.07	2.460	8.140E+01	PA231
327.94	293.	11.17	1.64	3.104E-02	328.76	20.300	HL>Cutoff	La140
					328.76	20.300	HL>Cutoff	La140
338.33	1078.	3.31	1.23	3.031E-02	338.32	12.010	2.009E+02	AC228
340.76	59.	48.96	1.23	3.015E-02	340.57	46.900	HL>Cutoff	Cs136
					340.57	46.900	HL>Cutoff	Cs136
351.82	22.	96.03	1.24	2.942E-02	351.93	37.600	PBC<MDA	PB214
					351.93	37.600	5.595E-01	PB214
366.15	28.	67.73	1.25	2.864E-02	364.48	81.700	HL>Cutoff	I131
392.02	23.	82.80	1.27	2.708E-02	391.69	64.000	HL>Cutoff	SN113
427.90	11.	163.69	1.30	2.527E-02	427.88	29.600	PBC<MDA	SB125
					427.88	29.600	2.624E+00	SB125
433.53	4.	388.06	1.30	2.499E-02	433.94	90.480	PBC<MDA	AG108M
452.85	21.	82.95	1.32	2.412E-02	453.88	65.000	PBC<MDA	pm146
463.02	311.	9.71	1.38	2.374E-02	463.37	10.470	2.260E+02	SB125
					463.37	10.470	2.260E+02	SB125
478.41	38.	44.42	1.33	2.315E-02	477.60	10.520	HL>Cutoff	BE7
483.80	24.	64.30	1.34	2.298E-02	482.00	80.500	HL>Cutoff	HF181
					482.00	80.500	HL>Cutoff	HF181
510.69	402.	8.60	1.43	2.194E-02	511.86	20.000	3.966E+03	RH106
					511.86	20.000	3.966E+03	RH106
562.43	62.	26.57	1.39	2.025E-02	563.24	8.350	1.250E+02	CS134
					563.24	8.350	1.250E+02	CS134
570.04	23.	76.26	1.40	2.006E-02	569.70	97.740	PBC<MDA	BI207
					569.32	15.380	2.557E+01	CS134
					569.47	8.200	3.937E+00	PA234
583.09	1159.	3.63	1.49	1.968E-02	583.02	84.500	2.871E+02	TL208
603.29	18.	90.35	1.42	1.914E-02	602.73	98.260	HL>Cutoff	SB124
604.87	4.	424.81	1.42	1.909E-02	604.71	97.620	PBC<MDA	CS134
					604.71	97.620	7.434E-01	CS134
610.02	26.	64.82	1.42	1.897E-02	609.31	46.090	PBC<MDA	BI214
					610.30	5.750	HL>Cutoff	RU103
					610.30	5.750	HL>Cutoff	RU103
610.09	22.	79.31	1.42	1.895E-02	609.31	46.090	PBC<MDA	BI214
					610.30	5.750	HL>Cutoff	RU103
619.31	14.	115.55	1.43	1.875E-02	618.06	99.100	PBC<MDA	PM144
					621.92	9.930	3.323E+02	RH106
619.51	23.	58.00	1.43	1.865E-02	618.06	99.100	PBC<MDA	PM144
					621.92	9.930	5.366E+02	RH106
					621.92	9.930	5.366E+02	RH106
635.43	10.	159.14	1.44	1.831E-02	635.89	11.310	PBC<MDA	SB125
					635.89	11.310	8.507E+00	SB125
661.69	-14.	378.65	1.46	1.770E-02	661.66	85.210	PBC<MDA	CS137
692.56	7.	152.32	1.48	1.695E-02	696.54	99.000	PBC<MDA	PM144
719.23	22.	49.55	1.50	1.643E-02	722.79	10.810	HL>Cutoff	SB124
					724.20	44.150	HL>Cutoff	ZR95
720.25	6.	209.32	1.50	1.642E-02	722.94	90.840	PBC<MDA	AG108M
727.23	267.	7.28	1.50	1.634E-02	727.17	7.550	8.962E+02	BI212
729.96	23.	71.57	1.50	1.629E-02				
735.23	15.	90.22	1.51	1.618E-02	735.72	22.500	PBC<MDA	pm146
755.27	67.	21.45	1.52	1.579E-02	756.73	54.460	HL>Cutoff	ZR95
					756.73	54.460	HL>Cutoff	ZR95
763.29	56.	40.44	0.50	1.567E-02	763.94	22.280	8.414E+03	AG110M
765.54	8.	176.91	1.53	1.563E-02	765.79	99.790	HL>Cutoff	NB95
782.27	16.	72.65	1.54	1.529E-02	785.42	1.280	PBC<MDA	BI212
794.83	154.	10.38	1.54	1.512E-02	795.87	85.530	4.035E+01	CS134

				795.87	85.530	4.035E+01	CS134
802.65	9.	109.84	1.55 1.502E-02	801.95	8.690	PBC<MDA	CS134
				801.95	8.690	2.377E+01	CS134
816.24	8.	137.10	1.56 1.480E-02	815.77	23.280	HL>Cutoff	La140
				815.77	23.280	HL>Cutoff	La140
830.72	22.	42.35	1.57 1.450E-02	834.85	99.980	PBC<MDA	MN54
845.57	5.	154.64	1.58 1.432E-02	846.77	99.935	HL>Cutoff	Co56

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
860.19	165.	11.74	1.50	1.412E-02	860.56	12.420	3.898E+02	TL208
871.05	9.	87.38	1.59	1.397E-02	871.10	99.890	PBC<MDA	NB94
884.44	3.	254.91	1.60	1.379E-02	883.24	9.600	PBC<MDA	PA234
					884.68	72.680	1.766E+02	AG110M
					884.68	72.680	1.766E+02	AG110M
					883.24	9.600	7.031E-01	PA234
884.50	5.	160.87	1.60	1.381E-02	883.24	9.600	PBC<MDA	PA234
					884.68	72.680	2.618E+02	AG110M
889.03	3.	321.51	1.60	1.372E-02	889.28	99.984	HL>Cutoff	Sc46
898.44	2.	553.65	1.61	1.360E-02	898.04	93.700	HL>Cutoff	y88
911.16	1131.	3.12	1.58	1.343E-02	911.16	29.000	1.971E+02	AC228
964.69	185.	8.52	1.65	1.277E-02	964.11	14.605	4.038E+01	EU152
					964.11	14.605	4.038E+01	EU152
968.93	624.	4.10	1.65	1.272E-02	968.97	17.460	1.907E+02	AC228
995.49	5.	147.21	1.67	1.241E-02	996.33	10.600	PBC<MDA	EU154
1004.25	2.	474.92	1.67	1.231E-02	1004.77	18.010	PBC<MDA	EU154
1064.14	14.	68.99	1.71	1.170E-02	1063.66	74.500	PBC<MDA	BI207
1078.30	7.	106.17	1.72	1.156E-02	1077.40	3.300	HL>Cutoff	Ga68
1173.52	-5.	61.16	1.77	1.070E-02	1173.24	99.900	PBC<MDA	CO60
1188.79	2.	319.17	1.78	1.057E-02	1189.05	16.200	HL>Cutoff	Ta182
1238.38	4.	174.72	1.81	1.018E-02	1238.28	66.070	HL>Cutoff	Co56
1271.64	1.	441.06	1.83	9.917E-03	1274.53	99.940	PBC<MDA	NA22
					1274.54	35.190	1.979E-01	EU154
1271.64	2.	327.73	1.83	9.917E-03	1274.53	99.940	PBC<MDA	NA22
					1274.54	35.190	2.857E-01	EU154
1332.37	0.	61.61	1.86	9.516E-03	1332.50	99.980	PBC<MDA	CO60
1384.28	1.	456.07	1.88	9.184E-03	1384.30	24.290	PBC<MDA	AG110M
1408.30	2.	318.02	1.90	9.039E-03	1408.00	21.005	PBC<MDA	EU152
1458.98	5.	42.91	1.92	8.732E-03	1460.83	10.670	PBC<MDA	K40
1764.67	1.	734.84	2.07	7.293E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV		Suspected Nuclide
146.78	36.74	341.	49.	5.253E+03	65.02	0.587	-	s
229.55	57.44	333.	35.	1.379E+03	76.39	0.456	-	sc
298.89	74.76	783.	850.	2.287E+04	5.78	1.034	-	D
308.40	77.13	581.	1350.	3.501E+04	3.71	1.036	-	D
348.45	87.11	584.	454.	1.041E+04	8.87	1.044	-	D
359.62	89.90	506.	505.	1.125E+04	7.72	1.046	-	D
516.40	129.14	554.	477.	9.038E+03	8.35	1.180	-	
580.47	145.23	312.	34.	6.471E+02	75.55	1.088	-	c
837.16	209.33	397.	575.	1.337E+04	6.43	0.961	-	M
1080.78	270.23	264.	389.	1.085E+04	7.78	1.046	-	
1311.64	327.94	462.	18.	5.703E+02	173.40	1.644	-	c
1362.98	340.77	390.	59.	1.973E+03	48.69	1.234	-	D
1851.98	463.02	387.	44.	1.867E+03	64.53	1.383	-	c
2042.66	510.69	474.	68.	3.109E+03	46.73	1.428	-	sM
2919.90	729.93	127.	23.	1.417E+03	72.13	1.502	-	sc

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
3053.14	763.29	93.	40.	2.570E+03	37.29	0.503 -	s
3858.76	964.69	68.	161.	1.261E+04	10.71	1.390 -	M

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_Routine Long_Rev4.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	186.39	46.65	616.	30.	0.008	119.14	1.012s
TH-227	201.49	50.42	639.	-7.	-0.002	540.18	1.015s
TH-234	253.37	63.39	628.	91.	0.025	32.87	0.582s
BA-133	323.46	80.91	752.	43.	0.012	90.78	1.039
EU-155	345.98	86.54	826.	293.	0.081	14.33	1.043D
Cd-109	351.97	88.04	1162.	41.	0.011	118.73	1.044D
TH-234	370.17	92.59	943.	45.	0.013	30.77	1.048D
AC-228	373.21	93.35	614.	464.	0.129	8.77	1.049D
Gd-153	389.43	97.40	744.	-21.	-0.006	181.23	1.052s
Np-239	397.32	99.38	630.	121.	0.034	30.73	1.053
Np-239	418.00	104.55	759.	-6.	-0.002	614.09	1.057
EU-155	420.85	105.26	537.	232.	0.064	21.03	0.786s
Np-239	421.36	105.39	669.	134.	0.037	28.55	1.058
EU-152	480.55	120.18	430.	-9.	-0.003	324.60	1.071s
CO-57	488.47	122.16	613.	-20.	-0.006	174.80	1.071s
EU-154	493.70	123.47	576.	16.	0.004	214.01	1.072s
PA-234	521.62	130.45	887.	-78.	-0.022	54.84	1.078s
CE-144	536.24	134.11	665.	-56.	-0.016	66.18	1.080s
HF-181	541.83	135.50	519.	15.	0.004	215.22	1.082s
CO-57	547.43	136.90	586.	40.	0.011	87.73	1.082
Tc-99m	561.34	140.38	698.	15.	0.004	252.24	1.085s
U-235	574.97	143.79	371.	8.	0.002	132.27	1.087D
Ba-140	651.38	162.89	605.	-7.	-0.002	513.16	1.102s
CE-139	663.71	165.97	576.	10.	0.003	329.41	1.104s
U-235	823.28	205.86	244.	16.	0.005	121.84	0.621s
TH-229	845.80	211.49	640.	-20.	-0.006	175.93	1.138s
TH-227	930.47	232.66	96.	-528.	-0.147	5.08	1.157s
PB-212	954.38	238.63	273.	3708.	1.030	1.75	1.159D
RA-224	963.79	240.99	1197.	372.	0.103	14.14	1.161D
PB-214	969.73	242.47	1025.	-154.	-0.043	30.41	1.162s
EU-152	973.78	243.48	358.	-31.	-0.009	87.75	1.164s
TH-227	1023.91	256.01	322.	-7.	-0.002	369.17	1.172s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
TL-208	1109.57	277.43	300.	191.	0.053	21.53	1.238
I-131	1140.95	285.27	317.	-30.	-0.008	87.18	1.193s
PB-214	1176.07	294.05	261.	7.	0.002	307.28	1.201
Ir-192	1174.93	293.77	194.	-6.	-0.002	317.54	1.202
PB-212	1201.00	300.28	207.	238.	0.066	13.85	0.874s
PA-231	1200.63	300.19	302.	203.	0.056	14.01	1.205s
PA-233	1200.63	300.19	308.	201.	0.056	14.24	1.205
PA-231	1209.36	302.37	465.	-54.	-0.015	57.98	1.207s
BA-133	1209.21	302.34	461.	-62.	-0.017	50.83	1.207s
La-140	1311.80	327.98	230.	275.	0.077	9.84	1.226s
AC-228	1353.15	338.32	103.	1073.	0.298	3.31	1.233D
Cs-136	1361.41	340.39	429.	-10.	-0.003	291.51	1.234s
EU-152	1373.14	343.32	248.	-23.	-0.006	100.73	1.237s
HF-181	1381.42	345.39	216.	-7.	-0.002	291.21	1.238s
PB-214	1407.14	351.82	216.	22.	0.006	96.03	1.243s
BA-133	1424.92	356.26	216.	-14.	-0.004	152.44	1.245s
I-131	1464.47	366.15	160.	28.	0.008	67.73	1.252s
SN-113	1567.96	392.02	166.	23.	0.006	82.80	1.271s
SB-125	1711.50	427.90	153.	11.	0.003	163.69	1.297s
AG-108M	1734.00	433.53	133.	4.	0.001	388.06	1.301s
pm-146	1811.29	452.85	135.	21.	0.006	82.95	1.315s
SB-125	1851.67	462.94	160.	267.	0.074	9.08	1.322
Ir-192	1872.26	468.09	173.	-11.	-0.003	171.33	1.325
BE-7	1913.53	478.41	123.	38.	0.011	44.42	1.332s
HF-181	1935.10	483.80	104.	24.	0.007	64.30	1.335s
RU-103	1988.44	497.13	114.	-9.	-0.002	173.49	1.346s
RH-106	2042.53	510.66	164.	334.	0.093	7.70	1.356s
Nd-147	2125.31	531.35	154.	-18.	-0.005	100.53	1.369
Ba-140	2156.69	539.19	125.	-8.	-0.002	201.77	1.373s
CS-134	2249.65	562.43	106.	62.	0.017	26.57	1.391s
CS-134	2277.20	569.32	145.	-2.	-0.001	862.43	1.395s
PA-234	2290.34	572.61	133.	-21.	-0.006	79.28	1.395s
BI-207	2280.09	570.04	146.	23.	0.006	76.26	1.396s
TL-208	2332.30	583.09	114.	1152.	0.320	3.63	1.491
SB-125	2397.64	599.43	126.	-11.	-0.003	144.63	1.416s
SB-124	2413.08	603.29	121.	18.	0.005	90.35	1.418s
CS-134	2419.40	604.87	149.	4.	0.001	424.81	1.419s
BI-214	2440.02	610.02	129.	26.	0.007	64.82	1.422s
RU-103	2440.28	610.09	142.	22.	0.006	79.31	1.423s
AG-108M	2458.54	614.65	143.	-6.	-0.002	271.71	1.426s
PM-144	2477.19	619.31	128.	14.	0.004	115.55	1.428s
RH-106	2477.98	619.51	78.	23.	0.006	58.00	1.431s
SB-125	2541.64	635.43	116.	10.	0.003	159.14	1.440s
CS-137	2646.69	661.69	161.	-14.	-0.004	378.65	1.457s
PM-144	2770.18	692.56	57.	7.	0.002	152.32	1.480s
NB-94	2810.83	702.72	147.	-16.	-0.004	108.66	1.484s
SB-124	2876.86	719.23	49.	22.	0.006	49.55	1.497s
AG-108M	2880.97	720.25	81.	6.	0.002	209.32	1.497s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
EU-154	2893.37	723.36	842.	-4.	-0.001	966.38	1.498s
ZR-95	2897.76	724.45	241.	-35.	-0.010	65.55	1.498s
BI-212	2908.63	727.17	55.	267.	0.074	7.28	1.500D
pm-146	2940.89	735.23	82.	15.	0.004	90.22	1.506s
ZR-95	3021.02	755.27	71.	67.	0.019	21.45	1.519s
AG-110M	3053.86	763.48	98.	15.	0.004	94.31	1.524s
NB-95	3062.14	765.54	108.	8.	0.002	176.91	1.525s
EU-152	3115.16	778.80	109.	-7.	-0.002	215.59	1.534s
BI-212	3129.02	782.27	62.	16.	0.005	72.65	1.538s
CS-134	3179.29	794.83	51.	154.	0.043	10.38	1.544s
CS-134	3210.55	802.65	46.	9.	0.003	109.84	1.548s
CO-58	3250.80	812.71	56.	-2.	-0.001	561.35	1.554s
La-140	3264.94	816.24	53.	8.	0.002	137.10	1.557s
MN-54	3322.83	830.72	31.	22.	0.006	42.35	1.569s
Co-56	3382.25	845.57	26.	5.	0.001	154.64	1.577s
TL-208	3440.73	860.19	30.	165.	0.046	11.74	1.501
NB-94	3484.16	871.05	30.	9.	0.003	87.38	1.592s
EU-154	3492.16	873.05	47.	-7.	-0.002	136.23	1.593s
PA-234	3517.35	879.34	41.	-5.	-0.001	187.57	1.598s
PA-234	3538.00	884.50	30.	5.	0.001	160.87	1.599s
AG-110M	3537.76	884.44	35.	3.	0.001	254.91	1.600s
Sc-46	3556.09	889.03	39.	3.	0.001	321.51	1.603s
y-88	3593.73	898.44	46.	2.	0.000	553.65	1.608s
AC-228	3644.62	911.16	22.	1126.	0.313	3.12	1.577
AG-110M	3743.91	935.98	28.	-1.	0.000	779.85	1.633s
PA-234	3782.99	945.75	40.	-3.	-0.001	356.20	1.638s
EU-152	3861.43	965.36	466.	7.	0.002	415.34	1.649s
AC-228	3875.73	968.93	41.	582.	0.162	4.66	1.430
EU-154	3981.95	995.49	24.	5.	0.001	147.21	1.668s
EU-154	4017.01	1004.25	29.	2.	0.000	474.92	1.673s
Co-56	4142.94	1035.73	39.	-7.	-0.002	131.88	1.693s
Cs-136	4194.25	1048.56	26.	-3.	-0.001	248.17	1.698s
RH-106	4201.58	1050.39	23.	-2.	-0.001	375.42	1.700s
BI-207	4256.56	1064.14	38.	14.	0.004	68.99	1.708s
Ga-68	4313.21	1078.30	28.	7.	0.002	106.17	1.715s
BI-214	4482.09	1120.52	39.	-6.	-0.002	151.64	1.740s
Sc-46	4481.40	1120.35	40.	-6.	-0.002	152.48	1.740s
Ta-182	4481.59	1120.39	37.	-6.	-0.002	153.62	1.741s
CO-60	4694.09	1173.52	40.	-5.	-0.001	61.16	1.770s
Ta-182	4755.20	1188.79	18.	2.	0.001	319.17	1.779s
Co-56	4953.58	1238.38	25.	4.	0.001	174.72	1.806s
NA-22	5086.61	1271.64	17.	1.	0.000	441.06	1.826s
EU-154	5086.62	1271.64	20.	2.	0.001	327.73	1.826s
FE-59	5169.43	1292.34	38.	-7.	-0.002	133.00	1.835s
AG-110M	5537.17	1384.28	23.	1.	0.000	456.07	1.884s
EU-152	5633.27	1408.30	16.	2.	0.001	318.02	1.896s
K-40	5836.00	1458.98	22.	5.	0.001	42.91	1.923s
La-140	6384.72	1596.16	24.	-4.	-0.001	191.25	1.990s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
SB-124	6752.71	1688.15	25.	-6.	-0.002	121.75	2.034s
BI-214	7058.81	1764.67	16.	1.	0.000	734.84	2.067s
Co-56	7082.13	1770.50	18.	-4.	-0.001	143.09	2.070s
Y-88	7349.85	1837.43	20.	-2.	-0.001	347.49	2.098s

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	Peak Energy keV	Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
BE-7	C	4.3262E+00					5.31E+01	
			477.60	4.326E+00	?(	6.202E+00	4.44E+01 1.05E+01	G
NA-22	C	2.7783E-01					9.50E+02	
			1274.53	2.778E-01	?(	4.513E+00	4.41E+02 9.99E+01	G
K-40	N	1.5163E+00					4.66E+11	
			1460.83	1.516E+00	?(P	7.261E+00	4.29E+01 1.07E+01	G
Sc-46	F	5.6765E-02					8.38E+01	
			889.28	5.676E-02	?(	6.458E-01	3.22E+02 1.00E+02	G
			1120.55	-1.510E-01	+	7.986E-01	1.52E+02 1.00E+02	G
CR-51	F	-7.6665E-02					2.77E+01	
			320.08	-7.666E-02	%(	5.718E+00	2.17E+03 9.94E+00	G
MN-54	C	1.7430E+02					3.12E+02	
			834.85	1.743E+02	?(	2.314E+02	4.23E+01 1.00E+02	G
FE-59	F	3.3269E-03					4.45E+01	
			1099.25	3.327E-03	&(	1.250E+00	1.03E+04 5.65E+01	G
			1291.60	-4.516E-01	+	2.074E+00	1.33E+02 4.32E+01	G
Co-56	C	1.2590E-01					7.73E+01	
			846.77	9.410E-02	&(	5.109E-01	1.55E+02 9.99E+01	G
			1238.28	1.740E-01	?(	1.074E+00	1.75E+02 6.61E+01	G
			1037.84	-1.155E+00	+	5.254E+00	1.32E+02 1.41E+01	G
			1771.35	-1.101E+00	+	5.566E+00	1.43E+02 1.55E+01	A
CO-57	C	1.0873E+02					2.72E+02	
			122.06	-1.289E+02	&(	7.534E+02	1.75E+02 8.56E+01	G
			136.47	2.013E+03	?(	5.861E+03	8.77E+01 1.07E+01	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CO-58	C	-3.5568E-02					7.09E+01	
			810.78	-3.557E-02	&(	7.032E-01	5.61E+02	9.95E+01 G
CO-60	F	-1.1036E-02					1.93E+03	
			1332.50	-1.104E-02	%(P	2.251E+00	6.16E+01	1.00E+02 G
			1173.24	-3.413E-01	+ P	2.216E+00	6.12E+01	9.99E+01 G
ZN-65	F	7.3177E+01					2.44E+02	
			1115.55	7.318E+01	%(	2.935E+03	1.10E+03	5.06E+01 G
NB-94	I	-2.7319E-01					7.41E+06	
			702.63	-2.732E-01	?(	9.979E-01	1.09E+02	9.79E+01 G
			871.10	1.888E-01	+	5.585E-01	8.74E+01	9.99E+01 G
ZR-95	I	2.1748E+00					6.40E+01	
			756.73	2.175E+00	?(	1.353E+00	2.15E+01	5.45E+01 G
			724.20	-1.331E+00	-	2.880E+00	6.56E+01	4.42E+01 G
NB-95	I	1.5049E-01					6.40E+01	
			765.79	1.505E-01	&(	9.088E-01	1.77E+02	9.98E+01 G
RU-103	I	-1.2066E-01					3.93E+01	
			497.05	-1.207E-01	?(	7.136E-01	1.73E+02	9.09E+01 G
			610.30	5.616E+00	&	1.483E+01	7.93E+01	5.75E+00 GA
RH-106	I	5.3660E+02					3.74E+02	
			621.92	5.366E+02	?(	1.020E+03	5.80E+01	9.93E+00 G
			1050.36	-4.290E+02	-	5.837E+03	3.75E+02	1.56E+00 G
			511.86	3.293E+03	?	6.147E+02	7.70E+00	2.00E+01 GA
AG-108M	C	8.4814E-02					1.53E+05	
			433.94	5.273E-02	?(	7.027E-01	3.88E+02	9.05E+01 G
			722.94	1.168E-01	&(	8.415E-01	2.09E+02	9.08E+01 G
			614.28	-1.044E-01	+	9.693E-01	2.72E+02	8.98E+01 G
AG-110M	F	6.1406E+02					2.50E+02	
			884.68	1.766E+02	&(	1.591E+03	2.55E+02	7.27E+01 G
			657.76	-6.467E+01	&	2.330E+03	1.06E+03	9.46E+01 G
			937.49	-1.128E+02	+	3.192E+03	7.80E+02	3.44E+01 G
			1384.30	3.537E+02	?(	5.871E+03	4.56E+02	2.43E+01 G
			763.94	2.325E+03	?(	7.366E+03	9.43E+01	2.23E+01 G
SN-113	F	3.6501E-01					1.15E+02	
			391.69	3.650E-01	?(	1.007E+00	8.28E+01	6.40E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
SB-124	F	5.7981E-01					6.02E+01	
			602.73	2.635E-01	&(	7.972E-01	9.03E+01	9.83E+01 G
			1690.98	-4.710E-01	+	1.990E+00	1.22E+02	4.78E+01 G
			722.79	3.454E+00	&(	5.518E+00	4.96E+01	1.08E+01 G
SB-125	I	4.2882E+01					1.01E+03	
			427.88	2.624E+00	&(	1.456E+01	1.64E+02	2.96E+01 G
			600.50	-5.906E+00	+	2.896E+01	1.45E+02	1.79E+01 G
			635.89	8.507E+00	(	4.606E+01	1.59E+02	1.13E+01 G
			463.37	1.938E+02	(	4.479E+01	9.08E+00	1.05E+01 G
I-131	I	3.2706E-01					8.02E+00	
			364.48	3.271E-01	?(	7.327E-01	6.77E+01	8.17E+01 G
			284.30	-3.870E+00	&	1.122E+01	8.72E+01	6.14E+00 G
			636.97	-9.754E-02	%	1.050E+01	3.09E+03	7.17E+00 G
Gd-153	F	-1.0230E+03					2.42E+02	
			97.50	-1.023E+03	&(	6.195E+03	1.81E+02	3.00E+01 G
			103.20	-1.903E+02	%	8.509E+03	1.33E+03	2.18E+01 G
Ga-68	C	7.2989E+00					4.71E-02	
			1077.40	7.299E+00	?(	2.661E+01	1.06E+02	3.30E+00 G
Tc-99m	I	9.3044E-02					2.51E-01	
			140.51	9.304E-02	&(	7.862E-01	2.52E+02	8.93E+01 G
BA-133	F	-3.4734E-01					3.85E+03	
			356.00	-3.473E-01	?(	1.785E+00	1.52E+02	6.20E+01 G
			302.85	-4.631E+00	+	7.713E+00	5.08E+01	1.83E+01 G
			383.84	0.000E+00	+	1.326E+01	1.00E+03	8.94E+00 GA
			80.99	1.418E+00	?	4.269E+00	9.08E+01	3.41E+01 GA
CS-134	I	2.3846E+01					7.54E+02	
			604.71	7.434E-01	&(	1.083E+01	4.25E+02	9.76E+01 G
			795.87	4.035E+01	?(	9.423E+00	1.04E+01	8.55E+01 G
			569.32	-2.171E+00	&	6.447E+01	8.62E+02	1.54E+01 G
			801.95	2.377E+01	&(	8.906E+01	1.10E+02	8.69E+00 G
			563.24	1.250E+02	&(	1.016E+02	2.66E+01	8.35E+00 G
CS-137	I	-3.1382E-01					1.10E+04	
			661.66	-3.138E-01	?(P	1.351E+00	3.79E+02	8.52E+01 G
CE-139	F	7.1267E-02					1.38E+02	
			165.85	7.127E-02	?(	7.888E-01	3.29E+02	7.99E+01 G

Nuclide		Ave activity	Energy		Activity	Code	Peak	MDA	Comments
Ba-140	I	-4.3131E-01						1.28E+01	
			537.26	-4.313E-01	?(	2.970E+00	2.02E+02	2.44E+01	G
			162.66	-5.977E-01	&	1.032E+01	5.13E+02	6.22E+00	G
			304.85	3.221E-03	&	1.567E+01	1.43E+05	4.29E+00	G
La-140	I	1.7887E+00						1.28E+01	
			1596.21	-1.362E-01	?(	9.247E-01	1.91E+02	9.54E+01	G
			487.02	0.000E+00	+	1.610E+00	1.00E+03	4.55E+01	G
			328.76	1.217E+01	?(	3.240E+00	9.84E+00	2.03E+01	G
			815.77	6.264E-01	?(	2.950E+00	1.37E+02	2.33E+01	G
CE-141	I	-7.0982E-03						3.25E+01	
			145.44	-7.098E-03	%(	1.133E+00	4.72E+03	4.82E+01	G
CE-144	I	-1.9962E+03						2.85E+02	
			133.54	-1.996E+03	?(	4.360E+03	6.62E+01	1.11E+01	G
PM-144	C	2.9974E+01						3.63E+02	
			696.54	2.156E+01	?(	1.130E+02	1.52E+02	9.90E+01	G
			618.06	3.838E+01	&(	1.495E+02	1.16E+02	9.91E+01	G
			476.81	4.523E+00	%	2.962E+02	1.90E+03	4.20E+01	G
EU-152	F	-1.7608E-01						4.94E+03	
			344.29	-1.160E+00	?(	3.904E+00	1.01E+02	2.65E+01	G
			1112.07	0.000E+00	&	1.015E+01	1.00E+03	1.36E+01	G
			121.78	-2.468E-01	&	2.699E+00	3.25E+02	2.86E+01	G
			778.92	-1.419E+00	+	1.048E+01	2.16E+02	1.29E+01	G
			964.11	1.609E+00	?(	2.252E+01	4.15E+02	1.46E+01	G
			244.69	-4.340E+00	+	1.266E+01	8.78E+01	7.58E+00	G
			1408.00	3.892E-01	?	4.547E+00	3.18E+02	2.10E+01	GA
EU-154	I	-2.8988E-01						3.14E+03	
			873.23	-2.191E+00	?(	1.027E+01	1.36E+02	1.23E+01	G
			123.10	3.779E-01	+	2.710E+00	2.14E+02	4.08E+01	G
			1274.54	2.857E-01	+	3.405E+00	3.28E+02	3.52E+01	G
			723.36	-6.489E-01	&	2.105E+01	9.66E+02	2.02E+01	G
			1004.77	3.704E-01	+	6.336E+00	4.75E+02	1.80E+01	G
			996.33	1.911E+00	?(	9.870E+00	1.47E+02	1.06E+01	G
EU-155	I	1.7286E+01						1.81E+03	
			105.31	1.729E+01	(	8.248E+00	2.10E+01	2.12E+01	G
			86.54	1.729E+01	}	8.068E+00	1.43E+01	3.07E+01	G
HF-181	F	4.2307E-01						4.24E+01	
			482.00	3.553E-01	?(	7.539E-01	6.43E+01	8.05E+01	G
			133.02	1.860E-02	%	1.492E+00	2.38E+03	4.33E+01	G
			345.83	-4.451E-01	&	4.403E+00	2.91E+02	1.51E+01	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
			136.30	1.356E+00	?(	9.789E+00	2.15E+02	5.85E+00 G
Ta-182	F	-1.8548E-01					1.14E+02	
			1121.30	-4.173E-01	?(	2.228E+00	1.54E+02	3.49E+01 G
			1221.41	-1.290E-02	%	2.580E+00	5.44E+03	2.70E+01 G
			1189.05	3.139E-01	?(	3.656E+00	3.19E+02	1.62E+01 G
Hg-203	F	7.8913E-03					4.66E+01	
			279.20	7.891E-03	%(	7.871E-01	2.93E+03	8.15E+01 G
TL-208	N	2.8712E+02					6.98E+02	
			583.02	2.871E+02	(P	1.308E+01	3.63E+00	8.45E+01 G
			277.28	3.566E+02	+	1.558E+02	2.15E+01	6.31E+00 G
			860.56	3.898E+02	+	6.671E+01	1.17E+01	1.24E+01 G
pm-146	C	1.0274E+00					2.02E+03	
			747.16	0.000E+00	?(	7.717E+00	1.00E+03	3.40E+01 G
			735.72	2.872E+00	&(	8.702E+00	9.02E+01	2.25E+01 G
			453.88	9.262E-01	&(	2.563E+00	8.30E+01	6.50E+01 G
y-88	F	3.8149E-02					1.07E+02	
			898.04	3.815E-02	&(	7.485E-01	5.54E+02	9.37E+01 G
			1836.06	-7.447E-02	+	9.417E-01	3.47E+02	9.92E+01 G
Cd-109	F	4.3609E+02					4.53E+02	
			88.04	4.361E+02	(	1.720E+03	1.19E+02	3.79E+00 G
PB-210	N	1.4796E+01					8.14E+03	
			46.54	1.480E+01	(	5.874E+01	1.19E+02	4.25E+00 G
PB-212	N	9.0455E+02					6.98E+02	
			238.63	9.046E+02	(P	1.944E+01	1.75E+00	4.33E+01 G
			300.03	9.071E+02	P	2.655E+02	1.38E+01	3.28E+00 GA
PB-214	N	4.7896E-01					5.84E+05	
			351.93	5.595E-01	?(	1.795E+00	9.60E+01	3.76E+01 G
			295.09	3.220E-01	(	3.354E+00	3.07E+02	1.93E+01 G
			242.00	-1.491E+01	+	1.467E+01	3.04E+01	7.43E+00 GA
BI-207	C	4.4136E-01					1.18E+04	
			569.70	3.878E-01	&(	9.831E-01	7.63E+01	9.77E+01 G
			1063.66	5.116E-01	(	1.171E+00	6.90E+01	7.45E+01 G
BI-212	N	8.9631E+02					6.98E+02	
			727.17	8.963E+02	(	1.254E+02	7.28E+00	7.55E+00 G
			785.42	3.444E+02	-	8.325E+02	7.27E+01	1.28E+00 GA

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
BI-214	N	8.2995E-01					5.84E+05	
			609.31	8.300E-01	&(	1.776E+00	6.48E+01	4.61E+01 G
			1120.29	-1.001E+00	-	5.267E+00	1.52E+02	1.51E+01 G
			1764.49	1.908E-01	-	5.237E+00	7.35E+02	1.54E+01 G
BI-210M	T	1.7695E-02					1.10E+09	
			265.83	1.769E-02	%(	1.196E+00	1.98E+03	5.00E+01 G
			304.90	2.201E-02	&	2.399E+00	3.20E+03	2.80E+01 G
RA-224	N	9.6504E+02					6.98E+02	
			240.99	9.650E+02	(	4.254E+02	1.41E+01	4.10E+00 G
AC-228	N	1.9818E+02					2.10E+03	
			911.16	1.971E+02	(P	4.295E+00	3.12E+00	2.90E+01 G
			968.97	1.788E+02	- P	9.947E+00	4.66E+00	1.75E+01 G
			338.32	2.009E+02	(P	9.373E+00	3.31E+00	1.20E+01 G
			93.35	1.233E+02	- P	3.135E+01	8.77E+00	5.56E+00 XA
TH-227	N	-3.8228E+01					7.95E+03	
			235.97	-3.823E+01	&(	3.504E+00	5.08E+00	1.23E+01 G
			50.14	-1.502E+00	&	2.728E+01	5.40E+02	8.00E+00 G
			256.24	-9.334E-01	+	1.166E+01	3.69E+02	7.00E+00 G
TH-229	N	1.2286E-01					2.68E+06	
			193.51	1.229E-01	%(	1.211E+01	2.90E+03	4.40E+00 G
			210.85	-4.449E+00	&	2.618E+01	1.76E+02	2.99E+00 G
TH-234	N	2.2459E+01					1.63E+12	
			63.29	2.246E+01	(P	2.950E+01	3.29E+01	3.81E+00 G
			92.59	4.886E+00	- P	1.580E+01	3.08E+01	5.58E+00 G
PA-231	N	-1.5835E+01					1.20E+07	
			302.65	-1.583E+01	?(	3.020E+01	5.80E+01	2.88E+00 G
			300.07	6.897E+01	+	2.847E+01	1.40E+01	2.46E+00 G
PA-233	C	3.9804E+00					7.82E+08	
			312.01	0.000E+00	?(	1.962E+00	1.00E+03	3.60E+01 G
			300.18	2.709E+01	(	1.141E+01	1.42E+01	6.20E+00 G
PA-234	N	-2.2931E+00					1.63E+12	
			131.29	-2.293E+00	?(	4.134E+00	5.48E+01	1.80E+01 G
			946.02	-4.073E-01	+	5.138E+00	3.56E+02	1.34E+01 G
			569.47	-3.609E+00	&	9.528E+00	7.93E+01	8.20E+00 G
			883.24	1.042E+00	+	5.874E+00	1.61E+02	9.60E+00 G
			880.53	-1.665E+00	+	1.090E+01	1.88E+02	6.00E+00 GA

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PA-234M	N	-1.5147E+01					1.63E+12	
			1001.00	-1.515E+01	%(P	1.029E+02	1.00E+03	8.37E-01 G
			766.41	-1.714E+01	% P	3.616E+02	1.00E+03	2.94E-01 G
U-235	N	9.1332E-01					2.57E+11	
			143.79	3.886E-01	(P	4.459E+00	1.32E+02	1.10E+01 G
			205.33	2.061E+00	(P	9.589E+00	1.22E+02	5.01E+00 G
			163.38	-4.047E-01	% P	1.193E+01	3.93E+03	5.08E+00 G
AM-241	T	7.8937E-02					1.58E+05	
			59.54	7.894E-02	&(P	4.183E+00	1.50E+02	3.59E+01 G
Ir-192	F	-1.3636E-02					7.40E+01	
			316.49	-1.364E-02	%(	6.418E-01	1.37E+03	8.70E+01 G
			468.06	-2.518E-01	+	1.461E+00	1.71E+02	5.18E+01 G
			308.44	0.000E+00	+	2.162E+00	1.00E+03	3.18E+01 G
			295.95	-1.719E-01	+	1.858E+00	3.18E+02	3.02E+01 G
Cs-136	F	-7.2578E-03					1.30E+01	
			818.50	-7.258E-03	%(	7.313E-01	2.85E+03	1.00E+02 G
			1048.07	-8.793E-02	+	7.787E-01	2.48E+02	8.00E+01 G
			340.57	-1.985E-01	&	1.948E+00	2.92E+02	4.69E+01 G
Np-239	T	3.3115E+00					2.36E+00	
			103.70	-1.499E-01	-	3.091E+00	6.14E+02	2.40E+01 X
			106.13	3.312E+00	(	3.036E+00	2.85E+01	2.27E+01 G
			99.50	4.672E+00		4.624E+00	3.07E+01	1.50E+01 X
Nd-147		-1.8054E+00					1.11E+01	
			531.00	-1.805E+00	(	6.086E+00	1.01E+02	1.30E+01 G
			91.10	6.435E-02	%	3.356E+00	1.56E+03	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	46.65	616.	30.	0.008	119.14	1.480E+01
TH-227	50.42	639.	-7.	-0.002	540.18	-1.502E+00
BA-133	80.91	752.	43.	0.012	90.78	1.418E+00
Gd-153	97.40	744.	-21.	-0.006	181.23	-1.023E+03
EU-152	120.18	430.	-9.	-0.003	324.60	-2.468E-01
CO-57	122.16	613.	-20.	-0.006	174.80	-1.289E+02
EU-154	123.47	576.	16.	0.004	214.01	3.779E-01
PA-234	130.45	887.	-78.	-0.022	54.84	-2.293E+00
CE-144	134.11	665.	-56.	-0.016	66.18	-1.996E+03
HF-181	135.50	519.	15.	0.004	215.22	0.000E+00
CO-57	136.90	586.	40.	0.011	87.73	2.013E+03
Tc-99m	140.38	698.	15.	0.004	252.24	0.000E+00
Ba-140	162.89	605.	-7.	-0.002	513.16	0.000E+00
CE-139	165.97	576.	10.	0.003	329.41	0.000E+00
TH-229	211.49	640.	-20.	-0.006	175.93	-4.449E+00
TH-227	232.66	96.	-528.	-0.147	5.08	-3.823E+01
PB-214	242.47	1025.	-154.	-0.043	30.41	-1.491E+01
EU-152	243.48	358.	-31.	-0.009	87.75	-4.340E+00
TH-227	256.01	322.	-7.	-0.002	369.17	-9.334E-01
I-131	285.27	317.	-30.	-0.008	87.18	0.000E+00
PB-214	294.05	261.	7.	0.002	307.28	3.220E-01
Ir-192	293.77	194.	-6.	-0.002	317.54	0.000E+00
PA-231	300.19	302.	203.	0.056	14.01	6.897E+01
PA-231	302.37	465.	-54.	-0.015	57.98	-1.583E+01
BA-133	302.34	461.	-62.	-0.017	50.83	-4.631E+00
La-140	327.98	230.	275.	0.077	9.84	0.000E+00
Cs-136	340.39	429.	-10.	-0.003	291.51	0.000E+00
EU-152	343.32	248.	-23.	-0.006	100.73	-1.160E+00
HF-181	345.39	216.	-7.	-0.002	291.21	0.000E+00
PB-214	351.82	216.	22.	0.006	96.03	5.595E-01
BA-133	356.26	216.	-14.	-0.004	152.44	-3.473E-01
I-131	366.15	160.	28.	0.008	67.73	0.000E+00

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
SN-113	392.02	166.	23.	0.006	82.80	0.000E+00		
SB-125	427.90	153.	11.	0.003	163.69	2.624E+00		
AG-108M	433.53	133.	4.	0.001	388.06	5.273E-02		
pm-146	452.85	135.	21.	0.006	82.95	9.262E-01		
SB-125	462.94	160.	267.	0.074	9.08	1.938E+02		
Ir-192	468.09	173.	-11.	-0.003	171.33	0.000E+00		
BE-7	478.41	123.	38.	0.011	44.42	0.000E+00		
HF-181	483.80	104.	24.	0.007	64.30	0.000E+00		
RU-103	497.13	114.	-9.	-0.002	173.49	0.000E+00		
RH-106	510.66	164.	334.	0.093	7.70	3.293E+03		
Nd-147	531.35	154.	-18.	-0.005	100.53	0.000E+00		
Ba-140	539.19	125.	-8.	-0.002	201.77	0.000E+00		
CS-134	562.43	106.	62.	0.017	26.57	1.250E+02		
CS-134	569.32	145.	-2.	-0.001	862.43	-2.171E+00		
PA-234	572.61	133.	-21.	-0.006	79.28	-3.609E+00		
BI-207	570.04	146.	23.	0.006	76.26	3.878E-01		
SB-125	599.43	126.	-11.	-0.003	144.63	-5.906E+00		
SB-124	603.29	121.	18.	0.005	90.35	0.000E+00		
CS-134	604.87	149.	4.	0.001	424.81	7.434E-01		
BI-214	610.02	129.	26.	0.007	64.82	8.300E-01		
RU-103	610.09	142.	22.	0.006	79.31	0.000E+00		
AG-108M	614.65	143.	-6.	-0.002	271.71	-1.044E-01		
PM-144	619.31	128.	14.	0.004	115.55	3.838E+01		
RH-106	619.51	78.	23.	0.006	58.00	5.366E+02		
SB-125	635.43	116.	10.	0.003	159.14	8.507E+00		
CS-137	661.69	161.	-14.	-0.004	378.65	-3.138E-01		P
PM-144	692.56	57.	7.	0.002	152.32	2.156E+01		
NB-94	702.72	147.	-16.	-0.004	108.66	-2.732E-01		
SB-124	719.23	49.	22.	0.006	49.55	0.000E+00		
AG-108M	720.25	81.	6.	0.002	209.32	1.168E-01		
EU-154	723.36	842.	-4.	-0.001	966.38	-6.489E-01		
ZR-95	724.45	241.	-35.	-0.010	65.55	0.000E+00		
pm-146	735.23	82.	15.	0.004	90.22	2.872E+00		
ZR-95	755.27	71.	67.	0.019	21.45	0.000E+00		
AG-110M	763.48	98.	15.	0.004	94.31	2.325E+03		
NB-95	765.54	108.	8.	0.002	176.91	0.000E+00		
EU-152	778.80	109.	-7.	-0.002	215.59	-1.419E+00		
CS-134	794.83	51.	154.	0.043	10.38	4.035E+01		
CS-134	802.65	46.	9.	0.003	109.84	2.377E+01		
CO-58	812.71	56.	-2.	-0.001	561.35	0.000E+00		
La-140	816.24	53.	8.	0.002	137.10	0.000E+00		
Co-56	845.57	26.	5.	0.001	154.64	0.000E+00		
NB-94	871.05	30.	9.	0.003	87.38	1.888E-01		
EU-154	873.05	47.	-7.	-0.002	136.23	-2.191E+00		
PA-234	879.34	41.	-5.	-0.001	187.57	-1.665E+00		
PA-234	884.50	30.	5.	0.001	160.87	1.042E+00		
AG-110M	884.44	35.	3.	0.001	254.91	1.766E+02		
Sc-46	889.03	39.	3.	0.001	321.51	0.000E+00		

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
y-88	898.44	46.	2.	0.000	553.65	0.000E+00		
AG-110M	935.98	28.	-1.	0.000	779.85	-1.128E+02		
PA-234	945.75	40.	-3.	-0.001	356.20	-4.073E-01		
EU-152	965.36	466.	7.	0.002	415.34	1.609E+00		
EU-154	995.49	24.	5.	0.001	147.21	1.911E+00		
EU-154	1004.25	29.	2.	0.000	474.92	3.704E-01		
Co-56	1035.73	39.	-7.	-0.002	131.88	0.000E+00		
Cs-136	1048.56	26.	-3.	-0.001	248.17	0.000E+00		
RH-106	1050.39	23.	-2.	-0.001	375.42	-4.290E+02		
BI-207	1064.14	38.	14.	0.004	68.99	5.116E-01		
Ga-68	1078.30	28.	7.	0.002	106.17	0.000E+00		
BI-214	1120.52	39.	-6.	-0.002	151.64	-1.001E+00		
Sc-46	1120.35	40.	-6.	-0.002	152.48	0.000E+00		
Ta-182	1120.39	37.	-6.	-0.002	153.62	0.000E+00		
CO-60	1173.52	40.	-5.	-0.001	61.16	-3.413E-01	P	
Ta-182	1188.79	18.	2.	0.001	319.17	0.000E+00		
Co-56	1238.38	25.	4.	0.001	174.72	0.000E+00		
NA-22	1271.64	17.	1.	0.000	441.06	2.778E-01		
EU-154	1271.64	20.	2.	0.001	327.73	2.857E-01		
FE-59	1292.34	38.	-7.	-0.002	133.00	0.000E+00		
AG-110M	1384.28	23.	1.	0.000	456.07	3.537E+02		
EU-152	1408.30	16.	2.	0.001	318.02	3.892E-01		
K-40	1458.98	22.	5.	0.001	42.91	1.516E+00	P	
La-140	1596.16	24.	-4.	-0.001	191.25	0.000E+00		
SB-124	1688.15	25.	-6.	-0.002	121.75	0.000E+00		
BI-214	1764.67	16.	1.	0.000	734.84	1.908E-01		
Co-56	1770.50	18.	-4.	-0.001	143.09	0.000E+00		
y-88	1837.43	20.	-2.	-0.001	347.49	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 1 Sigma Counting		MDA Bq/Sample
BE-7	#A	4.3262E+00	>12 Halflives	4.4415E+01%	6.2025E+00	
NA-22	#A	3.8209E-02	2.7783E-01	4.411E+02%		4.51E+00
K-40	#A	1.5163E+00	1.5163E+00	1.225E+02%		7.26E+00
Sc-46	#A	5.6765E-02	>12 Halflives	3.2151E+02%	6.4577E-01	
CR-51	#A	-7.6665E-02	>12 Halflives	2.1714E+03%	5.7182E+00	
MN-54	#A	4.1626E-01	1.7430E+02	4.235E+01%		2.31E+02
FE-59	#A	3.3269E-03	>12 Halflives	1.0341E+04%	1.2502E+00	
Co-56	#A	1.2590E-01	>12 Halflives	1.1666E+02%	5.1093E-01	
CO-57	#A	1.0553E-01	1.0873E+02	8.773E+01%		7.53E+02
CO-58	#A	-3.5568E-02	>12 Halflives	5.6135E+02%	7.0325E-01	
CO-60	#A	-4.1446E-03	-1.1036E-02	5.179E+03%		2.25E+00
ZN-65	#A	3.2514E-02	7.3177E+01	1.100E+03%		2.93E+03

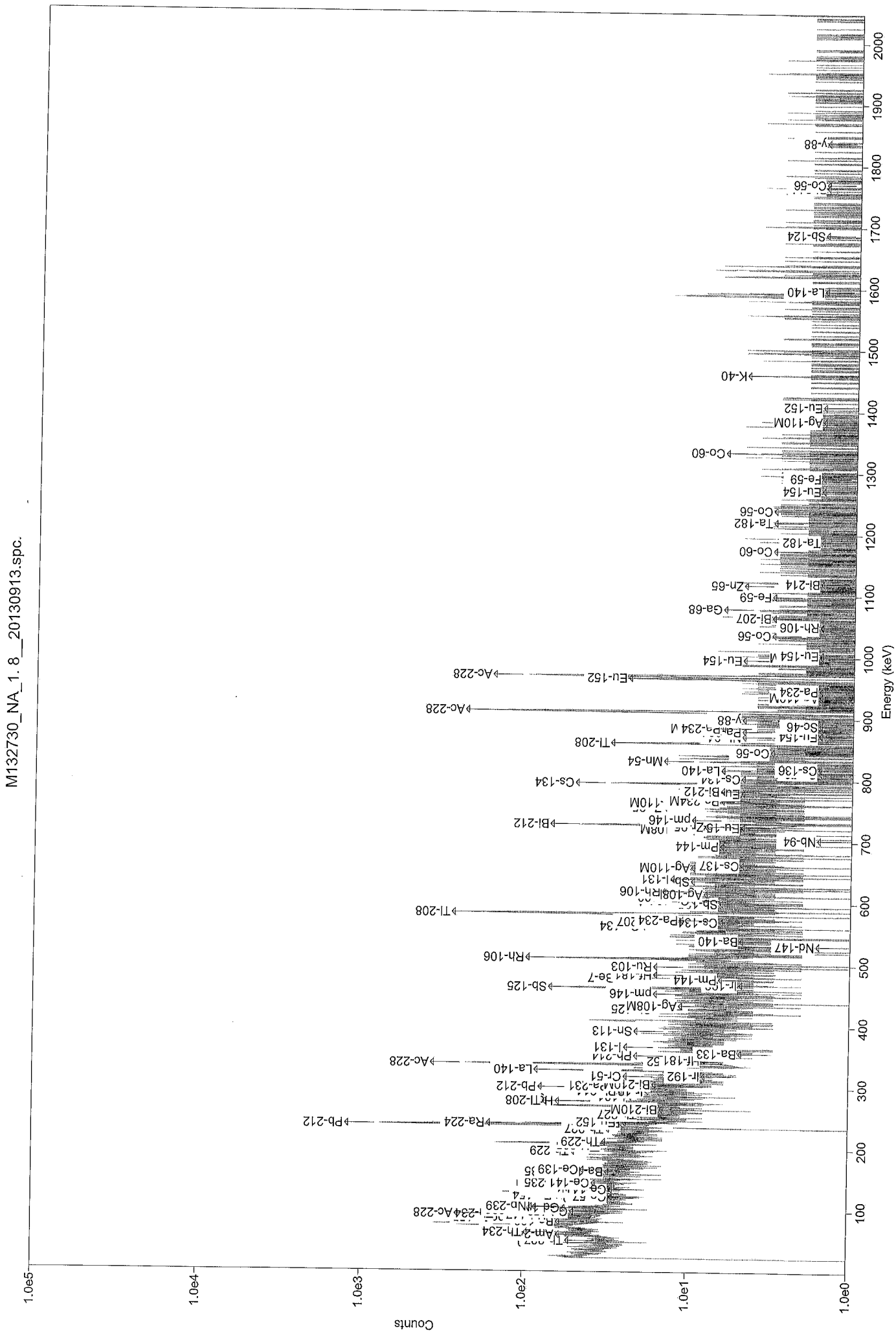
NB-94	#A	-2.7312E-01	-2.7319E-01	1.087E+02%		9.98E-01
ZR-95	#	2.1748E+00	>12 Halflives	2.1451E+01%	1.3526E+00	
NB-95	#A	1.5049E-01	>12 Halflives	1.7691E+02%	9.0878E-01	
RU-103	#A	-1.2066E-01	>12 Halflives	1.7349E+02%	7.1364E-01	
RH-106	#A	3.4503E+00	5.3660E+02	5.800E+01%		1.02E+03
AG-108M	#A	8.3773E-02	8.4814E-02	2.093E+02%		7.03E-01
AG-110M	#A	3.2339E-01	6.1406E+02	9.431E+01%		1.59E+03
SN-113	#A	3.6501E-01	>12 Halflives	8.2796E+01%	1.0068E+00	
SB-124	#A	5.7981E-01	>12 Halflives	4.9551E+01%	7.9721E-01	
SB-125	#C	6.5987E+00	4.2882E+01	9.080E+00%		1.46E+01
I-131	#A	3.2706E-01	>12 Halflives	6.7734E+01%	7.3268E-01	
Gd-153	#A	-4.1683E-01	-1.0230E+03	1.812E+02%		6.19E+03
Ga-68	#A	7.2989E+00	>12 Halflives	1.0617E+02%	2.6615E+01	
Tc-99m	#A	9.3044E-02	>12 Halflives	2.5224E+02%	7.8618E-01	
BA-133	#A	-2.1284E-01	-3.4734E-01	1.524E+02%		1.79E+00
CS-134	#C	1.9572E+00	2.3846E+01	1.038E+01%		1.08E+01
CS-137	#A	-2.6421E-01	-3.1382E-01	8.756E+02%		1.35E+00
CE-139	#A	7.1267E-02	>12 Halflives	3.2941E+02%	7.8876E-01	
Ba-140	#A	-4.3131E-01	>12 Halflives	2.0177E+02%	2.9696E+00	
La-140	#C	1.7887E+00	>12 Halflives	9.8428E+00%	9.2466E-01	
CE-141	#A	-7.0982E-03	>12 Halflives	4.7197E+03%	1.1333E+00	
CE-144	#A	-2.6675E+00	-1.9962E+03	6.618E+01%		4.36E+03
PM-144	#A	1.6635E-01	2.9974E+01	9.559E+01%		1.13E+02
EU-152	#A	-1.2025E-01	-1.7608E-01	1.007E+02%		3.90E+00
EU-154	#A	-1.5897E-01	-2.8988E-01	1.003E+02%		1.03E+01
EU-155	#	6.1053E+00	1.7286E+01	2.103E+01%		8.25E+00
HF-181	#A	4.2307E-01	>12 Halflives	6.4295E+01%	7.5392E-01	
Ta-182	#A	-1.8548E-01	>12 Halflives	1.5362E+02%	2.2278E+00	
Hg-203	#A	7.8913E-03	>12 Halflives	2.9275E+03%	7.8710E-01	
TL-208		1.9244E+01	2.8712E+02	3.649E+00%		1.31E+01
pm-146	#A	4.0396E-01	1.0274E+00	8.295E+01%		7.72E+00
y-88	#A	3.8149E-02	>12 Halflives	5.5365E+02%	7.4851E-01	
Cd-109	A	6.8143E+00	4.3609E+02	1.187E+02%		1.72E+03
PB-210	#A	1.1738E+01	1.4796E+01	1.191E+02%		5.87E+01
PB-212		6.0626E+01	9.0455E+02	1.756E+00%		1.94E+01
PB-214	#A	4.7741E-01	4.7896E-01	9.603E+01%		1.79E+00
BI-207	#A	3.7598E-01	4.4136E-01	5.142E+01%		9.83E-01
BI-212		6.0074E+01	8.9631E+02	7.279E+00%		1.25E+02
BI-214	#A	8.2728E-01	8.2995E-01	6.482E+01%		1.78E+00
BI-210M	#A	1.7695E-02	1.7695E-02	1.983E+03%		1.20E+00
RA-224		6.4681E+01	9.6504E+02	1.414E+01%		4.25E+02
AC-228		8.0754E+01	1.9818E+02	2.285E+00%		4.29E+00
TH-227	#A	-3.0158E+01	-3.8228E+01	5.082E+00%		3.50E+00
TH-229	#A	1.2277E-01	1.2286E-01	2.901E+03%		1.21E+01
TH-234	A	2.2459E+01	2.2459E+01	5.113E+01%		2.95E+01
PA-231	#A	-1.5832E+01	-1.5835E+01	5.798E+01%		3.02E+01
PA-233	C	3.9804E+00	3.9804E+00	1.424E+01%		1.96E+00
PA-234	#A	-2.2931E+00	-2.2931E+00	5.484E+01%		4.13E+00
PA-234M	#A	-1.5147E+01	-1.5147E+01	2.000E+03%		1.03E+02

U-235	A	9.1332E-01	9.1332E-01	1.627E+02%		4.46E+00
AM-241	#A	7.8001E-02	7.8937E-02	1.568E+03%		4.18E+00
Np-237	#A	0.0000E+00	0.0000E+00	0.000E+00%		6.98E+00
Ir-192	#A	-1.3636E-02	>12 Halflives	1.3706E+03%	6.4178E-01	
Cs-136	#A	-7.2578E-03	>12 Halflives	2.8491E+03%	7.3129E-01	
Np-239	C	3.3115E+00	>12 Halflives	2.8547E+01%	3.0361E+00	
Nd-147	#A	-1.8054E+00	>12 Halflives	1.0053E+02%	6.0861E+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 (763.3 to 2000.0 keV) 3.139E+02 Bq/Sample
Total Decayed Activity (763.3 to 2000.0 keV) 3.2909561E+03 Bq/Sample


M132730_NA_1.8__20130913.spc.
Counts
Energy (keV)
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Ac-228
Pb-212
Ra-224
Th-229
Ba-140
Nd-147
Rh-106
Sb-125
Pm-146
Sn-113
Ac-228
La-140
Pb-212
Cr-51
Ba-133
Ac-228
Bi-212
Cs-134
Mn-54
Co-56
Tl-208
Sc-46
Eu-154
Eu-152
Ac-228
Eu-154
Co-56
Rh-106
Bi-207
Ga-68
Fe-59
Bi-214
Zn-65
Co-60
Ta-182
Co-56
Eu-154
Fe-59
Co-60
Ag-110M
Eu-152
K-40
La-140
Sb-124
Co-56
y-88

Test America St. Louis Spectrum ID: 7_NA_20131033

Sample Description: M132730_NA_2
Detector: Ge 7 SN/154
Batch ID: M132730
Work Order Number: NA
Lot Number: 2

Decay to Time: 2/3/2006 12:00 Live Time: 3600 sec
Acquisition Time: 7/16/2013 17:54:35 Real Time: 3673 sec
Analysis Time: 7/17/2013 08:39 Dead Time: 1.98 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 7_Liquid_Marinelli 0.5L.Clb
Efficiency Cal Desc: 7_0.5LMarn_83925-334_050211
Efficiency Cal Date: 5/2/2011 10:46
Energy Cal Date: 2/23/2012 08:40
Library: Client_Routine Long_Rev4.lib
Bkgd Correction File: 7_2013-07-06_0324.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
NA-22	-2.383E-01	545.5	1.300E+00	1.300E+00	4.790E+00
K-40	-3.523E+00	556.2	1.959E+01	1.959E+01	9.752E+00
MN-54	1.965E+00	5955.0	1.170E+02	1.170E+02	4.075E+02
CO-57	-5.725E+01	293.1	1.678E+02	1.678E+02	5.638E+02
CO-60	-3.465E-01	180.3	6.247E-01	6.250E-01	2.202E+00
ZN-65	0.000E+00	1000.0	3.214E+02	3.214E+02	5.839E+03
NB-94	-1.519E-01	170.7	2.593E-01	2.594E-01	8.840E-01
RH-106	1.667E+02	92.2	1.537E+02	1.539E+02	1.265E+03
AG-108M	6.220E-02	210.8	1.311E-01	1.312E-01	6.168E-01
AG-110M	2.694E+02	168.7	4.545E+02	4.546E+02	1.856E+03
SB-125	5.809E+01	8.4	4.875E+00	5.622E+00	1.276E+01
Gd-153	0.000E+00	1000.0	7.768E+02	7.768E+02	4.408E+03
BA-133	-9.468E-02	424.8	4.022E-01	4.022E-01	1.381E+00
CS-134	2.272E+01	10.8	2.459E+00	2.696E+00	9.800E+00
CS-137	2.096E-01	166.4	3.487E-01	3.488E-01	1.186E+00
CE-144	7.745E+01	1303.0	1.009E+03	1.009E+03	3.401E+03
PM-144	2.555E+01	121.8	3.112E+01	3.114E+01	1.331E+02
EU-152	-2.170E-01	171.5	3.722E-01	3.723E-01	3.665E+00
EU-154	1.946E+00	163.6	3.184E+00	3.185E+00	1.100E+01
EU-155	1.394E+01	16.9	2.361E+00	2.473E+00	5.613E+00
TL-208	2.643E+02	3.9	1.038E+01	1.652E+01	1.419E+01
pm-146	9.464E-01	203.8	1.929E+00	1.930E+00	6.606E+00
Cd-109	7.491E+02	44.6	3.339E+02	3.362E+02	1.093E+03
PB-210	7.975E+00	66.3	5.283E+00	5.308E+00	1.438E+01
PB-212	8.556E+02	1.7	1.474E+01	4.833E+01	1.751E+01
PB-214	3.882E-01	96.4	3.743E-01	3.748E-01	1.578E+00
BI-207	4.132E-01	56.3	2.328E-01	2.336E-01	7.618E-01
BI-212	1.092E+03	9.1	9.948E+01	1.128E+02	1.530E+02
BI-214	-4.349E-01	112.2	4.881E-01	4.885E-01	1.647E+00
BI-210M	2.163E-02	1482.0	3.205E-01	3.205E-01	1.093E+00
RA-224	7.709E+02	12.0	9.272E+01	1.015E+02	2.773E+02
AC-228	1.898E+02	2.4	4.583E+00	1.024E+01	4.022E+00
TH-227	-2.253E+00	379.2	8.544E+00	8.545E+00	2.830E+01
TH-229	9.293E-01	345.7	3.213E+00	3.213E+00	1.031E+01
TH-234	-1.342E+00	809.6	1.087E+01	1.087E+01	1.862E+01
PA-231	2.776E+01	11.7	3.233E+00	3.513E+00	2.746E+01
PA-233	4.477E+00	11.7	5.214E-01	5.660E-01	1.550E+00

PA-234	-2.591E+00	40.3	1.044E+00	1.052E+00	3.405E+00
PA-234M	6.285E+00	321.1	2.018E+01	2.019E+01	7.255E+01
U-235	-1.559E+00	94.4	1.471E+00	1.473E+00	4.887E+00
AM-241	1.639E-01	346.1	5.673E-01	5.673E-01	1.898E+00
Np-237	0.000E+00	0.0	1.468E+00	1.468E+00	4.921E+00
Total	4.609E+03				

Analyst: Micha Korrinhizer

TestAmerica Spectrum name: 7_NA_20131033.An1

Sample description
M132730_NA_2

Spectrum Filename: C:\User\SPC\Det7\7_NA_20131033.An1

Acquisition information

Start time:	7/16/2013 5:54:35 PM
Live time:	3600
Real time:	3673
Dead time:	1.98 %
Detector ID:	7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Liquid_Marinelli 0.5L.Clb
7_0.5LMarn_83925-334_050211

Energy Calibration

Created:	2/23/2012 8:40:56 AM
Zero offset:	0.117 keV
Gain:	0.250 keV/channel
Quadratic:	3.508E-09 keV/channel^2

Efficiency Calibration

Created:	5/2/2011 10:46:17 AM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 1.05 %
Log(Eff):	3.617098E-01 + (-4.516868E-01*Log(E)) + (-3.479132E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.63 %
Log(Eff):	-1.406192E+01 + (5.002862E+00*Log(E)) + (-5.499353E-01*Log(E)^2)

Library Files

Main analysis library:	Client_Routine Long_Rev4.lib
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters

Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (2000.12keV)
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

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	2/3/2006 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	7_2013-07-06_0324.PBC 7/6/2013 3:24:27 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 49 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 334.3665

***** 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
46.44	50.	40.45	0.48	5.183E-02	46.54	4.250	PBC<MDA	PB210
59.48	13.	346.08	0.85	6.073E-02	59.54	35.900	PBC<MDA	AM241
63.70	-12.	199.97	0.85	6.252E-02	63.29	3.810	PBC<MDA	TH234
					63.29	3.810	PBC<MDA	TH234
74.84	1359.	4.05	0.87	6.628E-02				
77.16	2207.	2.64	0.87	6.677E-02				
84.33	149.	23.83	0.88	6.781E-02				
86.54	370.	17.11	0.88	6.800E-02	86.49	13.100	1.155E+01	Np237
					86.54	30.700	1.394E+01	EU155
87.22	693.	6.14	0.88	6.805E-02				
88.02	109.	44.57	0.88	6.811E-02	88.04	3.790	PBC<MDA	Cd109
89.98	622.	6.40	0.88	6.820E-02				
93.30	858.	6.85	0.90	6.829E-02	92.59	5.584	5.917E+01	TH234
					93.35	5.561	1.540E+02	AC228
					92.59	5.584	5.917E+01	TH234
99.51	188.	20.51	1.09	6.819E-02	99.50	15.000	HL>Cutoff	Np239
105.17	248.	16.65	1.25	6.787E-02	105.31	21.200	1.358E+01	EU155
					106.13	22.700	HL>Cutoff	Np239
116.99	23.	77.65	0.29	6.660E-02				
129.01	481.	9.50	0.92	6.475E-02				
131.96	30.	104.25	0.93	6.404E-02	133.02	43.300	HL>Cutoff	HF181
145.79	48.	72.01	0.94	6.166E-02	145.44	48.200	HL>Cutoff	CE141
165.98	4.	856.17	0.96	5.751E-02	165.85	79.900	HL>Cutoff	CE139
191.41	6.	406.70	0.99	5.074E-02	193.51	4.400	PBC<MDA	TH229
209.26	555.	8.10	0.95	4.758E-02				
210.86	6.	559.18	1.01	4.728E-02	210.85	2.990	PBC<MDA	TH229
238.69	3832.	1.71	1.04	4.267E-02	238.63	43.300	8.557E+02	PB212
241.13	323.	12.15	1.04	4.231E-02	240.99	4.100	7.709E+02	RA224

					242.00	7.430	2.870E+01 PB214
270.38	465.	9.07	0.89	3.844E-02			
277.80	228.	15.55	1.10	3.757E-02	277.28	6.310	3.971E+02 TL208
					279.20	81.460	HL>Cutoff Hg203
294.59	39.	55.86	0.55	3.576E-02	295.09	19.300	1.564E+00 PB214
					295.09	19.300	1.564E+00 PB214

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
295.05	3.	729.92	1.10	3.562E-02	295.09	19.300	PBC<MDA	PB214
					295.95	30.160	HL>Cutoff	Ir192
					295.95	30.160	HL>Cutoff	Ir192
300.30	249.	14.98	1.05	3.518E-02	300.03	3.280	8.950E+02	PB212
					300.07	2.460	7.999E+01	PA231
					300.18	6.200	3.174E+01	PA233
					300.07	2.460	7.999E+01	PA231
					300.18	6.200	3.174E+01	PA233
307.99	9.	241.66	1.11	3.439E-02	308.44	31.750	HL>Cutoff	Ir192
					308.44	31.750	HL>Cutoff	Ir192
310.86	5.	382.35	1.12	3.405E-02	312.01	36.000	PBC<MDA	PA233
					312.01	36.000	1.190E-01	PA233
317.14	18.	123.28	1.12	3.364E-02	316.49	87.040	HL>Cutoff	Ir192
					316.49	87.040	HL>Cutoff	Ir192
328.05	305.	10.27	1.32	3.263E-02	328.76	20.300	HL>Cutoff	La140
					328.76	20.300	HL>Cutoff	La140
338.40	1094.	3.61	1.25	3.177E-02	338.32	12.010	1.955E+02	AC228
346.84	25.	78.38	1.15	3.118E-02	345.83	15.070	HL>Cutoff	HF181
352.25	20.	96.43	1.16	3.072E-02	351.93	37.600	PBC<MDA	PB214
					351.93	37.600	4.893E-01	PB214
391.36	14.	142.08	1.20	2.801E-02	391.69	64.000	HL>Cutoff	SN113
409.44	186.	16.20	1.09	2.695E-02				
427.22	21.	78.20	1.23	2.594E-02	427.88	29.600	PBC<MDA	SB125
					427.88	29.600	4.901E+00	SB125
436.81	7.	210.81	1.24	2.562E-02	433.94	90.480	PBC<MDA	AG108M
					433.94	90.480	8.543E-02	AG108M
463.00	317.	10.32	1.23	2.420E-02	463.37	10.470	2.261E+02	SB125
					463.37	10.470	2.261E+02	SB125
467.24	19.	83.85	1.27	2.397E-02	468.06	51.750	HL>Cutoff	Ir192
					468.06	51.750	HL>Cutoff	Ir192
477.60	2.	945.21	1.28	2.355E-02	477.60	10.520	HL>Cutoff	BE7
					476.81	42.000	9.195E+00	PM144
498.47	9.	170.93	1.30	2.274E-02	497.05	90.900	HL>Cutoff	RU103
510.76	422.	8.35	1.65	2.220E-02	511.86	20.000	4.111E+03	RH106
					511.86	20.000	4.111E+03	RH106
562.46	54.	33.98	1.36	2.035E-02	563.24	8.350	PBC<MDA	CS134
					563.24	8.350	1.081E+02	CS134
572.34	25.	56.33	1.37	2.014E-02	569.47	8.200	4.194E+00	PA234
					569.70	97.740	4.132E-01	BI207
					569.32	15.380	2.724E+01	CS134
					569.47	8.200	4.194E+00	PA234
583.17	1063.	3.93	1.35	1.972E-02	583.02	84.500	2.643E+02	TL208
601.72	18.	81.51	1.40	1.915E-02	602.73	98.260	HL>Cutoff	SB124
604.90	8.	197.08	1.40	1.909E-02	604.71	97.620	PBC<MDA	CS134
					604.71	97.620	1.457E+00	CS134
614.38	2.	734.69	1.41	1.883E-02	614.28	89.850	PBC<MDA	AG108M
					614.28	89.850	3.880E-02	AG108M
617.84	13.	121.82	1.42	1.872E-02	618.06	99.100	PBC<MDA	PM144
					618.06	99.100	3.521E+01	PM144
636.51	19.	75.00	1.43	1.822E-02	636.97	7.170	HL>Cutoff	I131
					635.89	11.310	1.670E+01	SB125
661.67	10.	166.38	1.46	1.761E-02	661.66	85.210	PBC<MDA	CS137
693.08	5.	242.73	1.49	1.681E-02	696.54	99.000	PBC<MDA	PM144
					696.54	99.000	1.587E+01	PM144
727.18	322.	9.11	1.59	1.616E-02	727.17	7.550	1.092E+03	BI212
749.20	7.	203.84	1.53	1.577E-02	747.16	34.000	PBC<MDA	pm146
					747.16	34.000	9.464E-01	pm146

778.41	3.	403.30	1.56	1.518E-02	778.92	12.940	PBC<MDA EU152
783.39	26.	49.66	1.57	1.506E-02	785.42	1.280	PBC<MDA BI212
794.77	145.	10.83	1.58	1.488E-02	795.87	85.530	3.864E+01 CS134
					795.87	85.530	3.864E+01 CS134
819.57	11.	103.80	1.60	1.451E-02	818.50	100.000	HL>Cutoff Cs136
860.45	134.	11.32	1.42	1.385E-02	860.56	12.420	3.229E+02 TL208
871.74	2.	501.64	1.64	1.370E-02	871.10	99.890	PBC<MDA NB94
873.54	6.	163.57	1.64	1.367E-02	873.23	12.270	PBC<MDA EU154
880.60	4.	231.86	1.65	1.356E-02	880.53	6.000	PBC<MDA PA234
					880.53	6.000	1.429E+00 PA234
883.97	2.	567.15	1.65	1.352E-02	883.24	9.600	PBC<MDA PA234
911.22	1076.	3.22	1.67	1.314E-02	911.16	29.000	1.925E+02 AC228
969.02	576.	5.40	1.75	1.241E-02	968.97	17.460	1.812E+02 AC228
1000.31	2.	321.14	1.75	1.204E-02	1001.00	0.837	PBC<MDA PA234M
1051.35	8.	92.22	1.79	1.151E-02	1050.36	1.560	PBC<MDA RH106
					1050.36	1.560	1.822E+03 RH106
1078.34	11.	75.38	1.81	1.124E-02	1077.40	3.300	HL>Cutoff Ga68
1120.51	8.	95.10	1.85	1.083E-02	1120.55	99.987	HL>Cutoff Sc46
					1121.30	34.900	HL>Cutoff Ta182

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
1120.58	9.	82.48	1.85	1.083E-02	1120.55	99.987	HL>Cutoff	Sc46
					1121.30	34.900	HL>Cutoff	Ta182
1220.46	4.	157.52	1.92	9.987E-03	1221.41	27.000	HL>Cutoff	Ta182
1292.14	2.	435.55	1.98	9.472E-03	1291.60	43.200	HL>Cutoff	FE59
1383.46	4.	168.71	2.04	8.867E-03	1384.30	24.290	PBC<MDA	AG110M

********** 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
298.95	74.85	1206.	1142.	1.722E+04	6.29	0.865 -	
308.22	77.16	959.	1970.	2.950E+04	3.17	0.859 -	
336.85	84.34	555.	148.	2.185E+03	23.94	0.877 -	D
348.39	87.23	614.	636.	9.344E+03	6.79	0.880 -	D
359.44	89.99	480.	623.	9.132E+03	6.39	0.883 -	D
397.63	99.51	560.	40.	5.880E+02	84.94	1.094 -	c
467.55	116.99	148.	23.	3.453E+02	77.65	0.294 -	c
515.64	129.01	331.	587.	9.061E+03	6.02	0.915 -	sM
836.70	209.26	290.	529.	1.111E+04	6.30	1.011 -	D
1081.17	270.38	254.	465.	1.209E+04	6.71	0.888 -	s
1177.98	294.59	133.	34.	9.492E+02	51.04	0.554 -	s
1311.86	328.05	410.	52.	1.588E+03	56.99	1.322 -	
1637.43	409.44	130.	186.	6.883E+03	16.20	1.087 -	sM
1851.70	463.00	438.	25.	1.024E+03	121.11	1.226 -	sc
2042.74	510.76	467.	103.	4.652E+03	31.19	1.651 -	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: Client_Routine Long_Rev4.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	185.31	46.44	355.	50.	0.014	40.45	0.477s
AM-241	237.49	59.48	961.	13.	0.004	346.08	0.850s
TH-234	254.36	63.70	1135.	-12.	-0.003	199.97	0.854s
EU-155	345.74	86.54	802.	370.	0.103	17.11	0.880D
Cd-109	351.73	88.04	1120.	109.	0.030	44.57	0.881D
Nd-147	355.40	88.96	760.	-41.	-0.012	95.31	0.885s
TH-234	371.77	93.05	1314.	-76.	-0.021	166.02	0.886s
AC-228	372.78	93.30	648.	858.	0.238	6.85	0.902s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Np-239	397.04	99.37	649.	148.	0.041	25.65	0.894
Gd-153	412.68	103.28	858.	-65.	-0.018	65.38	0.898s
EU-155	420.28	105.17	460.	255.	0.071	16.94	1.280s
Np-239	420.83	105.31	578.	163.	0.045	22.23	0.901
EU-152	496.34	124.19	320.	-6.	-0.002	461.21	0.918s
CO-57	488.11	122.13	541.	-11.	-0.003	293.10	0.918s
EU-154	491.10	122.88	543.	-8.	-0.002	394.29	0.919s
PA-234	521.26	130.42	893.	-108.	-0.030	40.29	0.928s
HF-181	527.41	131.96	462.	30.	0.008	104.25	0.930
CO-57	547.39	136.95	616.	-8.	-0.002	424.90	0.934s
Tc-99m	560.21	140.16	572.	-23.	-0.007	145.44	0.938s
U-235	575.14	143.89	628.	-38.	-0.011	94.36	0.941s
CE-141	582.77	145.79	567.	48.	0.013	72.01	0.943s
U-235	646.44	161.71	380.	-8.	-0.002	340.80	0.962s
CE-139	663.53	165.98	479.	4.	0.001	856.17	0.965s
TH-229	765.24	191.41	295.	6.	0.002	406.70	0.994s
U-235	822.14	205.63	485.	-18.	-0.005	170.91	1.007s
TH-229	843.02	210.85	576.	6.	0.002	559.18	1.012D
TH-227	943.50	235.97	8248.	-34.	-0.009	379.19	1.039s
PB-212	954.15	238.63	261.	3815.	1.060	1.72	1.041D
RA-224	963.57	240.99	592.	323.	0.090	12.03	1.044D
PB-214	969.50	242.47	866.	-130.	-0.036	33.16	1.045s
EU-152	979.31	244.92	318.	-8.	-0.002	308.47	1.048s
TH-227	1022.75	255.78	283.	-21.	-0.006	112.87	1.060s
TL-208	1110.74	277.78	235.	227.	0.063	16.00	1.103s
Hg-203	1109.82	277.55	203.	160.	0.044	14.87	1.083
I-131	1139.88	285.06	295.	-8.	-0.002	292.50	1.089
PB-214	1178.99	294.84	225.	5.	0.001	450.58	1.100s
Ir-192	1179.84	295.05	202.	3.	0.001	729.92	1.100s
PB-212	1200.84	300.30	246.	249.	0.069	14.98	1.049
PA-231	1200.53	300.22	254.	234.	0.065	11.65	1.105
PA-233	1200.53	300.22	254.	234.	0.065	11.65	1.105
PA-231	1209.25	302.40	431.	-46.	-0.013	65.86	1.107s
BA-133	1206.80	301.79	428.	-57.	-0.016	53.21	1.108s
Ir-192	1231.61	307.99	214.	9.	0.002	241.66	1.113s
PA-233	1243.09	310.86	199.	5.	0.001	382.35	1.117s
Ir-192	1268.19	317.14	226.	18.	0.005	123.28	1.121s
CR-51	1276.24	319.15	252.	-22.	-0.006	101.99	1.125s
La-140	1312.12	328.12	215.	254.	0.070	10.32	1.134s
AC-228	1353.24	338.40	132.	1094.	0.304	3.61	1.253
Cs-136	1360.53	340.22	745.	-132.	-0.037	30.55	1.146s
EU-152	1380.57	345.23	239.	-13.	-0.004	171.54	1.150s
HF-181	1387.00	346.84	183.	25.	0.007	78.38	1.151
PB-214	1408.65	352.25	181.	20.	0.006	96.43	1.157s
BA-133	1432.21	358.14	138.	-4.	-0.001	424.80	1.161s
I-131	1456.37	364.18	195.	-16.	-0.004	129.17	1.170
BA-133	1535.81	384.04	203.	-8.	-0.002	244.46	1.189s
SN-113	1565.12	391.36	194.	14.	0.004	142.08	1.197s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
SB-125	1708.56	427.22	122.	21.	0.006	78.20	1.233s
AG-108M	1746.92	436.81	107.	7.	0.002	210.81	1.239s
SB-125	1852.11	463.11	155.	292.	0.081	8.39	1.268
Ir-192	1868.63	467.24	115.	19.	0.005	83.85	1.272
BE-7	1910.07	477.60	147.	2.	0.001	945.21	1.282
HF-181	1925.22	481.38	142.	-4.	-0.001	465.48	1.286
La-140	1951.64	487.99	147.	-18.	-0.005	100.43	1.291s
RU-103	1993.56	498.47	122.	9.	0.003	170.93	1.300
RH-106	2042.93	510.81	177.	318.	0.088	8.15	1.315s
Nd-147	2134.36	533.66	88.	-3.	-0.001	411.42	1.333s
CS-134	2249.54	562.46	143.	54.	0.015	33.98	1.364s
CS-134	2272.15	568.11	144.	-14.	-0.004	120.79	1.369s
BI-207	2289.09	572.34	86.	25.	0.007	56.33	1.370s
TL-208	2332.37	583.17	136.	1063.	0.295	3.93	1.352
SB-125	2399.21	599.87	149.	-15.	-0.004	116.08	1.399s
SB-124	2406.58	601.72	95.	18.	0.005	81.51	1.401s
CS-134	2419.33	604.90	121.	8.	0.002	197.08	1.403s
BI-214	2427.34	606.91	110.	-14.	-0.004	112.24	1.407s
RU-103	2449.85	612.53	131.	-4.	-0.001	436.41	1.408
AG-108M	2457.23	614.38	146.	2.	0.001	734.69	1.412s
PM-144	2471.06	617.84	120.	13.	0.004	121.82	1.415s
RH-106	2487.60	621.97	122.	-4.	-0.001	393.50	1.419s
SB-125	2537.71	634.50	131.	-22.	-0.006	77.47	1.432s
I-131	2545.75	636.51	93.	19.	0.005	75.00	1.433
AG-110M	2632.62	658.22	142.	-11.	-0.003	153.83	1.452s
CS-137	2646.39	661.67	121.	10.	0.003	166.38	1.455s
PM-144	2772.03	693.08	79.	5.	0.001	242.73	1.487s
NB-94	2810.42	702.67	112.	-9.	-0.002	170.70	1.493s
SB-124	2893.96	723.56	242.	-36.	-0.010	63.48	1.511s
AG-108M	2893.96	723.56	242.	-36.	-0.010	63.47	1.511s
EU-154	2894.40	723.67	276.	-43.	-0.012	57.39	1.511s
BI-212	2908.47	727.18	82.	322.	0.089	9.11	1.591s
pm-146	2941.78	735.51	105.	-10.	-0.003	146.43	1.523s
pm-146	2996.53	749.20	104.	7.	0.002	203.84	1.533s
ZR-95	3027.33	756.90	139.	-9.	-0.002	192.94	1.541
NB-95	3061.39	765.41	104.	-4.	-0.001	346.40	1.549s
EU-152	3113.38	778.41	75.	3.	0.001	403.30	1.561
BI-212	3133.29	783.39	71.	26.	0.007	49.66	1.567s
CS-134	3178.83	794.77	51.	145.	0.040	10.83	1.576s
CO-58	3244.95	811.30	57.	-1.	0.000	869.03	1.589s
La-140	3257.45	814.43	54.	-4.	-0.001	288.17	1.593s
Cs-136	3278.00	819.57	57.	11.	0.003	103.80	1.596s
TL-208	3441.54	860.45	24.	134.	0.037	11.32	1.421
NB-94	3486.70	871.74	55.	2.	0.001	501.64	1.641s
EU-154	3493.92	873.54	52.	6.	0.002	163.57	1.643s
PA-234	3522.16	880.60	45.	4.	0.001	231.86	1.649s
PA-234	3535.60	883.97	43.	2.	0.000	567.15	1.651s
y-88	3585.20	896.36	56.	-12.	-0.003	91.50	1.664s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
AC-228	3644.61	911.22	18.	1076.	0.299	3.22	1.672
PA-234	3784.01	946.07	38.	-5.	-0.001	185.74	1.704s
AC-228	3875.82	969.02	65.	576.	0.160	5.40	1.754
PA-234M	4000.98	1000.31	26.	2.	0.001	321.14	1.750s
Cs-136	4186.60	1046.71	26.	-6.	-0.002	134.83	1.788s
RH-106	4205.13	1051.35	21.	8.	0.002	92.22	1.790s
Ga-68	4313.11	1078.34	29.	11.	0.003	75.38	1.812s
FE-59	4398.96	1099.81	33.	-5.	-0.001	171.96	1.829s
BI-214	4466.56	1116.70	24.	-3.	-0.001	265.05	1.845s
Sc-46	4481.78	1120.51	25.	8.	0.002	95.10	1.845s
Ta-182	4482.06	1120.58	21.	9.	0.002	82.48	1.846s
CO-60	4694.51	1173.69	39.	-9.	-0.002	106.53	1.887s
Ta-182	4881.58	1220.46	21.	4.	0.001	157.52	1.923s
Co-56	4953.63	1238.48	35.	-5.	-0.001	177.93	1.936s
NA-22	5110.04	1277.58	18.	-1.	0.000	545.52	1.963s
EU-154	5109.02	1277.33	19.	-1.	0.000	551.76	1.963s
FE-59	5168.30	1292.14	26.	2.	0.000	435.55	1.975s
CO-60	5324.87	1331.29	28.	-4.	-0.001	180.31	2.005s
AG-110M	5533.54	1383.46	23.	4.	0.001	168.71	2.042s
K-40	5850.15	1462.61	38.	-11.	-0.003	312.46	2.095s
La-140	6383.49	1595.96	44.	-7.	-0.002	138.14	2.185s
SB-124	6767.76	1692.03	19.	-1.	0.000	661.83	2.245s
BI-214	7049.61	1762.50	22.	-1.	0.000	462.82	2.290s
Co-56	7085.14	1771.39	24.	-4.	-0.001	187.75	2.294s
y-88	7334.87	1833.82	25.	-6.	-0.002	130.99	2.332s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
BE-7	C	2.0395E-01					5.31E+01	
			477.60	2.040E-01	(	6.637E+00	9.45E+02 1.05E+01	G
NA-22	C	-2.3827E-01					9.50E+02	
			1274.53	-2.383E-01	?(	4.790E+00	5.46E+02 9.99E+01	G
K-40	N	-3.5225E+00					4.66E+11	
			1460.83	-3.522E+00	?(P	9.752E+00	3.12E+02 1.07E+01	G
Sc-46	F	1.0256E-01					8.38E+01	
			889.28	0.000E+00	?(	8.896E-01	1.00E+03 1.00E+02	G
			1120.55	2.051E-01	?(	6.662E-01	9.51E+01 1.00E+02	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CR-51	F	-1.8862E+00					2.77E+01	
			320.08	-1.886E+00	&(	6.429E+00	1.02E+02	9.94E+00 G
MN-54	C	1.9647E+00					3.12E+02	
			834.85	1.965E+00	%(	4.075E+02	5.96E+03	1.00E+02 G
FE-59	F	-7.3611E-02					4.45E+01	
			1099.25	-2.173E-01	?(	1.309E+00	1.72E+02	5.65E+01 G
			1291.60	1.143E-01	?(	1.799E+00	4.36E+02	4.32E+01 G
CO-57	C	-5.7248E+01					2.72E+02	
			122.06	-5.725E+01	&(	5.638E+02	2.93E+02	8.56E+01 G
			136.47	-3.503E+02	&	5.003E+03	4.25E+02	1.07E+01 G
CO-58	C	-2.3539E-02					7.09E+01	
			810.78	-2.354E-02	?(	7.222E-01	8.69E+02	9.95E+01 G
CO-60	F	-3.4648E-01					1.93E+03	
			1332.50	-3.465E-01	?(	2.202E+00	1.80E+02	1.00E+02 G
			1173.24	-6.266E-01	+	2.280E+00	1.07E+02	9.99E+01 G
NB-94	I	-1.5191E-01					7.41E+06	
			702.63	-1.519E-01	?(	8.840E-01	1.71E+02	9.79E+01 G
			871.10	4.280E-02	+	7.557E-01	5.02E+02	9.99E+01 G
ZR-95	I	-2.8731E-01					6.40E+01	
			756.73	-2.873E-01	(	1.887E+00	1.93E+02	5.45E+01 G
			724.20	-1.020E-02	%	2.942E+00	8.45E+03	4.42E+01 G
NB-95	I	-7.5970E-02					6.40E+01	
			765.79	-7.597E-02	?(	9.074E-01	3.46E+02	9.98E+01 G
RU-103	I	1.2537E-01					3.93E+01	
			497.05	1.254E-01	(	7.295E-01	1.71E+02	9.09E+01 G
			610.30	-9.537E-01	+	1.431E+01	4.36E+02	5.75E+00 GA
RH-106	I	1.6669E+02					3.74E+02	
			621.92	-9.342E+01	?(	1.265E+03	3.94E+02	9.93E+00 G
			1050.36	1.822E+03	?(	5.742E+03	9.22E+01	1.56E+00 G
			511.86	3.104E+03	?	6.316E+02	8.15E+00	2.00E+01 GA
AG-108M	C	6.2199E-02					1.53E+05	
			433.94	8.543E-02	&(	6.168E-01	2.11E+02	9.05E+01 G
			722.94	-6.851E-01	&	1.434E+00	6.35E+01	9.08E+01 G
			614.28	3.880E-02	?(	9.807E-01	7.35E+02	8.98E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
AG-110M	F	2.6937E+02					2.50E+02	
			884.68	1.420E+01	%(	1.856E+03	3.66E+03	7.27E+01 G
			657.76	-3.515E+02	+	1.833E+03	1.54E+02	9.46E+01 G
			937.49	0.000E+00	-	4.687E+03	1.00E+03	3.44E+01 G
			1384.30	1.033E+03	?(	6.162E+03	1.69E+02	2.43E+01 G
			763.94	3.890E+01	&	5.421E+03	3.91E+03	2.23E+01 G
SN-113	F	2.1886E-01					1.15E+02	
			391.69	2.189E-01	?(	1.048E+00	1.42E+02	6.40E+01 G
SB-124	F	2.6042E-01					6.02E+01	
			602.73	2.604E-01	?(	7.089E-01	8.15E+01	9.83E+01 G
			1690.98	-7.574E-02	-	1.847E+00	6.62E+02	4.78E+01 G
			722.79	-5.684E+00	&	1.190E+01	6.35E+01	1.08E+01 G
SB-125	I	5.8085E+01					1.01E+03	
			427.88	4.901E+00	&(	1.276E+01	7.82E+01	2.96E+01 G
			600.50	-8.016E+00	-	3.133E+01	1.16E+02	1.79E+01 G
			635.89	-1.905E+01	&	4.910E+01	7.75E+01	1.13E+01 G
			463.37	2.084E+02	(	4.328E+01	8.39E+00	1.05E+01 G
I-131	I	1.6395E-01					8.02E+00	
			364.48	-1.779E-01	(	7.735E-01	1.29E+02	8.17E+01 G
			284.30	-1.027E+00	+	1.017E+01	2.92E+02	6.14E+00 G
			636.97	4.059E+00	(	1.013E+01	7.50E+01	7.17E+00 G
Ga-68	C	1.1087E+01					4.71E-02	
			1077.40	1.109E+01	&(	2.797E+01	7.54E+01	3.30E+00 G
Tc-99m	I	-1.2368E-01					2.51E-01	
			140.51	-1.237E-01	?(	6.010E-01	1.45E+02	8.93E+01 G
BA-133	F	-9.4678E-02					3.85E+03	
			356.00	-9.468E-02	?(	1.381E+00	4.25E+02	6.20E+01 G
			302.85	-4.019E+00	+	7.017E+00	5.32E+01	1.83E+01 G
			383.84	-1.482E+00	+	1.230E+01	2.44E+02	8.94E+00 GA
			80.99	-2.449E-02	%	2.591E+00	3.15E+03	3.41E+01 GA
CS-134	I	2.2716E+01					7.54E+02	
			604.71	1.457E+00	&(	9.800E+00	1.97E+02	9.76E+01 G
			795.87	3.864E+01	?(	9.576E+00	1.08E+01	8.55E+01 G
			569.32	-1.574E+01	+	6.411E+01	1.21E+02	1.54E+01 G
			801.95	0.000E+00	-	1.254E+02	1.00E+03	8.69E+00 G
			563.24	1.081E+02	(	1.164E+02	3.40E+01	8.35E+00 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CS-137	I	2.0956E-01					1.10E+04	
			661.66	2.096E-01	&(	1.186E+00	1.66E+02	8.52E+01 G
CE-139	F	2.1897E-02					1.38E+02	
			165.85	2.190E-02	?(	6.330E-01	8.56E+02	7.99E+01 G
Ba-140	I	-8.1972E-02					1.28E+01	
			537.26	-8.197E-02	&(	2.938E+00	1.04E+03	2.44E+01 G
			162.66	6.951E-02	&	7.697E+00	3.27E+03	6.22E+00 G
			304.85	-4.497E-03	&	1.082E+01	6.96E+04	4.29E+00 G
La-140	I	1.6500E+00					1.28E+01	
			1596.21	-2.654E-01	?(	1.265E+00	1.38E+02	9.54E+01 G
			487.02	-4.639E-01	+	1.563E+00	1.00E+02	4.55E+01 G
			328.76	1.065E+01	?(	2.987E+00	1.03E+01	2.03E+01 G
			815.77	-2.999E-01	-	3.022E+00	2.88E+02	2.33E+01 G
CE-141	I	4.4612E-01					3.25E+01	
			145.44	4.461E-01	(	1.062E+00	7.20E+01	4.82E+01 G
CE-144	I	7.7445E+01					2.85E+02	
			133.54	7.745E+01	%(	3.401E+03	1.30E+03	1.11E+01 G
PM-144	C	2.5545E+01					3.63E+02	
			696.54	1.587E+01	?(	1.331E+02	2.43E+02	9.90E+01 G
			618.06	3.521E+01	&(	1.449E+02	1.22E+02	9.91E+01 G
			476.81	-5.869E+00	%	2.577E+02	1.27E+03	4.20E+01 G
EU-152	F	-2.1697E-01					4.94E+03	
			344.29	-6.332E-01	&(	3.665E+00	1.72E+02	2.65E+01 G
			1112.07	0.000E+00	+	9.651E+00	1.00E+03	1.36E+01 G
			121.78	-1.190E-01	&	1.859E+00	4.61E+02	2.86E+01 G
			778.92	6.355E-01	(	8.922E+00	4.03E+02	1.29E+01 G
			964.11	-4.768E-01	%	2.096E+01	1.30E+03	1.46E+01 G
			244.69	-1.057E+00	&	1.102E+01	3.08E+02	7.58E+00 G
			1408.00	0.000E+00	+	9.388E+00	1.00E+03	2.10E+01 GA
EU-154	I	1.9463E+00					3.14E+03	
			873.23	1.946E+00	?(	1.100E+01	1.64E+02	1.23E+01 G
			123.10	-1.585E-01	-	2.102E+00	3.94E+02	4.08E+01 G
			1274.54	-1.712E-01	-	3.473E+00	5.52E+02	3.52E+01 G
			723.36	-6.556E+00	+	1.236E+01	5.74E+01	2.02E+01 G
			1004.77	4.239E-02	%	6.072E+00	3.90E+03	1.80E+01 G
			996.33	0.000E+00	-	1.722E+01	1.00E+03	1.06E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak MDA	Comments
EU-155	I	1.3943E+01				1.81E+03	
			105.31	1.394E+01	*(	5.613E+00 1.69E+01	2.12E+01 G
			86.54	1.394E+01	}	5.075E+00 1.71E+01	3.07E+01 G
HF-181	F	2.2314E-01				4.24E+01	
			482.00-5.374E-02		(	8.591E-01 4.65E+02	8.05E+01 G
			133.02	2.967E-01	(	1.030E+00 1.04E+02	4.33E+01 G
			345.83	1.491E+00	(	3.884E+00 7.84E+01	1.51E+01 G
			136.30-1.139E-01		%	8.820E+00 2.30E+03	5.85E+00 G
Ta-182	F	5.5384E-01				1.14E+02	
			1121.30	6.345E-01	?(	1.770E+00 8.25E+01	3.49E+01 G
			1221.41	4.495E-01	?(	2.502E+00 1.58E+02	2.70E+01 G
			1189.05-7.109E-02		%	4.220E+00 1.62E+03	1.62E+01 G
Hg-203	F	1.4574E+00				4.66E+01	
			279.20	1.457E+00	(	6.293E-01 1.49E+01	8.15E+01 G
TL-208	N	2.6430E+02				6.98E+02	
			583.02	2.643E+02	(	1.419E+01 3.93E+00	8.45E+01 G
			277.28	3.968E+02	+	1.293E+02 1.60E+01	6.31E+00 G
			860.56	3.229E+02	+	6.153E+01 1.13E+01	1.24E+01 G
pm-146	C	9.4639E-01				2.02E+03	
			747.16	9.464E-01	?(	6.606E+00 2.04E+02	3.40E+01 G
			735.72-1.990E+00		+	9.910E+00 1.46E+02	2.25E+01 G
			453.88	0.000E+00	-	2.919E+00 1.00E+03	6.50E+01 G
y-88	F	-2.7098E-01				1.07E+02	
			898.04-2.710E-01		?(	8.362E-01 9.15E+01	9.37E+01 G
			1836.06-2.374E-01		+	1.084E+00 1.31E+02	9.92E+01 G
Cd-109	F	7.4907E+02				4.53E+02	
			88.04	7.491E+02	(	1.093E+03 4.46E+01	3.79E+00 G
PB-210	N	7.9745E+00				8.14E+03	
			46.54	7.974E+00	*(P	1.438E+01 4.04E+01	4.25E+00 G
PB-212	N	8.5564E+02				6.98E+02	
			238.63	8.556E+02	(P	1.751E+01 1.72E+00	4.33E+01 G
			300.03	8.950E+02	+	2.719E+02 1.50E+01	3.28E+00 GA
PB-214	N	3.8821E-01				5.84E+05	
			351.93	4.893E-01	@(	1.578E+00 9.64E+01	3.76E+01 G
			295.09	1.912E-01	?(	2.934E+00 4.51E+02	1.93E+01 G
			242.00-1.157E+01		+	1.243E+01 3.32E+01	7.43E+00 GA

Nuclide		Ave activity	Energy		Activity	Code	Peak	MDA	Comments
BI-207	C	4.1319E-01						1.18E+04	
			569.70	4.132E-01	?(	7.618E-01	5.63E+01	9.77E+01	G
			1063.66	-2.972E-02	%	1.127E+00	1.05E+03	7.45E+01	G
BI-212	N	1.0921E+03						6.98E+02	
			727.17	1.092E+03	@(	1.530E+02	9.11E+00	7.55E+00	G
			785.42	5.613E+02	-	9.024E+02	4.97E+01	1.28E+00	GA
BI-214	N	-4.3485E-01						5.84E+05	
			609.31	-4.349E-01	(	1.647E+00	1.12E+02	4.61E+01	G
			1120.29	-4.604E-01	+	4.375E+00	2.65E+02	1.51E+01	G
			1764.49	-3.745E-01	&	6.318E+00	4.63E+02	1.54E+01	G
BI-210M	T	2.1629E-02						1.10E+09	
			265.83	2.163E-02	&(	1.093E+00	1.48E+03	5.00E+01	G
			304.90	1.417E-02	%	1.658E+00	3.39E+03	2.80E+01	G
RA-224	N	7.7093E+02						6.98E+02	
			240.99	7.709E+02	(	2.773E+02	1.20E+01	4.10E+00	G
AC-228	N	1.8975E+02						2.10E+03	
			911.16	1.925E+02	(	4.022E+00	3.22E+00	2.90E+01	G
			968.97	1.812E+02	(	1.267E+01	5.40E+00	1.75E+01	G
			338.32	1.955E+02	(	1.007E+01	3.61E+00	1.20E+01	G
			93.35	1.540E+02	-	2.178E+01	6.85E+00	5.56E+00	XA
TH-227	N	-2.2532E+00						7.95E+03	
			235.97	-2.253E+00	?(	2.830E+01	3.79E+02	1.23E+01	G
			50.14	-1.286E-01	&	9.088E+00	2.09E+03	8.00E+00	G
			256.24	-2.685E+00	&	1.014E+01	1.13E+02	7.00E+00	G
TH-229	N	9.2929E-01						2.68E+06	
			193.51	7.477E-01	&(	1.031E+01	4.07E+02	4.40E+00	G
			210.85	1.196E+00	(	2.252E+01	5.59E+02	2.99E+00	G
TH-234	N	-1.3421E+00						1.63E+12	
			63.29	-1.342E+00	?(P	1.862E+01	2.00E+02	3.81E+00	G
			92.59	-5.565E+00	+ P	1.250E+01	1.66E+02	5.58E+00	G
PA-231	N	2.7758E+01						1.20E+07	
			302.65	-1.263E+01	?(	2.746E+01	6.59E+01	2.88E+00	G
			300.07	7.505E+01	(	2.470E+01	1.16E+01	2.46E+00	G
PA-233	C	4.4771E+00						7.82E+08	
			312.01	1.190E-01	&(	1.550E+00	3.82E+02	3.60E+01	G
			300.18	2.978E+01	(	9.802E+00	1.16E+01	6.20E+00	G

Nuclide		Ave activity	Energy	Activity	Code	Peak MDA	Comments
PA-234	N	-2.5908E+00				1.63E+12	
			131.29	-2.591E+00	?(	3.405E+00	4.03E+01 1.80E+01 G
			946.02	-7.926E-01	+	5.147E+00	1.86E+02 1.34E+01 G
			569.47	2.953E-02	%	8.908E+00	8.69E+03 8.20E+00 G
			883.24	3.543E-01	&	7.139E+00	5.67E+02 9.60E+00 G
			880.53	1.429E+00	+	1.160E+01	2.32E+02 6.00E+00 GA
PA-234M	N	6.2850E+00				1.63E+12	
			1001.00	6.285E+00	?(	7.255E+01	3.21E+02 8.37E-01 G
			766.41	0.000E+00	-	3.146E+02	1.00E+03 2.94E-01 G
U-235	N	-1.5591E+00				2.57E+11	
			143.79	-1.559E+00	?(	4.887E+00	9.44E+01 1.10E+01 G
			205.33	-2.111E+00	+	1.209E+01	1.71E+02 5.01E+00 G
			163.38	-7.681E-01	&	8.836E+00	3.41E+02 5.08E+00 G
AM-241	T	1.6392E-01				1.58E+05	
			59.54	1.639E-01	&(	1.898E+00	3.46E+02 3.59E+01 G
Ir-192	F	2.5372E-01				7.40E+01	
			316.49	1.668E-01	(	6.904E-01	1.23E+02 8.70E+01 G
			468.06	4.208E-01	?(	1.178E+00	8.38E+01 5.18E+01 G
			308.44	2.198E-01	?(	1.802E+00	2.42E+02 3.18E+01 G
			295.95	7.144E-02	-	1.782E+00	7.30E+02 3.02E+01 G
Cs-136	F	2.0690E-01				1.30E+01	
			818.50	2.069E-01	&(	7.285E-01	1.04E+02 1.00E+02 G
			1048.07	-1.710E-01	-	8.037E-01	1.35E+02 8.00E+01 G
			340.57	-2.471E+00	+	2.434E+00	3.05E+01 4.69E+01 G
Np-239	T	2.9685E+00				2.36E+00	
			103.70	-5.754E-02	%	2.275E+00	1.18E+03 2.40E+01 X
			106.13	2.968E+00	(	2.085E+00	2.22E+01 2.27E+01 G
			99.50	4.051E+00		3.318E+00	2.57E+01 1.50E+01 X
Nd-147		-3.2343E-01				1.11E+01	
			531.00	-3.234E-01	?(	4.615E+00	4.11E+02 1.30E+01 G
			91.10	-5.964E-01	+	1.887E+00	9.53E+01 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	
AM-241	59.48	961.	13.	0.004	346.08	1.639E-01	
TH-234	63.70	1135.	-12.	-0.003	199.97	-1.342E+00	P
Nd-147	88.96	760.	-41.	-0.012	95.31	0.000E+00	
TH-234	93.05	1314.	-76.	-0.021	166.02	-5.565E+00	P
Gd-153	103.28	858.	-65.	-0.018	65.38	-2.969E+03	
CO-57	122.13	541.	-11.	-0.003	293.10	-5.725E+01	
EU-154	122.88	543.	-8.	-0.002	394.29	-1.585E-01	
PA-234	130.42	893.	-108.	-0.030	40.29	-2.591E+00	
CO-57	136.95	616.	-8.	-0.002	424.90	-3.503E+02	
Tc-99m	140.16	572.	-23.	-0.007	145.44	0.000E+00	
U-235	143.89	628.	-38.	-0.011	94.36	-1.559E+00	
CE-141	145.79	567.	48.	0.013	72.01	0.000E+00	
U-235	161.71	380.	-8.	-0.002	340.80	-7.681E-01	
CE-139	165.98	479.	4.	0.001	856.17	0.000E+00	
U-235	205.63	485.	-18.	-0.005	170.91	-2.111E+00	
TH-227	235.97	8248.	-34.	-0.009	379.19	-2.253E+00	
PB-214	242.47	866.	-130.	-0.036	33.16	-1.157E+01	
TH-227	255.78	283.	-21.	-0.006	112.87	-2.685E+00	
PB-214	294.84	225.	5.	0.001	450.58	1.912E-01	
Ir-192	295.05	202.	3.	0.001	729.92	0.000E+00	
PA-231	300.22	254.	234.	0.065	11.65	7.505E+01	
PA-233	300.22	254.	234.	0.065	11.65	2.978E+01	
PA-231	302.40	431.	-46.	-0.013	65.86	-1.263E+01	
BA-133	301.79	428.	-57.	-0.016	53.21	-4.019E+00	
Ir-192	307.99	214.	9.	0.002	241.66	0.000E+00	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
PA-233	310.86	199.	5.	0.001	382.35	1.190E-01	
Ir-192	317.14	226.	18.	0.005	123.28	0.000E+00	
CR-51	319.15	252.	-22.	-0.006	101.99	0.000E+00	
La-140	328.12	215.	254.	0.070	10.32	0.000E+00	
Cs-136	340.22	745.	-132.	-0.037	30.55	0.000E+00	
PB-214	352.25	181.	20.	0.006	96.43	4.893E-01	
BA-133	358.14	138.	-4.	-0.001	424.80	-9.468E-02	
BA-133	384.04	203.	-8.	-0.002	244.46	-1.482E+00	
SN-113	391.36	194.	14.	0.004	142.08	0.000E+00	
SB-125	427.22	122.	21.	0.006	78.20	4.901E+00	
AG-108M	436.81	107.	7.	0.002	210.81	8.543E-02	
SB-125	463.11	155.	292.	0.081	8.39	2.084E+02	
Ir-192	467.24	115.	19.	0.005	83.85	0.000E+00	
La-140	487.99	147.	-18.	-0.005	100.43	0.000E+00	
RH-106	510.81	177.	318.	0.088	8.15	3.104E+03	
Nd-147	533.66	88.	-3.	-0.001	411.42	0.000E+00	
CS-134	562.46	143.	54.	0.015	33.98	1.081E+02	
CS-134	568.11	144.	-14.	-0.004	120.79	-1.574E+01	
BI-207	572.34	86.	25.	0.007	56.33	4.132E-01	
SB-125	599.87	149.	-15.	-0.004	116.08	-8.016E+00	
SB-124	601.72	95.	18.	0.005	81.51	0.000E+00	
CS-134	604.90	121.	8.	0.002	197.08	1.457E+00	
BI-214	606.91	110.	-14.	-0.004	112.24	-4.349E-01	
AG-108M	614.38	146.	2.	0.001	734.69	3.880E-02	
PM-144	617.84	120.	13.	0.004	121.82	3.521E+01	
RH-106	621.97	122.	-4.	-0.001	393.50	-9.342E+01	
SB-125	634.50	131.	-22.	-0.006	77.47	-1.905E+01	
AG-110M	658.22	142.	-11.	-0.003	153.83	-3.515E+02	
CS-137	661.67	121.	10.	0.003	166.38	2.096E-01	
PM-144	693.08	79.	5.	0.001	242.73	1.587E+01	
NB-94	702.67	112.	-9.	-0.002	170.70	-1.519E-01	
SB-124	723.56	242.	-36.	-0.010	63.48	0.000E+00	
AG-108M	723.56	242.	-36.	-0.010	63.47	-6.851E-01	
EU-154	723.67	276.	-43.	-0.012	57.39	-6.556E+00	
pm-146	735.51	105.	-10.	-0.003	146.43	-1.990E+00	
pm-146	749.20	104.	7.	0.002	203.84	9.464E-01	
ZR-95	756.90	139.	-9.	-0.002	192.94	0.000E+00	
NB-95	765.41	104.	-4.	-0.001	346.40	0.000E+00	
CS-134	794.77	51.	145.	0.040	10.83	3.864E+01	
CO-58	811.30	57.	-1.	0.000	869.03	0.000E+00	
La-140	814.43	54.	-4.	-0.001	288.17	0.000E+00	
Cs-136	819.57	57.	11.	0.003	103.80	0.000E+00	
NB-94	871.74	55.	2.	0.001	501.64	4.280E-02	
EU-154	873.54	52.	6.	0.002	163.57	1.946E+00	
PA-234	880.60	45.	4.	0.001	231.86	1.429E+00	
PA-234	883.97	43.	2.	0.000	567.15	3.543E-01	
y-88	896.36	56.	-12.	-0.003	91.50	0.000E+00	
PA-234	946.07	38.	-5.	-0.001	185.74	-7.926E-01	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
PA-234M	1000.31	26.	2.	0.001	321.14	6.285E+00		
Cs-136	1046.71	26.	-6.	-0.002	134.83	0.000E+00		
RH-106	1051.35	21.	8.	0.002	92.22	1.822E+03		
Ga-68	1078.34	29.	11.	0.003	75.38	0.000E+00		
FE-59	1099.81	33.	-5.	-0.001	171.96	0.000E+00		
BI-214	1116.70	24.	-3.	-0.001	265.05	-4.604E-01		
Sc-46	1120.51	25.	8.	0.002	95.10	0.000E+00		
Ta-182	1120.58	21.	9.	0.002	82.48	0.000E+00		
CO-60	1173.69	39.	-9.	-0.002	106.53	-6.266E-01		
Ta-182	1220.46	21.	4.	0.001	157.52	0.000E+00		
Co-56	1238.48	35.	-5.	-0.001	177.93	0.000E+00		
NA-22	1277.58	18.	-1.	0.000	545.52	-2.383E-01		
EU-154	1277.33	19.	-1.	0.000	551.76	-1.712E-01		
FE-59	1292.14	26.	2.	0.000	435.55	0.000E+00		
CO-60	1331.29	28.	-4.	-0.001	180.31	-3.465E-01		
AG-110M	1383.46	23.	4.	0.001	168.71	1.033E+03		
K-40	1462.61	38.	-11.	-0.003	312.46	-3.522E+00	P	
La-140	1595.96	44.	-7.	-0.002	138.14	0.000E+00		
SB-124	1692.03	19.	-1.	0.000	661.83	0.000E+00		
BI-214	1762.50	22.	-1.	0.000	462.82	-3.745E-01		
Co-56	1771.39	24.	-4.	-0.001	187.75	0.000E+00		
y-88	1833.82	25.	-6.	-0.002	130.99	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 1 Sigma Counting		MDA Bq/Sample
BE-7	A	2.0395E-01	>12 Halflives	9.4521E+02%	6.6366E+00	
NA-22	#A	-3.2765E-02	-2.3827E-01	5.455E+02%		4.79E+00
K-40	#A	-3.5225E+00	-3.5225E+00	5.562E+02%		9.75E+00
Sc-46	#A	1.0256E-01	>12 Halflives	9.5098E+01%	8.8964E-01	
CR-51	#A	-1.8862E+00	>12 Halflives	1.0199E+02%	6.4294E+00	
MN-54	#A	4.6904E-03	1.9647E+00	5.955E+03%		4.07E+02
FE-59	#A	-7.3611E-02	>12 Halflives	1.7196E+02%	1.3086E+00	
Co-56	#A	0.0000E+00	>12 Halflives	1.0000E+03%	9.7025E-01	
CO-57	#A	-5.5544E-02	-5.7248E+01	2.931E+02%		5.64E+02
CO-58	#A	-2.3539E-02	>12 Halflives	8.6903E+02%	7.2216E-01	
CO-60	#A	-1.3011E-01	-3.4648E-01	1.803E+02%		2.20E+00
ZN-65	#A	0.0000E+00	0.0000E+00	1.000E+03%		5.84E+03
NB-94	#A	-1.5187E-01	-1.5191E-01	1.707E+02%		8.84E-01
ZR-95	#A	-2.8731E-01	>12 Halflives	1.9294E+02%	1.8871E+00	
NB-95	#A	-7.5970E-02	>12 Halflives	3.4640E+02%	9.0743E-01	
RU-103	A	1.2537E-01	>12 Halflives	1.7093E+02%	7.2949E-01	
RH-106	#A	1.0715E+00	1.6669E+02	9.222E+01%		1.26E+03
AG-108M	#A	6.1436E-02	6.2199E-02	2.108E+02%		6.17E-01

AG-110M#A	1.4181E-01	2.6937E+02	1.687E+02%		1.86E+03
SN-113 #A	2.1886E-01	>12 Halflives	1.4208E+02%	1.0485E+00	
SB-124 #A	2.6042E-01	>12 Halflives	8.1505E+01%	7.0890E-01	
SB-125 #C	8.9374E+00	5.8085E+01	8.393E+00%		1.28E+01
I-131 A	1.6395E-01	>12 Halflives	7.4684E+01%	7.7351E-01	
Gd-153 #A	0.0000E+00	0.0000E+00	1.000E+03%		4.41E+03
Ga-68 #A	1.1087E+01	>12 Halflives	7.5377E+01%	2.7970E+01	
Tc-99m #A	-1.2368E-01	>12 Halflives	1.4544E+02%	6.0100E-01	
BA-133 #A	-5.8014E-02	-9.4678E-02	4.248E+02%		1.38E+00
CS-134 #C	1.8643E+00	2.2716E+01	1.083E+01%		9.80E+00
CS-137 #A	1.7643E-01	2.0956E-01	1.664E+02%		1.19E+00
CE-139 #A	2.1897E-02	>12 Halflives	8.5617E+02%	6.3298E-01	
Ba-140 #A	-8.1972E-02	>12 Halflives	1.0371E+03%	2.9382E+00	
La-140 #C	1.6500E+00	>12 Halflives	1.0317E+01%	1.2646E+00	
CE-141 #A	4.4612E-01	>12 Halflives	7.2011E+01%	1.0623E+00	
CE-144 #A	1.0345E-01	7.7445E+01	1.303E+03%		3.40E+03
PM-144 #A	1.4173E-01	2.5545E+01	1.218E+02%		1.33E+02
EU-152 A	-1.4817E-01	-2.1697E-01	1.715E+02%		3.66E+00
EU-154 #A	1.0673E+00	1.9463E+00	1.636E+02%		1.10E+01
EU-155 #	4.9241E+00	1.3943E+01	1.694E+01%		5.61E+00
HF-181 A	2.2314E-01	>12 Halflives	7.8378E+01%	8.5909E-01	
Ta-182 #A	5.5384E-01	>12 Halflives	8.2480E+01%	1.7700E+00	
Hg-203	1.4574E+00	>12 Halflives	1.4867E+01%	6.2927E-01	
TL-208	1.7712E+01	2.6430E+02	3.927E+00%		1.42E+01
pm-146 #A	3.7208E-01	9.4639E-01	2.038E+02%		6.61E+00
y-88 #A	-2.7098E-01	>12 Halflives	9.1500E+01%	8.3622E-01	
Cd-109 A	1.1702E+01	7.4907E+02	4.457E+01%		1.09E+03
PB-210 #A	6.3265E+00	7.9745E+00	6.625E+01%		1.44E+01
PB-212	5.7340E+01	8.5564E+02	1.723E+00%		1.75E+01
PB-214 #A	3.8696E-01	3.8821E-01	9.643E+01%		1.58E+00
BI-207 #A	3.5198E-01	4.1319E-01	5.633E+01%		7.62E-01
BI-212 #	7.3185E+01	1.0921E+03	9.110E+00%		1.53E+02
BI-214 #A	-4.3345E-01	-4.3485E-01	1.122E+02%		1.65E+00
BI-210M#A	2.1629E-02	2.1629E-02	1.482E+03%		1.09E+00
RA-224	5.1663E+01	7.7093E+02	1.203E+01%		2.77E+02
AC-228	7.7317E+01	1.8975E+02	2.415E+00%		4.02E+00
TH-227 #A	-1.7775E+00	-2.2532E+00	3.792E+02%		2.83E+01
TH-229 A	9.2864E-01	9.2929E-01	3.457E+02%		1.03E+01
TH-234 #A	-1.3421E+00	-1.3421E+00	8.096E+02%		1.86E+01
PA-231 #C	2.7754E+01	2.7758E+01	1.165E+01%		2.75E+01
PA-233 #C	4.4770E+00	4.4771E+00	1.165E+01%		1.55E+00
PA-234 #A	-2.5908E+00	-2.5908E+00	4.029E+01%		3.40E+00
PA-234M#A	6.2850E+00	6.2850E+00	3.211E+02%		7.25E+01
U-235 #A	-1.5591E+00	-1.5591E+00	9.436E+01%		4.89E+00
AM-241 #A	1.6197E-01	1.6392E-01	3.461E+02%		1.90E+00
Np-237 #A	0.0000E+00	0.0000E+00	0.000E+00%		4.92E+00
Ir-192 #A	2.5372E-01	>12 Halflives	8.3846E+01%	6.9041E-01	
Cs-136 #A	2.0690E-01	>12 Halflives	1.0380E+02%	7.2845E-01	
Np-239 C	2.9685E+00	>12 Halflives	2.2231E+01%	2.0847E+00	

Nd-147 #A -3.2343E-01 >12 Halflives 4.1142E+02% 4.6147E+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 (244.6 to 2000.1 keV) 3.002E+02 Bq/Sample
Total Decayed Activity (244.6 to 2000.1 keV) 3.9436992E+03 Bq/Sample

M132730_NA_2. 7_NA_20131033.spc.
Counts
Energy (keV)
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Th-229
Th-229 35
Ce-139 140
U-235 Ce-141
Np-239
Th-227 Am Th-234
Th-227 Bi-210M
Th-227 b-214
Ra-224
Pb-212
Pa-234
Eu-152
Ac-228
Eu-154
Rh-106
Bi-207
Cs-134
Ga-68
Fe-59
Bi-214
Ta-182
Co-56
Na-22
Fe-59
Co-60
Ag-110M
K-40
La-140
Sb-124
Co-56
Y-88
Ac-228
Y-88
Eu-154
Tl-208
Mn-54
Co-58
Cs-136 La-140
Cs-134
Bi-212
Eu-154 Zr-95
Nb-94
Pm-146
Sb-125
I-131
Cs-137
Ba-140 La-140
Rh-106
Ba-133
Sn-113
Ag-108M
Sb-125
Tl-208
Cs-134
Ba-140
La-140
Ac-228
Pb-212
Tl-208
Pb-214
Cs-136
I-131
Ba-133
Sn-113
Ag-108M
Sb-125
Rh-106
La-140
Ba-140
Cs-134
Tl-208

Test America St. Louis Spectrum ID: 11_NA_20130864

Sample Description: M132730_NA_3
Detector: Ge11 S/N09363993
Batch ID: M132730
Work Order Number: NA
Lot Number: 3

Decay to Time: 2/3/2006 12:00 Live Time: 3600 sec
Acquisition Time: 7/16/2013 19:01:05 Real Time: 3611 sec
Analysis Time: 7/17/2013 08:40 Dead Time: 0.31 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 11_Liquid_Marinelli 0.5L.Clb
Efficiency Cal Desc: 11_0.5L Marn_83925-334_112211
Efficiency Cal Date: 11/23/2011 08:59
Energy Cal Date: 2/28/2012 13:09
Library: Client_Routine Long_Rev4.lib
Bkgd Correction File: 11_2013-07-06_0324.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
NA-22	8.201E-02	1224.0	1.004E+00	1.004E+00	3.651E+00
K-40	4.355E+00	45.5	1.980E+00	1.991E+00	7.011E+00
MN-54	-2.594E+02	41.7	1.082E+02	1.089E+02	3.493E+02
CO-57	3.124E+02	37.6	1.174E+02	1.185E+02	3.796E+02
CO-60	-2.557E-01	168.8	4.315E-01	4.317E-01	1.509E+00
ZN-65	-5.218E+02	157.7	8.229E+02	8.233E+02	2.831E+03
NB-94	8.779E-02	117.2	1.029E-01	1.030E-01	7.258E-01
RH-106	9.717E+01	232.3	2.258E+02	2.258E+02	8.154E+02
AG-108M	2.623E-01	41.9	1.099E-01	1.107E-01	5.922E-01
AG-110M	1.059E+03	49.3	5.222E+02	5.247E+02	1.169E+03
SB-125	9.090E+00	39.0	3.548E+00	3.577E+00	8.933E+00
Gd-153	-1.971E+03	57.6	1.136E+03	1.141E+03	3.737E+03
BA-133	4.150E-01	88.5	3.673E-01	3.680E-01	1.224E+00
CS-134	2.250E+01	8.5	1.903E+00	2.196E+00	5.878E+00
CS-137	2.508E-01	105.3	2.642E-01	2.644E-01	8.870E-01
CE-144	3.555E+01	2433.0	8.648E+02	8.648E+02	2.911E+03
PM-144	4.063E+00	311.1	1.264E+01	1.264E+01	1.338E+02
EU-152	-6.397E-01	129.1	8.259E-01	8.266E-01	2.771E+00
EU-154	1.274E+00	78.3	9.977E-01	9.997E-01	8.360E+00
EU-155	1.843E+01	11.9	2.200E+00	2.405E+00	4.898E+00
TL-208	2.800E+02	3.0	8.391E+00	1.600E+01	1.037E+01
pm-146	2.330E+00	56.8	1.323E+00	1.328E+00	4.892E+00
Cd-109	5.761E+02	53.7	3.094E+02	3.108E+02	1.017E+03
PB-210	2.654E+00	170.0	4.511E+00	4.514E+00	1.537E+01
PB-212	8.807E+02	1.4	1.276E+01	6.790E+01	1.396E+01
PB-214	8.065E-01	44.5	3.591E-01	3.618E-01	9.602E-01
BI-207	7.502E-03	2283.0	1.713E-01	1.713E-01	5.940E-01
BI-212	9.248E+02	8.8	8.119E+01	9.287E+01	1.289E+02
BI-214	2.303E-01	190.3	4.383E-01	4.385E-01	1.510E+00
BI-210M	-1.191E-01	250.2	2.979E-01	2.980E-01	1.003E+00
RA-224	8.274E+02	10.6	8.748E+01	1.072E+02	2.640E+02
AC-228	1.989E+02	2.1	4.099E+00	1.050E+01	2.772E+00
TH-227	-2.113E+00	330.2	6.977E+00	6.979E+00	2.310E+01
TH-229	-1.881E+00	178.0	3.348E+00	3.353E+00	1.120E+01
TH-234	2.364E+01	7.1	1.669E+00	2.030E+00	1.694E+01
PA-231	-1.999E+01	36.3	7.253E+00	7.354E+00	2.352E+01
PA-233	4.436E+00	9.5	4.212E-01	4.963E-01	1.323E+00
PA-234	-2.560E+00	36.0	9.212E-01	9.301E-01	2.999E+00
PA-234M	-3.125E-01	6075.0	1.899E+01	1.899E+01	6.731E+01

U-235	-4.872E-02	2633.0	1.283E+00	1.283E+00	3.280E+00
AM-241	3.003E-01	176.0	5.286E-01	5.288E-01	1.760E+00
Np-237	0.000E+00	0.0	1.404E+00	1.404E+00	4.695E+00
Total	5.287E+03				

Analyst: Micha Korrinhizer

TestAmerica, Inc Spectrum name: 11_NA_20130864.An1

Sample description
M132730_NA_3

Spectrum Filename: C:\User\SPC\Det11\11_NA_20130864.An1

Acquisition information

Start time:	7/16/2013 7:01:05 PM
Live time:	3600
Real time:	3611
Dead time:	0.31 %
Detector ID:	11

Detector system
Ge11 S/N09363993

Calibration
Filename: 11_Liquid_Marinelli 0.5L.Clb
11_0.5L Marn_83925-334_112211

Energy Calibration

Created:	2/28/2012 1:09:34 PM
Zero offset:	0.055 keV
Gain:	0.250 keV/channel
Quadratic:	-2.946E-08 keV/channel^2

Efficiency Calibration

Created:	11/23/2011 8:59:14 AM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 0.86 %
Log(Eff):	-3.435442E-01 + (-2.043896E-01*Log(E)) + (-4.656259E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.69 %
Log(Eff):	-1.197907E+01 + (4.174114E+00*Log(E)) + (-4.577295E-01*Log(E)^2)

Library Files

Main analysis library:	Client_Routine Long_Rev4.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 (1999.47keV)
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

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	2/3/2006 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	11_2013-07-06_0324.PBC 7/6/2013 3:24:55 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 52 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 144.9118

***** 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
39.97	193.	22.02	0.97	6.017E-02				
46.56	90.	38.78	0.67	6.724E-02	46.54	4.250	PBC<MDA	PB210
59.90	29.	176.05	0.91	7.689E-02	59.54	35.900	PBC<MDA	AM241
74.86	1750.	3.54	0.93	8.289E-02				
77.12	2764.	2.47	0.93	8.341E-02				
84.36	290.	13.41	0.94	8.458E-02				
87.20	931.	5.06	0.94	8.486E-02	86.54	30.700	2.813E+01	EU155
88.06	104.	53.70	0.94	8.492E-02	88.04	3.790	PBC<MDA	Cd109
89.98	822.	5.51	0.94	8.504E-02				
93.38	869.	5.10	0.94	8.516E-02	92.59	5.584	4.733E+01	TH234
					93.35	5.561	1.251E+02	AC228
					92.59	5.584	4.733E+01	TH234
99.55	280.	16.94	0.70	8.512E-02	99.50	15.000	HL>Cutoff	Np239
105.37	421.	11.93	1.24	8.481E-02	105.31	21.200	1.843E+01	EU155
					106.13	22.700	HL>Cutoff	Np239
115.28	133.	27.59	0.94	8.382E-02				
124.49	77.	37.58	0.97	8.288E-02	121.78	28.580	1.328E+00	EU152
129.06	518.	13.14	1.15	8.173E-02				
134.88	6.	524.52	0.98	8.102E-02	136.30	5.850	HL>Cutoff	HF181
					136.47	10.680	2.150E+02	CO57
140.52	22.	169.77	0.99	7.958E-02	140.51	89.300	HL>Cutoff	Tc99m
141.88	-2.	329.00	0.99	7.891E-02	143.79	10.960	PBC<MDA	U235
145.26	25.	147.31	0.99	7.857E-02	145.44	48.200	HL>Cutoff	CE141
154.19	175.	21.39	1.23	7.670E-02				
162.35	31.	112.03	1.01	7.483E-02	162.66	6.220	HL>Cutoff	Ba140
209.35	771.	6.80	0.96	6.294E-02				
238.60	5299.	1.44	1.08	5.738E-02	238.63	43.300	8.783E+02	PB212
241.02	448.	11.04	1.08	5.696E-02	240.99	4.100	7.954E+02	RA224
241.96	14.	165.78	1.08	5.680E-02	242.00	7.430	PBC<MDA	PB214
270.19	613.	8.02	1.12	5.246E-02				

277.53	270.	14.68	0.86	5.145E-02	277.28	6.310	3.407E+02 TL208
278.61	4.	739.39	1.11	5.122E-02	279.20	81.460	HL>Cutoff Hg203
294.97	30.	58.54	1.13	4.919E-02	295.09	19.300	PBC<MDA PB214

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
299.99	348.	10.39	1.02	4.860E-02	300.03	3.280	8.992E+02	PB212
					300.07	2.460	8.088E+01	PA231
					300.18	6.200	3.210E+01	PA233
					300.07	2.460	8.088E+01	PA231
					300.18	6.200	3.210E+01	PA233
307.62	31.	73.64	1.14	4.761E-02	308.44	31.750	HL>Cutoff	Ir192
321.27	29.	80.65	1.15	4.633E-02	320.08	9.940	HL>Cutoff	CR51
328.00	496.	8.54	1.23	4.549E-02	328.76	20.300	HL>Cutoff	La140
					328.76	20.300	HL>Cutoff	La140
338.18	1547.	3.28	1.16	4.447E-02	338.32	12.010	1.976E+02	AC228
345.61	3.	722.06	1.17	4.373E-02	345.83	15.070	HL>Cutoff	HF181
351.60	45.	30.58	0.60	4.316E-02	351.93	37.600	PBC<MDA	PB214
354.83	24.	88.52	1.18	4.279E-02	356.00	62.050	PBC<MDA	BA133
					356.00	62.050	4.150E-01	BA133
383.60	14.	171.33	1.21	4.043E-02	383.84	8.940	PBC<MDA	BA133
					383.84	8.940	1.721E+00	BA133
390.15	17.	117.33	1.21	3.981E-02	391.69	64.000	HL>Cutoff	SN113
394.71	32.	55.43	0.57	3.958E-02				
409.33	254.	14.31	1.22	3.849E-02				
427.85	61.	39.03	0.76	3.721E-02	427.88	29.600	1.008E+01	SB125
433.71	16.	133.37	1.25	3.681E-02	433.94	90.480	PBC<MDA	AG108M
463.06	427.	8.62	1.39	3.501E-02	463.37	10.470	2.104E+02	SB125
477.91	12.	175.38	1.29	3.418E-02	477.60	10.520	HL>Cutoff	BE7
481.97	19.	112.13	1.29	3.393E-02	482.00	80.500	HL>Cutoff	HF181
486.58	13.	148.86	1.30	3.366E-02	487.02	45.500	HL>Cutoff	La140
					487.02	45.500	HL>Cutoff	La140
510.85	599.	6.85	1.52	3.242E-02	511.86	20.000	3.996E+03	RH106
					511.86	20.000	3.996E+03	RH106
530.69	26.	60.10	0.50	3.147E-02				
562.86	99.	28.55	0.46	3.003E-02	563.24	8.350	1.337E+02	CS134
					563.24	8.350	1.337E+02	CS134
583.25	1678.	2.98	1.35	2.919E-02	583.02	84.500	2.800E+02	TL208
600.50	21.	86.60	1.40	2.852E-02	600.50	17.860	PBC<MDA	SB125
					604.71	97.620	2.569E+00	CS134
606.05	35.	38.99	1.40	2.844E-02				
609.47	31.	61.53	1.41	2.816E-02	609.31	46.090	PBC<MDA	BI214
					610.30	5.750	HL>Cutoff	RU103
609.47	9.	67.76	1.41	2.819E-02	609.31	46.090	PBC<MDA	BI214
					610.30	5.750	HL>Cutoff	RU103
618.56	3.	554.97	1.42	2.773E-02	618.06	99.100	PBC<MDA	PM144
					621.92	9.930	4.252E+01	RH106
					621.92	9.930	4.252E+01	RH106
618.72	6.	311.13	1.41	2.787E-02	618.06	99.100	PBC<MDA	PM144
					621.92	9.930	9.922E+01	RH106
636.69	13.	155.46	1.43	2.720E-02				
637.60	4.	414.76	1.43	2.724E-02	635.89	11.310	PBC<MDA	SB125
661.94	17.	105.34	1.45	2.638E-02	661.66	85.210	PBC<MDA	CS137
704.50	5.	402.23	1.49	2.513E-02	702.63	97.900	PBC<MDA	NB94
719.72	31.	41.90	1.50	2.455E-02	722.94	90.840	PBC<MDA	AG108M
					724.20	44.150	HL>Cutoff	ZR95
					723.36	20.220	3.175E+00	EU154
722.79	11.	467.26	1.50	2.455E-02	723.36	20.220	PBC<MDA	EU154
723.36	11.	481.41	1.50	2.454E-02	723.36	20.220	PBC<MDA	EU154
727.26	412.	8.78	1.40	2.443E-02	727.17	7.550	9.248E+02	BI212
736.86	30.	56.78	1.51	2.420E-02	735.72	22.500	PBC<MDA	pm146
747.29	14.	115.59	1.52	2.389E-02	747.16	34.000	PBC<MDA	pm146
755.38	95.	28.77	0.65	2.368E-02				
762.48	33.	49.33	1.54	2.346E-02	763.94	22.280	PBC<MDA	AG110M
784.82	104.	22.94	1.30	2.293E-02	785.42	1.280	1.476E+03	BI212

794.92	252.	8.46	1.57	2.268E-02	795.87	85.530	4.398E+01 CS134
					795.87	85.530	4.398E+01 CS134
818.04	13.	86.05	1.58	2.216E-02	818.50	100.000	HL>Cutoff Cs136
					818.50	100.000	HL>Cutoff Cs136
818.89	3.	415.52	1.58	2.222E-02	815.77	23.280	HL>Cutoff La140
860.90	233.	8.49	1.48	2.126E-02	860.56	12.420	3.658E+02 TL208
872.61	5.	242.64	1.63	2.100E-02	871.10	99.890	PBC<MDA NB94
					873.23	12.270	9.959E-01 EU154
					873.23	12.270	9.959E-01 EU154
873.08	9.	117.19	1.63	2.104E-02	871.10	99.890	PBC<MDA NB94

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					873.23	12.270	1.815E+00	EU154
883.86	10.	99.00	1.64	2.077E-02	883.24	9.600	1.384E+00	PA234
					884.68	72.680	3.477E+02	AG110M
					883.24	9.600	1.384E+00	PA234
883.90	9.	108.02	1.64	2.080E-02	883.24	9.600	PBC<MDA	PA234
					884.68	72.680	3.273E+02	AG110M
911.24	1719.	2.50	1.62	2.027E-02	911.16	29.000	1.994E+02	AC228
964.79	300.	6.12	1.71	1.931E-02	964.11	14.605	4.326E+01	EU152
968.99	928.	3.38	1.71	1.924E-02	968.97	17.460	1.883E+02	AC228
995.76	5.	233.54	1.73	1.880E-02	996.33	10.600	PBC<MDA	EU154
					996.33	10.600	1.149E+00	EU154
1004.96	12.	78.33	1.74	1.866E-02	1004.77	18.010	PBC<MDA	EU154
					1004.77	18.010	1.743E+00	EU154
1046.62	3.	232.33	1.78	1.797E-02	1050.36	1.560	PBC<MDA	RH106
					1050.36	1.560	4.450E+02	RH106
1048.01	1.	849.41	1.78	1.800E-02	1048.07	80.000	HL>Cutoff	Cs136
1073.52	3.	244.51	1.80	1.759E-02	1077.40	3.300	HL>Cutoff	Ga68
1102.71	11.	64.05	1.82	1.729E-02	1099.25	56.500	HL>Cutoff	FE59
					1099.25	56.500	HL>Cutoff	FE59
1120.39	3.	69.60	1.83	1.701E-02	1120.29	15.100	PBC<MDA	BI214
					1120.55	99.987	HL>Cutoff	Sc46
1120.50	14.	70.25	1.83	1.700E-02	1120.29	15.100	PBC<MDA	BI214
					1120.55	99.987	HL>Cutoff	Sc46
					1121.30	34.900	HL>Cutoff	Ta182
1121.41	14.	69.79	1.84	1.699E-02	1120.55	99.987	HL>Cutoff	Sc46
					1121.30	34.900	HL>Cutoff	Ta182
1189.19	2.	302.15	1.89	1.616E-02	1189.05	16.200	HL>Cutoff	Ta182
1238.60	4.	205.87	1.93	1.560E-02	1238.28	66.070	HL>Cutoff	Co56
					1238.28	66.070	HL>Cutoff	Co56
1291.90	3.	279.42	1.97	1.504E-02	1291.60	43.200	HL>Cutoff	FE59
					1291.60	43.200	HL>Cutoff	FE59
1459.54	23.	23.33	2.10	1.350E-02	1460.83	10.670	PBC<MDA	K40
1688.45	1.	789.53	2.28	1.185E-02	1690.98	47.790	HL>Cutoff	SB124

********** 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
159.56	39.97	440.	193.	3.207E+03	22.02	0.973	-	s
299.05	74.86	1040.	1750.	2.112E+04	3.54	0.927	-	D
308.06	77.12	946.	2764.	3.314E+04	2.47	0.929	-	D
337.02	84.34	622.	281.	3.324E+03	13.89	0.936	-	D
348.36	87.18	748.	829.	9.767E+03	5.82	0.938	-	D
359.50	89.97	654.	782.	9.195E+03	5.85	0.941	-	D
397.75	99.55	786.	33.	3.842E+02	122.52	0.704	-	c
460.63	115.28	381.	133.	1.583E+03	27.59	0.939	-	s
515.71	129.06	716.	653.	7.988E+03	6.99	1.153	-	
616.19	154.19	366.	175.	2.277E+03	21.39	1.232	-	s
836.73	209.35	399.	829.	1.318E+04	4.86	0.958	-	
1079.96	270.19	338.	613.	1.169E+04	5.86	1.120	-	M
1311.13	328.00	690.	74.	1.621E+03	51.71	1.233	-	s
1577.89	394.71	101.	32.	8.127E+02	55.43	0.572	-	sM
1636.36	409.33	199.	254.	6.590E+03	14.31	1.225	-	s
1851.23	463.06	570.	36.	1.024E+03	95.70	1.391	-	sc
2042.36	510.85	647.	143.	4.423E+03	26.43	1.525	-	sM
2121.70	530.69	76.	27.	8.543E+02	49.79	0.499	-	sM

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
2250.37	562.86	195.	44.	1.477E+03	46.95	0.465 -	s
3020.40	755.38	113.	103.	4.331E+03	17.70	0.654 -	sM
3858.33	964.81	18.	301.	1.560E+04	6.09	1.707 -	D

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_Routine Long_Rev4.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	186.22	46.64	694.	22.	0.006	48.28	0.901
AM-241	239.22	59.90	1332.	29.	0.008	176.05	0.913s
BA-133	328.49	82.23	957.	-60.	-0.017	73.85	0.933s
EU-155	345.74	86.54	759.	610.	0.169	12.18	0.938D
Cd-109	351.72	88.04	1516.	104.	0.029	53.70	0.939D
Nd-147	367.40	91.96	1664.	-176.	-0.049	33.69	0.942
TH-234	373.11	93.39	1007.	735.	0.204	6.53	0.943s
AC-228	373.00	93.36	798.	902.	0.251	7.21	1.018s
Gd-153	390.90	97.84	868.	-74.	-0.021	57.61	0.948s
Np-239	397.57	99.51	657.	248.	0.069	15.96	0.950
Gd-153	414.55	103.75	1067.	-62.	-0.017	75.55	0.953s
Np-239	413.66	103.53	999.	-88.	-0.025	51.62	0.954
EU-155	421.00	105.37	550.	421.	0.117	11.93	1.241s
Np-239	421.75	105.55	681.	287.	0.080	14.16	0.956
EU-152	491.49	123.00	657.	-40.	-0.011	90.94	0.970s
CO-57	497.45	124.49	384.	77.	0.021	37.58	0.970s
EU-154	491.62	123.03	678.	-36.	-0.010	105.04	0.971s
PA-234	521.30	130.46	1111.	-135.	-0.037	35.99	0.979s
HF-181	538.97	134.88	568.	6.	0.002	524.52	0.980s
CO-57	540.05	135.15	605.	-4.	-0.001	902.09	0.984s
Tc-99m	561.52	140.52	715.	22.	0.006	169.77	0.987s
CE-141	580.47	145.26	663.	25.	0.007	147.31	0.992s
Ba-140	648.82	162.35	598.	31.	0.009	112.03	1.008s
U-235	655.39	164.00	669.	-19.	-0.005	194.38	1.008s
TH-229	774.52	193.79	611.	-20.	-0.005	178.03	1.036s
U-235	821.55	205.56	601.	-16.	-0.004	222.29	1.047s
TH-229	845.76	211.61	743.	-62.	-0.017	63.65	1.052s
TH-227	943.15	235.97	9910.	-43.	-0.012	330.24	1.074s
PB-212	953.79	238.63	302.	5277.	1.466	1.44	1.077D
RA-224	963.21	240.99	982.	466.	0.130	10.57	1.079D
PB-214	967.25	242.00	696.	14.	0.004	165.78	1.080D

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
EU-152	974.37	243.78	431.	-41.	-0.011	73.13	1.082s
TH-227	1024.28	256.26	385.	-8.	-0.002	334.35	1.093s
BI-210M	1064.00	266.19	399.	-11.	-0.003	250.20	1.101s
TL-208	1109.33	277.53	294.	267.	0.074	14.68	0.862s
Hg-203	1113.63	278.61	430.	4.	0.001	739.39	1.113s
PB-214	1179.08	294.97	332.	30.	0.008	58.54	1.128s
Ir-192	1184.51	296.33	379.	-16.	-0.004	175.36	1.129s
PB-212	1199.11	299.99	242.	346.	0.096	10.39	1.024
PA-231	1199.17	300.00	318.	332.	0.092	9.38	1.132
PA-233	1199.17	300.00	324.	329.	0.091	9.50	1.132
PA-231	1206.58	301.85	609.	-100.	-0.028	36.28	1.135s
BA-133	1206.63	301.87	577.	-103.	-0.029	34.26	1.135s
Ba-140	1220.09	305.23	337.	-31.	-0.009	85.79	1.137s
BI-210M	1220.08	305.23	337.	-31.	-0.009	85.72	1.137s
Ir-192	1229.63	307.62	238.	31.	0.008	73.64	1.140s
Ir-192	1265.33	316.55	305.	-17.	-0.005	146.20	1.147s
CR-51	1284.23	321.27	258.	29.	0.008	80.65	1.150s
La-140	1310.93	327.95	297.	422.	0.117	7.55	1.158s
AC-228	1351.83	338.18	237.	1547.	0.430	3.28	1.165
Cs-136	1359.15	340.01	975.	-155.	-0.043	29.60	1.169
EU-152	1373.20	343.52	270.	-18.	-0.005	129.10	1.172s
HF-181	1381.54	345.61	229.	3.	0.001	722.06	1.173s
PB-214	1405.51	351.60	130.	45.	0.012	30.58	0.604s
BA-133	1418.41	354.83	219.	24.	0.007	88.52	1.182s
I-131	1457.62	364.63	299.	-21.	-0.006	121.03	1.190
BA-133	1533.45	383.60	269.	14.	0.004	171.33	1.207s
SN-113	1559.66	390.15	198.	17.	0.005	117.33	1.214
SB-125	1710.43	427.85	124.	61.	0.017	39.03	0.761s
AG-108M	1733.84	433.71	209.	16.	0.004	133.37	1.252s
pm-146	1823.71	456.18	183.	-21.	-0.006	93.73	1.269s
SB-125	1851.13	463.04	191.	391.	0.109	7.11	1.278
PM-144	1904.81	476.46	210.	-10.	-0.003	205.75	1.290s
BE-7	1910.60	477.91	198.	12.	0.003	175.38	1.290s
HF-181	1926.83	481.97	210.	19.	0.005	112.13	1.294s
La-140	1945.28	486.58	184.	13.	0.004	148.86	1.299s
RU-103	1977.95	494.75	152.	-6.	-0.002	302.37	1.307s
RH-106	2042.18	510.81	258.	455.	0.126	6.85	1.320s
Nd-147	2129.75	532.71	190.	-3.	-0.001	644.13	1.337
Ba-140	2149.21	537.57	203.	-15.	-0.004	135.00	1.343s
CS-134	2249.62	562.68	186.	55.	0.015	37.77	1.365s
PA-234	2272.56	568.41	206.	-36.	-0.010	59.19	1.371s
TL-208	2331.91	583.25	160.	1667.	0.463	2.98	1.354
SB-125	2400.89	600.50	155.	21.	0.006	86.60	1.398s
SB-124	2423.11	606.05	77.	35.	0.010	38.99	1.400s
CS-134	2401.20	600.58	95.	-6.	-0.002	240.64	1.401s
BI-214	2436.79	609.47	211.	9.	0.003	67.76	1.405s
RU-103	2436.78	609.47	170.	31.	0.009	61.53	1.406s
AG-108M	2453.51	613.65	189.	-14.	-0.004	142.63	1.410s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
PM-144	2473.79	618.72	190.	6.	0.002	311.13	1.413
RH-106	2473.13	618.56	112.	3.	0.001	554.97	1.416s
SB-125	2549.30	637.60	169.	4.	0.001	414.76	1.428s
I-131	2545.65	636.69	187.	13.	0.004	155.46	1.429
CS-137	2646.66	661.94	153.	17.	0.005	105.34	1.451s
NB-94	2816.90	704.50	174.	5.	0.001	402.23	1.486
SB-124	2890.03	722.79	1237.	11.	0.003	467.26	1.503
AG-108M	2877.75	719.72	69.	31.	0.009	41.90	1.503
EU-154	2892.31	723.36	1314.	11.	0.003	481.41	1.503
BI-212	2907.93	727.26	138.	412.	0.114	8.78	1.400
pm-146	2946.31	736.86	134.	30.	0.008	56.78	1.514s
pm-146	2988.06	747.29	132.	14.	0.004	115.59	1.524s
ZR-95	3026.05	756.79	188.	-8.	-0.002	247.93	1.532s
AG-110M	3048.80	762.48	119.	33.	0.009	49.33	1.538
NB-95	3063.18	766.07	175.	-12.	-0.003	161.45	1.540s
PA-234M	3062.46	765.89	187.	-17.	-0.005	116.22	1.540s
EU-152	3115.55	779.16	138.	-20.	-0.006	86.37	1.551s
BI-212	3138.18	784.82	86.	104.	0.029	22.94	1.303s
CS-134	3178.57	794.92	101.	252.	0.070	8.46	1.565s
CS-134	3204.79	801.47	115.	-10.	-0.003	149.73	1.570s
CO-58	3240.21	810.32	76.	-8.	-0.002	167.38	1.578s
La-140	3274.49	818.89	59.	3.	0.001	415.52	1.582s
Cs-136	3271.07	818.04	59.	13.	0.004	86.05	1.584s
MN-54	3330.26	832.83	181.	-49.	-0.013	41.72	1.598s
Co-56	3385.29	846.59	76.	-9.	-0.002	144.64	1.608s
TL-208	3442.53	860.90	28.	233.	0.065	8.49	1.479
NB-94	3491.26	873.08	54.	9.	0.003	117.19	1.629
EU-154	3489.39	872.61	73.	5.	0.001	242.64	1.630s
PA-234	3519.23	880.07	62.	-8.	-0.002	140.33	1.637s
PA-234	3534.57	883.90	46.	9.	0.003	108.02	1.639s
AG-110M	3534.41	883.86	44.	10.	0.003	99.00	1.640s
Sc-46	3552.46	888.37	72.	-9.	-0.003	134.24	1.644s
y-88	3590.21	897.81	82.	-4.	-0.001	369.74	1.651s
AC-228	3643.93	911.24	21.	1719.	0.478	2.50	1.622
PA-234	3783.45	946.11	47.	-7.	-0.002	147.18	1.691s
EU-152	3866.16	966.78	364.	-76.	-0.021	37.15	1.706s
AC-228	3874.92	968.97	29.	928.	0.258	3.38	1.710D
EU-154	3982.10	995.76	53.	5.	0.001	233.54	1.733s
EU-154	4018.93	1004.96	35.	12.	0.003	78.33	1.740s
Co-56	4151.11	1038.00	57.	-6.	-0.002	175.13	1.767s
Cs-136	4191.17	1048.01	37.	1.	0.000	849.41	1.776s
RH-106	4185.61	1046.62	21.	3.	0.001	232.33	1.777s
Ga-68	4293.26	1073.52	33.	3.	0.001	244.51	1.799s
FE-59	4410.03	1102.71	17.	11.	0.003	64.05	1.817s
EU-152	4451.86	1113.16	52.	-1.	0.000	698.78	1.828s
ZN-65	4462.46	1115.81	61.	-7.	-0.002	157.72	1.831s
BI-214	4480.80	1120.39	50.	3.	0.001	69.60	1.834s
Sc-46	4481.24	1120.50	39.	14.	0.004	70.25	1.835s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Ta-182	4484.87	1121.41	39.	14.	0.004	69.79	1.835s
CO-60	4691.49	1173.04	53.	-7.	-0.002	159.50	1.877s
Ta-182	4756.13	1189.19	27.	2.	0.001	302.15	1.890s
Ta-182	4876.85	1219.36	35.	-2.	-0.001	411.92	1.916s
Co-56	4953.84	1238.60	38.	4.	0.001	205.87	1.929s
FE-59	5167.15	1291.90	36.	3.	0.001	279.42	1.972s
CO-60	5333.94	1333.57	34.	-5.	-0.001	168.76	2.004s
AG-110M	5535.86	1384.01	38.	-2.	0.000	535.62	2.045s
EU-152	5644.17	1411.07	29.	-1.	0.000	544.30	2.064s
K-40	5838.15	1459.54	52.	23.	0.006	23.33	2.105s
La-140	6381.55	1595.28	72.	-10.	-0.003	119.40	2.209s
SB-124	6754.57	1688.45	22.	1.	0.000	789.53	2.281s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
BE-7	C	8.8854E-01				5.31E+01		
			477.60	8.885E-01	&(	5.271E+00	1.75E+02 1.05E+01	G
NA-22	C	8.2007E-02				9.50E+02		
			1274.53	8.201E-02	&(	3.651E+00	1.22E+03 9.99E+01	G
K-40	N	4.3548E+00				4.66E+11		
			1460.83	4.355E+00	?(P	7.011E+00	2.33E+01 1.07E+01	G
Sc-46	F	4.9696E-02				8.38E+01		
			889.28	-1.235E-01	?(	5.658E-01	1.34E+02 1.00E+02	G
			1120.55	2.229E-01	*(	5.203E-01	7.03E+01 1.00E+02	G
CR-51	F	1.7470E+00				2.77E+01		
			320.08	1.747E+00	&(	4.681E+00	8.06E+01 9.94E+00	G
MN-54	C	-2.5939E+02				3.12E+02		
			834.85	-2.594E+02	?(	3.493E+02	4.17E+01 1.00E+02	G
FE-59	F	2.2688E-01				4.45E+01		
			1099.25	2.996E-01	?(	6.314E-01	6.41E+01 5.65E+01	G
			1291.60	1.318E-01	?(	1.304E+00	2.79E+02 4.32E+01	G
Co-56	C	-2.1725E-02				7.73E+01		
			846.77	-1.133E-01	?(	5.600E-01	1.45E+02 9.99E+01	G
			1238.28	1.168E-01	?(	8.433E-01	2.06E+02 6.61E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
		1037.84	-6.778E-01	+	4.102E+00	1.75E+02	1.41E+01 G
		1771.35	6.236E-02	&	4.279E+00	1.88E+03	1.55E+01 A
CO-57	C 3.1239E+02					2.72E+02	
		122.06	3.124E+02	?(	3.796E+02	3.76E+01	8.56E+01 G
		136.47	-1.288E+02	&	3.913E+03	9.02E+02	1.07E+01 G
CO-58	C -9.4548E-02					7.09E+01	
		810.78	-9.455E-02	?(	5.429E-01	1.67E+02	9.95E+01 G
CO-60	F -2.5572E-01					1.93E+03	
		1332.50	-2.557E-01	?(	1.509E+00	1.69E+02	1.00E+02 G
		1173.24	-3.006E-01	+	1.655E+00	1.60E+02	9.99E+01 G
ZN-65	F -5.2175E+02					2.44E+02	
		1115.55	-5.218E+02	?(	2.831E+03	1.58E+02	5.06E+01 G
NB-94	I 8.7785E-02					7.41E+06	
		702.63	5.280E-02	(	7.258E-01	4.02E+02	9.79E+01 G
		871.10	1.221E-01	(	4.882E-01	1.17E+02	9.99E+01 G
ZR-95	I -1.7049E-01					6.40E+01	
		756.73	-1.705E-01	&(	1.437E+00	2.48E+02	5.45E+01 G
		724.20	0.000E+00	&	2.601E+00	1.00E+03	4.42E+01 G
NB-95	I -1.4011E-01					6.40E+01	
		765.79	-1.401E-01	?(	7.654E-01	1.61E+02	9.98E+01 G
RU-103	I -5.3761E-02					3.93E+01	
		497.05	-5.376E-02	&(	5.556E-01	3.02E+02	9.09E+01 G
		610.30	5.378E+00	&	1.090E+01	6.15E+01	5.75E+00 GA
RH-106	I 9.7172E+01					3.74E+02	
		621.92	4.252E+01	?(	8.154E+02	5.55E+02	9.93E+00 G
		1050.36	4.450E+02	?(	3.714E+03	2.32E+02	1.56E+00 G
		511.86	3.039E+03	?	5.179E+02	6.85E+00	2.00E+01 GA
AG-108M	C 2.6232E-01					1.53E+05	
		433.94	1.319E-01	?(	5.922E-01	1.33E+02	9.05E+01 G
		722.94	3.922E-01	?(	5.236E-01	4.19E+01	9.08E+01 G
		614.28	-1.551E-01	-	7.460E-01	1.43E+02	8.98E+01 G
AG-110M	F 1.0586E+03					2.50E+02	
		884.68	3.477E+02	?(	1.169E+03	9.90E+01	7.27E+01 G
		657.76	6.110E+00	%	1.426E+03	6.80E+03	9.46E+01 G
		937.49	-2.391E+01	%	2.288E+03	2.64E+03	3.44E+01 G
		1384.30	-2.539E+02	-	4.849E+03	5.36E+02	2.43E+01 G
		763.94	3.378E+03	(	5.416E+03	4.93E+01	2.23E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
SN-113	F	1.8886E-01					1.15E+02	
			391.69	1.889E-01	(	7.443E-01	1.17E+02	6.40E+01 G
SB-124	F	4.2715E-01					6.02E+01	
			602.73	3.513E-01	?(	4.341E-01	3.90E+01	9.83E+01 G
			1690.98	4.136E-02	&	1.199E+00	7.90E+02	4.78E+01 G
			722.79	1.116E+00	?(	1.744E+01	4.67E+02	1.08E+01 G
SB-125	I	9.0902E+00					1.01E+03	
			427.88	1.008E+01	(	8.933E+00	3.90E+01	2.96E+01 G
			600.50	7.448E+00	&(	2.153E+01	8.66E+01	1.79E+01 G
			635.89	2.615E+00	&	3.710E+01	4.15E+02	1.13E+01 G
			463.37	1.927E+02	+	3.310E+01	7.11E+00	1.05E+01 G
I-131	I	-7.4029E-03					8.02E+00	
			364.48	-1.662E-01	(	6.738E-01	1.21E+02	8.17E+01 G
			284.30	-1.933E-02	%	6.926E+00	1.05E+04	6.14E+00 G
			636.97	1.803E+00	(	9.468E+00	1.55E+02	7.17E+00 G
Gd-153	F	-1.9713E+03					2.42E+02	
			97.50	-1.971E+03	?(	3.737E+03	5.76E+01	3.00E+01 G
			103.20	-2.284E+03	&	5.706E+03	7.56E+01	2.18E+01 G
Ga-68	C	2.1843E+00					4.71E-02	
			1077.40	2.184E+00	&(	1.890E+01	2.45E+02	3.30E+00 G
Tc-99m	I	9.2939E-02					2.51E-01	
			140.51	9.294E-02	?(	5.271E-01	1.70E+02	8.93E+01 G
BA-133	F	4.1497E-01					3.85E+03	
			356.00	4.150E-01	@(	1.224E+00	8.85E+01	6.20E+01 G
			302.85	-5.303E+00	+	5.875E+00	3.43E+01	1.83E+01 G
			383.84	1.721E+00	*	9.935E+00	1.71E+02	8.94E+00 GA
			80.99	-9.520E-01	+	2.324E+00	7.39E+01	3.41E+01 GA
CS-134	I	2.2498E+01					7.54E+02	
			604.71	-7.101E-01	?(	5.878E+00	2.41E+02	9.76E+01 G
			795.87	4.398E+01	?(	8.657E+00	8.46E+00	8.55E+01 G
			569.32	-1.438E+00	%	5.870E+01	1.20E+03	1.54E+01 G
			801.95	-1.789E+01	+	9.103E+01	1.50E+02	8.69E+00 G
			563.24	7.380E+01	?(	8.941E+01	3.78E+01	8.35E+00 G
CS-137	I	2.5076E-01					1.10E+04	
			661.66	2.508E-01	?(	8.870E-01	1.05E+02	8.52E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CE-139	F	-8.2397E-03					1.38E+02	
			165.85-8.240E-03		&(	4.925E-01	1.77E+03	7.99E+01 G
Ba-140	I	-6.3261E-02					1.28E+01	
			537.26-5.553E-01		?(	2.524E+00	1.35E+02	2.44E+01 G
			162.66 1.866E+00		(	6.962E+00	1.12E+02	6.22E+00 G
			304.85-4.172E+00		+	1.190E+01	8.58E+01	4.29E+00 G
La-140	I	1.5237E+00					1.28E+01	
			1596.21-2.437E-01		?(	9.891E-01	1.19E+02	9.54E+01 G
			487.02 2.376E-01		(	1.194E+00	1.49E+02	4.55E+01 G
			328.76 1.271E+01		?(	2.501E+00	7.55E+00	2.03E+01 G
			815.77 1.420E-01		-	2.068E+00	4.16E+02	2.33E+01 G
CE-141	I	1.8297E-01					3.25E+01	
			145.44 1.830E-01		(	8.998E-01	1.47E+02	4.82E+01 G
CE-144	I	3.5551E+01					2.85E+02	
			133.54 3.555E+01		%(	2.911E+03	2.43E+03	1.11E+01 G
PM-144	C	4.0630E+00					3.63E+02	
			696.54-3.344E+00		%(	1.338E+02	1.17E+03	9.90E+01 G
			618.06 1.146E+01		(	1.215E+02	3.11E+02	9.91E+01 G
			476.81-3.515E+01		+	2.450E+02	2.06E+02	4.20E+01 G
EU-152	F	-6.3974E-01					4.94E+03	
			344.29-6.397E-01		?(	2.771E+00	1.29E+02	2.65E+01 G
			1112.07-2.554E-01		+	6.311E+00	6.99E+02	1.36E+01 G
			121.78-6.945E-01		+	2.096E+00	9.09E+01	2.86E+01 G
			778.92-2.707E+00		+	7.808E+00	8.64E+01	1.29E+01 G
			964.11-1.100E+01		+	1.320E+01	3.72E+01	1.46E+01 G
			244.69-3.913E+00		+	9.471E+00	7.31E+01	7.58E+00 G
			1408.00-1.972E-01		+	3.871E+00	5.44E+02	2.10E+01 GA
EU-154	I	1.2738E+00					3.14E+03	
			873.23 9.959E-01		?(	8.360E+00	2.43E+02	1.23E+01 G
			123.10-5.331E-01		+	1.862E+00	1.05E+02	4.08E+01 G
			1274.54 3.956E-02		&	2.886E+00	2.02E+03	3.52E+01 G
			723.36 1.089E+00		&(	1.752E+01	4.81E+02	2.02E+01 G
			1004.77 1.743E+00		(	4.579E+00	7.83E+01	1.80E+01 G
			996.33 1.149E+00		?(	9.352E+00	2.34E+02	1.06E+01 G
EU-155	I	1.8431E+01					1.81E+03	
			105.31 1.843E+01		*(	4.898E+00	1.19E+01	2.12E+01 G
			86.54 1.843E+01		}	3.960E+00	1.22E+01	3.07E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
HF-181	F	1.7963E-01					4.24E+01	
			482.00	1.898E-01	(	7.137E-01	1.12E+02	8.05E+01 G
			133.02	5.104E-02	-	9.011E-01	5.25E+02	4.33E+01 G
			345.83	1.254E-01	?(	3.089E+00	7.22E+02	1.51E+01 G
			136.30	-9.968E-02	&	6.721E+00	2.00E+03	5.85E+00 G
Ta-182	F	6.4360E-01					1.14E+02	
			1121.30	6.436E-01	*(	1.492E+00	6.98E+01	3.49E+01 G
			1221.41	-1.340E-01	-	1.969E+00	4.12E+02	2.70E+01 G
			1189.05	2.650E-01	-	2.867E+00	3.02E+02	1.62E+01 G
Hg-203	F	2.6453E-02					4.66E+01	
			279.20	2.645E-02	?(	6.610E-01	7.39E+02	8.15E+01 G
TL-208	N	2.7996E+02					6.98E+02	
			583.02	2.800E+02	(P	1.037E+01	2.98E+00	8.45E+01 G
			277.28	3.407E+02	+ P	1.054E+02	1.47E+01	6.31E+00 G
			860.56	3.658E+02	+	4.297E+01	8.49E+00	1.24E+01 G
pm-146	C	2.3304E+00					2.02E+03	
			747.16	1.255E+00	&(	4.892E+00	1.16E+02	3.40E+01 G
			735.72	3.955E+00	&(	7.365E+00	5.68E+01	2.25E+01 G
			453.88	-6.410E-01	&	2.008E+00	9.37E+01	6.50E+01 G
y-88	F	-5.0727E-02					1.07E+02	
			898.04	-5.073E-02	?(	6.507E-01	3.70E+02	9.37E+01 G
			1836.06	-8.177E-03	&	5.837E-01	1.92E+03	9.92E+01 G
Cd-109	F	5.7611E+02					4.53E+02	
			88.04	5.761E+02	(	1.017E+03	5.37E+01	3.79E+00 G
PB-210	N	2.6538E+00					8.14E+03	
			46.54	2.654E+00	?(P	1.537E+01	4.83E+01	4.25E+00 G
PB-212	N	8.8066E+02					6.98E+02	
			238.63	8.807E+02	(P	1.396E+01	1.44E+00	4.33E+01 G
			300.03	8.992E+02	P	1.957E+02	1.04E+01	3.28E+00 GA
PB-214	N	8.0649E-01					5.84E+05	
			351.93	7.665E-01	(P	9.602E-01	3.06E+01	3.76E+01 G
			295.09	8.844E-01	?(P	2.570E+00	5.85E+01	1.93E+01 G
			242.00	8.920E-01	P	8.300E+00	1.66E+02	7.43E+00 GA
BI-207	C	7.5020E-03					1.18E+04	
			569.70	7.502E-03	&(	5.940E-01	2.28E+03	9.77E+01 G
			1063.66	-1.471E-02	%	9.056E-01	1.74E+03	7.45E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
BI-212	N	9.2477E+02					6.98E+02	
			727.17	9.248E+02	(	1.289E+02	8.78E+00	7.55E+00 G
			785.42	1.476E+03	+	6.468E+02	2.29E+01	1.28E+00 GA
BI-214	N	2.3028E-01					5.84E+05	
			609.31	1.955E-01	?(P	1.510E+00	6.78E+01	4.61E+01 G
			1120.29	3.364E-01	*(P	3.859E+00	6.96E+01	1.51E+01 G
			1764.49	-1.481E+00	% P	4.744E+00	1.00E+03	1.54E+01 G
BI-210M	T	-1.1905E-01					1.10E+09	
			265.83	-1.190E-01	?(	1.003E+00	2.50E+02	5.00E+01 G
			304.90	-6.398E-01	+	1.823E+00	8.57E+01	2.80E+01 G
RA-224	N	8.2740E+02					6.98E+02	
			240.99	8.274E+02	(	2.640E+02	1.06E+01	4.10E+00 G
AC-228	N	1.9889E+02					2.10E+03	
			911.16	1.994E+02	(	2.772E+00	2.50E+00	2.90E+01 G
			968.97	1.883E+02	-	5.641E+00	3.38E+00	1.75E+01 G
			338.32	1.976E+02	(	9.500E+00	3.28E+00	1.20E+01 G
			93.35	1.298E+02	-	1.934E+01	7.21E+00	5.56E+00 XA
TH-227	N	-2.1126E+00					7.95E+03	
			235.97	-2.113E+00	?(	2.310E+01	3.30E+02	1.23E+01 G
			50.14	-1.345E-02	%	7.977E+00	1.76E+04	8.00E+00 G
			256.24	-7.697E-01	&	8.685E+00	3.34E+02	7.00E+00 G
TH-229	N	-1.8808E+00					2.68E+06	
			193.51	-1.881E+00	?(	1.120E+01	1.78E+02	4.40E+00 G
			210.85	-9.173E+00	&	1.925E+01	6.37E+01	2.99E+00 G
TH-234	N	2.3642E+01					1.63E+12	
			63.29	-4.631E+00	%(P	1.694E+01	5.73E+03	3.81E+00 G
			92.59	4.293E+01	?(P	8.798E+00	6.53E+00	5.58E+00 G
PA-231	N	-1.9992E+01					1.20E+07	
			302.65	-1.999E+01	&(	2.352E+01	3.63E+01	2.88E+00 G
			300.07	7.710E+01	+	1.995E+01	9.38E+00	2.46E+00 G
PA-233	C	4.4357E+00					7.82E+08	
			312.01	-3.185E-02	%(	1.323E+00	1.22E+03	3.60E+01 G
			300.18	3.038E+01	(	7.992E+00	9.50E+00	6.20E+00 G
PA-234	N	-2.5595E+00					1.63E+12	
			131.29	-2.559E+00	?(	2.999E+00	3.60E+01	1.80E+01 G
			946.02	-7.206E-01	+	3.661E+00	1.47E+02	1.34E+01 G
			569.47	-4.068E+00	&	7.919E+00	5.92E+01	8.20E+00 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
		883.24	1.303E+00	+	4.796E+00	1.08E+02	9.60E+00 G
		880.53-1.821E+00		+	8.756E+00	1.40E+02	6.00E+00 GA
PA-234M	N -3.1254E-01					1.63E+12	
		1001.00-3.125E-01		%(	6.731E+01	6.07E+03	8.37E-01 G
		766.41-6.861E+01		&	2.679E+02	1.16E+02	2.94E-01 G
U-235	N -4.8722E-02					2.57E+11	
		143.79-4.872E-02		&(P	3.280E+00	3.29E+02	1.10E+01 G
		205.33-1.365E+00		+	1.017E+01	2.22E+02	5.01E+00 G
		163.38-1.387E+00		+	9.023E+00	1.94E+02	5.08E+00 G
AM-241	T 3.0026E-01					1.58E+05	
		59.54	3.003E-01	?(	1.760E+00	1.76E+02	3.59E+01 G
Ir-192	F 6.4320E-02					7.40E+01	
		316.49-1.170E-01		?(	5.745E-01	1.46E+02	8.70E+01 G
		468.06-1.215E-02		%	1.043E+00	2.50E+03	5.18E+01 G
		308.44	5.614E-01	?(	1.370E+00	7.36E+01	3.18E+01 G
		295.95-2.978E-01		&	1.754E+00	1.75E+02	3.02E+01 G
Cs-136	F 1.6639E-01					1.30E+01	
		818.50	1.664E-01	&(	4.811E-01	8.60E+01	1.00E+02 G
		1048.07	1.977E-02	-	6.019E-01	8.49E+02	8.00E+01 G
		340.57-2.075E+00		+	1.985E+00	2.96E+01	4.69E+01 G
Np-239	T 4.1666E+00					2.36E+00	
		103.70-1.213E+00		-	2.057E+00	5.16E+01	2.40E+01 X
		106.13	4.167E+00	(	1.806E+00	1.42E+01	2.27E+01 G
		99.50	5.421E+00		2.675E+00	1.60E+01	1.50E+01 X
Nd-147	-2.0664E-01					1.11E+01	
		531.00-2.066E-01		(	4.553E+00	6.44E+02	1.30E+01 G
		91.10-2.026E+00		+	2.224E+00	3.37E+01	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	
AM-241	59.90	1332.	29.	0.008	176.05	3.003E-01	
BA-133	82.23	957.	-60.	-0.017	73.85	-9.520E-01	
Nd-147	91.96	1664.	-176.	-0.049	33.69	0.000E+00	
TH-234	93.39	1007.	735.	0.204	6.53	4.293E+01	P
Gd-153	97.84	868.	-74.	-0.021	57.61	-1.971E+03	
Gd-153	103.75	1067.	-62.	-0.017	75.55	-2.284E+03	
EU-152	123.00	657.	-40.	-0.011	90.94	-6.945E-01	
CO-57	124.49	384.	77.	0.021	37.58	3.124E+02	
EU-154	123.03	678.	-36.	-0.010	105.04	-5.331E-01	
PA-234	130.46	1111.	-135.	-0.037	35.99	-2.559E+00	
HF-181	134.88	568.	6.	0.002	524.52	0.000E+00	
CO-57	135.15	605.	-4.	-0.001	902.09	-1.288E+02	
Tc-99m	140.52	715.	22.	0.006	169.77	0.000E+00	
CE-141	145.26	663.	25.	0.007	147.31	0.000E+00	
Ba-140	162.35	598.	31.	0.009	112.03	0.000E+00	
U-235	164.00	669.	-19.	-0.005	194.38	-1.387E+00	
TH-229	193.79	611.	-20.	-0.005	178.03	-1.881E+00	
U-235	205.56	601.	-16.	-0.004	222.29	-1.365E+00	
TH-229	211.61	743.	-62.	-0.017	63.65	-9.173E+00	
TH-227	235.97	9910.	-43.	-0.012	330.24	-2.113E+00	
EU-152	243.78	431.	-41.	-0.011	73.13	-3.913E+00	
TH-227	256.26	385.	-8.	-0.002	334.35	-7.697E-01	
BI-210M	266.19	399.	-11.	-0.003	250.20	-1.190E-01	
Hg-203	278.61	430.	4.	0.001	739.39	0.000E+00	
Ir-192	296.33	379.	-16.	-0.004	175.36	0.000E+00	
PA-231	300.00	318.	332.	0.092	9.38	7.710E+01	
PA-233	300.00	324.	329.	0.091	9.50	3.038E+01	
PA-231	301.85	609.	-100.	-0.028	36.28	-1.999E+01	
BA-133	301.87	577.	-103.	-0.029	34.26	-5.303E+00	
Ba-140	305.23	337.	-31.	-0.009	85.79	0.000E+00	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
BI-210M	305.23	337.	-31.	-0.009	85.72	-6.398E-01	
Ir-192	307.62	238.	31.	0.008	73.64	0.000E+00	
Ir-192	316.55	305.	-17.	-0.005	146.20	0.000E+00	
CR-51	321.27	258.	29.	0.008	80.65	0.000E+00	
La-140	327.95	297.	422.	0.117	7.55	0.000E+00	
Cs-136	340.01	975.	-155.	-0.043	29.60	0.000E+00	
EU-152	343.52	270.	-18.	-0.005	129.10	-6.397E-01	
HF-181	345.61	229.	3.	0.001	722.06	0.000E+00	
BA-133	354.83	219.	24.	0.007	88.52	4.150E-01	
BA-133	383.60	269.	14.	0.004	171.33	1.721E+00	
AG-108M	433.71	209.	16.	0.004	133.37	1.319E-01	
pm-146	456.18	183.	-21.	-0.006	93.73	-6.410E-01	
BE-7	477.91	198.	12.	0.003	175.38	0.000E+00	
HF-181	481.97	210.	19.	0.005	112.13	0.000E+00	
La-140	486.58	184.	13.	0.004	148.86	0.000E+00	
RU-103	494.75	152.	-6.	-0.002	302.37	0.000E+00	
RH-106	510.81	258.	455.	0.126	6.85	3.039E+03	
Nd-147	532.71	190.	-3.	-0.001	644.13	0.000E+00	
Ba-140	537.57	203.	-15.	-0.004	135.00	0.000E+00	
CS-134	562.68	186.	55.	0.015	37.77	7.380E+01	
PA-234	568.41	206.	-36.	-0.010	59.19	-4.068E+00	
SB-124	606.05	77.	35.	0.010	38.99	0.000E+00	
CS-134	600.58	95.	-6.	-0.002	240.64	-7.101E-01	
BI-214	609.47	211.	9.	0.003	67.76	1.955E-01	P
RU-103	609.47	170.	31.	0.009	61.53	0.000E+00	
AG-108M	613.65	189.	-14.	-0.004	142.63	-1.551E-01	
RH-106	618.56	112.	3.	0.001	554.97	4.252E+01	
CS-137	661.94	153.	17.	0.005	105.34	2.508E-01	
SB-124	722.79	1237.	11.	0.003	467.26	0.000E+00	
AG-108M	719.72	69.	31.	0.009	41.90	3.922E-01	
EU-154	723.36	1314.	11.	0.003	481.41	1.089E+00	
pm-146	736.86	134.	30.	0.008	56.78	3.955E+00	
pm-146	747.29	132.	14.	0.004	115.59	1.255E+00	
ZR-95	756.79	188.	-8.	-0.002	247.93	0.000E+00	
NB-95	766.07	175.	-12.	-0.003	161.45	0.000E+00	
PA-234M	765.89	187.	-17.	-0.005	116.22	-6.861E+01	
EU-152	779.16	138.	-20.	-0.006	86.37	-2.707E+00	
CS-134	794.92	101.	252.	0.070	8.46	4.398E+01	
CS-134	801.47	115.	-10.	-0.003	149.73	-1.789E+01	
CO-58	810.32	76.	-8.	-0.002	167.38	0.000E+00	
La-140	818.89	59.	3.	0.001	415.52	0.000E+00	
Cs-136	818.04	59.	13.	0.004	86.05	0.000E+00	
MN-54	832.83	181.	-49.	-0.013	41.72	-2.594E+02	
Co-56	846.59	76.	-9.	-0.002	144.64	0.000E+00	
EU-154	872.61	73.	5.	0.001	242.64	9.959E-01	
PA-234	880.07	62.	-8.	-0.002	140.33	-1.821E+00	
PA-234	883.90	46.	9.	0.003	108.02	1.303E+00	
Sc-46	888.37	72.	-9.	-0.003	134.24	0.000E+00	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
y-88	897.81	82.	-4.	-0.001	369.74	0.000E+00		
PA-234	946.11	47.	-7.	-0.002	147.18	-7.206E-01		
EU-152	966.78	364.	-76.	-0.021	37.15	-1.100E+01		
EU-154	995.76	53.	5.	0.001	233.54	1.149E+00		
EU-154	1004.96	35.	12.	0.003	78.33	1.743E+00		
Co-56	1038.00	57.	-6.	-0.002	175.13	0.000E+00		
Cs-136	1048.01	37.	1.	0.000	849.41	0.000E+00		
RH-106	1046.62	21.	3.	0.001	232.33	4.450E+02		
Ga-68	1073.52	33.	3.	0.001	244.51	0.000E+00		
FE-59	1102.71	17.	11.	0.003	64.05	0.000E+00		
EU-152	1113.16	52.	-1.	0.000	698.78	-2.554E-01		
ZN-65	1115.81	61.	-7.	-0.002	157.72	-5.218E+02		
BI-214	1120.39	50.	3.	0.001	69.60	3.364E-01	P	
Sc-46	1120.50	39.	14.	0.004	70.25	0.000E+00		
Ta-182	1121.41	39.	14.	0.004	69.79	0.000E+00		
CO-60	1173.04	53.	-7.	-0.002	159.50	-3.006E-01		
Ta-182	1189.19	27.	2.	0.001	302.15	0.000E+00		
Ta-182	1219.36	35.	-2.	-0.001	411.92	0.000E+00		
Co-56	1238.60	38.	4.	0.001	205.87	0.000E+00		
FE-59	1291.90	36.	3.	0.001	279.42	0.000E+00		
CO-60	1333.57	34.	-5.	-0.001	168.76	-2.557E-01		
EU-152	1411.07	29.	-1.	0.000	544.30	-1.972E-01		
La-140	1595.28	72.	-10.	-0.003	119.40	0.000E+00		
SB-124	1688.45	22.	1.	0.000	789.53	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 1 Sigma Counting		MDA Bq/Sample
BE-7	#A	8.8854E-01	>12 Halflives	1.7538E+02%	5.2712E+00	
NA-22	#A	1.1277E-02	8.2007E-02	1.224E+03%		3.65E+00
K-40	#A	4.3548E+00	4.3548E+00	4.547E+01%		7.01E+00
Sc-46	#A	4.9696E-02	>12 Halflives	7.0252E+01%	5.6579E-01	
CR-51	#A	1.7470E+00	>12 Halflives	8.0650E+01%	4.6811E+00	
MN-54	#A	-6.1919E-01	-2.5939E+02	4.172E+01%		3.49E+02
FE-59	#A	2.2688E-01	>12 Halflives	6.4054E+01%	6.3144E-01	
Co-56	#A	-2.1725E-02	>12 Halflives	1.2580E+02%	5.6000E-01	
CO-57	#A	3.0306E-01	3.1239E+02	3.758E+01%		3.80E+02
CO-58	#A	-9.4548E-02	>12 Halflives	1.6738E+02%	5.4290E-01	
CO-60	#A	-9.6028E-02	-2.5572E-01	1.688E+02%		1.51E+00
ZN-65	#A	-2.3170E-01	-5.2175E+02	1.577E+02%		2.83E+03
NB-94	A	8.7763E-02	8.7785E-02	1.172E+02%		7.26E-01
ZR-95	#A	-1.7049E-01	>12 Halflives	2.4793E+02%	1.4369E+00	
NB-95	#A	-1.4011E-01	>12 Halflives	1.6145E+02%	7.6538E-01	
RU-103	#A	-5.3761E-02	>12 Halflives	3.0237E+02%	5.5560E-01	

RH-106 #A	6.2459E-01	9.7172E+01	2.323E+02%		8.15E+02
AG-108M#A	2.5910E-01	2.6232E-01	4.190E+01%		5.92E-01
AG-110M A	5.5722E-01	1.0586E+03	4.933E+01%		1.17E+03
SN-113 A	1.8886E-01	>12 Halflives	1.1733E+02%	7.4425E-01	
SB-124 #A	4.2715E-01	>12 Halflives	3.8988E+01%	4.3412E-01	
SB-125	1.3986E+00	9.0902E+00	3.903E+01%		8.93E+00
I-131 A	-7.4029E-03	>12 Halflives	9.8510E+01%	6.7378E-01	
Gd-153 #A	-8.0284E-01	-1.9713E+03	5.761E+01%		3.74E+03
Ga-68 #A	2.1843E+00	>12 Halflives	2.4451E+02%	1.8899E+01	
Tc-99m #A	9.2939E-02	>12 Halflives	1.6977E+02%	5.2710E-01	
BA-133 #A	2.5427E-01	4.1497E-01	8.852E+01%		1.22E+00
CS-134 #C	1.8463E+00	2.2498E+01	8.460E+00%		5.88E+00
CS-137 #A	2.1112E-01	2.5076E-01	1.053E+02%		8.87E-01
CE-139 #A	-8.2397E-03	>12 Halflives	1.7685E+03%	4.9246E-01	
Ba-140 #A	-6.3261E-02	>12 Halflives	8.7716E+01%	2.5243E+00	
La-140 #C	1.5237E+00	>12 Halflives	7.5535E+00%	9.8914E-01	
CE-141 #A	1.8297E-01	>12 Halflives	1.4731E+02%	8.9977E-01	
CE-144 #A	4.7484E-02	3.5551E+01	2.433E+03%		2.91E+03
PM-144 A	2.2540E-02	4.0630E+00	3.111E+02%		1.34E+02
EU-152 #A	-4.3690E-01	-6.3974E-01	1.291E+02%		2.77E+00
EU-154 #A	6.9852E-01	1.2738E+00	7.833E+01%		8.36E+00
EU-155 #	6.5091E+00	1.8431E+01	1.193E+01%		4.90E+00
HF-181 #A	1.7963E-01	>12 Halflives	1.1213E+02%	7.1366E-01	
Ta-182 #A	6.4360E-01	>12 Halflives	6.9786E+01%	1.4919E+00	
Hg-203 #A	2.6453E-02	>12 Halflives	7.3939E+02%	6.6105E-01	
TL-208	1.8760E+01	2.7996E+02	2.997E+00%		1.04E+01
pm-146 #A	9.1622E-01	2.3304E+00	5.678E+01%		4.89E+00
y-88 #A	-5.0727E-02	>12 Halflives	3.6974E+02%	6.5071E-01	
Cd-109 A	8.9996E+00	5.7611E+02	5.370E+01%		1.02E+03
PB-210 #A	2.1053E+00	2.6538E+00	1.700E+02%		1.54E+01
PB-212	5.9014E+01	8.8066E+02	1.449E+00%		1.40E+01
PB-214 A	8.0389E-01	8.0649E-01	4.452E+01%		9.60E-01
BI-207 #A	6.3907E-03	7.5020E-03	2.283E+03%		5.94E-01
BI-212	6.1970E+01	9.2477E+02	8.780E+00%		1.29E+02
BI-214 #A	2.2954E-01	2.3028E-01	1.903E+02%		1.51E+00
BI-210M#A	-1.1905E-01	-1.1905E-01	2.502E+02%		1.00E+00
RA-224	5.5445E+01	8.2740E+02	1.057E+01%		2.64E+02
AC-228	8.1039E+01	1.9889E+02	2.061E+00%		2.77E+00
TH-227 #A	-1.6666E+00	-2.1126E+00	3.302E+02%		2.31E+01
TH-229 #A	-1.8795E+00	-1.8808E+00	1.780E+02%		1.12E+01
TH-234 #C	2.3642E+01	2.3642E+01	7.058E+00%		1.69E+01
PA-231 #A	-1.9989E+01	-1.9992E+01	3.628E+01%		2.35E+01
PA-233 #C	4.4357E+00	4.4357E+00	9.497E+00%		1.32E+00
PA-234 #A	-2.5595E+00	-2.5595E+00	3.599E+01%		3.00E+00
PA-234M#A	-3.1254E-01	-3.1254E-01	6.075E+03%		6.73E+01
U-235 #A	-4.8722E-02	-4.8722E-02	2.633E+03%		3.28E+00
AM-241 #A	2.9670E-01	3.0026E-01	1.760E+02%		1.76E+00
Np-237 #A	0.0000E+00	0.0000E+00	0.000E+00%		4.69E+00
Ir-192 #A	6.4320E-02	>12 Halflives	7.3642E+01%	5.7446E-01	

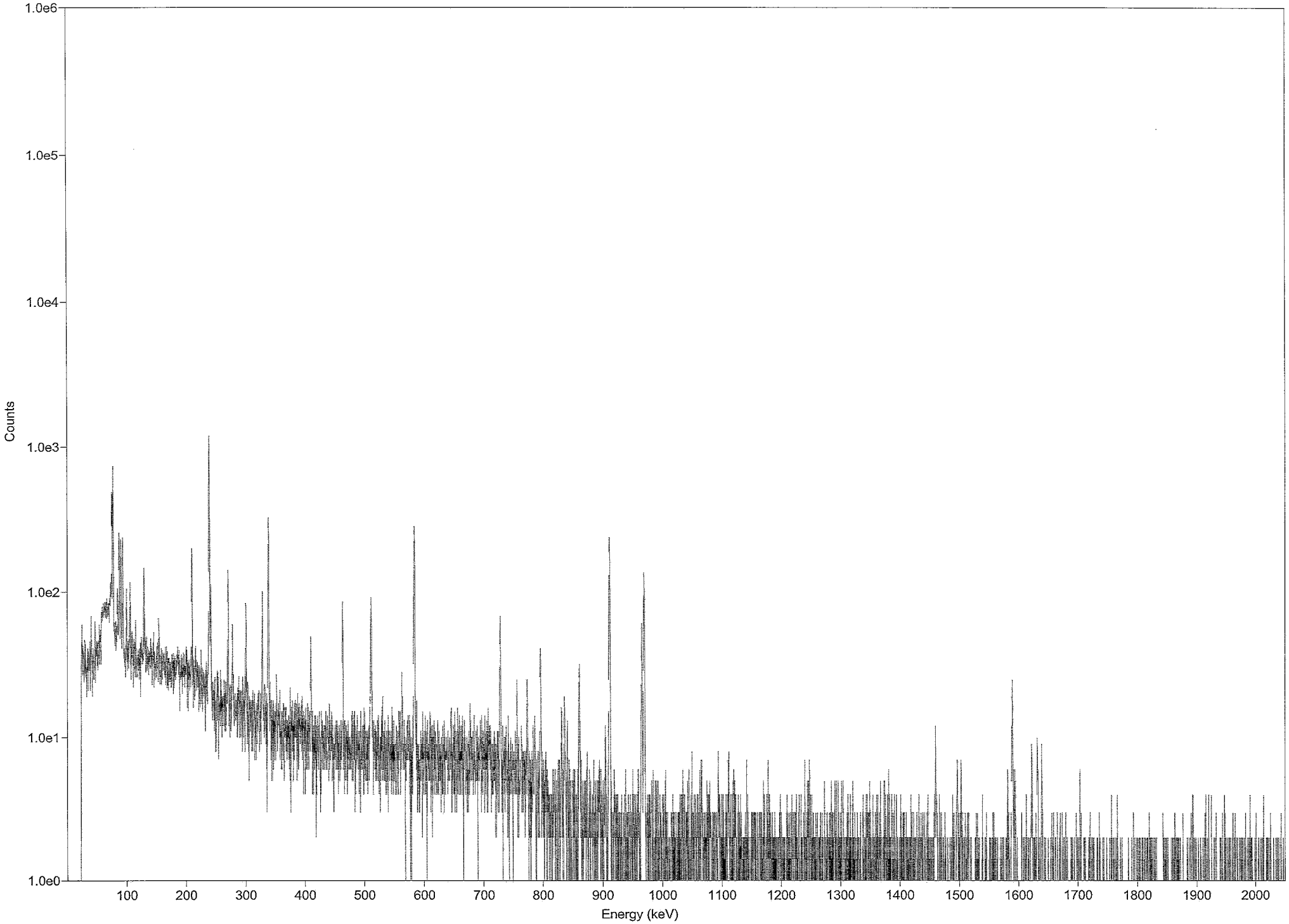
Cs-136	#A	1.6639E-01	>12 Halflives	8.6047E+01%	4.8111E-01
Np-239	C	4.1666E+00	>12 Halflives	1.4159E+01%	1.8062E+00
Nd-147	#A	-2.0664E-01	>12 Halflives	6.4413E+02%	4.5526E+00

- 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 (1384.1 to 1999.5 keV) 2.939E+02 Bq/Sample
Total Decayed Activity (1384.1 to 1999.5 keV) 3.7161255E+03 Bq/Sample

M132730_NA_3. 11_NA_20130864.spc.

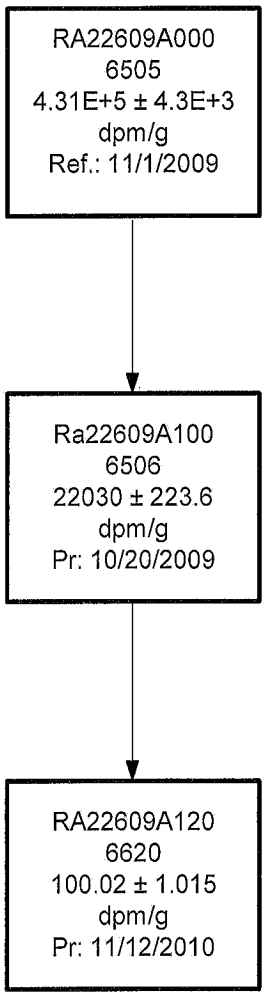


Reagent

RA22609A120_00003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Ra22609A



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ISOTOPE DILUTION RECORD

1) Prepared by	drm		2) Date Prepared	11/12/2010
3) Source Identification Number / Ref. Number			***RA22609A100***	***6506***
4) Source Activity (dpm ± dpm/g)			2.2030E+04 ±	2.236E+02
5) Percent error of Source Activity			1.015 %	
6) Weight of Source Material used (g)			4.5672	
7) (% Error) of Weight of Source Material used			0.0066 %	
8) Diluent		S-09-00265	1M HNO3	
9) Total Weight of the Dilution (g)			1006	
10) (% Error) of Total Weight of the Dilution			0.0172 %	
11) Specific Activity of Diluted Solution dpm/g			***1.0002E+02*** ±	***1.015E+00***
12) Total Uncertainty			1.015 %	
13) Dilution Identification Number / Ref. Number			***RA22609A120***	***6620***
14) Calibration Reference Date			11/1/2009	
15) Isotope Inventory File update by/date			drm	11/12/2010
16) Reviewed by/date			tda	11/29/2010
17) Location	QCLB		18) Exhausted	

****

CALCULATIONS

5) **Cert value at 99.7% (K=3) level / 3 OR Cert Value 95% (K=2) level/2 = 1 sigma uncertainty for propagation**

*7) % error of wt. used = (0.0003 / weight of source material used * 100)*

wt uncert (4 place balance) = Sqrt($0.0002^2 + 0.0002^2 + 0.00001^2$) = 0.0003 g

*10) % error of dilution wt. = (0.173 / total weight of dilution * 100)*

wt uncert (0.1 place balance) = Sqrt($0.1^2 + 0.1^2 + 0.1^2$) = 0.173 g

*11) Specific Activity = Source Activity * Wt. of Source Material used / Total Wt. of the Dilution*

12) % Total Uncertainty = $\sqrt{(\%\ \text{error of Source Activity}^2 + \%\ \text{error of Wt. Used}^2 + \%\ \text{error of Dilution Wt.}^2)}$

CC-006, 6/16/09, Rev 6

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ISOTOPE DILUTION RECORD

1) Prepared by	DRM	2) Date Prepared	10/20/2009
3) Source Identification Number / Ref. Number	***RA22609A000***		***6505***
4) Source Activity (dpm ± dpm/g)	4.3068E+05	±	4.307E+03
5) Percent error of Source Activity	1 %		
6) Weight of Source Material used (g)	5.1219		
7) (% Error) of Weight of Source Material used	0.0059 %		
8) Diluent	1M HNO3		
9) Total Weight of the Dilution (g)	100.1319		
10) (% Error) of Total Weight of the Dilution	0.1728 %		
11) Specific Activity of Diluted Solution dpm/g	***2.2030E+04***	***±***	***2.236E+02***
12) Total Uncertainty	1.015 %		
13) Dilution Identification Number / Ref. Number	***RA22609A100***		***6506***
14) Callbration Reference Date	11/1/2009		
15) Isotope Inventory File update by/date	DRM		10/20/2009
16) Reviewed by/date	tda		1/26/2010
17) Location	QCLB	18) Exhausted	

****

CALCULATIONS

5) **Cert value at 99.7% (K=3) level / 3 OR Cert Value 95% (K=2) level/2 = 1 sigma uncertainty for propagation**

*7) % error of wt. used = (0.0003 / weight of source material used * 100)*

wt uncert (4 place balance) = Sqrt(0.0002^2 + 0.0002^2 + 0.00001^2) = 0.0003 g

*10) % error of dilution wt. = (0.173 / total weight of dilution * 100)*

wt uncert (0.1 place balance) = Sqrt(0.1^2 + 0.1^2 + 0.1^2) = 0.173 g

*11) Specific Activity = Source Activity * Wt. of Source Material used / Total Wt. of the Dilution*

12) % Total Uncertainty = $\sqrt{(\%\ \text{error of Source Activity}^2 + \%\ \text{error of Wt. Used}^2 + \%\ \text{error of Dilution Wt.}^2)}$

CC-006, 6/16/09, Rev 6

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ISOTOPE RECORD FORM

1) Isotope	RA-226	2) Reference Number	6505
3) Half Life	1600 ± 7 years	4) Storage Location	Standards Lab 134A

5) Source Identification Number: RA22609A000-6505

****

CALIBRATION DATA

6) Activity as Received Units	0.1940 uCi/g or 7.178 kBq/g
7) Overall Uncertainty Percent	3.0% @ 99% = 1.0%
8) Reference Date / Time	November 1, 2009
9) Activity dpm/g	4.3068E+5 ± 4.3068E+3 dpm/g
10) Volume or Mass (ml/g)	5.15872
11) Calibrated by	Isotope Products
12) Certificate Solution Number	1388-74

****

SURVEY DATA

13) Date Received	10/20/2009
14) Surveyed by	DRM
15) Survey Reading (Beta/Gamma) cpm	~15,000
16) Survey Reading (Alpha) cpm	BKGD

****

17) Activity Conversion: 0.1940 uCi/g * 2220000 uCi/dpm =

4.3068E+5 ± 4.3068E+3 dpm/g

18) Remarks: Used entire ampoule for first dilution drm 10/20/2009

19) Isotope File Updated by	drm 10/20/2009
20) QC Approved	tda 1/26/10

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661•309•1010
Fax 661•257•8303

RA22609A000
6505
Rec: 10/20/2009

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

Radionuclide:	Ra-226	**Customer:**	TEST AMERICA
Half-life:	1600 ± 7 years	**P.O. No.:**	2328217
Catalog No.:	7226	**Reference Date:**	1-Nov-09 12:00 PST
Source No.:	1388-74	**Contained Radioactivity: (Ra-226 only)**	1.001 µCi 37.04 kBq

Physical Description:

A.	Mass of solution:	5.15872 g in 5 mL flame-sealed ampoule
B.	Chemical form:	$Ra(NO_3)_2$ in 1M HNO_3
C.	Carrier content:	10 µg Ba/mL of solution
D.	Density:	1.0318 g/mL @ 20°C

Radioimpurities:

None detected (daughters not in equilibrium as of 14-Oct-09)

Radionuclide Concentration: 0.1940 µCi/g, 7.178 kBq/g

Method of Calibration:

This source was prepared from a weighed aliquot of solution whose activity in µCi/g was determined using gamma ray spectrometry.

Peak energy used for integration:	186.0 keV
Branching ratio used:	0.0351 gammas per decay

Uncertainty of Measurement:

A.	Type A (random) uncertainty:	± 0.5 %
B.	Type B (systematic) uncertainty:	± 3.0 %
C.	Uncertainty in aliquot weighing:	± 0.0 %
D.	Total uncertainty at the 99% confidence level:	± 3.0 %

Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from NCRP Report No. 58, 1985.
- This solution has a working life of 5 years.

Daniel James Van Dalsem
Quality Control

15-OCT-09
Date

EZIP Ref. No.: 1388-74

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Standard
Re-verification Check

Source I.D.:	Ra22609A120	*Date:*	5/16/2013
Check Source:	Analyzed with 3 other sources	*Initials:*	drm
Procedure:	Direct De-em		
Batch #:	T130136		

Sample I.D.	*Found*	*2 σ TPU*	*Expected*	*Chem Yield %*	*RadChem Yield %*
DVF6991	104	23.8	103.39		100.59%
DVF6992	98.3	19.66	103.05		95.39%
DVF6993	100	21	103.06		97.03%

AVERAGE (95%-105%)	97.67%
STANDARD DEVIATION	2.17%
RSD<10% (2 sigma / average)	4.44%

Chemical Yield 20 - 115%
RadChem Yield 75 - 125%
Expected within 2 σ TPU of Found

Evaluation: *Data accepted 5/16/2013 drm*

The original NIST Certificate is located in Document Control Department.

Reagent

Source A_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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
Am-241	59.5	157860	———	3.390E+03	0.1	0.9	1.8	4π 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
Co-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: 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:
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: [signature] for
W. Mao, Radiochemist

QA Approved: [signature] Date: 5-13-09
D. M. Montgomery, QA Manager

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Reagent

Source C_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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
Am-241	59.5	157860	———	3.390E+03	0.1	0.9	1.8	4π 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
Co-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: 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:
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: _____ for
W. Mao, Radiochemist

QA Approved: _____ Date: 5-13-09
D. M. Montgomery, QA Manager

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Reagent

Source D_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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
Am-241	59.5	157860	———	3.390E+03	0.1	0.9	1.8	4π 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
Co-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: 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:
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: for
W. Mao, Radiochemist

QA Approved: Date: 5-13-09
D. M. Montgomery, QA Manager

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
Am-241	59.5	157860	———	3.390E+03	0.1	0.9	1.8	4π 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
Co-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: 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:
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: _____ for
W. Mao, Radiochemist

QA Approved: _____ Date: 5-13-09
D. M. Montgomery, QA Manager

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Reagent

Source F_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

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, % Type u_A	u_B	U	Calibration Method
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 Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved: _____ Date: 13 JAN 11
J. D. McCorvey, QA Manager Alternate

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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
Am-241	59.5	157860	———	3.390E+03	0.1	0.9	1.8	4π 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
Co-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: 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:
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: [signature] for
W. Mao, Radiochemist

QA Approved: [signature] Date: 5-13-09
D. M. Montgomery, QA Manager

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

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

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, % Type u_A	u_B	U	Calibration Method
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: MTaskaeva
M. I. Taskaeva, Radiochemist

QA Approved: _____ Date: 13 JAN 11
J. D. McCorvey, QA Manager Alternate

Reagent

Source H_00002

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

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, % Type u_A	u_B	U	Calibration Method
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: MTaskaeva
M. I. Taskaeva, Radiochemist

QA Approved: _____ Date: 13 JAN 11
J. D. McCorvey, QA Manager Alternate

Reagent

Sr-90_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

80573-334
5 mL Liquid in Flame Sealed Vial

Customer: Test America St. Louis
P.O. No.: 2324797, Item 1

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting. Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below. 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.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, % Type u_A	u_B	U	Reference Date (12:00 PM EST)
Sr-90	10515.5	3.782E+04	0.1	0.9	1.8	09/17/2009

*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: γ-impurities <0.1%. 5.04317 grams 0.1M HCl solution with approximately 30 microg/g each of Sr and Y carriers. NOTE: This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total beta emission rate for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ Date: 9-22-09
D. M. Montgomery, QA Manager

ACCREDITED SOURCE CALIBRATION LABORATORY
HEALTH PHYSICS SOCIETY
FOUNDED 1956

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318

Reagent

Sr-90_00017

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

92352

Sr-90 5 mL Liquid in Flame Sealed Vial

Customer: TestAmerica St. Louis
P.O. No.: 2502682, Item 1 Product Code: 8090-5FSA-37kBq

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* , % Type u_A	u_B	U	Reference Date (12:00 PM EST)
Sr-90	1.052E+04	3.749E+04	0.1	0.9	1.8	11/29/2012

***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: γ-impurities<0.1%.
5.02357 g 0.1M HCl solution with approximately 30 µg/g each Sr and Y carriers.

NOTE: This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total activity for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

Source Prepared by: _____
Z. Dimitrova, Radiochemist

QA Approved: _____ Date: 26 Nov 12
J.D. McCorvey, Counting Room Manager

RAD12-0042
Sr-90
hursts
None
Prep/Opened: 11/28/2012
Exp(1): 11/29/2062
Exp(2): 11/29/2062

51511
ID Sr-90_00017
Sr-90 Ampoule

ACCREDITED SOURCE CALIBRATION LABORATORY — HEALTH PHYSICS SOCIETY — FOUNDED 1956

Single Isotope Certificate Rev 3, 23 August 2012

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Reagent

Sr-90_00018

TestAmerica St. Louis

Standards Preparation Logbook Record

Nov-28-2012

Logbook: \\Qstlmo01\Stdslog\RAD_STD.std

RAD12-0042, Sr-90 Sr-90_00017 #51511 Analyst: hursts

Vendor: Analytics Lot No.: 92352
Solvent: None
Date Prep./Opened: 11-28-2012
Date Expires(1): 11-29-2062 (50 Years)
Date Expires(2): 11-29-2062 (50 Years)
Cert: 92352 Activity: 37490Bq Mass: 5.02357 Ref. Date: 11/29/12

Component	Initial Conc (dpm/g)	Final Conc (dpm/g)
Sr-90	447,769	447,769

RAD12-0043, Sr-90 Calibration STD Sr-90_00018 #51512 Analyst: hursts

Solvent: None Volume (ml): 100.00
Date Prep./Opened: 11-28-2012
Date Expires(1): 11-29-2062 (50 Years)
Date Expires(2): 11-29-2062 (50 Years)

Parent Std No.: RAD12-0042, Sr-90 Aliquot Amount (g): 4.9997
Parent Date Expires(1): 11-29-2062 Parent Date Expires(2): 11-29-2062

Component	Initial Conc (dpm/g)	Final Conc (dpm/mL)
Sr-90	447,769	22,387

Reviewed By: SR

St. Louis Radiological Standard Reverification Form

Standard ID Number: Rad12-0043
True Value = 2016.7 pCi/L or g
Date Analyzed: 11/30/2012

Radionuclide: Sr90

	Replicates	
#1	1964	pCi/L or g
#2	1958	pCi/L or g
#3	2015	pCi/L or g

Mean = 1979

1 sigma = 31.32092 1.96 sigma = 61.389

True Value minus 5% = 1915.865 (True Value - 5%)
True Value plus 5% = 2117.535 (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: 11/30/12

SOP Reference: STL-QA-0002, Current Revision

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Analysis Report for Gross Alpha/Beta

Batch: M122629 **Operator:** 63903

Sample ID	WRKNO	Aliquot		Mass		Instr ID	CountTime		Ts	Tb	Dilution	Sigma	
	Analyte	Cs	Cb	XT		CPMs	CPMb	Eff	Activity	UncTot	UncCnt	MDA	DLC
verification-1b	NA	1.000E+000sample		0.0536	g	Purple16	11/30/12 10:42		8.00	1000.00	1.00	1.00	
	Gross Alpha	123	175	0.00		1.538E+001	1.750E-001	0.4314	**1.587E+001**pCi/sample	1.707E+000	1.448E+000	8.638E-001	3.593E-001
	Gross Beta	14954	485	0.00		1.869E+003	4.850E-001	0.4285	**1.964E+003**pCi/sample	9.953E+001	1.607E+001	1.211E+000	6.021E-001
verification-2b	NA	1.000E+000sample		0.0529	g	Purple17	11/30/12 10:43		8.00	1000.00	1.00	1.00	
	Gross Alpha	53	87	0.00		6.625E+000	8.700E-002	0.1306	**2.254E+001**pCi/sample	3.391E+000	3.138E+000	2.356E+000	8.365E-001
	Gross Beta	15152	362	0.00		1.894E+003	3.620E-001	0.4356	**1.958E+003**pCi/sample	9.919E+001	1.591E+001	1.077E+000	5.117E-001
verification-3b	NA	1.000E+000sample		0.0528	g	Purple18	11/30/12 10:43		8.00	1000.00	1.00	1.00	
	Gross Alpha	85	62	0.00		1.063E+001	6.200E-002	0.1313	**3.624E+001**pCi/sample	4.462E+000	3.954E+000	2.160E+000	7.027E-001
	Gross Beta	15378	395	0.00		1.922E+003	3.950E-001	0.4296	**2.015E+003**pCi/sample	1.020E+002	1.625E+001	1.125E+000	5.420E-001

Laboratory Control Sample Information

SampID	WRKNO	Analyte	Activity	StdAdded	Recovery	LCL	UCL	ZFactor
					%			

Sample Duplicate Information

Sample ID	Dup Sample ID	Analyte	Sample Activity	Dup Activity	RPD	RER	DER	ZFactor

Matrix Spike Information

SampID	SampMSID	Analyte	Sample Activity	MS Activity	StdAdded	MSRecovery	ZFactor
						%	

Blanks Information

SampID	WRKNO	Analyte	Activity	UncTotal	ZFactor

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Prep Report for Gross Alpha/Beta

Batch: M122629 **Prep Analyst:** 250

SampID	WRKNO	Aliquot		purple Gross	Tare	Mass	Dilution
verification-1b	NA	1.000E+000	sample	8.7067 g	8.6531 g	0.0536 g	1.00
verification-2b	NA	1.000E+000	sample	8.6615 g	8.6086 g	0.0529 g	1.00
verification-3b	NA	1.000E+000	sample	8.6935 g	8.6407 g	0.0528 g	1.00

Spike Information

Sample ID	Standard ID	Analyte	Std Conc	Aliquot	Ref Date	StdAdded
	Rad12-0043	SR-90	22.387 dpm/mL	0.1mL	11-29-12	

MS — Spiked By

LM — Spike Verified By

11-28-12 — Spike Date

Standard Operating Procedures

SOPNumber	Title	Revision
☐		

Reviewed By — 11/30/12 Review Date

MS — Analyst/Relenquished By

11/28/12 — Release Date

Received By

11/28/12 — Receipt Date

MS 11-30-12 ~~112~~ 112343897/MS/11-28-12

Balance ID / Initials / Date

Reagent

Th-229_00002

Eckert & Ziegler
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1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404•352•8677
Fax 404•352•2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

82832-334
5 mL Liquid in Flame Sealed Vial

Customer: Test America/Earth City, MO
P.O. No.: 2370431, Item 1

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 purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. 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 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.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, % Type u_A	u_B	U	Reference Date (12:00 PM EST)
Th-229	2.681E+06	3.813E+03	0.3	1.0	2.1	07/14/2010

***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: Th-228 - 1.25 Bq, Th-230 - 23.7 Bq, Th-232 - 1.5 Bq. 5.11380 grams 0.5M HNO3 solution.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ Date: 7/21/10
J. D. McCorvey, QA Manager Alternate

ACCREDITED SOURCE CALIBRATION LABORATORY
HEALTH PHYSICS SOCIETY
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Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Reagent

Th-229_00012

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Th-229-00012

Reagent ID: Th-229_00012

Description:	Th-229 Tracer	Expiration Date:	12/26/2014
No. of Bottles:	1	Laboratory:	TestAmerica St. Louis
Storage Location:	RAD Actinide STDs	Prepared By:	Bramblett, Megan L
Reagent Volume:	500.000 mL	Solvent:	0.1M HNO3
Creation Date:	12/23/2013	Solvent Lot:	L0022
Container(s):	282329		
Comment:			

282329
ID: Th-229_00012
Exp: 12/26/14 Prpd: MLM Crt: 12/23/13
Th-229 Tracer

Reagent Analyte Information

Analyte	Source ID	Source Exp. Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
Th-229	Th-229_00004	07/14/2060	2264.31000	dpm/mL	67.92931	dpm/mL

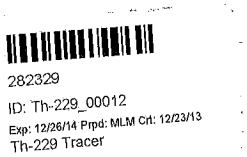
Source Reagents

Reagent	Description	Type	Expiration	Vendor	Vendor Lot #	Vendor Cat Lot #	Volume Used	Volume Units
Th-229_00004	Th-229 Parent		07/14/60				15.00000	mL

St. Louis Radiological Standard Reverification Form

Standard ID Number: Th-229_00012
True Value = 67.90686 DPM/L or g
Date Analyzed: 12/26/2013

Radionuclide: Th-229



Replicates

#1	69.113	DPM/L or g
#2	66.755	DPM/L or g
#3	68.034	DPM/L or g

Mean = 67.96733

1 sigma = 1.180413

1.96 sigma = 2.313609

True Value minus 5% = 64.51152 (True Value - 5%)
True Value plus 5% = 71.3022 (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: RTM 12/30/2013

SOP Reference: STL-QA-0002, Current Revision

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
11:30:35AM 12/30/2013

Sample

Sample Name: Verification-1
SampleType: Sample
:
Sample Collection Date:

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

Batch

Batch Name: Th-229_0012
AnalysisID: 592567

Analyst: 60040

Tracer

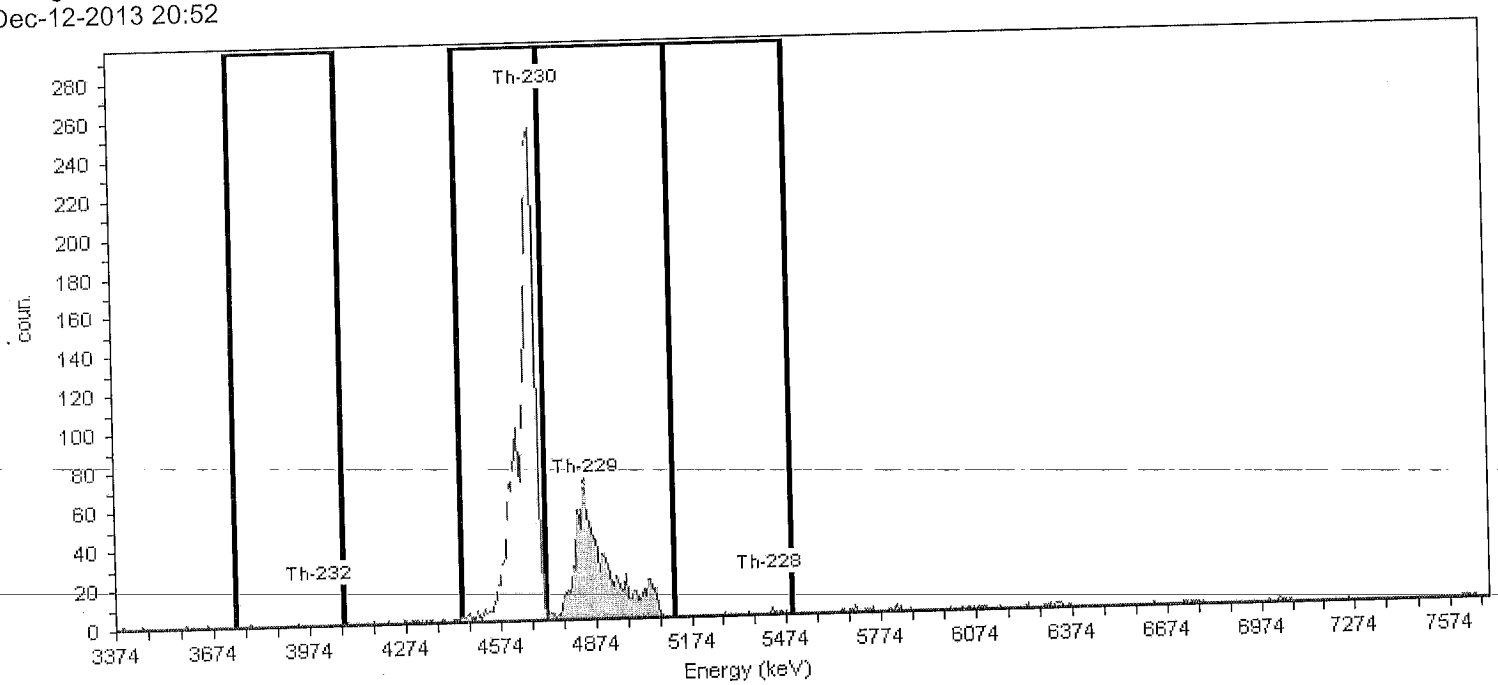
Tracer Name: Th-230_00017
Tracer Activity: 47.94 DPM/mL x (Vol.)0.30 mL = 14.38 DPM
Tracer Ref. Date: 4/11/2011 11:00:10AM

Tracer Nuclide: Th-230
Tracer Recovery: 90.73%

Acquisition

Detector: AV44
Serial Number: 50-051JJ1
Acquisition Start Date: 12/26/2013 4:26:11PM
Live Time: 600.00 min.
Real Time: 600.01 min.
Background Date: 12/12/2013 8:52:36PM
Background Info: Sample: ICB;AV44; Det: AV44; Spectrum #1;
Dec-12-2013 20:52

Calibration Name: IC-9795;AV44-20130515
Calibration Date: 5/15/2013 9:25:41PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.64% +/- 0.35% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th-230_Tracer
Decay Correction: 12/26/2013 4:24:41PM
MDA Constants: Kα = 1.65 , Kβ = 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	61.6	100.2	2	0.6250	1.38	0.095	DPM/mL
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	31.6	99.7	2079	0.0000	2079.38	130.481	DPM/mL
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	84.3	99.8	1004	3.7500	1000.25	69.113	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	36.0	99.8	8	7.5000	0.50	0.035	DPM/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
11:31:26AM 12/30/2013

Sample

Sample Name: Verification-2
SampleType: Sample
:
Sample Collection Date:

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

Batch

Batch Name: Th-229_0012
AnalysisID: 592570

Analyst: 60040

Tracer

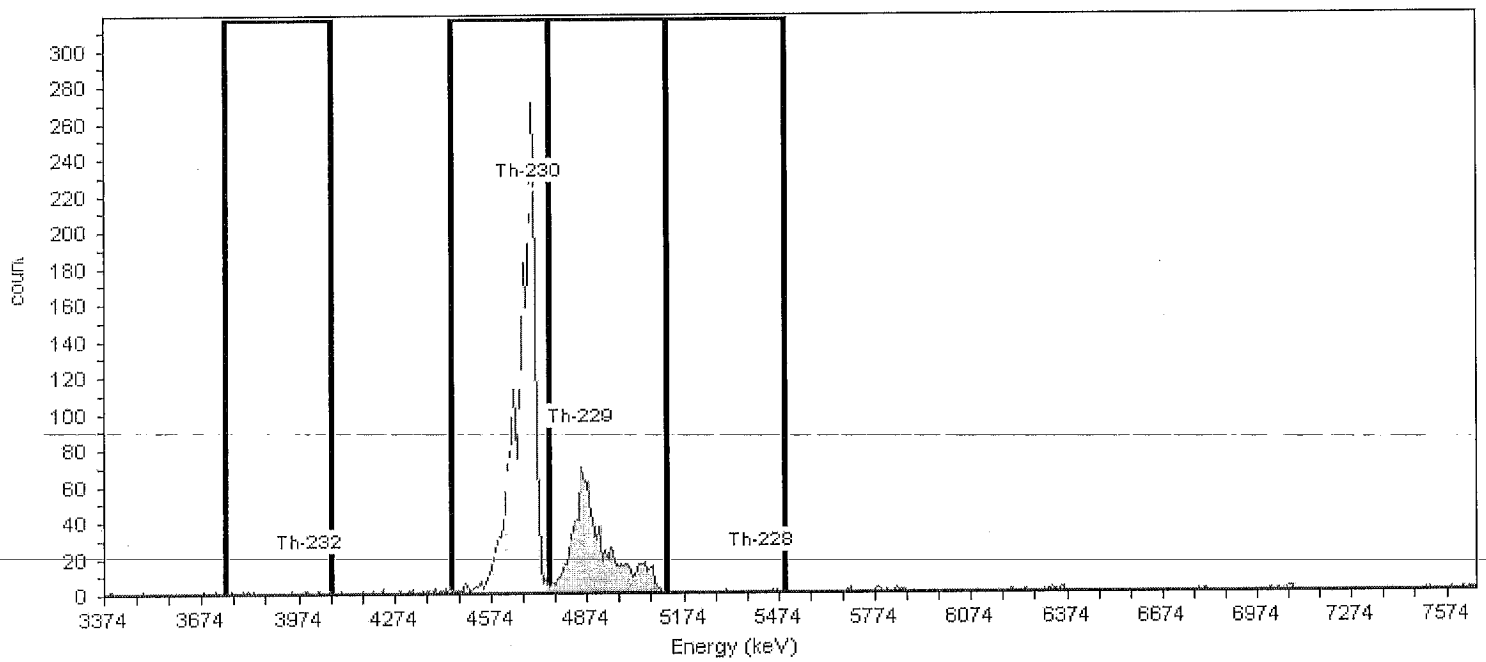
Tracer Name: Th-230_00017
Tracer Activity: 47.94 DPM/mL x (Vol.)0.30 mL = 14.38 DPM
Tracer Ref. Date: 4/11/2011 11:00:10AM

Tracer Nuclide: Th-230
Tracer Recovery: 95.22%

Acquisition

Detector: AV45
Serial Number: 48-158FF2
Acquisition Start Date: 12/26/2013 4:26:13PM
Live Time: 600.00 min.
Real Time: 600.01 min.
Background Date: 12/12/2013 8:52:38PM
Background Info: Sample: ICB;AV45; Det: AV45; Spectrum #1; Dec-12-2013 20:52

Calibration Name: IC-9817;AV45-20130515
Calibration Date: 5/15/2013 9:25:55PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.68% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th-230_Tracer
Decay Correction: 12/26/2013 4:24:41PM
MDA Constants: Kα = 1.65 , Kβ = 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	37.3	100.2	7	0.0000	7.46	0.488	DPM/mL
Th-230	4688.0	4,687.5	0.5	4448.3	4754.1	64.3	99.7	2186	0.6250	2185.38	136.944	DPM/mL
Th-229	4848.0	4,845.3	2.7	4754.1	5119.5	79.8	99.8	1016	0.6250	1015.38	66.755	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	24.9	99.8	3	5.6250	-2.63	-0.173	DPM/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
11:32:04AM 12/30/2013

Sample

Sample Name: Verification-3
SampleType: Sample
:
Sample Collection Date:

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

Batch

Batch Name: Th-229_0012
AnalysisID: 592571

Analyst: 60040

Tracer

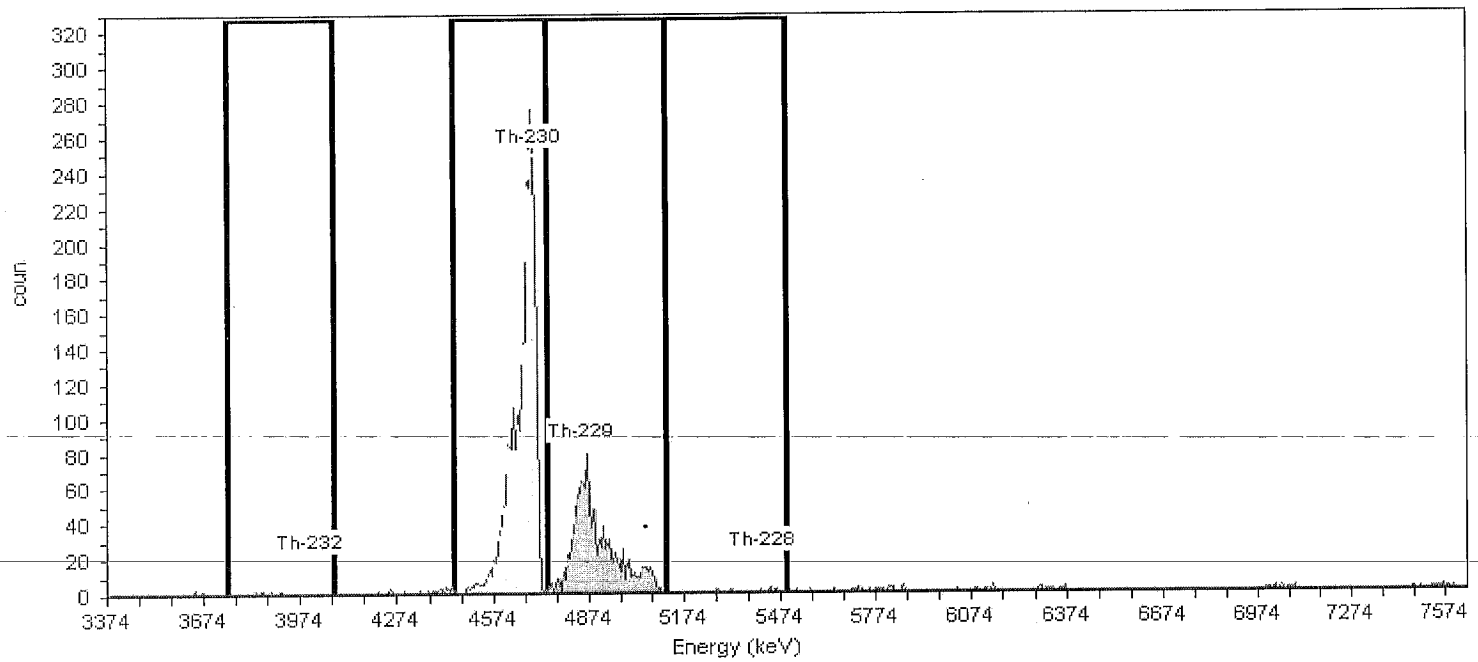
Tracer Name: Th-230_00017
Tracer Activity: 47.94 DPM/mL x (Vol.)0.30 mL = 14.38 DPM
Tracer Ref. Date: 4/11/2011 11:00:10AM

Tracer Nuclide: Th-230
Tracer Recovery: 93.94%

Acquisition

Detector: AV46
Serial Number: 49-202GG2
Acquisition Start Date: 12/26/2013 4:26:15PM
Live Time: 600.00 min.
Real Time: 600.01 min.
Background Date: 12/12/2013 8:52:40PM
Background Info: Sample: ICB;AV46; Det: AV46; Spectrum #1; Dec-12-2013 20:52

Calibration Name: IC-9884;AV46-20130515a
Calibration Date: 5/16/2013 12:12:59AM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.46% +/- 0.39% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th-230_Tracer
Decay Correction: 12/26/2013 4:24:41PM
MDA Constants: Kα = 1.65 , Kβ = 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	95.0	100.2	5	0.6250	4.38	0.282	DPM/mL
Th-230	4688.0	4,687.5	0.5	4448.3	4739.1	36.4	99.7	2219	0.0000	2219.00	135.103	DPM/mL
Th-229	4848.0	4,845.3	2.7	4739.1	5119.5	78.0	99.8	1052	1.2500	1050.75	68.034	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	15.7	99.8	7	4.3750	2.63	0.170	DPM/mL

Decay Correction

Thorium-229								
Initial Activity:	67.929	dpm						
Reference Date:	7/14/2010							
Current Date:	12/26/2013		(or date at which you wish to determine activity)					
Elapsed Time:	1261	days						
Half Life:	2680935	days	64342440					
Exponential Term:	0.999674026							
Corrected Activity:	67.90685689	dpm	30.58867427	pCi				

Lm 12/30/13

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Actinide Prep

Batch No. : —

Balance ID : —

Note: If a section below is not used, marked the N/A box and initial & date next to the N/A. i.e. Mark the N/A box if a tracer is not added to the sample(s) then initial and date next to the N/A

No.	Sample Number	Aliquot (g / mL)	MS	Initials
44 1	Verification 1	0.1		
45 2	1 2 3	1		
46 3	1 2 3	1		
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Tracer ☐ N/A

	Initials / Date
Isotope :	Th-230
Std Sol'n No. :	Th-230.00017
Vol (mL) :	0.3
Ref Activity (dpm/mL) :	47.94 dpm/mL
Act Ref Date :	4-11-11

Samples Spiked and Traced By: MB 12/23/13 (Initials / Date)

Verification Signature & Date: [signature] 12/23/13 (Initials / Date)

LCS Standard ☐ N/A

	Initials / Date
Isotope :	Th-229
Std Sol'n ID. :	Th-229-0002
Vol (mL) :	0.1
Ref Activity (dpm/mL) :	67.929 dpm/mL — corrected activity 67.9086
Act Ref Date :	7-14-10

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

☐ ST-RC-0003 Rev.	☐ ST-RC-0040 Rev.	☐ ST-RC-0110 Rev.
☐ ST-RC-0004 Rev.	☐ ST-RC-0041 Rev.	☐ ST-RC-0120 Rev.
☐ ST-RC-0014 Rev.	☐ ST-RC-0050 Rev.	☐ ST-RC-0232 Rev.
☐ ST-RC-0020 Rev.	☐ ST-RC-0090 Rev.	☐ ST-RC-0238 Rev.
☐ ST-RC-0021 Rev.	☑ ST-RC-0100 Rev.	☐ ST-RC-0240 Rev.
		☐ ST-RC-0241 Rev.
		☑ ST-RC-0242 Rev.
		☐ ST-RC-5016 Rev.

Isotope(s)

αβ ☐	Iso Pu ☐	Tc-99 ☐	Iso Cm ☐
Iso Am ☐	Ra ☐	Iso Th ☑	Pu-241 ☐
KPA ☐	Sr ☐	Iso U ☐	Th-229 ☐
Np ☐	TAR ☐	C-14 ☑	Cl-36 ☐

Count Time	Matrix
Long Count ☐	Soil ☐
Short Count ☐	H_2O ☐

Prepared By : MB

Date : 12/23/13

Reviewed by: _____

Date: _____

\\SIsvr01\RAD\MasterForms\RAD-0045 Rev(3)

Sequential Thorium, Plutonium and Uranium via TEVA/UTEVA ST-RC-0242

Batch: Th229 Verification

All rinses should flow at 1 mL/minute (only 3M HNO_3 may be done at 3 mL/minute)

*only necessary when analyzing for *Pu*

TEVA lot: TF512BM

UTEVA lot: _____

11.5.2 Stack TEVA on top of UTEVA cartridge

11.5.3 5mL 3M HNO_3 — COMPLETED ☐

*11.5.4 To samples, add 1mL ascorbic acid solution Place in hot water bath for 5 minutes — COMPLETED ☐

*11.5.5 To samples, add 1mL $NaNO_2$ solution Place in hot water bath for 5 minutes — COMPLETED ☐

*11.5.6 Cold water bath until samples reach room temperature

11.5.7 Load sample

11.5.8 20mL 3M HNO_3 — COMPLETED ☐

11.59 Split cartridges: TEVA / UTEVA

TEVA:

11.5.10-11.5.11 Elute *Th* into clean tube using 20mL 9M HCl — COMPLETED ☐

11.5.12 5mL 6M HCl into *Th* tube — COMPLETED ☐

11.5.16 Elute *Pu* into clean tube with 20mL 1M HCl + 0.250 mL $TiCl_3$ — COMPLETED ☐ — COMPLETED ☐

UTEVA:

11.5.19 5mL 3M HNO_3 — COMPLETED ☐

11.5.20 5mL 9M HCl — COMPLETED ☐

11.5.21 20mL 5M HCl / 0.05M oxalic — COMPLETED ☐

11.5.22-11.5.23 Elute *U* into clean tube with 15mL 1M HCl — COMPLETED ☐

Reagent

Th-230 Ra226_00001

ANALYTICS

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

65090-334

Th-230 5 mL Liquid in Flame Sealed Vial

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

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

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

ISOTOPE:	Th-230
ACTIVITY (dps):	7.654 E3
HALF-LIFE:	7.538 E4 Years
CALIBRATION DATE:	December 19, 2002 12:00 EST
TOTAL UNCERTAINTY*:	3.5%
SYSTEMATIC:	2.6%
RANDOM:	0.9%

*99% Confidence Level

Impurities: γ-impurities <0.1%, α-impurities <0.05%

5.17738 grams 0.5M HNO_3 solution.

P O NUMBER 1614557-000 OP, Item 3

SOURCE PREPARED BY: M. Taskaeva, Radiochemist

Q A APPROVED: 12-19-02

Reagent

Th-230_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

84460-334
5 mL Liquid in Flame Sealed Vial

Customer: Test America/Earth City, MO
P.O. No.: 2414204, Item 1

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 purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. 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 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.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, % Type u_A	u_B	U	Reference Date (12:00 PM EST)
Th-230	2.753E+07	4.016E+03	0.1	0.9	1.8	04/11/2011

***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: γ-impurities < 0.1 %, α-impurities < 0.01 %. 5.11451 grams 0.5M HNO3 solution.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ Date: 4/11/11
J. D. McCorvey, QA Manager Alternate

ACCREDITED SOURCE CALIBRATION LABORATORY
HEALTH PHYSICS SOCIETY
FOUNDED 1958

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Reagent

Th-230_00002

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

84460-334
5 mL Liquid in Flame Sealed Vial

Customer: Test America/Earth City, MO
P.O. No.: 2414204, Item 1

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 purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. 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 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.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty* , % Type u_A	u_B	U	Reference Date (12:00 PM EST)
Th-230	2.753E+07	4.016E+03	0.1	0.9	1.8	04/11/2011

***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: γ-impurities < 0.1 %, α-impurities < 0.01 %. 5.11451 grams 0.5M HNO3 solution.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ Date: 4/11/11
J. D. McCorvey, QA Manager Alternate

ACCREDITED SOURCE CALIBRATION LABORATORY · HEALTH PHYSICS SOCIETY · FOUNDED 1956

Corporate Office
24937 Avenue Tibbitts · Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd · Atlanta, Georgia 30318

Reagent

Th-230_00015

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

92523
Th-230 5 mL Liquid in Flame Sealed Vial

Customer: TestAmerica St. Louis
P.O. No.: 2502650, Item 2 Product Code: 8230-5FSA-4kBq

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*, % Type u_A	u_B	U	Reference Date (12:00 PM EST)
Th-230	2.753E+07	3.979E+03	0.1	0.9	1.8	11/29/2012

***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 1.5915 Bq; γ-impurities (other than decay products)<0.1%.
5.07636 g 0.5M HNO3 solution. Carrier free.

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

QA Approved:
J.D. McCorvey, Counting Room Manager

Date: 27 Nov 12

51464
ID Th-230_00015
Th-230 Ampoule

RAD12-0040
Th-230 Ampoule
hursts
None
Prep/Opened: 11/28/2012
Exp(1): 11/28/2062
Exp(2): 11/28/2062

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1956

Single Isotope Certificate Rev 3, 23 August 2012

Reagent

Th-230_00016

TestAmerica St. Louis

Standards Preparation Logbook Record

Nov-28-2012

Logbook: \\Qstlmo01\Stdslog\RAD_STD.std

RAD12-0040, Th-230 Ampoule Th-230_00015 # 51464 Analyst: hursts

Vendor: Analytics Lot No.: 92523
Solvent: None
Date Prep./Opened: 11-28-2012 Date Consumed: 11-28-2012
Date Expires(1): 11-28-2062 (50 Years)
Date Expires(2): 11-28-2062 (50 Years)
Cert: 92523 Activity: 3979Bq Reference Date: 11/29/12 Mass: 5.07636

Component	Initial Conc (dpm/g)	Final Conc (dpm/g)
Th-230	47,030	47,030

RAD12-0041, Th-230 Calibration Standard Th-230_00016 # 51465 Analyst: hursts

Solvent: 0.5M HNO3 Volume (ml): 100.00
Date Prep./Opened: 11-28-2012
Date Expires(1): 11-29-2062 (50 Years)
Date Expires(2): 11-29-2062 (50 Years)

Parent Std No.: RAD12-0040, Th-230 Ampoule Aliquot Amount (g): 5.0489
Parent Date Expires(1): 11-28-2062 Parent Date Expires(2): 11-28-2062

Component	Initial Conc (dpm/g)	Final Conc (dpm/mL)
Th-230	47,030	2,374.5

Reviewed By: SH

St. Louis Radiological Standard Reverification Form

Standard ID Number: Rad12-0041
True Value = 1069.59 pCi/mL
Date Analyzed: 11/30/2012

Radionuclide: Th-230 Gross Alpha

	Replicates	
#1	1071	pCi/mL
#2	1027	pCi/mL
#3	1085	pCi/mL

Mean = 1061

1 sigma = 30.26549 1.96 sigma = 59.32036

True Value minus 5% = 1016.111 (True Value - 5%)
True Value plus 5% = 1123.07 (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: JL 11/30/12

SOP Reference: STL-QA-0002, Current Revision

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Analysis Report for Gross Alpha/Beta

Batch: M122628 **Operator:** 63903

Sample ID	WRKNO	*Aliquot*		*Mass*	*Instr ID*	*CountTime*		*Ts*	*Tb*	*Dilution*	*Sigma*	
	Analyte	Cs	Cb	XT	CPMs	CPMb	Eff	Activity	UncTot	UncCnt	MDA	DLC
verification 1a	NA	*1.000E+000mL*		*0.0546 g*	*Purple16*	*11/30/12 13:03*		*8.00*	*1000.00*	*1.00*	*1.00*	
	Gross Alpha	2528	175	0.00	3.160E+002	1.750E-001	0.1328	**1.071E+006**pCi/L	6.469E+004	2.132E+004	2.807E+003	1.167E+003
	Gross Beta	792	485	0.00	9.900E+001	4.850E-001	0.4280	**1.037E+005**pCi/L	6.370E+003	3.702E+003	1.212E+003	6.028E+002
verification 2a	NA	*1.000E+000mL*		*0.0536 g*	*Purple17*	*11/30/12 13:03*		*8.00*	*1000.00*	*1.00*	*1.00*	
	Gross Alpha	2364	87	0.00	2.955E+002	8.700E-002	0.1295	**1.027E+006**pCi/L	6.225E+004	2.113E+004	2.376E+003	8.436E+002
	Gross Beta	764	362	0.00	9.550E+001	3.620E-001	0.4353	**9.846E+004**pCi/L	6.084E+003	3.576E+003	1.078E+003	5.121E+002
verification 3a	NA	*1.000E+000mL*		*0.0531 g*	*Purple18*	*11/30/12 13:04*		*8.00*	*1000.00*	*1.00*	*1.00*	
	Gross Alpha	2521	62	0.00	3.151E+002	6.200E-002	0.1308	**1.085E+006**pCi/L	6.551E+004	2.161E+004	2.168E+003	7.052E+002
	Gross Beta	788	395	0.00	9.850E+001	3.950E-001	0.4295	**1.029E+005**pCi/L	6.325E+003	3.680E+003	1.125E+003	5.421E+002

Laboratory Control Sample Information

SampID	WRKNO	Analyte	Activity	StdAdded	Recovery %	LCL	UCL	ZFactor

Sample Duplicate Information

Sample ID	Dup Sample ID	Analyte	Sample Activity	Dup Activity	RPD	RER	DER	ZFactor

Matrix Spike Information

SampID	SampMSID	Analyte	Sample Activity	MS Activity	StdAdded	MSRecovery %	ZFactor

Blanks Information

SampID	WRKNO	Analyte	Activity	UncTotal	ZFactor

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Prep Report for Gross Alpha/Beta

Batch: M122628 **Prep Analyst:** 250

SampID	WRKNO	Aliquot	Gross	Tare	Mass	Dilution
verification 1a	NA	6.500E-001 mL	8.6982 g	8.6436 g	0.0546 g	1.00
		Orange 5	protean 14		16	
verification 2a	NA	6.500E-001 mL	8.6698 g	8.6162 g	0.0536 g	1.00
		7	15		17	
verification 3a	NA	6.500E-001 mL	8.6466 g	8.5935 g	0.0531 g	1.00
		8			18	

Spike Information

Sample ID	Standard ID	Analyte	Std Conc	Aliquot	Ref Date	StdAdded
	Rad12-0041	Th-230	2374.5 dpm/mL	1.00 mL	11-29-12	

MS — Spiked By

LM per MS — Spike Verified By

11-28-12 — Spike Date

Standard Operating Procedures

SOPNumber	Title	Revision
☐		

Reviewed By — 11/30/12 Review Date

MS — Analyst/Relenquished By — 11-28-12 Release Date — Received By — 11/28/12 Receipt Date

11234333897/MS/11-28-12

Balance ID / Initials / Date

Reagent

Th-230_00023

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Th - 230_ 00023

Reagent ID: Th-230_00023

		Expiration Date:	01/28/2015
Description:	Th-230 Spike	Laboratory:	TestAmerica St. Louis
No. of Bottles:	1	Prepared By:	Bernsen, Sarah C
Storage Location:	RAD Actinide STDs	Solvent:	1M HNO3
Reagent Volume:	200.000 mL	Solvent Lot:	0
Creation Date:	02/04/2013		
Container(s):	304693		
Comment:	Rad13-0003 Re-certified from Th-230_00017		

Reagent Analyte Information

Analyte	Source ID	Source Exp. Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
Th-230	Th-230_00006	04/11/2061	2397.01400	dpm/mL	47.94028	dpm/mL

Source Reagents

Reagent	Description	Type	Expiration	Vendor	Vendor Lot #	Vendor Cat Lot #	Volume Used	Volume Units
Th-230_00006	Th-230 Parent		04/11/61				4.00000	mL

St. Louis Radiological Standard Reverification Form

Standard ID Number: Th-230_00017
True Value = 47.94 DPM/L or g
Date Analyzed: 1/28/2014

Radionuclide: Th-230

Replicates		
#1	49.462	DPM/L or g
#2	48.579	DPM/L or g
#3	49.802	DPM/L or g

Mean = 49.281

1 sigma = 0.631271

1.96 sigma = 1.237291

True Value minus 5% = 45.543 (True Value - 5%)
True Value plus 5% = 50.337 (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: RTM 1/29/2014

SOP Reference: STL-QA-0002, Current Revision

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Th-230 Verification

Aliquot Only

Batch No. : —

Balance ID : —

Note: If a section below is not used, marked the N/A box and initial & date next to the N/A.
i.e. Mark the N/A box if a tracer 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	verification-1	0.3	112	960 min.
2	2	1	113	
3	3		114	
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Tracer ☐ N/A

Initials / Date

Isotope : Th-229
Std Sol'n No. : Th-229-00012
Vol (mL) : 0.1
Ref Activity (dpm/mL) : 67.929
Act Ref Date : 07-14-2010

Samples Spiked and Traced By: SLB 1/28/14
Initials / Date

Verification Signature & Date: NB 1/28/14
Initials / Date

LCS Standard ☐ N/A

Initials / Date

Isotope : Th-230
Std Sol'n ID. : Th-230-00017
Vol (mL) : 0.3
Ref Activity (dpm/mL) : 47.94
Act Ref Date : 04-11-2011

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

☐	ST-RC-0003 Rev.	☐	ST-RC-0040 Rev.	☐	ST-RC-0110 Rev.		
☐	ST-RC-0004 Rev.	☐	ST-RC-0041 Rev.	☐	ST-RC-0120 Rev.		
☐	ST-RC-0014 Rev.	☐	ST-RC-0050 Rev.	☐	ST-RC-0232 Rev.		
☐	ST-RC-0020 Rev.	☐	ST-RC-0090 Rev.	☐	ST-RC-0238 Rev.		
☐	ST-RC-0021 Rev.	☑	ST-RC-0100 Rev.	☐	ST-RC-0240 Rev.		
				☐	ST-RC-0241 Rev.		
				☑	ST-RC-0242 Rev.		
				☐	ST-RC-5016 Rev.		
				☐			
				☐			

Isotope(s)

αβ ☐	Iso Pu ☐	Tc-99 ☐	Iso Cm ☐
Iso Am ☐	Ra ☐	Iso Th ☑	Pu-241 ☐
KPA ☐	Sr ☐	Iso U ☐	Th-229 ☐
Np ☐	TAR ☐	C-14 ☐	Cl-36 ☐

Count Time	Matrix
Long Count ☐	Soil ☐
Short Count ☐	H_2O ☐

Prepared By : SLB
Date : 1/28/14

Reviewed by: _____
Date: _____

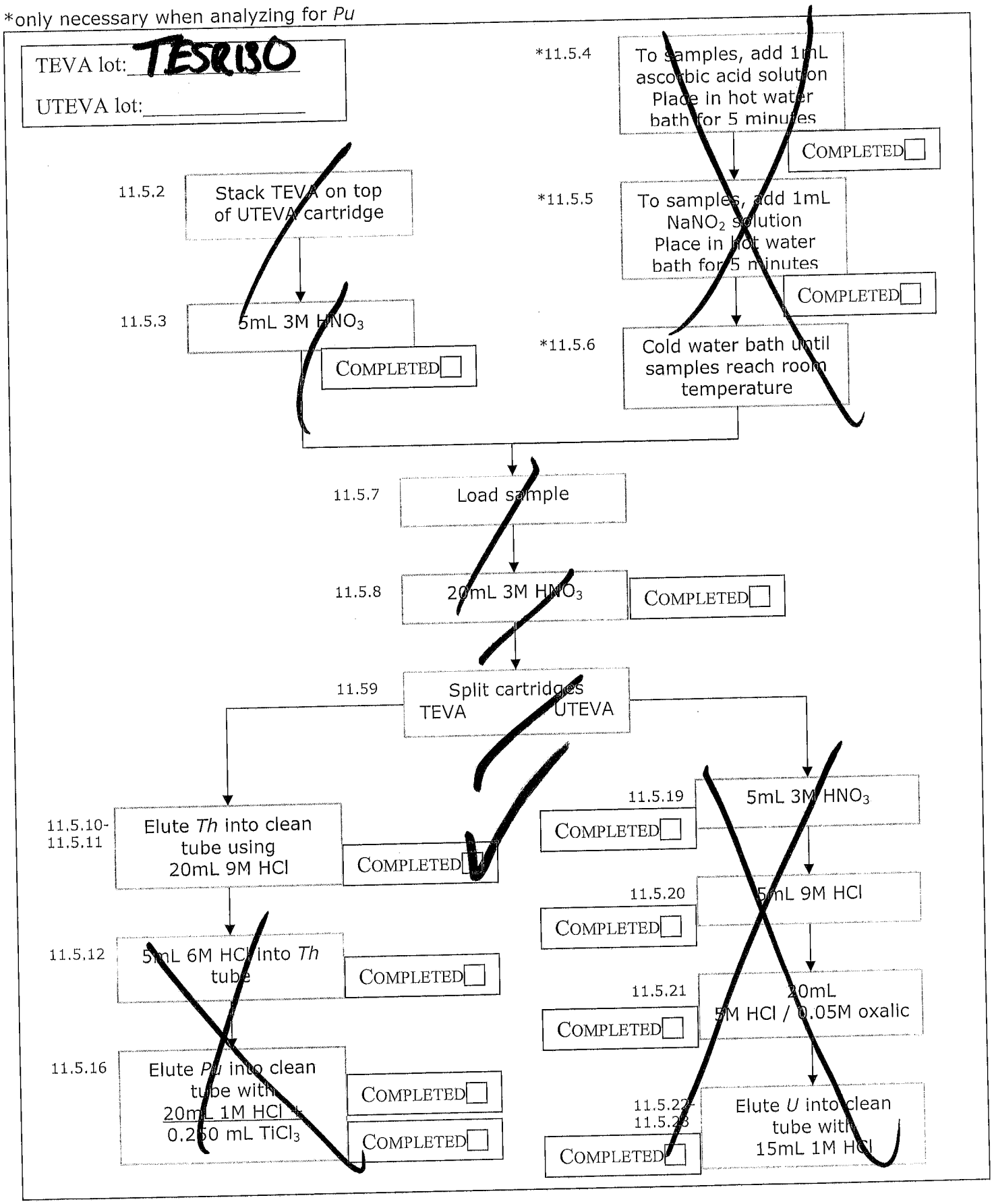
\\Slsvr01\RAD\MasterForms\RAD-0045 Rev(3)

Sequential Thorium, Plutonium and Uranium via TEVA/UTEVA ST-RC-0242

Batch:_____

All rinses should flow at 1 mL/minute (only 3M HNO_3 may be done at 3 mL/minute)

*only necessary when analyzing for *Pu*



Form: RAD-0063, Revised 09/18/13

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:19:33PM 1/29/2014

Sample

Sample Name: Verification 1
SampleType: Sample
:
Sample Collection Date:

Spectrum #1 Analysis #1
Sample Volume : 0.3000mL
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: Th-230_00017_Re-Verify
AnalysisID: 597024

Analyst: 60040

Tracer

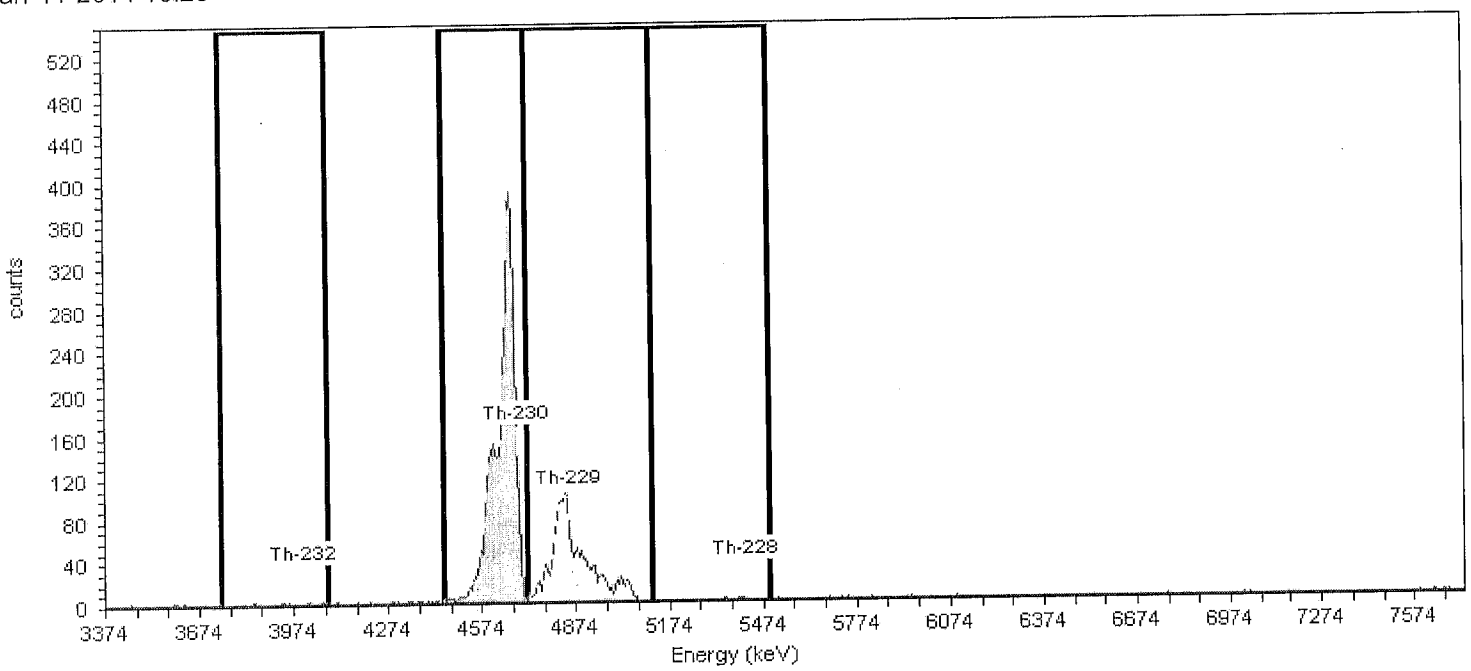
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.10 mL = 6.79 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 88.83%

Acquisition

Detector: AV112
Serial Number: 49-037G7
Acquisition Start Date: 1/28/2014 7:31:48PM
Live Time: 960.00 min.
Real Time: 960.01 min.
Background Date: 1/11/2014 4:25:27PM
Background Info: Sample: ICB;AV112; Det: AV112; Spectrum #1; Jan-11-2014 16:25

Calibration Name: IC-8876;AV112-20130514
Calibration Date: 5/14/2013 8:47:13PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.87% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 1/28/2014 7:30:15PM
MDA Constants: Kα = 1.65 , Kβ = 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	.0	100.2	6	0.0000	6.46	0.094	DPM/mL
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	20.4	99.7	3391	2.0000	3389.32	49.462	DPM/mL
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	74.0	99.6	1552	2.0000	1550.25	20.113	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	44.4	99.8	4	2.0000	2.00	0.029	DPM/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:19:42PM 1/29/2014

Sample

Sample Name: Verification 2
SampleType: Sample
:
Sample Collection Date:

Spectrum #1 Analysis #1
Sample Volume : 0.3000mL
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: Th-230_00017_Re-Verify
AnalysisID: 597025

Analyst: 60040

Tracer

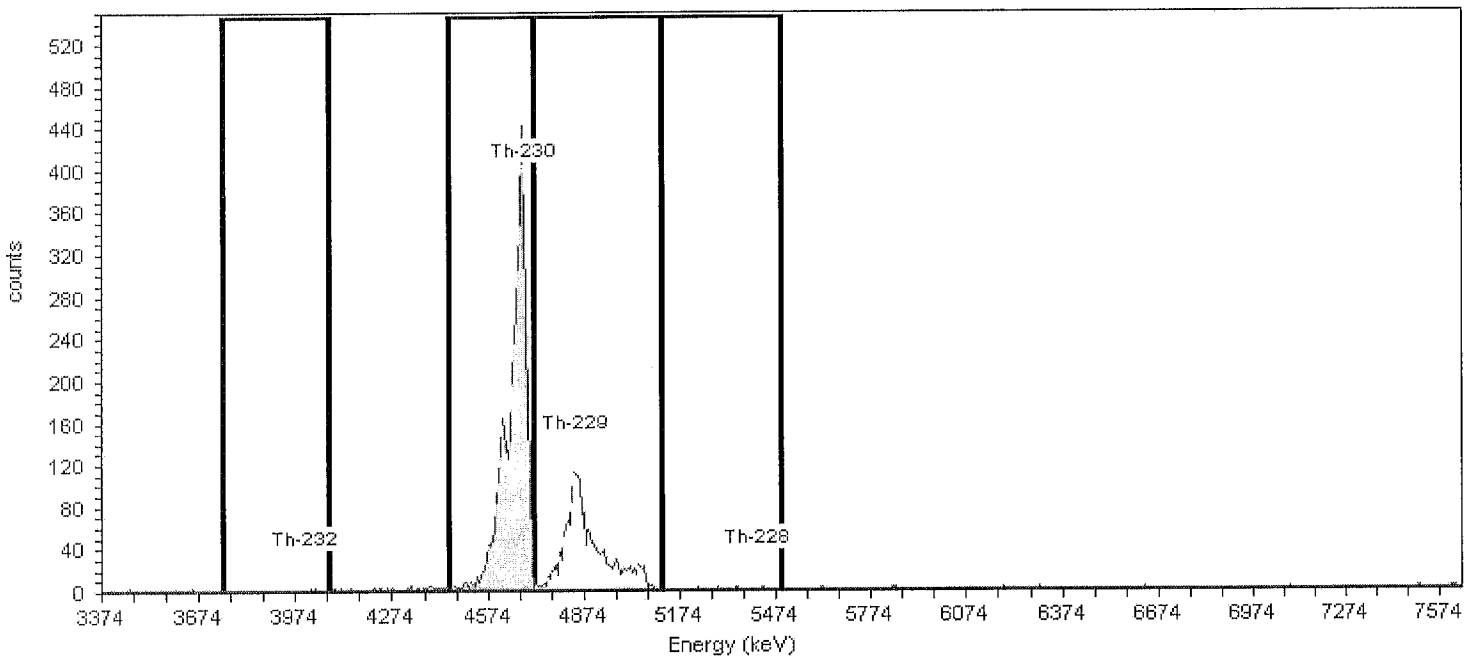
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.10 mL = 6.79 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 92.22%

Acquisition

Detector: AV113
Serial Number: 49-037X5
Acquisition Start Date: 1/28/2014 7:31:50PM
Live Time: 960.00 min.
Real Time: 960.01 min.
Background Date: 1/11/2014 4:25:29PM
Background Info: Sample: ICB;AV113; Det: AV113; Spectrum #1; Jan-11-2014 16:25

Calibration Name: IC-8877;AV113-20130514
Calibration Date: 5/14/2013 8:47:28PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.66% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 1/28/2014 7:30:15PM
MDA Constants: Kα = 1.65 , Kβ = 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	10.5	100.2	2	2.0000	0.00	0.000	DPM/mL
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	30.5	99.7	3429	0.0000	3429.40	48.579	DPM/mL
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	72.2	99.6	1598	1.0000	1597.09	20.881	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	163.8	99.8	4	3.0000	1.00	0.014	DPM/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:19:51PM 1/29/2014

Sample

Sample Name: Verification 3
SampleType: Sample
:
Sample Collection Date:

Spectrum #1 Analysis #1
Sample Volume : 0.3000mL
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: Th-230_00017_Re-Verify
AnalysisID: 597026

Analyst: 60040

Tracer

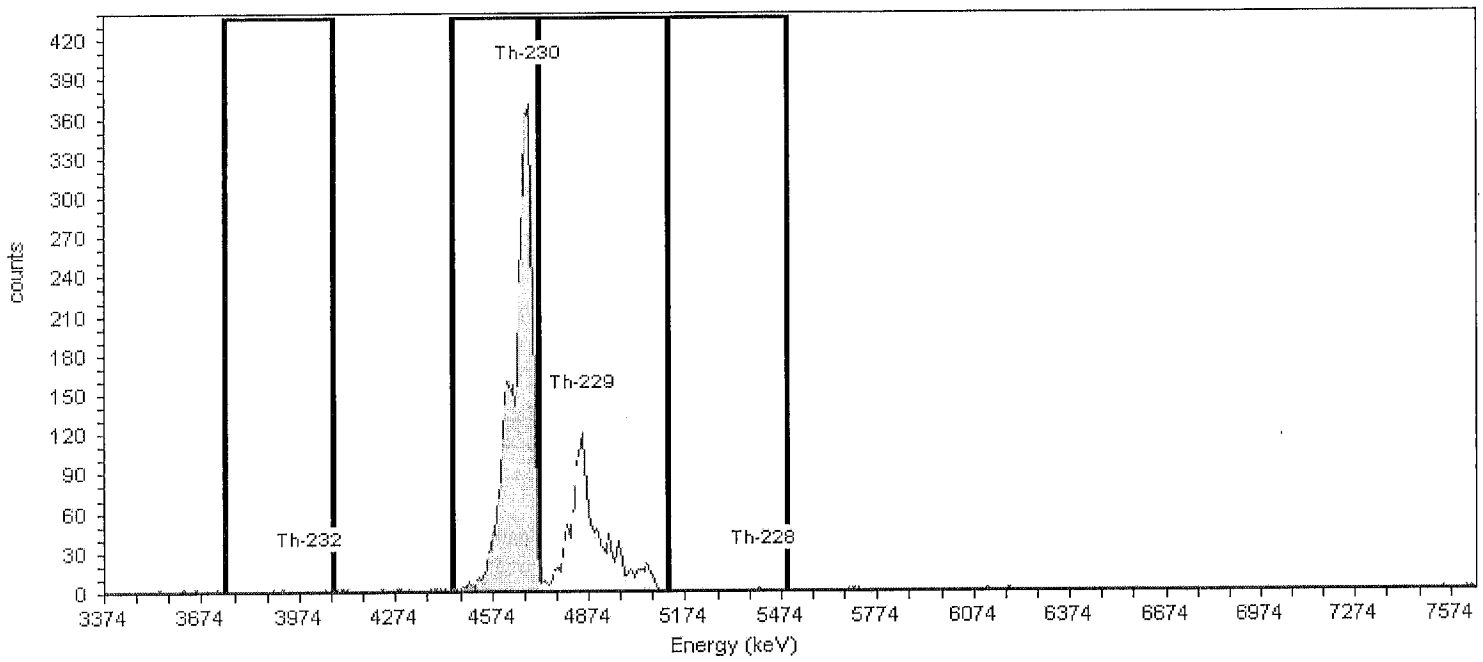
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.10 mL = 6.79 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 92.05%

Acquisition

Detector: AV114
Serial Number: 49-037E7
Acquisition Start Date: 1/28/2014 7:31:52PM
Live Time: 960.00 min.
Real Time: 960.01 min.
Background Date: 1/11/2014 4:25:31PM
Background Info: Sample: ICB;AV114; Det: AV114; Spectrum #1; Jan-11-2014 16:25

Calibration Name: IC-9520;AV114-20130514
Calibration Date: 5/14/2013 8:47:43PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.73% +/- 0.37% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 1/28/2014 7:30:15PM
MDA Constants: Kα = 1.65 , Kβ = 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	3	0.4250	2.57	0.036	DPM/mL
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	33.9	99.7	3518	0.0000	3517.66	49.802	DPM/mL
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	72.2	99.6	1598	0.0000	1597.97	20.842	DPM/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	44.5	99.8	1	1.0000	0.00	0.000	DPM/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: Minteer@aol.com [mailto:Minteer@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_00002

Rec'd : 12-26-06

ANALYTICS
An Isotope Products Laboratories Company

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

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:** 0.01552

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* γps/gram	This Source γps	Uncertainty , % Type u_A	u_B	U	Calibration Method
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 Analytics' 8-isotope mixture which is calibrated quarterly.

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

Comments:
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. Taskaeva, Radiochemist

QA Approved: D. M. Montgomery, QA Manager, for Date: 12-21-06

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Gamma LCS per Geometry

Geometry: Tuna Can
Reference date 10/1/2006
Calibration Standard: 74139-334
Standard volume g / vial 1550
volume transferred in g / geometry 341.9

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	γ abundance	dpm/g
Am-241	2034.3	449	0.359	219.35
Cs-137	1811.3	400	0.851	82.39
Co-60	3523	777	0.999856	136.39

Reviewed By: Chris Hough

Date: 3/15/2013

Reagent

Tuna Can LCS_00003

Rec'd : 12-26-06

ANALYTICS
An Isotope Products Laboratories Company

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

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:** 0.01552

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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
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 Analytics' 8-isotope mixture which is calibrated quarterly.

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

Comments:
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 Taskaeva
M. I. Taskaeva, Radiochemist

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

Date: 12-21-06

End of Certificate

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd Atlanta, Georgia 30318

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www.analyticsinc.com

ANALYSIS OF UNCERTAINTY FOR MIXED GAMMA STANDARDS
BATCH 127
CALIBRATION DATE: October 1, 2006 12:00 EST

Isotope	Energy (keV)	Calibration Method[1]	Statistics[2]	Calibration[2]	Peak Fitting[2]	Geometry[2]	Impurities[2]	Weighing	Combined Standard Uncertainty	Relative Expanded Uncertinty (k=2)
Cd-109	88	HPGe	0.16	1.1	0.88	0.8	0	0.2	1.64	3.3
Co-57	122	HPGe	0.23	1.1	0.71	0.7	0	0.2	1.52	3.0
Ce-139	166	HPGe	0.17	1.0	0.58	0.7	0	0.2	1.38	2.8
Hg-203	279	HPGe	0.11	1.1	0.34	0.7	0	0.2	1.37	2.7
Sn-113	392	HPGe	0.21	1.0	0.35	0.7	0	0.2	1.30	2.6
Cs-137	662	HPGe	0.36	1.1	0.60	0.7	0	0.2	1.49	3.0
Y-88	898	HPGe	0.19	1.0	0.33	0.7	0	0.2	1.29	2.6
Co-60	1173	HPGe	0.31	.97	0.45	0.7	0	0.2	1.33	2.7
Co-60	1332	HPGe	0.33	.93	0.48	0.7	0	0.2	1.32	2.6
Y-88	1836	HPGe	0.24	1.0	0.35	0.7	0	0.2	1.31	2.6

Optional Additional Isotopes

Pb-210	46.5	4π LS	0.33	1.1	0	0.9	0.30	0.2	1.50	3.0
Am-241	59.5	4π LS	0.33	1.1	0	0.9	0.30	0.2	1.50	3.0
Sr-85	514	IC	0.30	1.1	0	0.7	0.17	0.2	1.36	2.7
Cs-134	605	IC	0.30	1.0	0	0.8	0.17	0.2	1.34	2.7
Cs-134	796	IC	0.30	1.0	0	0.8	0.17	0.2	1.34	2.7
Mn-54	835	IC	0.30	1.0	0	0.8	0.17	0.2	1.34	2.7
Zn-65	1116	IC	0.30	1.0	0	0.8	0.17	0.2	1.34	2.7

[1]Calibration Methods:

4π LS (4 pi Liquid Scintillation Counting)
HPGe (High Purity Germanium Gamma Ray Spectrometer)
IC (Gamma Ray Ionization Chamber)

[2]As Percent (%)from counting data

No interfering gamma emitting impurities were detected during calibration. Depending on the resolution and energy dispersion (keV/channel) of the measuring system, the following spectral conflicts may occur: (1) between the 88 keV gamma-ray and the X-rays emitted in the decay of Hg-203, (2) between the 1333 keV gamma-ray and the 1325 keV single escape peak from the 1836 keV gamma-ray.

St. Louis Radiological Standard Reverification Form

Standard ID Number: Tuna Can LCS_00003 (259586)
True Value = 1249.94 Bq/Sample
Date Analyzed: 10/31/2013

Radionuclide: Am-241

	Replicates	
#1	1215	Bq/Sample
#2	1264	Bq/Sample
#3	1267	Bq/Sample

Mean = 1248.667

1 sigma = 29.19475

1.96 sigma = 57.22171

True Value minus 5% = 1187.443 (True Value - 5%)
True Value plus 5% = 1312.437 (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 12/1/13

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: Tuna Can LCS_00003 (259586)
True Value = 469.49 Bq/Sample
Date Analyzed: 10/31/2013

Radionuclide: Cs-137

	Replicates	
#1	451.6	Bq/Sample
#2	477.4	Bq/Sample
#3	455.6	Bq/Sample

Mean = 461.5333

1 sigma = 13.88572

1.96 sigma = 27.21602

True Value minus 5% = 446.0155 (True Value - 5%)
True Value plus 5% = 492.9645 (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 12/1/14

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: Tuna Can LCS_00003 (259586)
True Value = 777 Bq/Sample
Date Analyzed: 10/31/2013

Radionuclide: Co-60

	Replicates	
#1	724.3	Bq/Sample
#2	774.1	Bq/Sample
#3	770	Bq/Sample

Mean = 756.1333

1 sigma = 27.64459

1.96 sigma = 54.1834

True Value minus 5% = 738.15 (True Value - 5%)
True Value plus 5% = 815.85 (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 12/1/14

SOP Reference: STL-QA-0002, Current Revision

Gamma LCS per Geometry - Tuna Can

Reagent ID: Tuna Can LCS_00003
Container: 259586
Reference date 10/1/2006
Calibration Standard: 74139-334
Standard volume: 1550 g/vial
Standard volume transferred: 341.9 g/geometry

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	γ abundance	dpm/g	Bq/sample
Am-241	2034.3	448.7	0.359	219.35	1249.94
Cs-137	1811.3	399.5	0.851	82.39	469.49
Co-60	3522	776.9	0.999856	136.36	777.00

Reviewed By: Jody Watson

Date: 12/1/2013

SOP Reference: ST-RD-0102, Current Rev **Form:** RAD-0080 **Revised:** 11/27/2013

Test America St. Louis Spectrum ID: 9_Gamma_20130915

Sample Description: 77739_Gamma_LCS 160-77739~2-A
Detector: Ge9 S/N100228730
Batch ID: 77739
Work Order Number: Gamma
Lot Number: LCS 160-77739~2-A

Decay to Time: 10/1/2006 12:00 Live Time: 1800 sec
Acquisition Time: 10/31/2013 08:28:21 Real Time: 1810 sec
Analysis Time: 11/11/2013 19:50 Dead Time: 0.57 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 9_Soil_TunaCan.Clb
Efficiency Cal Desc: 9_Soil_TunaCan_90099_050312
Efficiency Cal Date: 6/14/2012 10:19
Energy Cal Date: 3/1/2012 13:57
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 9_2013-10-05_0100.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
K-40	5.305E-01	769.5	4.082E+00	4.082E+00	1.578E+01
CO-60	7.243E+02	1.0	7.254E+00	3.708E+01	3.977E+00
CS-134	7.235E+00	93.6	6.774E+00	6.784E+00	2.680E+01
CS-137	4.516E+02	1.0	4.733E+00	2.396E+01	3.540E+00
EU-152	6.293E+00	42.6	2.678E+00	2.698E+00	1.271E+01
EU-154	4.025E+00	75.0	3.020E+00	3.027E+00	5.177E+01
EU-155	5.881E+00	110.2	6.478E+00	6.486E+00	2.150E+01
TL-208	3.059E+01	64.6	1.977E+01	1.984E+01	3.918E+01
PB-210	1.442E+04	0.9	1.325E+02	8.572E+02	2.204E+02
PB-212	5.630E+01	36.7	2.065E+01	2.097E+01	6.722E+01
PB-214	5.714E+00	34.9	1.996E+00	2.018E+00	6.384E+00
BI-212	9.580E+01	152.1	1.457E+02	1.458E+02	4.895E+02
BI-214	7.078E+00	34.4	2.432E+00	2.460E+00	4.992E+00
AC-228	1.477E+01	57.1	8.428E+00	8.462E+00	3.552E+01
Pa-234	5.684E+00	65.7	3.737E+00	3.748E+00	9.406E+00
TH-234	-2.970E+02	9.4	2.787E+01	3.191E+01	8.608E+01
PA-234M	9.991E+01	80.0	7.990E+01	8.006E+01	4.336E+02
U-235	-4.791E+00	104.0	4.982E+00	4.988E+00	1.653E+01
AM-241	1.215E+03	0.8	9.198E+00	6.370E+01	1.316E+01
Total	1.715E+04				

Analyst: Jody Watson

TestAmerica, Inc Spectrum name: 9_Gamma_20130915.An1

Sample description
77739_Gamma_LCS 160-77739~2-A

Spectrum Filename: C:\User\SPC\Det9\9_Gamma_20130915.An1

Acquisition information
Start time: 10/31/2013 8:28:21 AM
Live time: 1800
Real time: 1810
Dead time: 0.57 %
Detector ID: 9

Detector system
Ge9 S/N100228730

Calibration
Filename: 9_Soil_TunaCan.Clb
9_Soil_TunaCan_90099_050312

Energy Calibration
Created: 3/1/2012 1:57:17 PM
Zero offset: 0.074 keV
Gain: 0.250 keV/channel
Quadratic: -2.269E-08 keV/channel^2

Efficiency Calibration
Created: 6/14/2012 10:19:51 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.30 %
Log(Eff): -8.079856E-01 + (-2.367265E-01*Log(E)) + (-3.950640E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.42 %
Log(Eff): -2.387916E+01 + (8.875647E+00*Log(E)) + (-9.401100E-01*Log(E)^2)

Library Files
Main analysis library: Client_Routine Short Rev1.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.59keV)
Stop channel: 8000 (1999.34keV)
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

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 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	9_2013-10-05_0100.PBC 10/5/2013 1:00:21 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 35 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 134.9778

***** 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
36.60	401.	16.10	1.13	1.639E-02				
46.55	22813.	0.92	0.93	2.578E-02	46.54	4.250	1.442E+04	PB210
59.57	28391.	0.76	0.93	3.661E-02	59.54	35.900	1.215E+03	AM241
77.08	140.	39.21	0.98	4.675E-02				
88.08	1206.	7.29	1.06	5.052E-02				
93.88	58.	87.63	1.04	5.171E-02	93.35	5.561	PBC<MDA	AC228
					93.35	5.810	1.069E+01	U235
					92.59	5.584	1.115E+01	TH234
					93.35	5.810	1.069E+01	U235
					93.35	5.561	2.622E+01	AC228
93.88	58.	87.63	1.04	5.171E-02	93.35	5.561	PBC<MDA	AC228
					93.35	5.810	1.069E+01	U235
105.44	44.	110.15	1.05	5.318E-02	105.31	21.200	PBC<MDA	EU155
					105.31	21.200	5.881E+00	EU155
122.44	45.	108.81	1.07	5.305E-02	121.78	28.580	PBC<MDA	EU152
					121.78	28.580	2.352E+00	EU152
131.16	35.	137.33	1.08	5.216E-02	131.29	18.000	PBC<MDA	Pa234
161.84	5.	850.44	1.11	4.676E-02	163.38	5.080	PBC<MDA	U235
					163.38	5.080	1.068E+00	U235
191.89	75.	47.73	0.55	4.310E-02				
199.99	66.	64.08	0.38	4.195E-02				
238.40	138.	27.30	0.91	3.734E-02	238.63	43.300	6.216E+01	PB212
242.14	11.	403.77	1.18	3.697E-02	242.00	7.430	PBC<MDA	PB214
276.94	34.	114.35	1.21	3.372E-02	277.28	6.310	PBC<MDA	TL208
283.56	5.	702.33	1.22	3.315E-02	284.30	6.140	HL>Cutoff	I131
294.85	92.	54.23	0.49	3.232E-02	295.09	19.300	PBC<MDA	PB214
300.38	48.	84.68	1.24	3.195E-02	300.03	3.280	PBC<MDA	PB212
338.25	45.	84.62	1.27	2.940E-02	338.32	12.010	PBC<MDA	AC228

					338.32	12.010	1.661E+01 AC228
344.89	28.	130.46	1.27	2.905E-02	344.29	26.500	PBC<MDA EU152
					344.29	26.500	2.923E+00 EU152
351.72	86.	44.07	1.28	2.860E-02	351.93	37.600	PBC<MDA PB214
367.42	39.	64.82	0.53	2.775E-02			
519.92	99.	37.67	0.41	2.164E-02			
562.86	22.	127.02	1.47	2.040E-02	563.24	8.350	PBC<MDA CS134
570.13	20.	136.61	1.47	2.024E-02	569.32	15.380	PBC<MDA CS134

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					569.47	8.200	6.589E+00	Pa234
570.13	20.	136.24	1.47	2.024E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	6.607E+00	Pa234
583.13	40.	60.64	1.48	1.989E-02	583.02	84.500	PBC<MDA	TL208
609.58	105.	31.70	0.98	1.925E-02	609.31	46.090	6.578E+00	BI214
661.61	10643.	1.05	1.45	1.810E-02	661.66	85.210	4.516E+02	CS137
712.89	39.	39.12	0.70	1.711E-02				
727.11	17.	152.13	1.60	1.686E-02	727.17	7.550	PBC<MDA	BI212
766.71	33.	79.97	1.63	1.620E-02	766.41	0.294	PBC<MDA	PA234M
					766.41	0.294	3.867E+02	PA234M
779.17	59.	42.55	1.64	1.600E-02	778.92	12.940	PBC<MDA	EU152
					778.92	12.940	2.273E+01	EU152
797.04	6.	290.73	1.66	1.565E-02	801.95	8.690	PBC<MDA	CS134
860.47	19.	137.44	1.71	1.482E-02	860.56	12.420	PBC<MDA	TL208
883.68	19.	133.89	1.72	1.456E-02	880.53	6.000	PBC<MDA	Pa234
					883.24	9.600	7.529E+00	Pa234
910.66	44.	76.62	1.75	1.418E-02	911.07	29.000	PBC<MDA	AC228
					911.07	29.000	1.400E+01	AC228
943.80	24.	117.47	1.77	1.377E-02	946.02	13.400	PBC<MDA	Pa234
964.12	14.	228.97	1.79	1.357E-02	964.11	14.605	PBC<MDA	EU152
					964.11	14.605	5.560E+00	EU152
996.48	16.	177.62	1.81	1.323E-02	996.33	10.600	PBC<MDA	EU154
					996.33	10.600	1.149E+01	EU154
1121.05	28.	81.71	1.90	1.206E-02	1120.29	15.100	PBC<MDA	BI214
1173.15	5976.	1.44	1.98	1.163E-02	1173.24	99.900	7.254E+02	CO60
1272.28	11.	75.03	2.01	1.088E-02	1274.54	35.190	PBC<MDA	EU154
					1274.54	35.190	2.924E+00	EU154
1332.36	5385.	1.39	2.00	1.050E-02	1332.50	99.980	7.231E+02	CO60
1460.86	1.	76.97	2.13	9.749E-03	1460.83	10.670	PBC<MDA	K40
1764.37	7.	64.03	2.31	8.350E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
146.03	36.60	1187.	401.	2.444E+04	16.10	1.125	-	
307.92	77.08	958.	140.	2.995E+03	39.21	0.976	-	s
351.89	88.08	1452.	1215.	2.405E+04	5.28	1.055	-	
767.05	191.89	448.	75.	1.732E+03	47.73	0.547	-	s
799.44	199.99	552.	66.	1.585E+03	64.08	0.381	-	s
1469.05	367.42	225.	39.	1.407E+03	56.65	0.534	-	sM
2079.05	519.92	287.	99.	4.576E+03	37.67	0.415	-	sM
2850.97	712.89	70.	39.	2.299E+03	39.12	0.697	-	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: Client_Routine Short Rev1.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	46.55	5511.	22813.	12.674	0.92	0.933
AM-241	237.89	59.57	4281.	28391.	15.773	0.76	0.933
TH-234	245.32	61.42	2410.	-799.	-0.444	9.38	1.014s
TH-234	365.80	91.55	1239.	-50.	-0.028	101.12	1.042s
AC-228	372.98	93.35	1253.	58.	0.032	87.63	1.043D
U-235	372.98	93.35	1253.	58.	0.032	87.63	1.043D
EU-155	421.32	105.44	1171.	44.	0.025	110.15	1.054s
EU-152	489.29	122.44	1159.	45.	0.025	108.81	1.070s
Pa-234	524.18	131.16	1124.	35.	0.019	137.33	1.079s
U-235	574.13	143.65	1203.	-48.	-0.026	103.98	1.091s
U-235	646.89	161.84	752.	5.	0.003	850.44	1.109s
U-235	821.22	205.44	1091.	-13.	-0.007	349.16	1.148s
PB-212	953.27	238.46	993.	125.	0.070	36.68	1.179
PB-214	968.00	242.14	1005.	11.	0.006	403.77	1.182
TL-208	1107.16	276.94	791.	34.	0.019	114.35	1.214
I-131	1133.66	283.56	738.	5.	0.003	702.33	1.221
PB-214	1178.79	294.85	573.	92.	0.051	54.23	0.490s
PB-212	1200.93	300.38	789.	48.	0.026	84.68	1.235
AC-228	1352.39	338.25	701.	45.	0.025	84.62	1.270s
EU-152	1378.94	344.89	662.	28.	0.016	130.46	1.275s
PB-214	1406.26	351.72	669.	86.	0.048	44.07	1.282
I-131	1455.88	364.13	713.	-34.	-0.019	113.88	1.293
BE-7	1909.01	477.42	744.	-6.	-0.003	644.25	1.392s
CS-134	2250.78	562.86	388.	22.	0.012	127.02	1.466s
CS-134	2279.86	570.13	352.	20.	0.011	136.61	1.471s
Pa-234	2279.88	570.13	352.	20.	0.011	136.24	1.471
TL-208	2331.87	583.13	356.	40.	0.022	60.64	1.482s
CS-134	2410.14	602.69	309.	-17.	-0.010	144.66	1.500s
BI-214	2437.68	609.58	271.	105.	0.058	31.70	0.982s
CS-137	2645.82	661.61	300.	10643.	5.913	1.05	1.452
BI-212	2907.87	727.11	318.	17.	0.009	152.13	1.601s
PA-234M	3066.30	766.71	335.	33.	0.018	79.97	1.633s
EU-152	3116.13	779.17	285.	59.	0.033	42.55	1.643s
CS-134	3187.66	797.04	169.	6.	0.004	290.73	1.661s
TL-208	3441.43	860.47	347.	19.	0.011	137.44	1.707
Pa-234	3534.30	883.68	311.	19.	0.010	133.89	1.722
AC-228	3642.26	910.66	550.	44.	0.025	76.62	1.746s
Pa-234	3774.84	943.80	378.	24.	0.013	117.47	1.772
EU-152	3856.15	964.12	492.	14.	0.008	228.97	1.786s
AC-228	3874.97	968.82	503.	-12.	-0.007	261.56	1.790s
EU-154	3985.65	996.48	415.	16.	0.009	177.62	1.810s
BI-214	4484.12	1121.05	307.	28.	0.016	81.71	1.901
CO-60	4692.63	1173.15	172.	5976.	3.320	1.44	1.975
EU-154	5089.34	1272.28	31.	11.	0.006	75.03	2.008s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
CO-60	5329.81	1332.36	33.	5385.	2.991	1.39	1.997
K-40	5844.14	1460.86	33.	1.	0.001	76.97	2.131
BI-214	7059.18	1764.37	18.	7.	0.004	64.03	2.314s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	Peak MDA Value Bq/Sample		COMMENTS
BE-7	C	-1.3766E+00				5.31E+01		
			477.60	-1.377E+00	&(	2.979E+01	6.44E+02 1.05E+01 G	
K-40	N	5.3052E-01				4.66E+11		
			1460.83	5.305E-01	(P	1.578E+01	7.70E+01 1.07E+01 G	
CO-60	F	7.2427E+02				1.93E+03		
			1332.50	7.231E+02	(	3.977E+00	1.39E+00 1.00E+02 G	
			1173.24	7.254E+02	(	7.748E+00	1.44E+00 9.99E+01 G	
I-131	I	-6.5562E-01				8.02E+00		
			364.48	-8.173E-01	(	3.098E+00	1.14E+02 8.17E+01 G	
			284.30	1.496E+00	(	3.530E+01	7.02E+02 6.14E+00 G	
			636.97	-6.785E-01	%	3.837E+01	1.67E+03 7.17E+00 G	
CS-134	I	7.2349E+00				7.54E+02		
			604.71	-5.518E+00	?(	2.680E+01	1.45E+02 9.76E+01 G	
			795.87	5.593E-02	%	3.854E+01	2.03E+04 8.55E+01 G	
			569.32	3.786E+01	?(	1.733E+02	1.37E+02 1.54E+01 G	
			801.95	2.811E+01	&(	2.787E+02	2.91E+02 8.69E+00 G	
			563.24	7.820E+01	?(	3.322E+02	1.27E+02 8.35E+00 G	
CS-137	I	4.5157E+02				1.10E+04		
			661.66	4.516E+02	(	3.540E+00	1.05E+00 8.52E+01 G	
EU-152	F	6.2931E+00				4.94E+03		
			344.29	2.923E+00	(	1.271E+01	1.30E+02 2.65E+01 G	
			121.78	2.352E+00	&(	8.497E+00	1.09E+02 2.86E+01 G	
			778.92	2.273E+01	(	3.138E+01	4.25E+01 1.29E+01 G	
			964.11	5.560E+00	?(	4.275E+01	2.29E+02 1.46E+01 G	
			1112.07	3.764E-02	&	4.286E+01	3.35E+04 1.36E+01 G	
			1408.00	2.382E-01	%	9.762E+00	1.12E+03 2.10E+01 G	

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
EU-154	I	4.0247E+00					3.14E+03	
			873.23	7.271E-01	&(	5.177E+01	2.10E+03	1.23E+01 G
			123.10	6.921E-02	&	7.391E+00	3.19E+03	4.08E+01 G
			1274.54	2.924E+00	?(	7.338E+00	7.50E+01	3.52E+01 G
			723.36	4.766E-01	%	2.324E+01	1.43E+03	2.02E+01 G
			1004.77	4.567E-01	%	3.539E+01	2.28E+03	1.80E+01 G
			996.33	1.149E+01	(	6.852E+01	1.78E+02	1.06E+01 G
EU-155	I	5.8806E+00					1.81E+03	
			105.31	5.881E+00	(	2.150E+01	1.10E+02	2.12E+01 G
			86.54	-3.761E-01	%	1.959E+01	1.56E+03	3.07E+01 G
TL-208	N	3.0591E+01					6.98E+02	
			583.02	1.750E+01	?(P	3.918E+01	6.06E+01	8.45E+01 G
			277.28	1.153E+02	(P	4.564E+02	1.14E+02	6.31E+00 G
			860.56	7.666E+01	(	3.531E+02	1.37E+02	1.24E+01 G
PB-210	N	1.4424E+04					8.14E+03	
			46.54	1.442E+04	(	2.204E+02	9.19E-01	4.25E+00 G
PB-212	N	5.6299E+01					6.98E+02	
			238.63	5.630E+01	?(	6.722E+01	3.67E+01	4.33E+01 G
			300.03	3.298E+02	+	9.255E+02	8.47E+01	3.28E+00 G
PB-214	N	5.7137E+00					5.84E+05	
			351.93	4.435E+00	?(	6.384E+00	4.41E+01	3.76E+01 G
			295.09	8.205E+00	(	1.021E+01	5.42E+01	1.93E+01 G
			242.00	2.259E+00	-	3.053E+01	4.04E+02	7.43E+00 G
BI-212	N	9.5804E+01					6.98E+02	
			727.17	9.580E+01	&(	4.895E+02	1.52E+02	7.55E+00 G
			785.42	5.436E+01	&	2.991E+03	1.62E+03	1.28E+00 G
BI-214	N	7.0777E+00					5.84E+05	
			609.31	6.578E+00	(P	4.992E+00	3.17E+01	4.61E+01 G
			1120.29	8.602E+00	(P	2.581E+01	8.17E+01	1.51E+01 G
			1764.49	3.099E+00	- P	9.807E+00	6.40E+01	1.54E+01 G
AC-228	N	1.4766E+01					2.10E+03	
			911.07	1.400E+01	?(	3.552E+01	7.66E+01	2.90E+01 G
			968.97	-6.746E+00	-	5.930E+01	2.62E+02	1.75E+01 G
			338.32	1.661E+01	(	4.660E+01	8.46E+01	1.20E+01 G
								Energy duplication
			93.35	2.622E+01	&	7.608E+01	8.76E+01	5.56E+00 XA
Pa-234	N	5.6844E+00					1.63E+12	
			131.29	2.059E+00	?(	9.406E+00	1.37E+02	1.80E+01 G
			569.47	6.607E+00	(	3.016E+01	1.36E+02	8.20E+00 G

TestAmerica, Inc Spectrum name: 9_Gamma_20130915.An1

Nuclide	Ave	activity	Energy	Activity	Code	Peak	MDA	Comments
			946.02	7.154E+00	(	2.808E+01	1.17E+02	1.34E+01 G
			883.24	0.000E+00	-	4.308E+01	1.00E+03	9.60E+00 G
			880.53	1.202E+01	(	5.396E+01	1.34E+02	6.00E+00 G
TH-234	N	-2.9703E+02					1.63E+12	
			63.29-2.970E+02		(	8.608E+01	9.38E+00	3.81E+00 G
			92.59-9.593E+00		&	3.217E+01	1.01E+02	5.58E+00 G
PA-234M	N	9.9914E+01					1.63E+12	
			1001.00-8.049E-01		%(	4.336E+02	1.58E+04	8.37E-01 G
			766.41	3.867E+02	&(	1.026E+03	8.00E+01	2.94E-01 G
U-235	N	-4.7913E+00					2.57E+11	
			143.79-4.791E+00		?(	1.653E+01	1.04E+02	1.10E+01 G
			205.33-3.609E+00		&	4.212E+01	3.49E+02	5.01E+00 G
			163.38	1.068E+00	+	3.053E+01	8.50E+02	5.08E+00 G
								Energy duplication
			93.35	1.069E+01	&	3.101E+01	8.76E+01	5.81E+00 X
AM-241	T	1.2145E+03					1.58E+05	
			59.54	1.215E+03	(	1.316E+01	7.57E-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.
+ - 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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape
K - Key Line
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
TH-234	61.42	2410.	-799.	-0.444	9.38	-2.970E+02
TH-234	91.55	1239.	-50.	-0.028	101.12	-9.593E+00
AC-228	93.35	1253.	58.	0.032	87.63	2.622E+01
U-235	93.35	1253.	58.	0.032	87.63	1.069E+01
EU-155	105.44	1171.	44.	0.025	110.15	5.881E+00
EU-152	122.44	1159.	45.	0.025	108.81	2.352E+00
U-235	143.65	1203.	-48.	-0.026	103.98	-4.791E+00
U-235	161.84	752.	5.	0.003	850.44	1.068E+00
U-235	205.44	1091.	-13.	-0.007	349.16	-3.609E+00
AC-228	338.25	701.	45.	0.025	84.62	1.661E+01
EU-152	344.89	662.	28.	0.016	130.46	2.923E+00
BE-7	477.42	744.	-6.	-0.003	644.25	0.000E+00
CS-134	562.86	388.	22.	0.012	127.02	7.820E+01
CS-134	570.13	352.	20.	0.011	136.61	3.786E+01
CS-134	602.69	309.	-17.	-0.010	144.66	-5.518E+00
PA-234M	766.71	335.	33.	0.018	79.97	3.867E+02
EU-152	779.17	285.	59.	0.033	42.55	2.273E+01
CS-134	797.04	169.	6.	0.004	290.73	2.811E+01
AC-228	910.66	550.	44.	0.025	76.62	1.400E+01
EU-152	964.12	492.	14.	0.008	228.97	5.560E+00
AC-228	968.82	503.	-12.	-0.007	261.56	-6.746E+00
EU-154	996.48	415.	16.	0.009	177.62	1.149E+01
EU-154	1272.28	31.	11.	0.006	75.03	2.924E+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 1 Sigma Counting		MDA Bq/Sample
BE-7	#A	-1.3766E+00	>12 Halflives	6.4425E+02%	2.9788E+01	
K-40	A	5.3052E-01	5.3052E-01	7.695E+02%		1.58E+01
CO-60		2.8537E+02	7.2427E+02	1.001E+00%		3.98E+00
I-131	A	-6.5562E-01	>12 Halflives	1.1388E+02%	3.0977E+00	
CS-134	#A	6.7120E-01	7.2349E+00	9.362E+01%		2.68E+01
CS-137		3.8340E+02	4.5157E+02	1.048E+00%		3.54E+00
EU-152	#A	4.3789E+00	6.2931E+00	4.255E+01%		1.27E+01
EU-154	#A	2.2731E+00	4.0247E+00	7.503E+01%		5.18E+01
EU-155	#A	2.1856E+00	5.8806E+00	1.102E+02%		2.15E+01
TL-208	A	2.3406E+00	3.0591E+01	6.464E+01%		3.92E+01
PB-210		1.1574E+04	1.4424E+04	9.188E-01%		2.20E+02
PB-212	A	4.3076E+00	5.6299E+01	3.668E+01%		6.72E+01

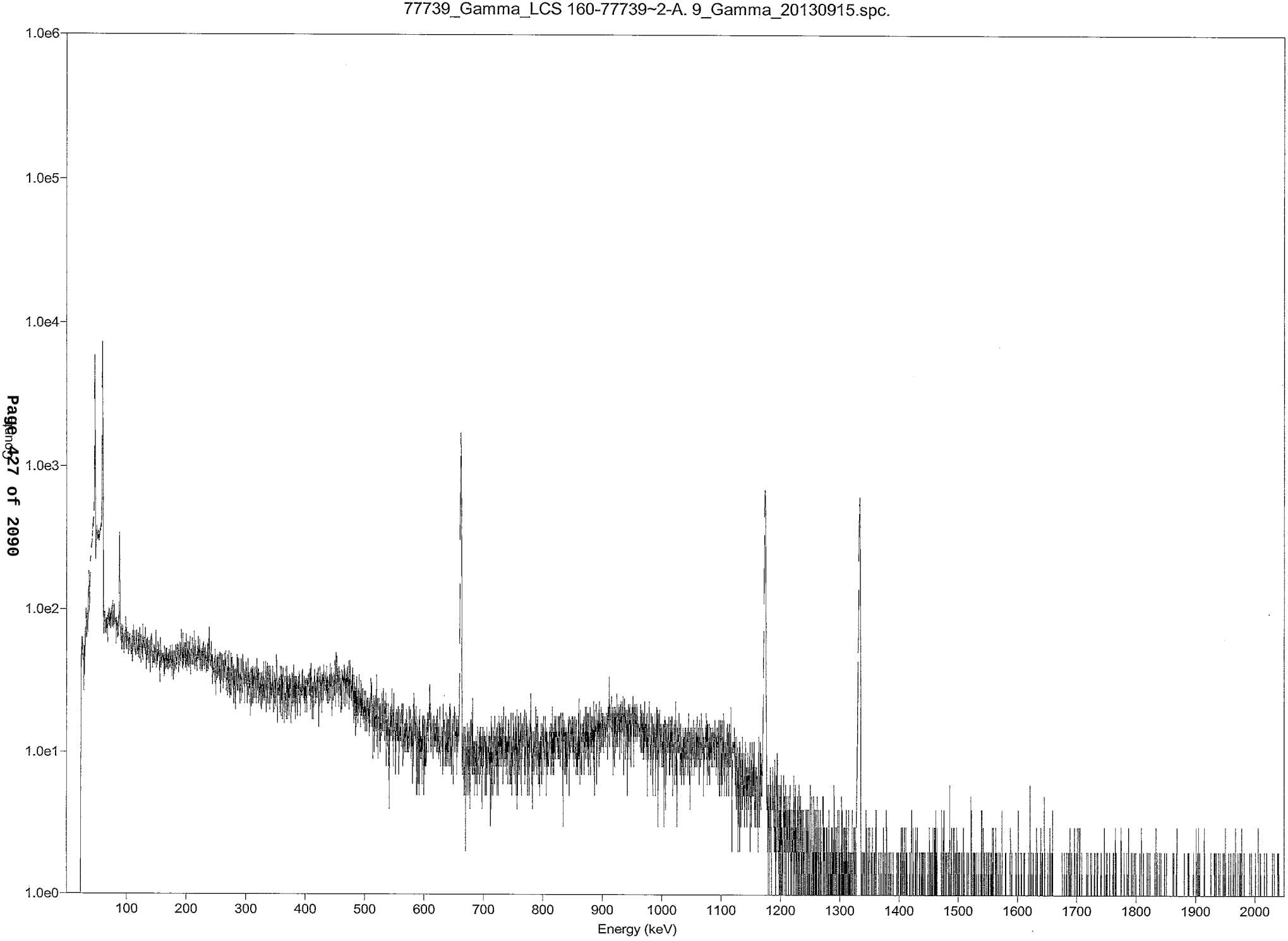
PB-214	A	5.6962E+00	5.7137E+00	3.494E+01%	6.38E+00
BI-212	#A	7.3301E+00	9.5804E+01	1.521E+02%	4.89E+02
BI-214		7.0561E+00	7.0777E+00	3.436E+01%	4.99E+00
AC-228	#A	6.2874E+00	1.4766E+01	5.708E+01%	3.55E+01
Pa-234	A	5.6844E+00	5.6844E+00	6.574E+01%	9.41E+00
TH-234	#A	-2.9703E+02	-2.9703E+02	9.384E+00%	8.61E+01
PA-234M	#A	9.9914E+01	9.9914E+01	7.997E+01%	4.34E+02
U-235	#A	-4.7913E+00	-4.7913E+00	1.040E+02%	1.65E+01
AM-241		1.2008E+03	1.2145E+03	7.573E-01%	1.32E+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 1999.3 keV) 1.346E+04 Bq/Sample
Total Decayed Activity (37.6 to 1999.3 keV) 1.6883195E+04 Bq/Sample

The library has energies which are not separable.


77739_Gamma_LCS 160-77739~2-A. 9_Gamma_20130915.spc.
1.0e6
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Counts
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Energy (keV)

Test America St. Louis Spectrum ID: 11_Gamma_20131574

Sample Description: 77739_Gamma_LCS 160-77739~2-A
Detector: Ge11 S/N09363993
Batch ID: 77739
Work Order Number: Gamma
Lot Number: LCS 160-77739~2-A

Decay to Time: 10/1/2006 12:00 Live Time: 1800 sec
Acquisition Time: 10/31/2013 09:57:50 Real Time: 1893 sec
Analysis Time: 11/11/2013 19:53 Dead Time: 4.93 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 11_Soil_TunaCan.Clb
Efficiency Cal Desc: Ge11_TunaCanCal_90099_032912
Efficiency Cal Date: 4/2/2012 17:29
Energy Cal Date: 2/28/2012 13:09
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 11_2013-10-05_0101.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
K-40	-3.130E+00	551.4	1.726E+01	1.726E+01	1.982E+01
CO-60	7.741E+02	1.0	7.995E+00	3.968E+01	3.551E+00
CS-134	5.627E+00	57.9	3.259E+00	3.273E+00	3.600E+01
CS-137	4.774E+02	1.1	5.441E+00	2.542E+01	4.209E+00
EU-152	2.514E+00	70.6	1.774E+00	1.779E+00	1.482E+01
EU-154	2.899E+00	99.0	2.868E+00	2.872E+00	6.079E+01
EU-155	-4.263E-01	1708.0	7.281E+00	7.281E+00	2.440E+01
TL-208	4.864E+01	31.0	1.507E+01	1.528E+01	3.485E+01
PB-210	1.502E+04	1.0	1.504E+02	8.949E+02	2.572E+02
PB-212	9.754E+01	22.9	2.231E+01	2.319E+01	5.738E+01
PB-214	8.604E+00	23.5	2.021E+00	2.070E+00	5.061E+00
BI-212	3.977E+02	48.0	1.908E+02	1.919E+02	5.097E+02
BI-214	2.554E+00	72.7	1.857E+00	1.862E+00	6.709E+00
AC-228	2.142E+01	41.5	8.893E+00	8.960E+00	3.627E+01
Pa-234	3.857E+00	167.3	6.451E+00	6.454E+00	7.418E+00
TH-234	-8.093E+01	34.3	2.773E+01	2.805E+01	7.226E+01
PA-234M	2.658E+01	103.4	2.749E+01	2.752E+01	5.227E+02
U-235	4.288E+00	110.2	4.726E+00	4.731E+00	1.716E+01
AM-241	1.264E+03	0.8	1.065E+01	6.644E+01	1.590E+01
Total	1.816E+04				

Analyst: Jody Watson

TestAmerica, Inc Spectrum name: 11_Gamma_20131574.An1

Sample description
77739_Gamma_LCS 160-77739~2-A

Spectrum Filename: C:\User\SPC\Det11\11_Gamma_20131574.An1

Acquisition information
Start time: 10/31/2013 9:57:50 AM
Live time: 1800
Real time: 1893
Dead time: 4.93 %
Detector ID: 11

Detector system
Ge11 S/N09363993

Calibration
Filename: 11_Soil_TunaCan.Clb
Ge11_TunaCanCal_90099_032912

Energy Calibration
Created: 2/28/2012 1:09:34 PM
Zero offset: 0.055 keV
Gain: 0.250 keV/channel
Quadratic: -2.946E-08 keV/channel^2

Efficiency Calibration
Created: 4/2/2012 5:29:36 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.14 %
Log(Eff): -6.858644E-01 + (-3.337421E-01*Log(E)) + (-3.199860E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.72 %
Log(Eff): -2.393599E+01 + (8.833910E+00*Log(E)) + (-9.364157E-01*Log(E)^2)

Library Files
Main analysis library: Client_Routine Short Rev1.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 (1999.47keV)
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

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 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	11_2013-10-05_0101.PBC 10/5/2013 1:01:56 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 20 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 46.5155

***** 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
36.68	379.	16.28	1.05	1.405E-02				
40.49	133.	55.66	1.66	1.711E-02				
46.62	19658.	0.86	0.90	2.193E-02	46.54	4.250	1.460E+04	PB210
49.77	415.	28.03	0.60	2.434E-02				
55.95	145.	50.29	0.62	2.870E-02				
59.56	25028.	0.84	0.88	3.101E-02	59.54	35.900	1.264E+03	AM241
77.07	147.	27.49	0.93	3.947E-02				
79.28	92.	44.04	0.93	4.022E-02				
88.07	1082.	8.02	0.97	4.263E-02				
93.79	56.	88.49	0.94	4.362E-02	93.35	5.561	PBC<MDA	AC228
					93.35	5.810	1.224E+01	U235
					93.35	5.561	3.003E+01	AC228
93.79	56.	88.49	0.94	4.362E-02	93.35	5.561	PBC<MDA	AC228
					93.35	5.810	1.224E+01	U235
122.18	61.	70.58	0.97	4.466E-02	121.78	28.580	PBC<MDA	EU152
143.95	39.	110.20	0.99	4.238E-02	143.79	10.960	PBC<MDA	U235
205.37	11.	379.21	1.05	3.439E-02	205.33	5.010	PBC<MDA	U235
238.51	197.	20.94	0.80	3.106E-02	238.63	43.300	9.754E+01	PB212
					242.00	7.430	4.711E+01	PB214
276.63	35.	99.46	1.11	2.800E-02	277.28	6.310	PBC<MDA	TL208
283.85	38.	97.31	1.12	2.752E-02	284.30	6.140	HL>Cutoff	I131
295.03	118.	34.12	0.33	2.681E-02	295.09	19.300	1.273E+01	PB214
338.09	43.	83.18	1.17	2.436E-02	338.32	12.010	PBC<MDA	AC228
					338.32	12.010	1.900E+01	AC228
351.83	104.	27.31	1.27	2.369E-02	351.93	37.600	6.484E+00	PB214
430.82	38.	58.13	0.50	2.050E-02				
582.88	93.	29.40	0.81	1.643E-02	583.02	84.500	4.864E+01	TL208
609.24	36.	53.14	1.4[illegible]	[illegible]E-02	609.31	46.090	PBC<MDA	BI214

					609.31	46.090	PBC<MDA BI214
661.78	9292.	1.14	1.38	1.495E-02	661.66	85.210	4.774E+02 CS137
727.09	28.	78.07	1.51	1.392E-02	727.17	7.550	PBC<MDA BI212
766.55	21.	103.43	1.54	1.338E-02	766.41	0.294	PBC<MDA PA234M

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
777.51	11.	209.97	1.55	1.322E-02	778.92	12.940	PBC<MDA	EU152
783.74	37.	55.82	1.56	1.313E-02	785.42	1.280	PBC<MDA	BI212
794.26	21.	97.99	1.57	1.300E-02	795.87	85.530	PBC<MDA	CS134
					795.87	85.530	1.118E+01	CS134
803.02	24.	97.75	1.57	1.293E-02	801.95	8.690	PBC<MDA	CS134
					801.95	8.690	1.296E+02	CS134
809.12	83.	35.39	0.57	1.284E-02				
881.76	16.	167.27	1.64	1.203E-02	880.53	6.000	PBC<MDA	Pa234
					880.53	6.000	1.263E+01	Pa234
911.09	50.	56.96	1.66	1.172E-02	911.07	29.000	PBC<MDA	AC228
					911.07	29.000	1.937E+01	AC228
946.06	15.	197.34	1.69	1.139E-02	946.02	13.400	PBC<MDA	Pa234
					946.02	13.400	5.589E+00	Pa234
964.47	6.	552.78	1.71	1.122E-02	964.11	14.605	PBC<MDA	EU152
969.64	40.	73.12	1.71	1.118E-02	968.97	17.460	PBC<MDA	AC228
					968.97	17.460	2.650E+01	AC228
995.59	5.	472.23	1.73	1.094E-02	996.33	10.600	PBC<MDA	EU154
					996.33	10.600	4.659E+00	EU154
1005.86	25.	98.95	1.74	1.087E-02	1004.77	18.010	PBC<MDA	EU154
					1004.77	18.010	1.238E+01	EU154
1111.78	13.	217.05	1.83	1.004E-02	1112.07	13.644	PBC<MDA	EU152
1120.17	-3.	815.86	1.83	9.985E-03	1120.29	15.100	PBC<MDA	BI214
					1120.29	15.100	PBC<MDA	BI214
1173.37	5261.	1.46	1.87	9.629E-03	1173.24	99.900	7.711E+02	CO60
1332.61	4798.	1.46	2.01	8.708E-03	1332.50	99.980	7.771E+02	CO60
1408.05	2.	375.29	2.06	8.334E-03	1408.00	21.005	PBC<MDA	EU152
1461.51	-5.	196.71	2.10	8.093E-03	1460.83	10.670	PBC<MDA	K40
1764.74	4.	76.03	2.34	6.950E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV		Suspected Nuclide
146.42	36.68	1142.	379.	2.697E+04	16.28	1.053	-	s
161.64	40.49	2139.	133.	7.772E+03	55.66	1.663	-	s
198.72	49.77	3929.	415.	1.703E+04	28.03	0.596	-	sM
223.43	55.95	2399.	145.	5.063E+03	50.29	0.624	-	sM
307.85	76.98	749.	144.	3.650E+03	28.13	0.929	-	D
316.66	79.18	776.	92.	2.284E+03	44.14	0.931	-	D
351.83	88.07	1541.	1188.	2.786E+04	5.50	0.967	-	M
1722.30	430.82	189.	38.	1.838E+03	58.13	0.499	-	sM
3235.39	809.12	156.	83.	6.465E+03	35.39	0.565	-	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_Routine Short Rev1.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	185.97	46.58	5420.	20194.	11.219	1.00	0.891
AM-241	237.87	59.56	4487.	25028.	13.905	0.84	0.879
TH-234	245.79	61.54	1206.	-184.	-0.102	30.79	0.916s
EU-155	344.35	86.20	1723.	-110.	-0.061	54.41	0.938s
TH-234	380.25	95.17	736.	-49.	-0.027	217.31	0.943s
AC-228	372.95	93.35	1192.	56.	0.031	88.49	0.944D
U-235	372.95	93.35	1192.	56.	0.031	88.49	0.944D
EU-152	488.19	122.18	902.	61.	0.034	70.58	0.970
Pa-234	515.00	128.88	487.	-5.	-0.003	614.61	0.979s
U-235	575.24	143.95	913.	39.	0.022	110.20	0.990
U-235	653.29	163.47	852.	-24.	-0.013	174.70	1.008s
U-235	820.79	205.37	802.	11.	0.006	379.21	1.047s
PB-212	953.29	238.51	493.	181.	0.100	20.94	0.805s
TL-208	1105.71	276.63	601.	35.	0.020	99.46	1.112
I-131	1134.60	283.85	649.	38.	0.021	97.31	1.118s
PB-214	1179.31	295.03	449.	118.	0.066	34.12	0.326s
AC-228	1351.48	338.09	606.	43.	0.024	83.18	1.167s
EU-152	1375.50	344.10	616.	-11.	-0.006	332.03	1.172s
PB-214	1406.43	351.83	281.	104.	0.058	27.31	1.272
I-131	1459.85	365.19	588.	-9.	-0.005	397.04	1.190s
CS-134	2276.28	569.34	325.	-6.	-0.003	443.16	1.371s
TL-208	2330.42	582.88	188.	93.	0.052	29.40	0.812s
CS-134	2420.48	605.39	382.	-27.	-0.015	105.10	1.401s
BI-214	2435.87	609.24	337.	36.	0.020	53.14	1.405
I-131	2546.22	636.83	346.	-21.	-0.011	129.62	1.429s
CS-137	2645.99	661.78	289.	9292.	5.162	1.14	1.383
BI-212	2907.26	727.09	233.	28.	0.016	78.07	1.507s
PA-234M	3065.10	766.55	231.	21.	0.012	103.43	1.540s
EU-152	3108.94	777.51	242.	11.	0.006	209.97	1.551
BI-212	3133.87	783.74	191.	37.	0.020	55.82	1.556s
CS-134	3175.96	794.26	196.	21.	0.012	97.99	1.565s
CS-134	3210.97	803.02	270.	24.	0.014	97.75	1.570s
EU-154	3489.14	872.55	366.	-19.	-0.011	144.57	1.630s
Pa-234	3525.99	881.76	369.	16.	0.009	167.27	1.637s
AC-228	3643.32	911.09	388.	50.	0.028	56.96	1.662s
Pa-234	3783.25	946.06	451.	15.	0.009	197.34	1.691s
EU-152	3856.91	964.47	471.	6.	0.003	552.78	1.706
AC-228	3877.61	969.64	400.	40.	0.022	73.12	1.710s
EU-154	3981.42	995.59	334.	5.	0.003	472.23	1.733s
PA-234M	3998.45	999.85	318.	-11.	-0.006	222.98	1.737s
EU-154	4022.53	1005.86	285.	25.	0.014	98.95	1.740s
EU-152	4446.33	1111.78	362.	13.	0.007	217.05	1.828
CO-60	4692.81	1173.37	99.	5261.	2.923	1.46	1.869
EU-154	5088.59	1272.27	32.	-3.	-0.002	240.74	1.958s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
CO-60	5330.12	1332.61	17.	4798.	2.666	1.46	2.011
EU-152	5632.05	1408.05	23.	2.	0.001	375.29	2.064s
K-40	5846.05	1461.51	36.	-5.	-0.003	196.71	2.105s
BI-214	7060.05	1764.74	19.	4.	0.002	76.03	2.336s

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	Peak Energy keV	Peak Activity Bq/Sample		Peak MDA Value Bq/Sample		COMMENTS
BE-7	C	5.0838E-01				5.31E+01		
			477.60	5.084E-01	%(	3.156E+01	1.84E+03	1.05E+01 G
K-40	N	-3.1300E+00				4.66E+11		
			1460.83	-3.130E+00	?(P	1.982E+01	1.97E+02	1.07E+01 G
CO-60	F	7.7409E+02				1.93E+03		
			1332.50	7.771E+02	(	3.551E+00	1.46E+00	1.00E+02 G
			1173.24	7.711E+02	(	7.193E+00	1.46E+00	9.99E+01 G
I-131	I	6.2628E-01				8.02E+00		
			364.48	-2.551E-01	?(	3.405E+00	3.97E+02	8.17E+01 G
			284.30	1.235E+01	&(	3.994E+01	9.73E+01	6.14E+00 G
			636.97	-1.037E+01	+	4.501E+01	1.30E+02	7.17E+00 G
CS-134	I	5.6266E+00				7.54E+02		
			604.71	-1.027E+01	?(	3.600E+01	1.05E+02	9.76E+01 G
			795.87	1.118E+01	&(	3.663E+01	9.80E+01	8.55E+01 G
			569.32	-1.345E+01	+	2.019E+02	4.43E+02	1.54E+01 G
			801.95	1.296E+02	(	4.227E+02	9.78E+01	8.69E+00 G
			563.24	8.247E+00	&	3.713E+02	1.33E+03	8.35E+00 G
CS-137	I	4.7736E+02				1.10E+04		
			661.66	4.774E+02	(	4.209E+00	1.14E+00	8.52E+01 G
EU-152	F	2.5135E+00				4.94E+03		
			344.29	-1.329E+00	?(	1.482E+01	3.32E+02	2.65E+01 G
			121.78	3.826E+00	(	8.921E+00	7.06E+01	2.86E+01 G
			778.92	4.945E+00	(	3.511E+01	2.10E+02	1.29E+01 G
			964.11	2.713E+00	(	5.060E+01	5.53E+02	1.46E+01 G
			1112.07	7.290E+00	(	5.327E+01	2.17E+02	1.36E+01 G
			1408.00	8.363E-01	&(	1.138E+01	3.75E+02	2.10E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
EU-154	I 2.8987E+00					3.14E+03	
		873.23-1.254E+01	?(	6.079E+01	1.45E+02	1.23E+01	G
		123.10-1.484E-01	&	7.938E+00	1.59E+03	4.08E+01	G
		1274.54-1.049E+00	+	8.950E+00	2.41E+02	3.52E+01	G
		723.36 0.000E+00	+	3.157E+01	1.00E+03	2.02E+01	G
		1004.77 1.238E+01	?(	4.090E+01	9.90E+01	1.80E+01	G
		996.33 4.659E+00	?(	7.449E+01	4.72E+02	1.06E+01	G
EU-155	I -4.2626E-01					1.81E+03	
		105.31-4.263E-01	%(	2.440E+01	1.71E+03	2.12E+01	G
		86.54-1.262E+01	+	2.258E+01	5.44E+01	3.07E+01	G
TL-208	N 4.8643E+01					6.98E+02	
		583.02 4.864E+01	(P	3.485E+01	2.94E+01	8.45E+01	G
		277.28 1.453E+02	+	4.806E+02	9.95E+01	6.31E+00	G
		860.56 1.003E+01	%	4.122E+02	1.21E+03	1.24E+01	G
PB-210	N 1.5023E+04					8.14E+03	
		46.54 1.502E+04	(P	2.572E+02	1.00E+00	4.25E+00	G
PB-212	N 9.7541E+01					6.98E+02	
		238.63 9.754E+01	(P	5.738E+01	2.09E+01	4.33E+01	G
		300.03-3.442E+00	%	9.786E+02	8.43E+03	3.28E+00	G
PB-214	N 8.6039E+00					5.84E+05	
		351.93 6.484E+00	(P	5.061E+00	2.73E+01	3.76E+01	G
		295.09 1.273E+01	(P	1.092E+01	3.41E+01	1.93E+01	G
		242.00-1.846E-01	& P	2.604E+01	9.18E+02	7.43E+00	G
BI-212	N 3.9766E+02					6.98E+02	
		727.17 1.966E+02	?(	5.097E+02	7.81E+01	7.55E+00	G
		785.42 1.584E+03	&(	2.899E+03	5.58E+01	1.28E+00	G
BI-214	N 2.5543E+00					5.84E+05	
		609.31 2.760E+00	(P	6.709E+00	5.31E+01	4.61E+01	G
		1120.29-9.480E-01	% P	2.996E+01	8.16E+02	1.51E+01	G
		1764.49 1.937E+00	&(P	1.185E+01	7.60E+01	1.54E+01	G
AC-228	N 2.1423E+01					2.10E+03	
		911.07 1.937E+01	?(	3.627E+01	5.70E+01	2.90E+01	G
		968.97 2.650E+01	&(	6.414E+01	7.31E+01	1.75E+01	G
		338.32 1.900E+01	(	5.238E+01	8.32E+01	1.20E+01	G
						Energy duplication	
		93.35 3.003E+01	*	8.802E+01	8.85E+01	5.56E+00	XA
Pa-234	N 3.8567E+00					1.63E+12	
		131.29-3.578E-01	&(	7.418E+00	6.15E+02	1.80E+01	G
		569.47 4.218E-01	%	3.150E+01	2.19E+03	8.20E+00	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
		946.02	5.589E+00	&(	3.703E+01	1.97E+02	1.34E+01 G
		883.24	1.525E-01	%	4.471E+01	8.64E+03	9.60E+00 G
		880.53	1.263E+01	&(	7.094E+01	1.67E+02	6.00E+00 G
TH-234	N -8.0934E+01					1.63E+12	
		63.29-8.093E+01		?(P	7.226E+01	3.08E+01	3.81E+00 G
		92.59-1.124E+01		& P	2.953E+01	2.17E+02	5.58E+00 G
PA-234M	N 2.6576E+01					1.63E+12	
		1001.00-6.951E+01		&(	5.227E+02	2.23E+02	8.37E-01 G
		766.41	3.001E+02	&(	1.038E+03	1.03E+02	2.94E-01 G
U-235	N 4.2884E+00					2.57E+11	
		143.79	4.687E+00	?(	1.716E+01	1.10E+02	1.10E+01 G
		205.33	3.417E+00	?(	4.342E+01	3.79E+02	5.01E+00 G
		163.38-6.618E+00		+	3.859E+01	1.75E+02	5.08E+00 G
							Energy duplication
		93.35	1.224E+01	*	3.587E+01	8.85E+01	5.81E+00 X
AM-241	T 1.2637E+03					1.58E+05	
		59.54	1.264E+03	(	1.590E+01	8.43E-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.
+ - 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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape
K - Key Line
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	
TH-234	61.54	1206.	-184.	-0.102	30.79	-8.093E+01	P
EU-155	86.20	1723.	-110.	-0.061	54.41	-1.262E+01	
TH-234	95.17	736.	-49.	-0.027	217.31	-1.124E+01	P
AC-228	93.35	1192.	56.	0.031	88.49	3.003E+01	
U-235	93.35	1192.	56.	0.031	88.49	1.224E+01	
Pa-234	128.88	487.	-5.	-0.003	614.61	-3.578E-01	
U-235	143.95	913.	39.	0.022	110.20	4.687E+00	
U-235	163.47	852.	-24.	-0.013	174.70	-6.618E+00	
U-235	205.37	802.	11.	0.006	379.21	3.417E+00	
I-131	283.85	649.	38.	0.021	97.31	0.000E+00	
AC-228	338.09	606.	43.	0.024	83.18	1.900E+01	
I-131	365.19	588.	-9.	-0.005	397.04	0.000E+00	
CS-134	569.34	325.	-6.	-0.003	443.16	-1.345E+01	
CS-134	605.39	382.	-27.	-0.015	105.10	-1.027E+01	
BI-214	609.24	337.	36.	0.020	53.14	2.760E+00	P
I-131	636.83	346.	-21.	-0.011	129.62	0.000E+00	
BI-212	727.09	233.	28.	0.016	78.07	1.966E+02	
PA-234M	766.55	231.	21.	0.012	103.43	3.001E+02	
BI-212	783.74	191.	37.	0.020	55.82	1.584E+03	
CS-134	794.26	196.	21.	0.012	97.99	1.118E+01	
CS-134	803.02	270.	24.	0.014	97.75	1.296E+02	
EU-154	872.55	366.	-19.	-0.011	144.57	-1.254E+01	
Pa-234	881.76	369.	16.	0.009	167.27	1.263E+01	
AC-228	911.09	388.	50.	0.028	56.96	1.937E+01	
Pa-234	946.06	451.	15.	0.009	197.34	5.589E+00	
AC-228	969.64	400.	40.	0.022	73.12	2.650E+01	
EU-154	995.59	334.	5.	0.003	472.23	4.659E+00	
PA-234M	999.85	318.	-11.	-0.006	222.98	-6.951E+01	
EU-154	1005.86	285.	25.	0.014	98.95	1.238E+01	
EU-154	1272.27	32.	-3.	-0.002	240.74	-1.049E+00	
K-40	1461.51	36.	-5.	-0.003	196.71	-3.130E+00	P
BI-214	1764.74	19.	4.	0.002	76.03	1.937E+00	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 *****

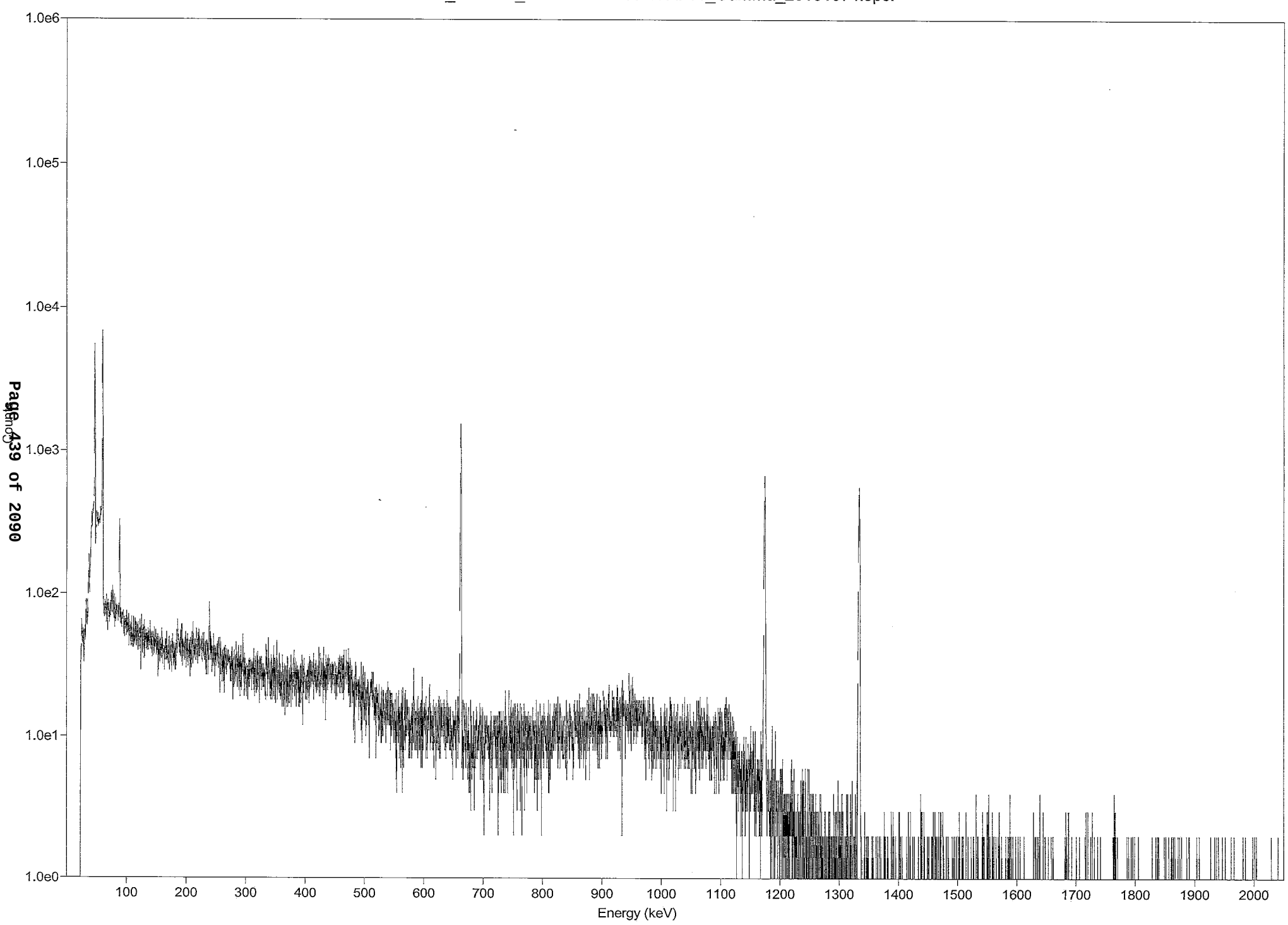
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty Counting	1 Sigma	MDA Bq/Sample
BE-7	A	5.0838E-01	>12 Halflives	1.8406E+03%	3.1560E+01	
K-40	#A	-3.1300E+00	-3.1300E+00	5.514E+02%		1.98E+01
CO-60		3.0499E+02	7.7409E+02	1.033E+00%		3.55E+00
I-131	#A	6.2628E-01	>12 Halflives	9.7311E+01%	3.4047E+00	
CS-134	#A	5.2196E-01	5.6266E+00	5.793E+01%		3.60E+01
CS-137		4.0529E+02	4.7736E+02	1.140E+00%		4.21E+00
EU-152	A	1.7489E+00	2.5135E+00	7.058E+01%		1.48E+01
EU-154	#A	1.6371E+00	2.8987E+00	9.895E+01%		6.08E+01
EU-155	#A	-1.5842E-01	-4.2626E-01	1.708E+03%		2.44E+01
TL-208		3.7216E+00	4.8643E+01	3.099E+01%		3.48E+01
PB-210		1.2054E+04	1.5023E+04	1.001E+00%		2.57E+02
PB-212		7.4625E+00	9.7541E+01	2.288E+01%		5.74E+01
PB-214		8.5775E+00	8.6039E+00	2.349E+01%		5.06E+00
BI-212	#A	3.0424E+01	3.9766E+02	4.799E+01%		5.10E+02
BI-214	#A	2.5465E+00	2.5543E+00	7.270E+01%		6.71E+00
AC-228	#A	9.1217E+00	2.1423E+01	4.151E+01%		3.63E+01
Pa-234	#A	3.8567E+00	3.8567E+00	1.673E+02%		7.42E+00
TH-234	#A	-8.0934E+01	-8.0934E+01	3.426E+01%		7.23E+01
PA-234M	#A	2.6576E+01	2.6576E+01	1.034E+02%		5.23E+02
U-235	#A	4.2884E+00	4.2884E+00	1.102E+02%		1.72E+01
AM-241		1.2494E+03	1.2637E+03	8.426E-01%		1.59E+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 (87.9 to 1999.5 keV) 1.403E+04 Bq/Sample
Total Decayed Activity (87.9 to 1999.5 keV) 1.7692848E+04 Bq/Sample

The library has energies which are not separable.


77739_Gamma_LCS 160-77739~2-A. 11_Gamma_20131574.spc.
1.0e6
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Counts
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Energy (keV)

Test America St. Louis Spectrum ID: 15_Gamma_20131338

Sample Description: 77739_Gamma_LCS 160-77739~2-A
Detector: Ge15 SN/11012216
Batch ID: 77739
Work Order Number: Gamma
Lot Number: LCS 160-77739~2-A

Decay to Time: 10/1/2006 12:00 Live Time: 1800 sec
Acquisition Time: 10/31/2013 10:54:41 Real Time: 1807 sec
Analysis Time: 11/11/2013 12:28 Dead Time: 0.38 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 15_Soil_TunaCan.Clb
Efficiency Cal Desc: 15_TunaCan_90099_032212
Efficiency Cal Date: 3/22/2012 13:03
Energy Cal Date: 2/28/2012 16:29
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 15_2013-10-05_0052.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
K-40	3.365E+00	147.9	4.978E+00	4.980E+00	1.890E+01
CO-60	7.700E+02	1.2	9.559E+00	3.982E+01	5.695E+00
CS-134	5.179E+00	73.9	3.829E+00	3.839E+00	3.939E+01
CS-137	4.556E+02	1.3	6.088E+00	2.447E+01	5.061E+00
EU-152	4.086E+00	106.8	4.362E+00	4.367E+00	1.678E+01
EU-154	1.345E+01	155.0	2.084E+01	2.085E+01	7.011E+01
EU-155	1.419E+00	123.9	1.757E+00	1.759E+00	2.813E+01
TL-208	4.567E+01	43.4	1.980E+01	1.994E+01	5.254E+01
PB-210	1.493E+04	1.1	1.619E+02	8.917E+02	2.762E+02
PB-212	1.324E+02	21.1	2.790E+01	2.919E+01	6.645E+01
PB-214	6.175E+00	39.3	2.429E+00	2.450E+00	8.077E+00
BI-212	4.218E+02	59.0	2.489E+02	2.499E+02	5.958E+02
BI-214	6.688E+00	33.6	2.247E+00	2.274E+00	5.883E+00
AC-228	1.495E+01	55.3	8.263E+00	8.298E+00	4.572E+01
Pa-234	3.895E+00	85.0	3.312E+00	3.318E+00	1.110E+01
TH-234	-3.768E+02	9.8	3.708E+01	4.199E+01	1.088E+02
PA-234M	1.072E+02	159.5	1.710E+02	1.710E+02	5.770E+02
U-235	5.110E+00	111.1	5.678E+00	5.684E+00	1.888E+01
AM-241	1.267E+03	0.9	1.133E+01	6.673E+01	1.689E+01
Total	1.820E+04				

Analyst: Jody Watson

TestAmerica, Inc. Spectrum name: 15_Gamma_20131338.An1

Sample description
77739_Gamma_LCS 160-77739~2-A

Spectrum Filename: C:\User\SPC\Det15\15_Gamma_20131338.An1

Acquisition information

Start time:	10/31/2013 10:54:41 AM
Live time:	1800
Real time:	1807
Dead time:	0.38 %
Detector ID:	15

Detector system
Ge15 SN/11012216

Calibration

Filename:	15_Soil_TunaCan.Clb

15_TunaCan_90099_032212

Energy Calibration

Created:	2/28/2012 4:29:17 PM
Zero offset:	0.044 keV
Gain:	0.250 keV/channel
Quadratic:	-3.267E-08 keV/channel^2

Efficiency Calibration

Created:	3/22/2012 1:03:01 PM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 1.00 %
Log(Eff):	-6.894897E-01 + (-3.290613E-01*Log(E)) + (-3.875629E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 1.13 %
Log(Eff):	-2.362677E+01 + (8.666669E+00*Log(E)) + (-9.214638E-01*Log(E)^2)

Library Files

Main analysis library:	Client_Routine Short Rev1.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 (1999.52keV)
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

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 12:00:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	15_2013-10-05_0052.PBC 10/5/2013 12:52:55 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 22 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0729

***** 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
40.83	107.	69.92	0.27	1.564E-02				
46.57	16947.	0.93	0.95	1.956E-02	46.54	4.250	1.409E+04	PB210
49.39	13.	607.24	0.95	2.141E-02				
59.56	22159.	0.89	0.99	2.738E-02	59.54	35.900	1.267E+03	AM241
77.46	120.	41.83	0.82	3.462E-02				
84.09	32.	123.88	0.98	3.679E-02	86.54	30.700	PBC<MDA	EU155
88.11	901.	7.82	1.12	3.707E-02				
92.79	98.	44.60	0.51	3.778E-02	92.59	5.584	PBC<MDA	TH234
					92.59	5.584	1.948E+01	TH234
93.24	5.	773.45	0.99	3.785E-02	93.35	5.561	PBC<MDA	AC228
					93.35	5.810	1.178E+00	U235
112.41	97.	39.62	0.77	3.882E-02				
121.38	35.	121.43	1.02	3.848E-02	121.78	28.580	PBC<MDA	EU152
					121.78	28.580	2.539E+00	EU152
124.36	78.	43.12	0.45	3.831E-02				
131.26	48.	85.04	1.02	3.775E-02	131.29	18.000	PBC<MDA	Pa234
					131.29	18.000	3.938E+00	Pa234
143.74	37.	111.11	1.04	3.639E-02	143.79	10.960	PBC<MDA	U235
					143.79	10.960	5.110E+00	U235
181.54	53.	54.86	0.41	3.176E-02				
185.96	61.	51.19	0.62	3.120E-02				
228.17	43.	62.64	0.30	2.681E-02				
233.55	23.	89.52	0.49	2.634E-02				
238.59	205.	19.87	1.43	2.592E-02	238.63	43.300	1.324E+02	PB212
243.73	4.	848.75	1.12	2.565E-02	242.00	7.430	PBC<MDA	PB214
					242.00	7.430	1.143E+00	PB214
246.53	44.	71.15	0.34	2.529E-02				
277.43	21.	164.07	1.15	2.513E-02	277.28	6.310	PBC<MDA	TL208

					277.28	6.310	PBC<MDA	TL208
289.99	45.	62.18	0.31	2.235E-02				
295.38	45.	74.52	1.17	2.205E-02	295.09	19.300	PBC<MDA	PB214
					295.09	19.300	5.882E+00	PB214
338.60	50.	55.28	0.30	1.983E-02	338.32	12.010	PBC<MDA	AC228
344.74	4.	742.34	1.21	1.956E-02	344.29	26.500	PBC<MDA	EU152
					344.29	26.500	6.704E-01	EU152
351.99	82.	39.34	1.22	1.923E-02	351.93	37.600	PBC<MDA	PB214
					351.93	37.600	6.325E+00	PB214
362.41	3.	994.26	1.23	1.871E-02	364.48	81.700	HL>Cutoff	I131
					364.48	81.700	HL>Cutoff	I131
434.37	25.	69.79	0.47	1.628E-02				
540.45	22.	51.83	0.32	1.364E-02				
563.18	29.	73.94	1.39	1.319E-02	563.24	8.350	PBC<MDA	CS134
					563.24	8.350	1.594E+02	CS134
583.36	55.	38.89	1.41	1.282E-02	583.02	84.500	PBC<MDA	TL208
					583.02	84.500	PBC<MDA	TL208
609.27	82.	30.58	0.70	1.236E-02	609.31	46.090	7.344E+00	BI214
637.24	36.	60.77	1.45	1.192E-02	636.97	7.170	HL>Cutoff	I131
					636.97	7.170	HL>Cutoff	I131
661.74	6850.	1.34	1.48	1.154E-02	661.66	85.210	4.556E+02	CS137

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
726.85	34.	59.01	1.52	1.067E-02	727.17	7.550	PBC<MDA	BI212
775.52	2.	756.00	1.56	1.007E-02	778.92	12.940	PBC<MDA	EU152
					778.92	12.940	1.462E+00	EU152
785.23	19.	107.79	1.57	9.998E-03	785.42	1.280	PBC<MDA	BI212
860.96	12.	207.24	1.62	9.252E-03	860.56	12.420	PBC<MDA	TL208
					860.56	12.420	7.432E+01	TL208
872.69	15.	154.96	1.63	9.137E-03	873.23	12.270	PBC<MDA	EU154
					873.23	12.270	1.345E+01	EU154
880.64	6.	446.96	1.64	9.072E-03	880.53	6.000	PBC<MDA	Pa234
					883.24	9.600	3.612E+00	Pa234
					880.53	6.000	5.764E+00	Pa234
881.05	4.	542.69	1.64	9.048E-03	880.53	6.000	PBC<MDA	Pa234
					883.24	9.600	2.646E+00	Pa234
					883.24	9.600	2.646E+00	Pa234
910.94	42.	55.81	0.50	8.812E-03	911.07	29.000	2.145E+01	AC228
969.54	11.	233.14	1.70	8.357E-03	968.97	17.460	PBC<MDA	AC228
998.60	13.	159.52	1.72	8.125E-03	1001.00	0.837	PBC<MDA	PA234M
1043.81	22.	49.44	0.50	7.836E-03				
1113.40	21.	106.75	1.80	7.416E-03	1112.07	13.644	PBC<MDA	EU152
					1112.07	13.644	1.645E+01	EU152
1120.71	3.	324.01	1.80	7.368E-03	1120.29	15.100	PBC<MDA	BI214
1173.35	3847.	1.77	1.69	7.076E-03	1173.24	99.900	7.674E+02	CO60
1274.60	4.	168.52	1.90	6.579E-03	1274.54	35.190	PBC<MDA	EU154
					1274.54	35.190	1.833E+00	EU154
1332.66	3465.	1.74	1.93	6.324E-03	1332.50	99.980	7.726E+02	CO60
1461.86	4.	71.29	2.02	5.828E-03	1460.83	10.670	PBC<MDA	K40
1764.84	6.	62.35	2.18	4.916E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV		Suspected Nuclide
163.02	40.83	2072.	107.	6.861E+03	69.92	0.275	-	s
197.05	49.34	2432.	256.	1.197E+04	32.03	0.813	-	M
309.42	77.46	800.	120.	3.466E+03	41.83	0.818	-	s
352.00	88.11	1017.	901.	2.430E+04	6.01	1.125	-	s
370.26	92.79	564.	97.	2.580E+03	35.89	0.989	-	D
449.15	112.41	460.	97.	2.499E+03	39.62	0.767	-	
496.92	124.36	413.	96.	2.498E+03	31.71	0.446	-	s
725.46	181.54	293.	53.	1.658E+03	54.86	0.413	-	s
743.15	185.96	347.	61.	1.966E+03	51.19	0.620	-	s
911.90	228.17	273.	43.	1.604E+03	62.64	0.301	-	s
933.42	233.55	188.	23.	8.795E+02	89.52	0.493	-	sc
985.29	246.53	312.	44.	1.740E+03	71.15	0.344	-	sM
1159.03	289.99	246.	45.	2.014E+03	62.18	0.308	-	sM
1736.34	434.37	127.	25.	1.526E+03	69.79	0.469	-	sc
2160.53	540.45	54.	22.	1.613E+03	51.83	0.320	-	s
4174.07	1043.81	40.	22.	2.871E+03	49.44	0.500	-	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_Routine Short Rev1.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	185.77	46.52	4987.	17937.	9.965	1.08	0.948
AM-241	237.90	59.56	3943.	22159.	12.310	0.89	0.989
TH-234	245.27	61.41	2137.	-756.	-0.420	9.58	0.962s
EU-155	335.93	84.09	763.	32.	0.018	123.88	0.983s
TH-234	370.20	92.66	1149.	52.	0.029	63.10	0.989s
AC-228	372.95	93.35	648.	5.	0.003	773.45	0.989D
U-235	372.95	93.35	981.	89.	0.049	50.97	0.989D
EU-155	421.17	105.41	1063.	-14.	-0.008	319.41	1.000s
EU-152	485.01	121.38	884.	35.	0.019	121.43	1.015s
EU-154	491.96	123.12	1007.	-29.	-0.016	154.75	1.017s
Pa-234	524.49	131.26	815.	48.	0.027	85.04	1.024s
U-235	574.37	143.74	812.	37.	0.020	111.11	1.036s
U-235	652.91	163.39	727.	-19.	-0.010	203.98	1.053s
PB-212	953.55	238.59	460.	205.	0.114	19.87	1.430s
PB-214	974.11	243.73	548.	4.	0.002	848.75	1.123s
TL-208	1108.85	277.43	600.	21.	0.012	164.07	1.154s
I-131	1131.84	283.18	485.	-11.	-0.006	281.74	1.160s
PB-214	1180.60	295.38	538.	45.	0.025	74.52	1.170
AC-228	1353.39	338.60	238.	50.	0.028	55.28	0.297s
EU-152	1377.94	344.74	520.	4.	0.002	742.34	1.212s
PB-214	1406.93	351.99	480.	82.	0.046	39.34	1.219
I-131	1448.61	362.41	377.	3.	0.002	994.26	1.229s
BE-7	1908.87	477.52	536.	-7.	-0.004	497.88	1.324s
CS-134	2251.43	563.18	220.	29.	0.016	73.94	1.394s
CS-134	2276.67	569.49	238.	-18.	-0.010	122.24	1.399s
Pa-234	2276.53	569.45	236.	-17.	-0.010	127.24	1.399s
TL-208	2332.17	583.36	264.	55.	0.031	38.89	1.410
CS-134	2417.07	604.59	274.	-16.	-0.009	146.27	1.427s
BI-214	2435.76	609.27	152.	75.	0.042	30.58	0.701s
I-131	2547.65	637.24	223.	36.	0.020	60.77	1.452s
CS-137	2645.63	661.74	248.	6850.	3.806	1.34	1.481
EU-154	2890.98	723.08	251.	-25.	-0.014	92.05	1.519s
BI-212	2906.06	726.85	185.	34.	0.019	59.01	1.522s
EU-152	3100.71	775.52	162.	2.	0.001	756.00	1.561s
BI-212	3139.57	785.23	208.	19.	0.011	107.79	1.566s
TL-208	3442.52	860.96	291.	12.	0.007	207.24	1.622s
EU-154	3489.45	872.69	274.	15.	0.009	154.96	1.631s
Pa-234	3521.25	880.64	316.	6.	0.003	446.96	1.636s
Pa-234	3522.88	881.05	250.	4.	0.002	542.69	1.638s
AC-228	3643.08	911.09	347.	25.	0.014	106.08	1.658s
Pa-234	3767.65	942.23	214.	-2.	-0.001	998.44	1.683s
AC-228	3876.90	969.54	319.	11.	0.006	233.14	1.699
EU-154	3986.82	997.01	298.	-15.	-0.008	169.19	1.718s
PA-234M	3993.17	998.60	212.	13.	0.007	159.52	1.722s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
EU-152	4452.54	1113.40	237.	21.	0.012	106.75	1.797s
BI-214	4481.79	1120.71	179.	3.	0.002	324.01	1.803
CO-60	4692.45	1173.35	117.	3847.	2.137	1.77	1.694
EU-154	5097.64	1274.60	24.	4.	0.002	168.52	1.902s
CO-60	5330.02	1332.66	24.	3465.	1.925	1.74	1.926
K-40	5847.16	1461.86	16.	4.	0.002	71.29	2.015s
BI-214	7060.16	1764.84	15.	6.	0.004	62.35	2.180s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	-2.3099E+00				5.31E+01	
			477.60	-2.310E+00	&(	3.873E+01 4.98E+02 1.05E+01	G
K-40	N	3.3645E+00				4.66E+11	
			1460.83	3.365E+00	&(P	1.890E+01 7.13E+01 1.07E+01	G
CO-60	F	7.7002E+02				1.93E+03	
			1332.50	7.726E+02	(	5.695E+00 1.74E+00 1.00E+02	G
			1173.24	7.674E+02	(	1.058E+01 1.77E+00 9.99E+01	G
I-131	I	1.9868E+00				8.02E+00	
			364.48	1.005E-01	&(	3.386E+00 9.94E+02 8.17E+01	G
			284.30	-4.432E+00	+	4.199E+01 2.82E+02 6.14E+00	G
			636.97	2.348E+01	(	4.698E+01 6.08E+01 7.17E+00	G
CS-134	I	5.1785E+00				7.54E+02	
			604.71	-8.013E+00	?(	3.939E+01 1.46E+02 9.76E+01	G
			795.87	2.035E-01	%	5.332E+01 7.67E+03 8.55E+01	G
			569.32	-5.420E+01	+	2.223E+02 1.22E+02 1.54E+01	G
			801.95	-5.550E+00	&	5.174E+02 2.73E+03 8.69E+00	G
			563.24	1.594E+02	&(	3.908E+02 7.39E+01 8.35E+00	G
CS-137	I	4.5561E+02				1.10E+04	
			661.66	4.556E+02	(	5.061E+00 1.34E+00 8.52E+01	G
EU-152	F	4.0858E+00				4.94E+03	
			344.29	6.704E-01	&(	1.678E+01 7.42E+02 2.65E+01	G
			121.78	2.539E+00	*(	1.026E+01 1.21E+02 2.86E+01	G
			778.92	1.462E+00	?(	3.795E+01 7.56E+02 1.29E+01	G
			964.11	1.838E-01	&	5.194E+01 8.29E+03 1.46E+01	G
			1112.07	1.645E+01	&(	5.876E+01 1.07E+02 1.36E+01	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
			1408.00	-9.699E-03 %		1.274E+01	3.45E+04	2.10E+01 G
EU-154	I	1.3449E+01					3.14E+03	
			873.23	1.345E+01 &(		7.011E+01	1.55E+02	1.23E+01 G
			123.10	-1.835E+00 -		9.460E+00	1.55E+02	4.08E+01 G
			1274.54	1.833E+00 -		1.090E+01	1.69E+02	3.52E+01 G
			723.36	-1.133E+01 +		3.476E+01	9.20E+01	2.02E+01 G
			1004.77	-4.802E-01 &		5.487E+01	3.35E+03	1.80E+01 G
			996.33	-1.660E+01 &		9.452E+01	1.69E+02	1.06E+01 G
EU-155	I	1.4186E+00					1.81E+03	
			105.31	-2.635E+00 ?(		2.813E+01	3.19E+02	2.12E+01 G
			86.54	4.218E+00 ?(		1.740E+01	1.24E+02	3.07E+01 G
TL-208	N	4.5666E+01					6.98E+02	
			583.02	3.712E+01 ?(P		5.254E+01	3.89E+01	8.45E+01 G
			277.28	1.037E+02 &(P		5.816E+02	1.64E+02	6.31E+00 G
			860.56	7.432E+01 ?(		5.196E+02	2.07E+02	1.24E+01 G
PB-210	N	1.4933E+04					8.14E+03	
			46.54	1.493E+04 (P		2.762E+02	1.08E+00	4.25E+00 G
PB-212	N	1.3244E+02					6.98E+02	
			238.63	1.324E+02 (P		6.645E+01	1.99E+01	4.33E+01 G
			300.03	-5.919E+00 %		1.025E+03	5.11E+03	3.28E+00 G
PB-214	N	6.1745E+00					5.84E+05	
			351.93	6.325E+00 (		8.077E+00	3.93E+01	3.76E+01 G
			295.09	5.882E+00 ?(		1.450E+01	7.45E+01	1.93E+01 G
			242.00	1.143E+00 -		3.269E+01	8.49E+02	7.43E+00 G
BI-212	N	4.2178E+02					6.98E+02	
			727.17	3.071E+02 (		5.958E+02	5.90E+01	7.55E+00 G
			785.42	1.098E+03 (		3.967E+03	1.08E+02	1.28E+00 G
BI-214	N	6.6878E+00					5.84E+05	
			609.31	7.344E+00 (P		5.883E+00	3.06E+01	4.61E+01 G
			1120.29	1.624E+00 - P		3.260E+01	3.24E+02	1.51E+01 G
			1764.49	4.725E+00 ?(P		1.524E+01	6.23E+01	1.54E+01 G
AC-228	N	1.4948E+01					2.10E+03	
			911.07	1.291E+01 ?(		4.572E+01	1.06E+02	2.90E+01 G
			968.97	9.765E+00 (		7.681E+01	2.33E+02	1.75E+01 G
			338.32	2.739E+01 (		4.087E+01	5.53E+01	1.20E+01 G
								Energy duplication
			93.35	2.891E+00 -		7.523E+01	7.73E+02	5.56E+00 XA

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
Pa-234 N	3.8949E+00				1.63E+12	
		131.29	3.938E+00	&(	1.110E+01 8.50E+01	1.80E+01 G
		569.47	-9.005E+00	+	3.848E+01 1.27E+02	8.20E+00 G
		946.02	-1.010E+00	-	3.446E+01 9.98E+02	1.34E+01 G
		883.24	2.646E+00	?(	4.886E+01 5.43E+02	9.60E+00 G
		880.53	5.764E+00	&(	8.727E+01 4.47E+02	6.00E+00 G
TH-234 N	-3.7684E+02				1.63E+12	
		63.29	-3.768E+02	?(P	1.088E+02 9.58E+00	3.81E+00 G
		92.59	1.379E+01	+ P	4.233E+01 6.31E+01	5.58E+00 G
PA-234M N	1.0717E+02				1.63E+12	
		1001.00	1.072E+02	?(	5.770E+02 1.60E+02	8.37E-01 G
		766.41	1.437E+01	%	1.209E+03 2.45E+03	2.94E-01 G
U-235 N	5.1103E+00				2.57E+11	
		143.79	5.110E+00	(	1.888E+01 1.11E+02	1.10E+01 G
		205.33	1.168E+00	&	5.126E+01 1.31E+03	5.01E+00 G
		163.38	-6.110E+00	+	4.168E+01 2.04E+02	5.08E+00 G
						Energy duplication
		93.35	2.244E+01	&	3.756E+01 5.10E+01	5.81E+00 X
AM-241 T	1.2671E+03				1.58E+05	
		59.54	1.267E+03	(	1.689E+01 8.94E-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.
+ - 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
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded

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	
TH-234	61.41	2137.	-756.	-0.420	9.58	-3.768E+02	P
EU-155	84.09	763.	32.	0.018	123.88	4.218E+00	
TH-234	92.66	1149.	52.	0.029	63.10	1.379E+01	P
U-235	93.35	981.	89.	0.049	50.97	2.244E+01	
EU-155	105.41	1063.	-14.	-0.008	319.41	-2.635E+00	
EU-152	121.38	884.	35.	0.019	121.43	2.539E+00	
EU-154	123.12	1007.	-29.	-0.016	154.75	-1.835E+00	
Pa-234	131.26	815.	48.	0.027	85.04	3.938E+00	
U-235	143.74	812.	37.	0.020	111.11	5.110E+00	
U-235	163.39	727.	-19.	-0.010	203.98	-6.110E+00	
PB-214	243.73	548.	4.	0.002	848.75	1.143E+00	
TL-208	277.43	600.	21.	0.012	164.07	1.037E+02	P
I-131	283.18	485.	-11.	-0.006	281.74	0.000E+00	
PB-214	295.38	538.	45.	0.025	74.52	5.882E+00	
EU-152	344.74	520.	4.	0.002	742.34	6.704E-01	
PB-214	351.99	480.	82.	0.046	39.34	6.325E+00	
I-131	362.41	377.	3.	0.002	994.26	0.000E+00	
BE-7	477.52	536.	-7.	-0.004	497.88	0.000E+00	
CS-134	563.18	220.	29.	0.016	73.94	1.594E+02	
CS-134	569.49	238.	-18.	-0.010	122.24	-5.420E+01	
Pa-234	569.45	236.	-17.	-0.010	127.24	-9.005E+00	
TL-208	583.36	264.	55.	0.031	38.89	3.712E+01	P
CS-134	604.59	274.	-16.	-0.009	146.27	-8.013E+00	
I-131	637.24	223.	36.	0.020	60.77	0.000E+00	
EU-154	723.08	251.	-25.	-0.014	92.05	-1.133E+01	
BI-212	726.85	185.	34.	0.019	59.01	3.071E+02	
EU-152	775.52	162.	2.	0.001	756.00	1.462E+00	
BI-212	785.23	208.	19.	0.011	107.79	1.098E+03	
TL-208	860.96	291.	12.	0.007	207.24	7.432E+01	
EU-154	872.69	274.	15.	0.009	154.96	1.345E+01	
Pa-234	880.64	316.	6.	0.003	446.96	5.764E+00	
Pa-234	881.05	250.	4.	0.002	542.69	2.646E+00	
Pa-234	942.23	214.	-2.	-0.001	998.44	-1.010E+00	
EU-154	997.01	298.	-15.	-0.008	169.19	-1.660E+01	
PA-234M	998.60	212.	13.	0.007	159.52	1.072E+02	
EU-152	1113.40	237.	21.	0.012	106.75	1.645E+01	
EU-154	1274.60	24.	4.	0.002	168.52	1.833E+00	
K-40	1461.86	16.	4.	0.002	71.29	3.365E+00	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 *****

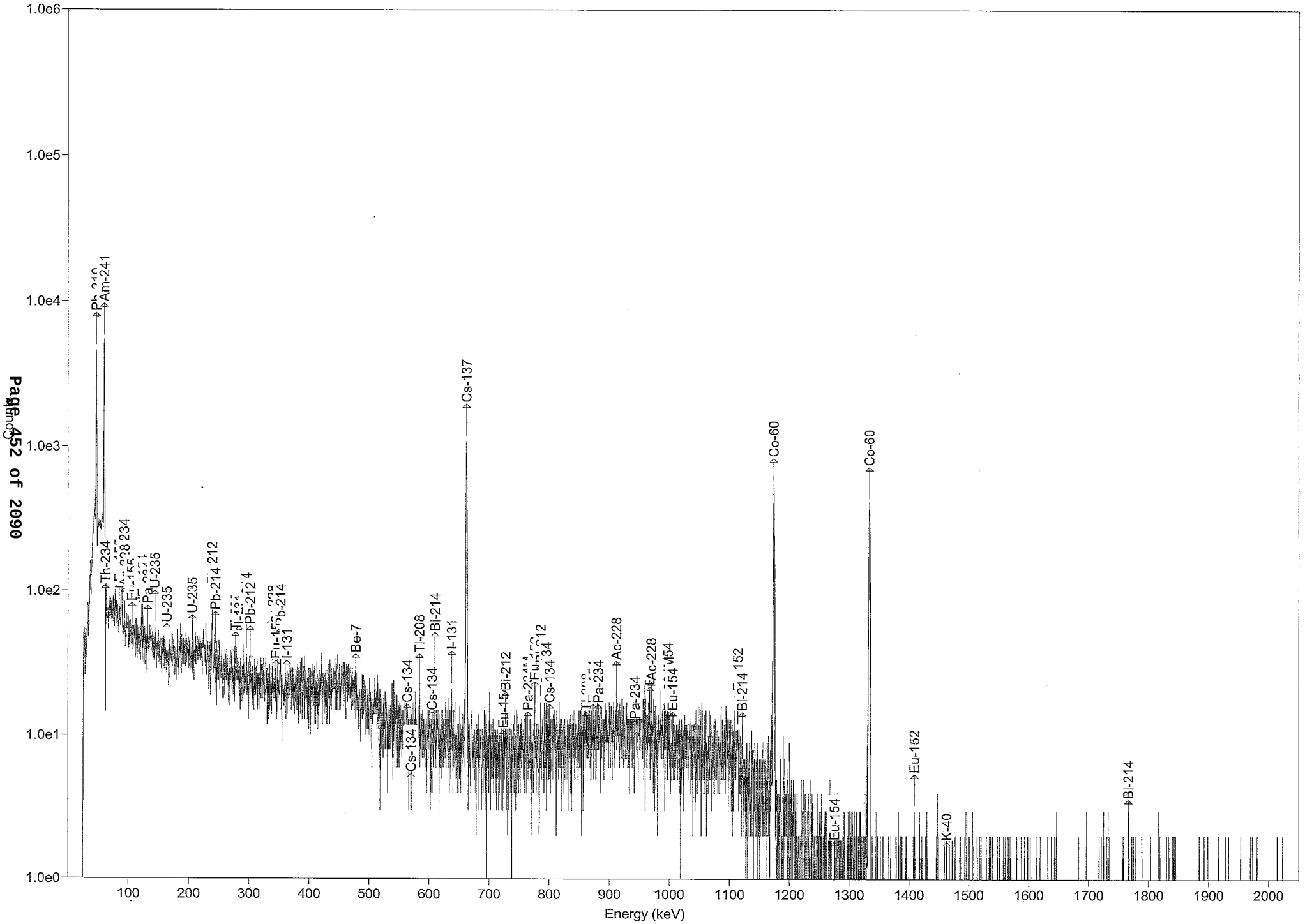
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting		MDA Bq/Sample
BE-7	#A	-2.3099E+00	>12 Halflives	4.9788E+02%	3.8727E+01	
K-40	#A	3.3645E+00	3.3645E+00	1.479E+02%		1.89E+01
CO-60		3.0338E+02	7.7002E+02	1.241E+00%		5.69E+00
I-131	#A	1.9868E+00	>12 Halflives	6.0769E+01%	3.3861E+00	
CS-134	#A	4.8037E-01	5.1785E+00	7.394E+01%		3.94E+01
CS-137		3.8683E+02	4.5561E+02	1.336E+00%		5.06E+00
EU-152	#A	2.8429E+00	4.0858E+00	1.068E+02%		1.68E+01
EU-154	#A	7.5957E+00	1.3449E+01	1.550E+02%		7.01E+01
EU-155	#A	5.2723E-01	1.4186E+00	1.239E+02%		2.81E+01
TL-208	#A	3.4936E+00	4.5666E+01	4.336E+01%		5.25E+01
PB-210		1.1982E+04	1.4933E+04	1.084E+00%		2.76E+02
PB-212	#	1.0132E+01	1.3244E+02	2.107E+01%		6.64E+01
PB-214	#A	6.1556E+00	6.1745E+00	3.934E+01%		8.08E+00
BI-212	#A	3.2268E+01	4.2178E+02	5.901E+01%		5.96E+02
BI-214		6.6673E+00	6.6878E+00	3.360E+01%		5.88E+00
AC-228	A	6.3644E+00	1.4948E+01	5.528E+01%		4.57E+01
Pa-234	#A	3.8949E+00	3.8949E+00	8.504E+01%		1.11E+01
TH-234	#A	-3.7684E+02	-3.7684E+02	9.841E+00%		1.09E+02
PA-234M	#A	1.0717E+02	1.0717E+02	1.595E+02%		5.77E+02
U-235	#A	5.1103E+00	5.1103E+00	1.111E+02%		1.89E+01
AM-241		1.2528E+03	1.2671E+03	8.940E-01%		1.69E+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 (112.4 to 1999.5 keV) 1.394E+04 Bq/Sample
Total Decayed Activity (112.4 to 1999.5 keV) 1.7565109E+04 Bq/Sample

The library has energies which are not separable.


77739_Gamma_LCS 160-77739~2-A. 15_Gamma_20131338.spc.
1.0e6
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Energy (keV)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Am-241
Th-234
U-235
U-235
Pb-214
Pb-214
I-131
Be-7
Cs-134
Cs-134
Tl-208
Bi-214
Cs-137
I-131
Bi-212
Cs-134
Ac-228
Pa-234
Ac-228
Co-60
Co-60
Bi-214
Eu-152
K-40
Bi-214

Reagent

Tuna Can_00002

Rec'd 2/3/10

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

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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
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)

ACCREDITED SOURCE CALIBRATION LABORATORY — HEALTH PHYSICS SOCIETY — FOUNDED 1956

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd Atlanta, Georgia 30318

Comments:
1550 grams of sand.
This standard will expire one year after the reference date.

Source Prepared by: _____
W. Mao, Radiochemist

QA Approved: _____ Date: 2/1/10
J. D. McCorvey, QA Manager Alternate

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* γps/gram	This Source γps	Uncertainty* , % Type u_A	u_B	U	Calibration Method*
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)

Corporate Office

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: _____ Date: 30 JAN 12
J.D. McCorvey, Counting Room Manager

Reagent

Tuna Can_00006

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

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* γps/gram	This Source γps	Uncertainty, % Type u_A	u_B	U	Calibration Method
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)

Corporate Office
Laboratory

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, Radiochemist

QA Approved: _____ Date: 2/11/11
J. D. McCorvey, QA Manager Alternate

Reagent

U-232_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

85539-334

5 mL Liquid in Flame Sealed Vial

Customer: Test America/Earth City, MO
P.O. No.: 2434448, Item 1

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 purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. 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 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.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, % Type u_A	u_B	U	Reference Date (12:00 PM EST)
U-232	2.517E+04	1.725E+04	0.5	2.4	4.9	08/25/2011

***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: U-232 daughters, γ-impurities (other than decay products) < 0.1 %.

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

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

Date: 8/25/11

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1956

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Reagent

U-232_00025

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

U - 232 - 00025

Reagent ID: U-232_00025

		Expiration Date:	05/11/2015
Description:	U-232 Clean Tracer	Laboratory:	TestAmerica St. Louis
No. of Bottles:	1	Prepared By:	Bernsen, Sarah C
Storage Location:	RAD Actinide STDs	Solvent:	DI Water
Reagent Volume:	250.000 mL	Solvent Lot:	0
Creation Date:	05/07/2014		
Container(s):	356776		

356776
ID: U-232_00025
Exp: 05/11/15 Prpd: SCB Crl: 05/07/14
U-232 Clean Tracer

Comment: Prepared according to SOP ST-RC-0244, Rev.16 section 7.28 to different volume. 2 mL of parent to ~100 mL, 3g potassium sulfate, pH adjusted with 2M sulfuric acid. 25 mL of 1% lead nitrate. pH checked. Final volume 250 mL (instead of 100 mL).

Reagent Analyte Information

Analyte	Source ID	Source Exp. Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
U-232	U-232_00009	08/25/2061	10280.70700	dpm/mL	82.24566	dpm/mL

Source Reagents

Reagent	Description	Type	Expiration	Vendor	Vendor Lot #	Vendor Cat Lot #	Volume Used	Volume Units
U-232_00009	U-232 Parent		08/25/61				2.00000	mL

St. Louis Radiological Standard Reverification Form

Standard ID Number: U-232_00025
True Value = 36.05162 DPM/L or g
Date Analyzed: 5/11/2014

Radionuclide: U-232

Replicates		
#1	36.21	DPM/L or g
#2	34.41	DPM/L or g
#3	35.61	DPM/L or g

Mean = 35.41

1 sigma = 0.916515 1.96 sigma = 1.79637

True Value minus 5% = 34.24904 (True Value - 5%)
True Value plus 5% = 37.8542 (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: Micha Korrinhizer 5/12/2014

SOP Reference: STL-QA-0002, Current Revision

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

960mins. U-232 clean verification

Actinide Prep

Batch No. : —

Balance ID : —

No.	Sample Number	Aliquot (g / mL)	Crucible ID	Dilution
1	Verification-1	0.1	243	247
2	BC=212	1	245	248
3		1	246	249
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

U Th

6/8/14 MLE

Th 229 U 232

157 158 159

240 241

Note: If a section below is not used, marked the N/A box and initial & date next to the N/A
i.e. Mark the N/A box if a tracer is not added to the sample(s) then initial and date next to the N/A

Tracer ☐ N/A

Initials / Date

Isotope : UNAT

Std Sol'n No. : UNAT SPK1 -08001

Vol (mL) : 0.1

Ref Activity (dpm/mL) : 234 - 0.691, 235 - 3.370

Act Ref Date : 238 - 12-2004

03-30-08

Samples Spiked and Traced By: SLB 5/7/14 (Initials / Date)

Verification Signature & Date: MB 5/7/14 (Initials / Date)

LCS Standard ☐ N/A

Initials / Date

Isotope : U-232 clean

Std Sol'n ID. : U-232-00025

Vol (mL) : 0.1

Ref Activity (dpm/mL) : 82.247

Act Ref Date : 08-25-11

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

☐ ST-RC-0003 Rev.	☐ ST-RC-0040 Rev.	☐ ST-RC-0110 Rev.
☐ ST-RC-0004 Rev.	☐ ST-RC-0041 Rev.	☐ ST-RC-0120 Rev.
☐ ST-RC-0014 Rev.	☐ ST-RC-0050 Rev.	☐ ST-RC-0232 Rev.
☐ ST-RC-0020 Rev.	☐ ST-RC-0090 Rev.	☐ ST-RC-0238 Rev.
☐ ST-RC-0021 Rev.	☐ ST-RC-0100 Rev.	☐ ST-RC-0240 Rev.
		☐ ST-RC-0241 Rev.
		☐ ST-RC-0242 Rev.
		☐ ST-RC-5016 Rev.

Isotope(s)

αβ ☐	Iso Pu ☐	Tc-99 ☐	Iso Cm ☐
Iso Am ☐	Ra ☐	Iso Th ☐	Pu-241 ☐
KPA ☐	Sr ☐	Iso U ☑	Th-229 ☐
Np ☐	TAR ☐	C-14 ☐	Cl-36 ☐

Count Time	Matrix
Long Count ☐	Soil ☐
Short Count ☐	H_2O ☐

Prepared By : SLB

Date : 5/7/14

Reviewed by: _____

Date: _____

\\Slsvr01\RAD\MasterForms\RAD-0045 Rev(3)

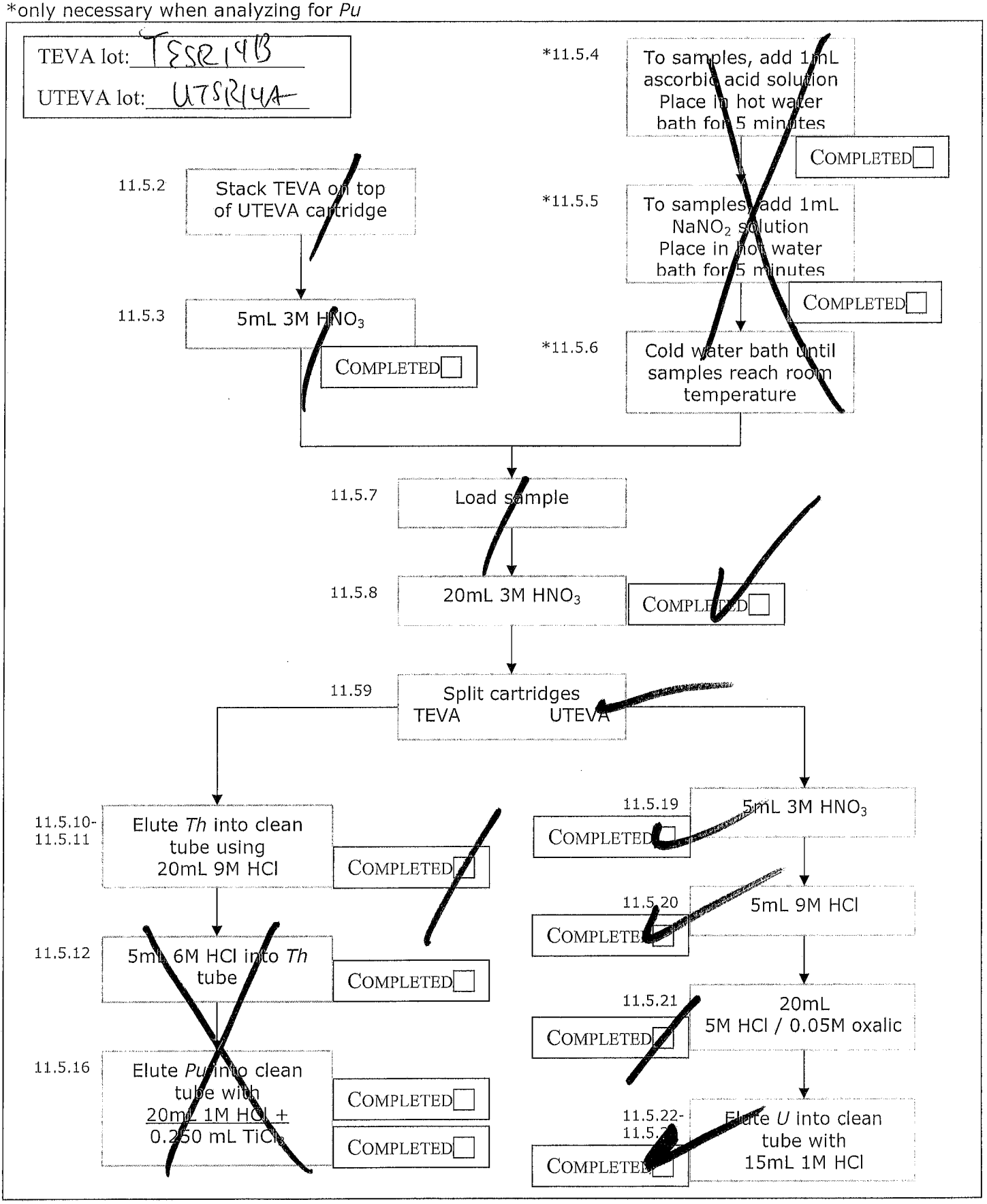
Sequential Thorium, Plutonium and Uranium via TEVA/UTEVA ST-RC-0242

Batch: U Vent

NMN 5/8/14

All rinses should flow at 1 mL/minute (only 3M HNO_3 may be done at 3 mL/minute)

*only necessary when analyzing for *Pu*

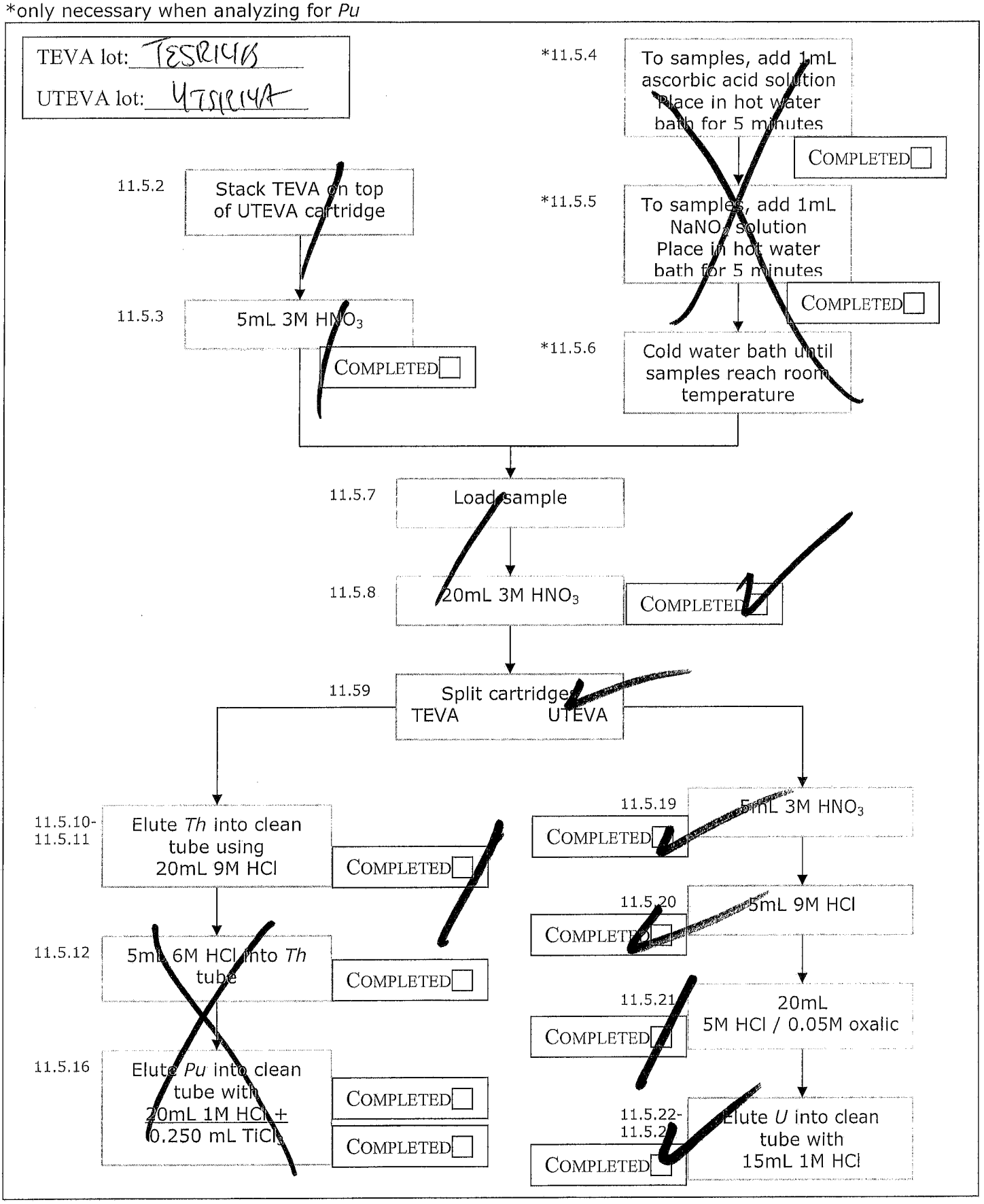


Sequential Thorium, Plutonium and Uranium via TEVA/UTEVA ST-RC-0242

Batch: U Vent

All rinses should flow at 1 mL/minute (only 3M HNO_3 may be done at 3 mL/minute)

*only necessary when analyzing for *Pu*



Uranium-232						
Initial Activity:	82.247	dpm				
Reference Date:	8/25/2011					
Current Date:	5/11/2014		(or date at which you wish to determine activity)			
Elapsed Time:	990	days				
Half Life:	25165.725	days	603977.4			
Exponential Term:	0.973100543					
Corrected Activity:	80.03460032	dpm	36.05162177	pCi		

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:29:44PM 5/12/2014

Sample

Sample Name: Verifcation 1 Type: Sample
Spectrum #4 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232_00025
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

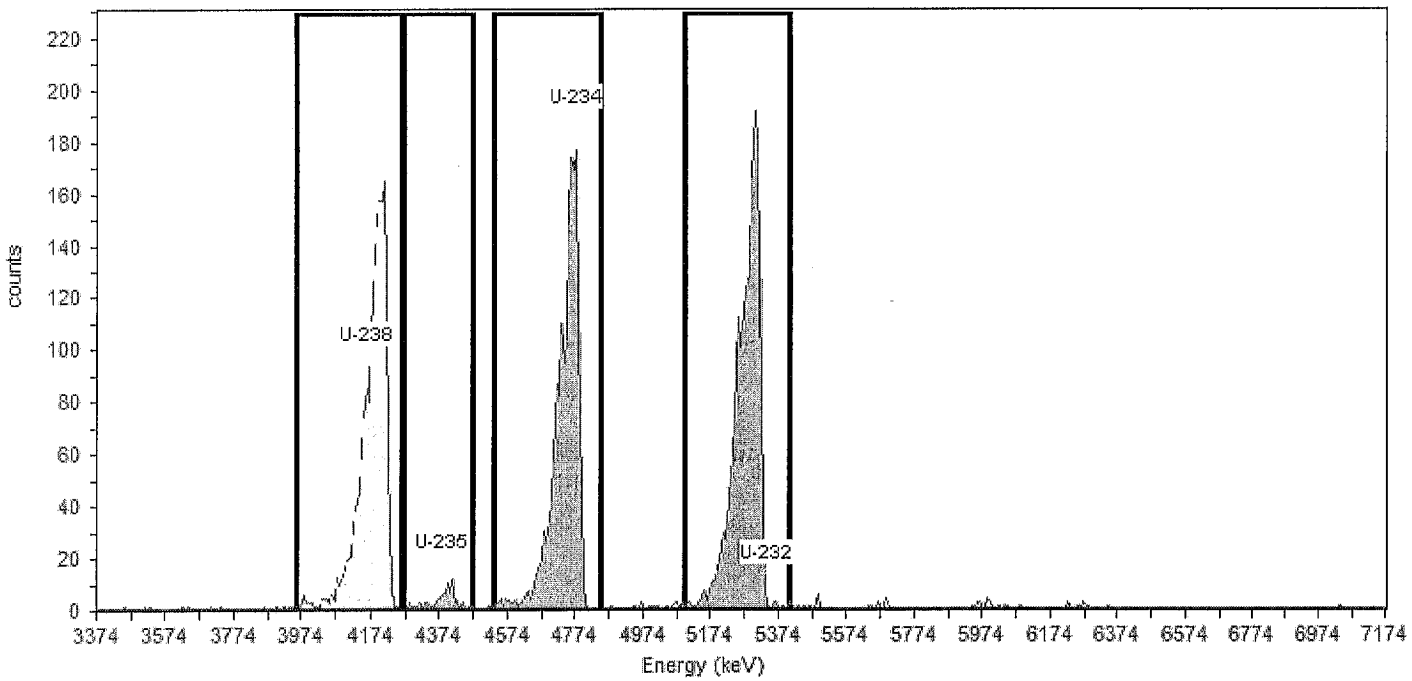
Tracer Name: UNAT Spike_00001
Tracer Activity: 72.26 DPM / mL x (Vol.) 0.10 mL = 7.23 DPM
Tracer Ref. Date: 3/30/2008 5:52:22PM

Tracer Nuclide: U-238
Tracer Recovery: 85.03%

Acquisition

Detector: AV243 SN: 51-005P6
Acquisition Start Date: 5/11/2014 7:17:31PM
Live Time: 960.00 min.
Real Time: 960.00 min.
Background Date: 4/13/2014 7:09:45PM
Bkgd Info: Sample: ICB;AV243; Det: AV243; Spectrum #1; 4/13/2014 7:09:45 PM

Energy Calibration: IC-9886;AV243-20130620
Efficiency Calibration:IC-9886;AV243-20130620
Calibration Date: 6/20/2013 11:02:42PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.99% +/- 0.36% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:5/5/2014 2:07:10AM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	72.2	100.0	1595	3.0000	1592.00	2.768E+001	pCi/mL
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	38.1	80.2	68	0.0000	68.00	1.734E+000	pCi/mL
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	66.3	99.8	1597	5.0000	1592.00	3.262E+001	pCi/mL
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	77.9	100.1	1775	3.0000	1772.00	3.621E+001	pCi/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:29:40PM 5/12/2014

Sample

Sample Name: Verifcation 2 Type: Sample
Spectrum #5 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232_00025
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

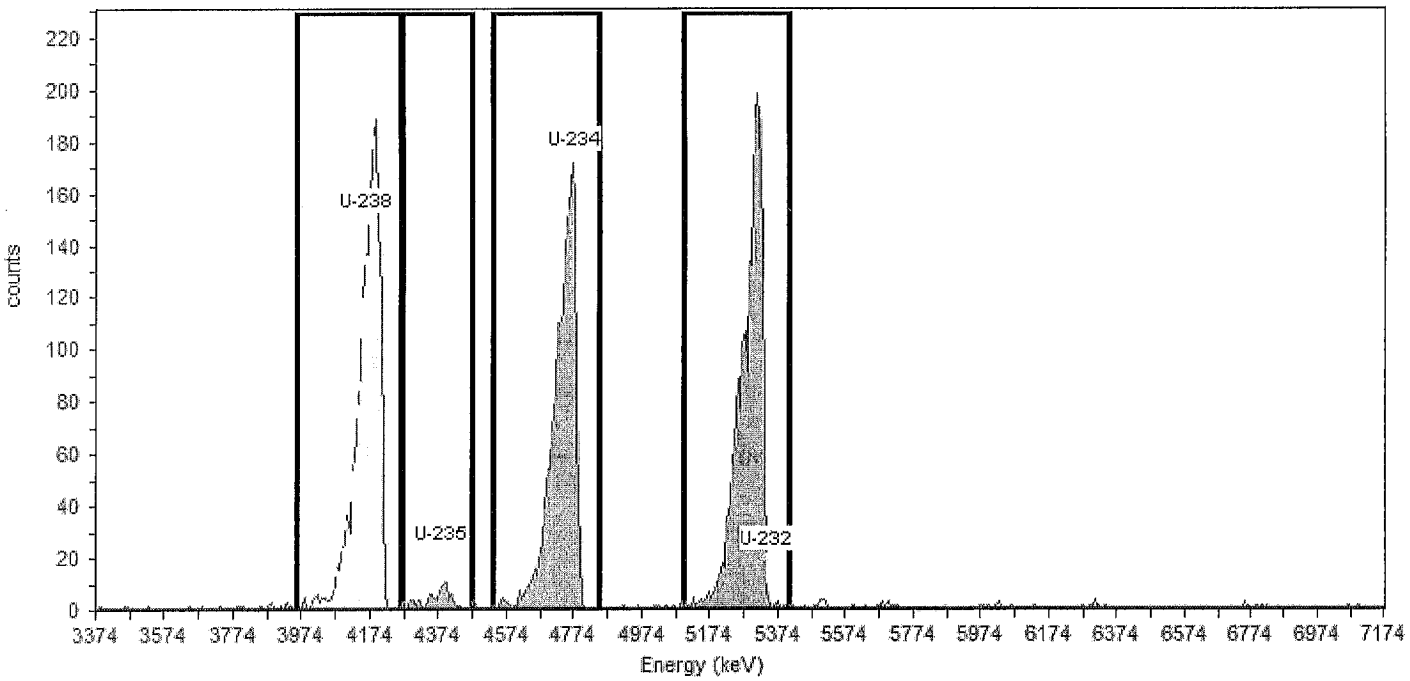
Tracer Name: UNAT Spike_00001
Tracer Activity: 72.26 DPM / mL x (Vol.) 0.10 mL = 7.23 DPM
Tracer Ref. Date: 3/30/2008 5:52:22PM

Tracer Nuclide: U-238
Tracer Recovery: 89.78%

Acquisition

Detector: AV245 SN: 51-005EE2
Acquisition Start Date: 5/11/2014 7:17:31PM
Live Time: 960.00 min.
Real Time: 960.00 min.
Background Date: 4/13/2014 7:09:46PM
Bkgd Info: Sample: ICB;AV245; Det: AV245; Spectrum #1; 4/13/2014 7:09:46 PM

Energy Calibration: IC-8874;AV245-20130620
Efficiency Calibration:IC-8874;AV245-20130620
Calibration Date: 6/20/2013 11:02:50PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.49% +/- 0.39% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:5/5/2014 2:07:10AM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	66.2	100.0	1714	2.0000	1712.00	2.923E+001	pCi/mL
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	33.9	80.2	79	0.0000	79.00	1.873E+000	pCi/mL
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	72.0	99.8	1629	2.0000	1627.00	3.100E+001	pCi/mL
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	70.7	100.1	1811	0.0000	1811.00	3.441E+001	pCi/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:29:35PM 5/12/2014

Sample

Sample Name: Verifcation 3 Type: Sample
Spectrum #4 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232_00025
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

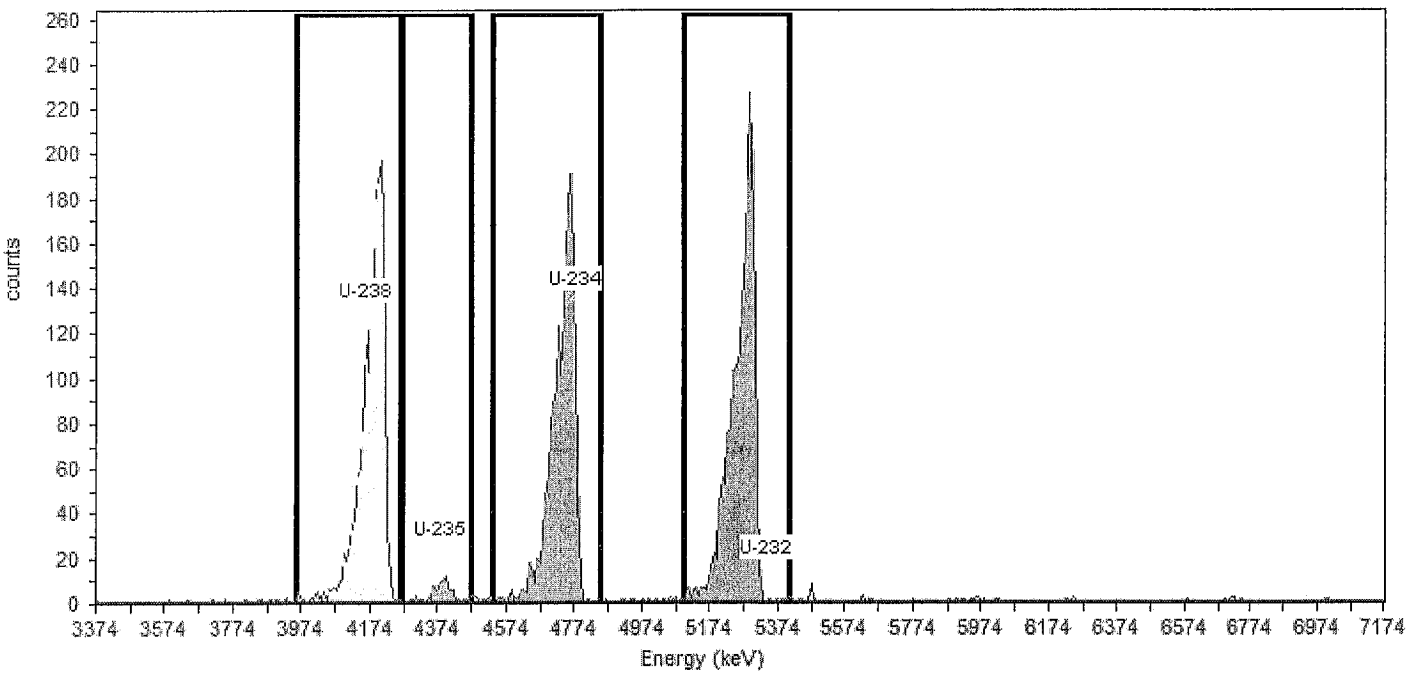
Tracer Name: UNAT Spike_00001
Tracer Activity: 72.26 DPM / mL x (Vol.) 0.10 mL = 7.23 DPM
Tracer Ref. Date: 3/30/2008 5:52:22PM

Tracer Nuclide: U-238
Tracer Recovery: 89.65%

Acquisition

Detector: AV246 SN: 51-005Q2
Acquisition Start Date: 5/11/2014 7:17:31PM
Live Time: 960.00 min.
Real Time: 960.00 min.
Background Date: 4/13/2014 7:09:46PM
Bkgd Info: Sample: ICB;AV246; Det: AV246; Spectrum #1; 4/13/2014 7:09:46 PM

Energy Calibration: IC-8875;AV246-20130620
Efficiency Calibration:IC-8875;AV246-20130620
Calibration Date: 6/20/2013 11:02:53PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.59% +/- 0.39% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:5/5/2014 2:07:10AM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	71.2	100.0	1779	1.0000	1778.00	2.918E+001	pCi/mL
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	50.1	80.2	82	1.0000	81.00	1.849E+000	pCi/mL
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	72.4	99.8	1706	0.0000	1706.00	3.130E+001	pCi/mL
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	69.4	100.1	1947	1.0000	1946.00	3.561E+001	pCi/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:40:18PM 5/12/2014

Sample

Sample Name: Verification 1 Type: Sample
Spectrum #4 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232_00025_Th
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

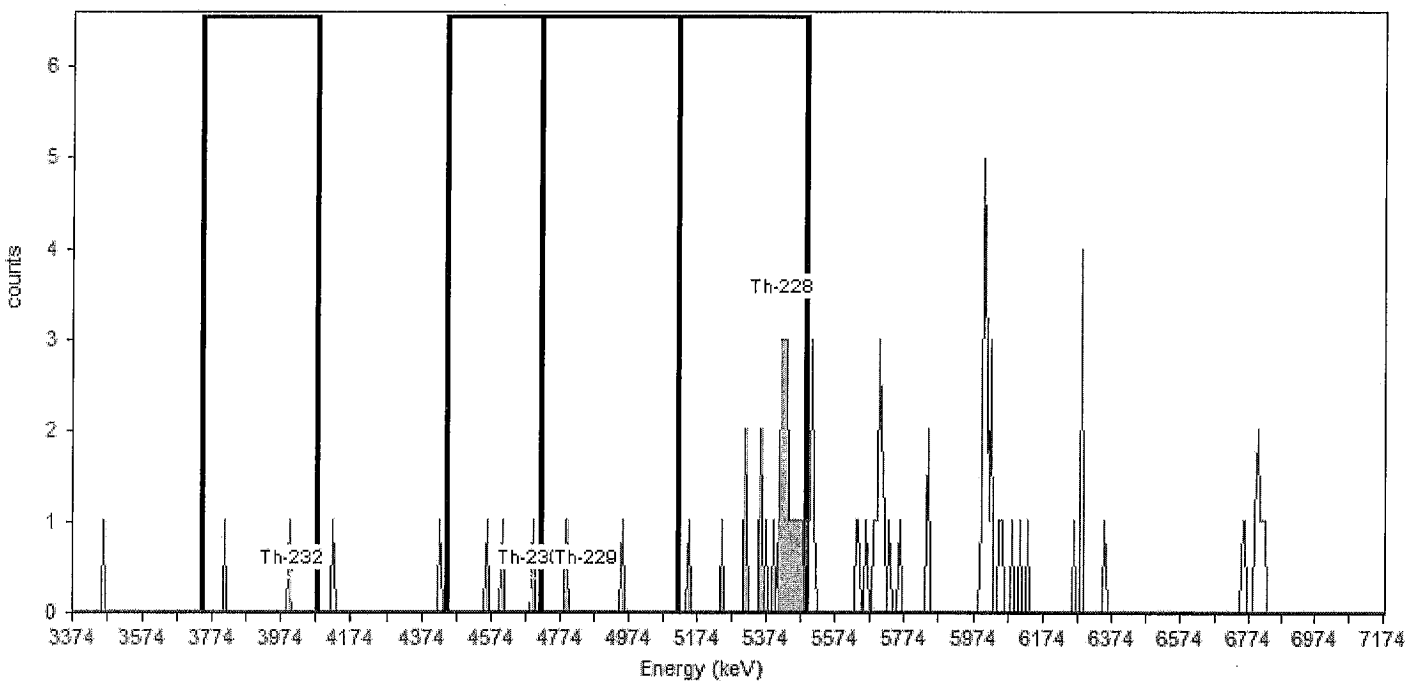
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: AV247 SN: 51-027F3
Acquisition Start Date: 5/11/2014 7:18:10PM
Live Time: 960.00 min.
Real Time: 960.00 min.
Background Date: 4/13/2014 7:09:46PM
Bkgd Info: Sample: ICB;AV247; Det: AV247; Spectrum #1; 4/13/2014 7:09:46 PM

Energy Calibration: IC-8876;AV247-20130620
Efficiency Calibration:IC-8876;AV247-20130620
Calibration Date: 6/20/2013 11:02:57PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.33% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction:5/5/2014 2:08:32AM
MDA Constants: Kα = 1.64 , Kβ = 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	44.5	100.2	2	0.0000	2.00	3.426E-002	pCi/mL
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	10.7	99.7	3	1.9690	1.03	1.775E-002	pCi/mL
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	44.5	99.8	2	5.9690	-3.97	-6.827E-002	pCi/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	75.2	99.8	25	21.0000	4.00	6.929E-002	pCi/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:40:26PM 5/12/2014

Sample

Sample Name: Verifcation 2 Type: Sample
Spectrum #4 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232_00025_Th
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

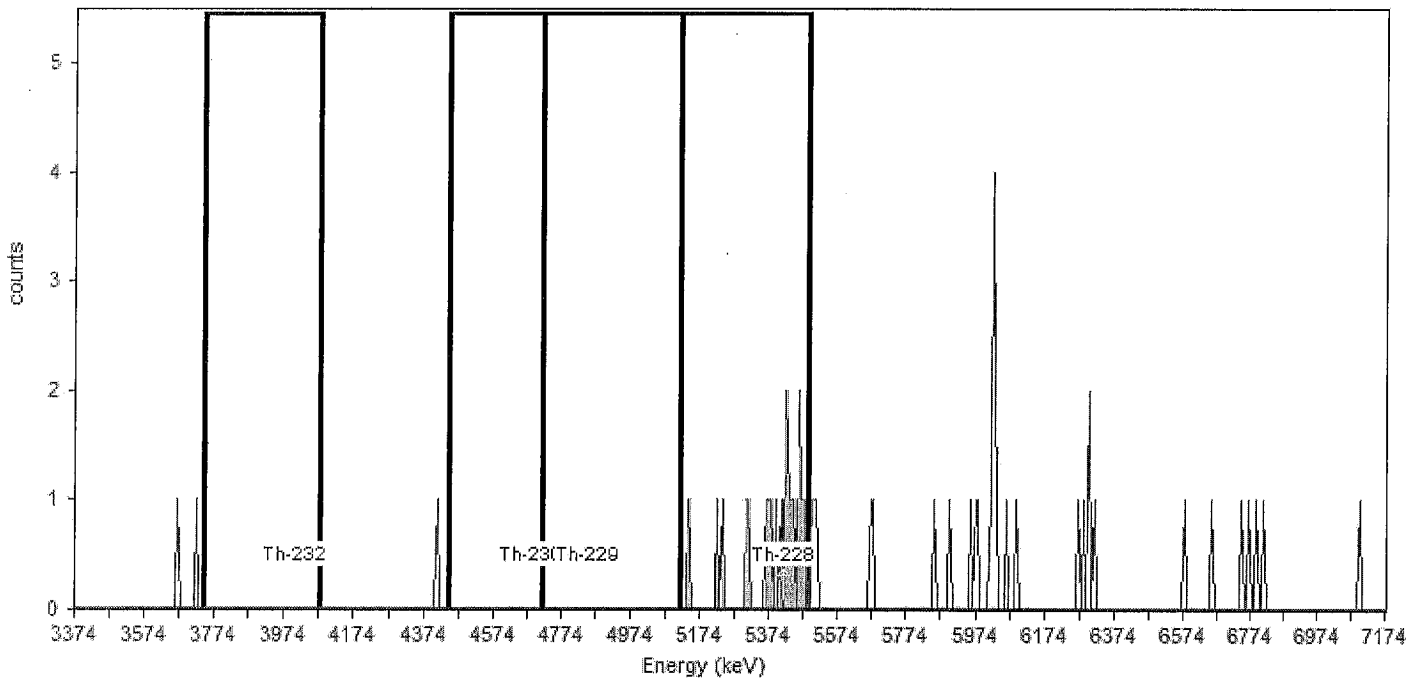
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: AV248 SN: 51-005P4
Acquisition Start Date: 5/11/2014 7:18:10PM
Live Time: 960.00 min.
Real Time: 960.57 min.
Background Date: 4/13/2014 7:09:47PM
Bkgd Info: Sample: ICB;AV248; Det: AV248; Spectrum #1; 4/13/2014 7:09:47 PM

Energy Calibration: IC-8877;AV248-20130620
Efficiency Calibration:IC-8877;AV248-20130620
Calibration Date: 6/20/2013 11:03:01PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.38% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction:5/5/2014 2:08:32AM
MDA Constants: Kα = 1.64 , Kβ = 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	1.0000	-1.00	-1.775E-002	pCi/mL
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	.0	99.7	0	0.0000	0.00	0.000E+000	pCi/mL
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	.0	99.8	0	3.0000	-3.00	-5.347E-002	pCi/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	36.7	99.8	19	6.0000	13.09	2.349E-001	pCi/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:40:32PM 5/12/2014

Sample

Sample Name: Verifcation 3 Type: Sample
Spectrum #4 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232_00025_Th
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

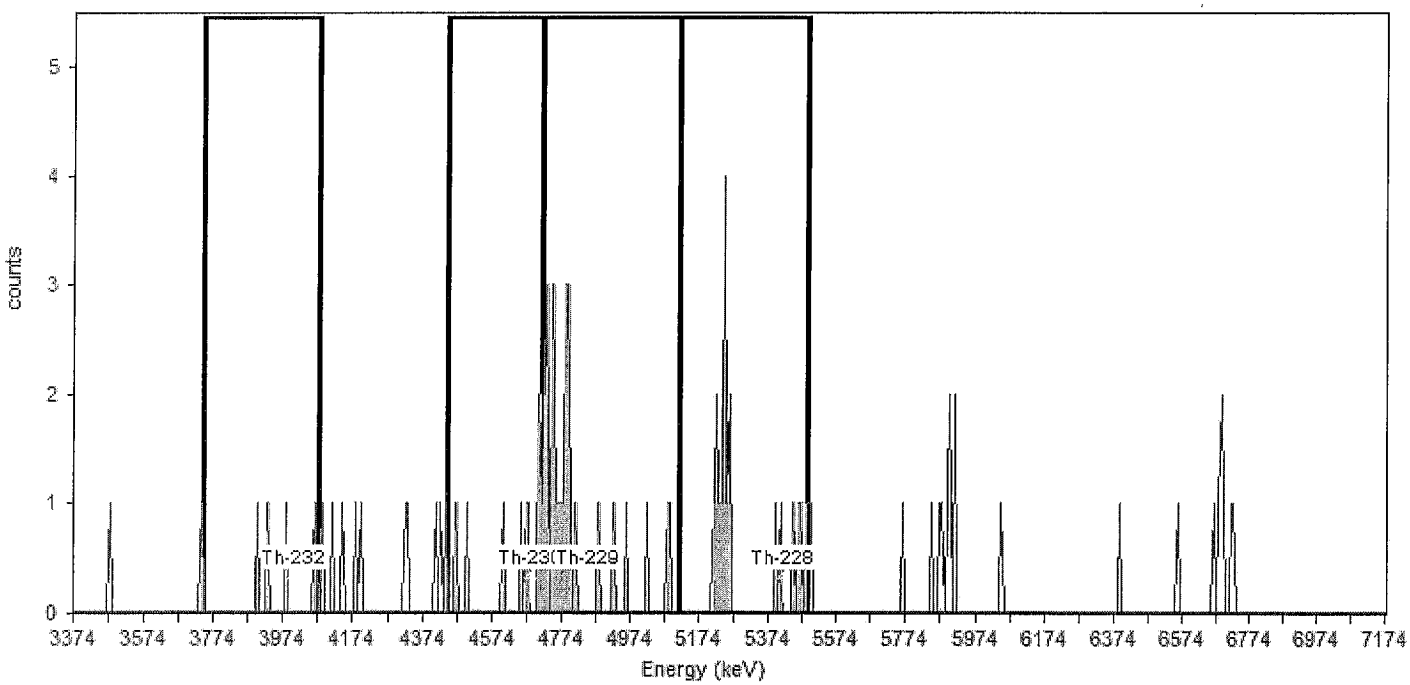
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: AV249 SN: 51-005EE5
Acquisition Start Date: 5/11/2014 7:18:10PM
Live Time: 960.00 min.
Real Time: 960.00 min.
Background Date: 4/13/2014 7:09:47PM
Bkgd Info: Sample: ICB;AV249; Det: AV249; Spectrum #1; 4/13/2014 7:09:47 PM

Energy Calibration: IC-9520;AV249-20130620
Efficiency Calibration:IC-9520;AV249-20130620
Calibration Date: 6/20/2013 11:03:06PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.78% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction:5/5/2014 2:08:32AM
MDA Constants: Kα = 1.64 , Kβ = 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	10.3	100.2	4	1.0000	3.00	5.058E-002	pCi/mL
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	33.4	99.7	9	0.0000	9.34	1.582E-001	pCi/mL
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	97.9	99.8	25	5.0000	20.03	3.391E-001	pCi/mL
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	47.7	99.8	19	7.9134	11.09	1.890E-001	pCi/mL

Reagent

U-232_00026

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

U - 232 _ 00026

Reagent ID: U-232_00026

		Expiration Date:	05/06/2015
Description:	U-232 Unclean tracer Bottle A	Laboratory:	TestAmerica St. Louis
No. of Bottles:	1	Prepared By:	Bernsen, Sarah C
Storage Location:	RAD Actinide STDs	Solvent:	2M HNO3
Reagent Volume:	1000.000 mL	Solvent Lot:	n/a
Creation Date:	06/13/2013		
Container(s):	363622		
Comment:	Standard was put into 2 bottles (Bottle A)		

363622
ID: U-232_00026
Exp: 05/06/15 Prpd: SCB Crl: 06/13/13
U-232 Unclean tracer Bott

Reagent Analyte Information

Analyte	Source ID	Source Exp. Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
U-232	U-232_00009	08/25/2061	10280.70700	dpm/mL	82.24566	dpm/mL

Source Reagents

Reagent	Description	Type	Expiration	Vendor	Vendor Lot #	Vendor Cat Lot #	Volume Used	Volume Units
U-232_00009	U-232 Parent		08/25/61				8.00000	mL

St. Louis Radiological Standard Reverification Form

Standard ID Number: U-232_00020 (A)
True Value = 80.0456 DPM/L or g
Date Analyzed: 5/6/2014

Radionuclide: U-232

	Replicates	
#1	77.49	DPM/L or g
#2	80.95	DPM/L or g
#3	78.03	DPM/L or g

Mean = 78.82333

1 sigma = 1.861433 1.96 sigma = 3.648409

True Value minus 5% = 76.04332 (True Value - 5%)
True Value plus 5% = 84.04788 (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: RTM 5/7/2014

SOP Reference: STL-QA-0002, Current Revision

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:11:46PM 5/7/2014

Sample

Sample Name: Verification 1 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232 Unclean (Bottle A)
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

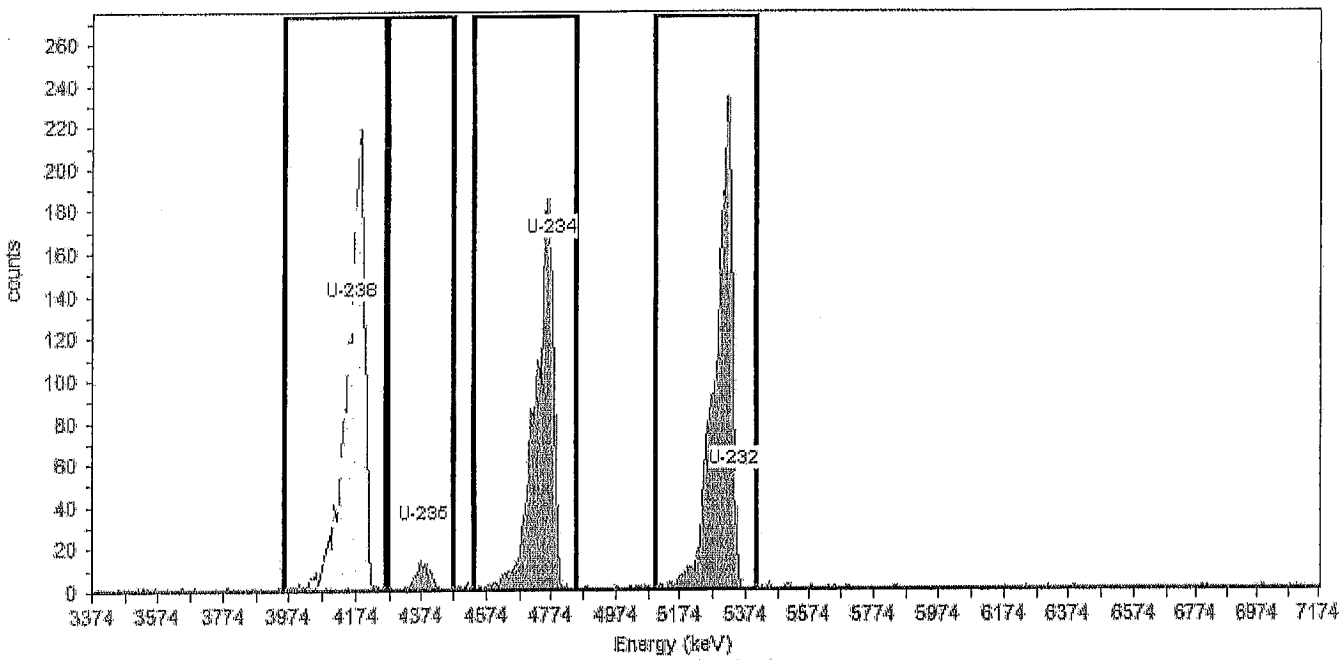
Tracer Name: UNAT Spike_00001
Tracer Activity: 72.26 DPM / mL x (Vol.) 0.10 mL = 7.23 DPM
Tracer Ref. Date: 3/30/2008 5:52:22PM

Tracer Nuclide: U-238
Tracer Recovery: 92.48%

Acquisition

Detector: AV240 SN: 51-005Q1
Acquisition Start Date: 5/6/2014 7:23:24PM
Live Time: 960.00 min.
Real Time: 960.67 min.
Background Date: 4/13/2014 7:09:45PM
Bkgd Info: Sample: ICB;AV240; Det: AV240; Spectrum #1; 4/13/2014 7:09:45 PM

Energy Calibration: IC-9817;AV240-20130620
Efficiency Calibration:IC-9817;AV240-20130620
Calibration Date: 6/20/2013 11:02:31PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.06% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:5/6/2014 7:22:37PM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	58.9	100.0	1736	0.0000	1736.00	6.683E+001	DPM/mL
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	53.1	80.2	84	0.0000	84.00	4.360E+000	DPM/mL
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	66.7	99.8	1619	2.0000	1617.00	6.745E+001	DPM/mL
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	64.3	100.1	1865	2.0000	1863.00	7.749E+001	DPM/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:11:53PM 5/7/2014

Sample

Sample Name: Verification 2 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232 Unclean (Bottle A)
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

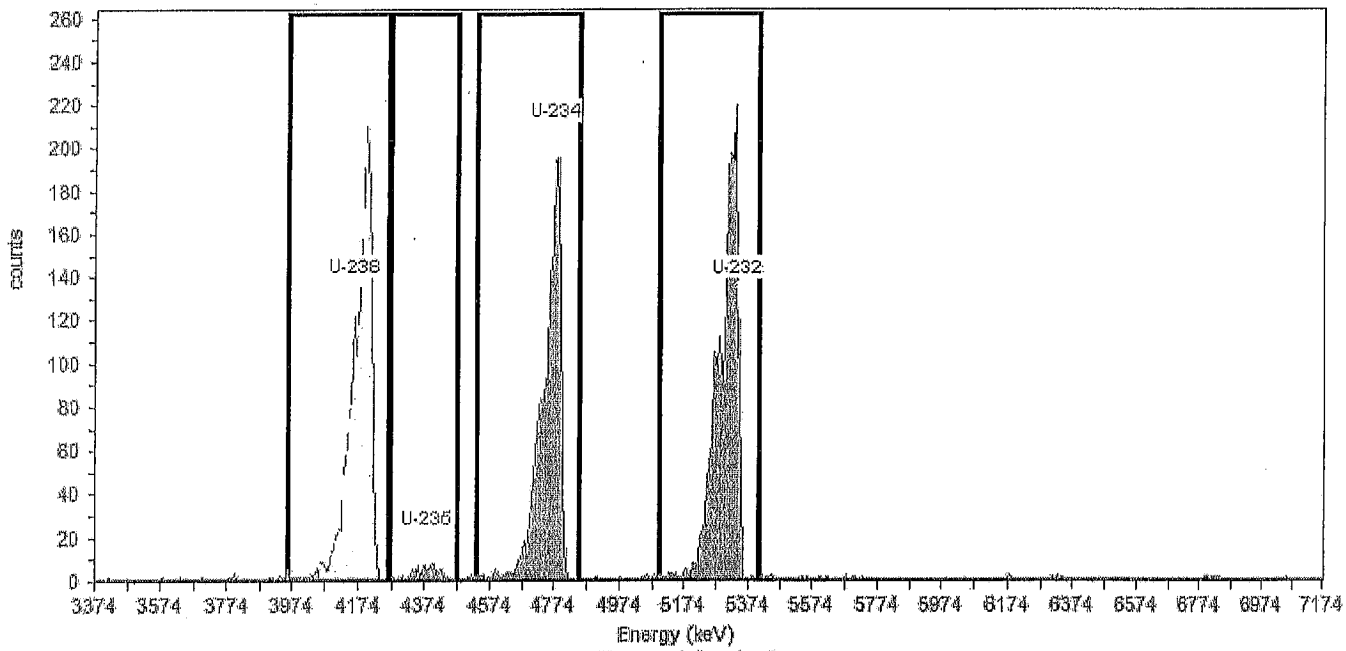
Tracer Name: UNAT Spike_00001
Tracer Activity: 72.26 DPM / mL x (Vol.) 0.10 mL = 7.23 DPM
Tracer Ref. Date: 3/30/2008 5:52:22PM

Tracer Nuclide: U-238
Tracer Recovery: 89.37%

Acquisition

Detector: AV241 SN: 50-005P1
Acquisition Start Date: 5/6/2014 7:23:25PM
Live Time: 960.00 min.
Real Time: 960.00 min.
Background Date: 4/13/2014 7:09:45PM
Bkgd Info: Sample: ICB;AV241; Det: AV241; Spectrum #1; 4/13/2014 7:09:45 PM

Energy Calibration: IC-9884;AV241-20130620
Efficiency Calibration:IC-9884;AV241-20130620
Calibration Date: 6/20/2013 11:02:35PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.05% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:5/6/2014 7:22:37PM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	66.5	100.0	1677	0.0000	1677.00	6.459E+001	DPM/mL
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	81.2	80.2	68	0.0000	68.00	3.654E+000	DPM/mL
U-234	4776.4	4,776.8	0.6	4530.3	4851.0	62.4	99.8	1585	3.0000	1582.00	6.831E+001	DPM/mL
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	66.5	100.1	1883	3.0000	1880.00	8.095E+001	DPM/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:11:59PM 5/7/2014

Sample

Sample Name: Verification 3 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U-232 Unclean (Bottle A)
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

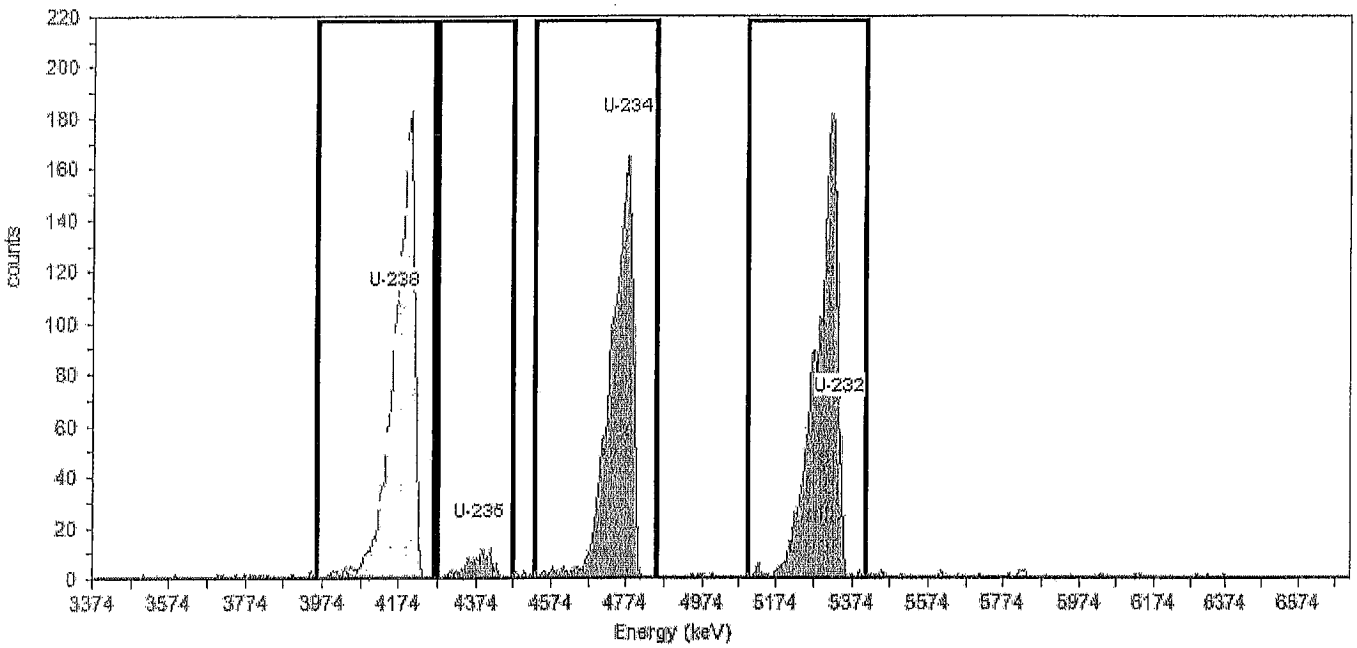
Tracer Name: UNAT Spike_00001
Tracer Activity: 72.26 DPM / mL x (Vol.) 0.10 mL = 7.23 DPM
Tracer Ref. Date: 3/30/2008 5:52:22PM

Tracer Nuclide: U-238
Tracer Recovery: 79.16%

Acquisition

Detector: AV242 SN: 51-005P7
Acquisition Start Date: 5/6/2014 7:23:25PM
Live Time: 960.00 min.
Real Time: 960.03 min.
Background Date: 4/13/2014 7:09:45PM
Bkgd Info: Sample: ICB;AV242; Det: AV242; Spectrum #1; 4/13/2014 7:09:45 PM

Energy Calibration: IC-9885;AV242-20130620
Efficiency Calibration:IC-9885;AV242-20130620
Calibration Date: 6/20/2013 11:02:39PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.86% +/- 0.39% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:5/6/2014 7:22:37PM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	63.4	100.0	1477	2.0000	1475.00	5.721E+001	DPM/mL
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	75.2	80.2	87	0.0000	87.00	5.315E+000	DPM/mL
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	70.8	99.8	1468	2.0000	1466.00	7.197E+001	DPM/mL
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	65.1	100.1	1597	3.0000	1594.00	7.803E+001	DPM/mL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

U-232 unclean tracer verification

Actinide Prep (bottle A)

Batch No.: —

Balance ID: —

Note: If a section below is not used, marked the N/A box and initial & date next to the N/A
ie. Mark the N/A box if a tracer is not added to the sample(s) then initial and date next to the N/A

No.	Sample Number	Aliquot (g / mL)	X	Initials
1	Verification-1	0.1	240	
2	2	1	241	
3	3	1	242	
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Tracer ☐ N/A

Initials / Date

Isotope: UNAT

Std Sol'n No.: UNATSpike-00021

Vol (mL): 0.1

Ref Activity (dpm/mL): 234- 70.169 / 235- 3.370 / 238- 72.204

Act Ref Date: 3-30-08

Samples Spiked and Traced By: SUB 5-5-14 (Initials / Date)

Verification Signature & Date: MB 5/8/14 (Initials / Date)

LCS Standard ☐ N/A

Initials / Date

Isotope: U-232 unclean

Std Sol'n ID.: U-232-00020

Vol (mL): 0.1

Ref Activity (dpm/mL): 82.247

Act Ref Date: 8-25-11

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

☐ ST-RC-0003 Rev.	☐ ST-RC-0040 Rev.	☐ ST-RC-0110 Rev.
☐ ST-RC-0004 Rev.	☐ ST-RC-0041 Rev.	☐ ST-RC-0120 Rev.
☐ ST-RC-0014 Rev.	☐ ST-RC-0050 Rev.	☐ ST-RC-0232 Rev.
☐ ST-RC-0020 Rev.	☐ ST-RC-0090 Rev.	☐ ST-RC-0238 Rev.
☐ ST-RC-0021 Rev.	☐ ST-RC-0100 Rev.	☐ ST-RC-0240 Rev.
		☐ ST-RC-0241 Rev.
		☐ ST-RC-0242 Rev.
		☐ ST-RC-5016 Rev.
		☐
		☐

Isotope(s)

αβ ☐	Iso Pu ☐	Tc-99 ☐	Iso Cm ☐
Iso Am ☐	Ra ☐	Iso Th ☐	Pu-241 ☐
KPA ☐	Sr ☐	Iso U ☑	Th-229 ☐
Np ☐	TAR ☐	C-14 ☑	Cl-36 ☐

Count Time	Matrix
Long Count ☐	Soil ☐
Short Count ☐	H_2O ☐

Prepared By: SUB.

Date: 5/2/14

Reviewed by: _____

Date: _____

\\Slsvr01\RAD\MasterForms\RAD-0045 Rev(3)

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

U - 232 - 00020

Reagent ID: U-232_00020

		Expiration Date:	06/18/2014
Description:	U-232 Unclean tracer	Laboratory:	TestAmerica St. Louis
No. of Bottles:	1	Prepared By:	Bramblett, Megan L
Storage Location:	RAD Actinide STDs	Solvent:	2M HNO3
Reagent Volume:	1000.000 mL	Solvent Lot:	n/a
Creation Date:	06/13/2013		
Container(s):	147873		
Comment:	Standard was put into 2 bottles (Bottle A and Bottle B)		

Reagent Analyte Information

Analyte	Source ID	Source Exp. Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
U-232	U-232_00009	08/25/2061	10280.70700	dpm/mL	82.24566	dpm/mL

Source Reagents

Reagent	Description	Type	Expiration	Vendor	Vendor Lot #	Vendor Cat Lot #	Volume Used	Volume Units
U-232_00009	U-232 Parent		08/25/61				8.00000	mL

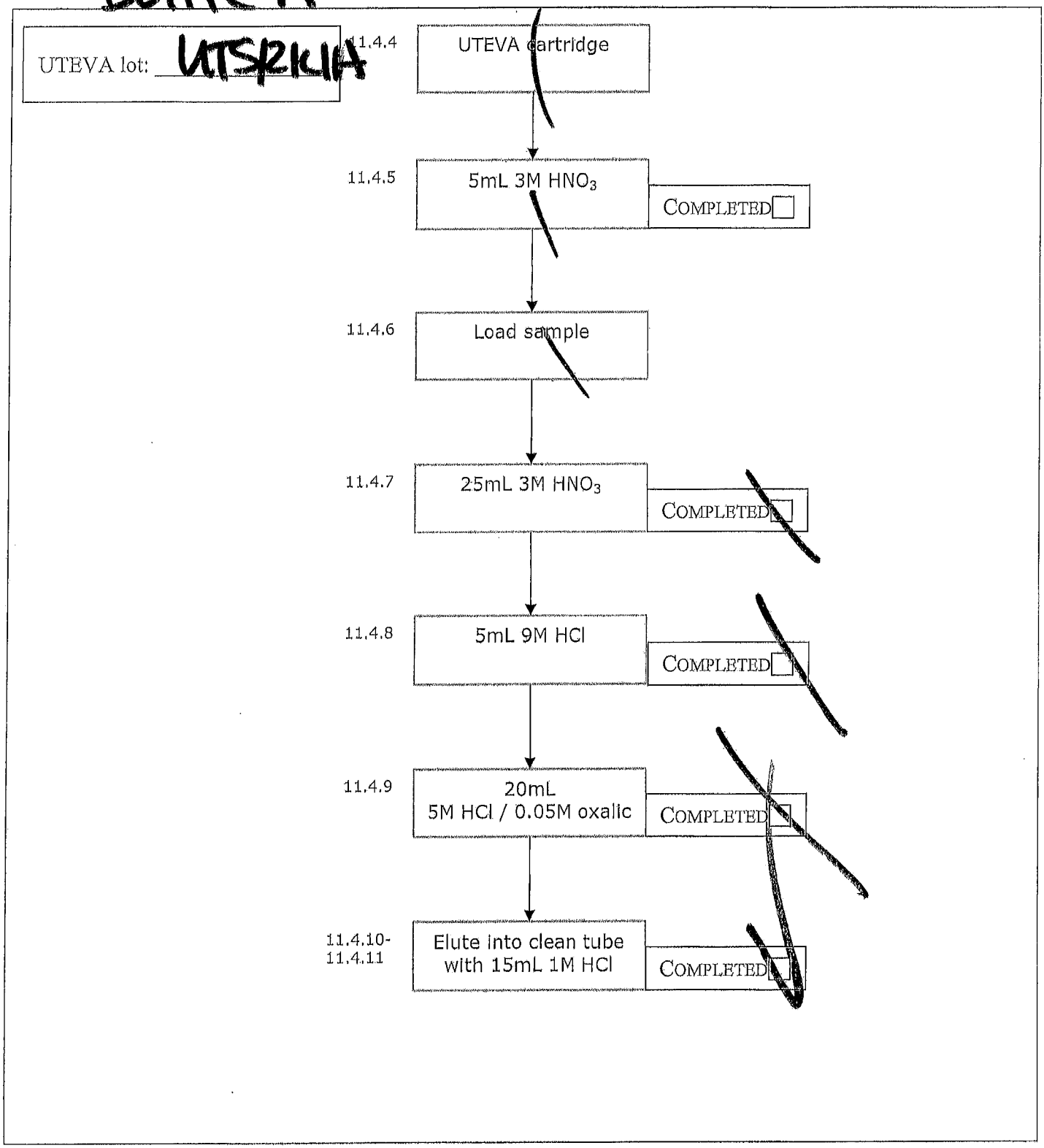
Uranium only via UTEVA

Batch: U232 090220 (Verification) ST-RC-0238

*All rinses should flow at 1 mL/minute (only 3M HNO_3 may be done at 3 mL/minute)

Bottle A

UTEVA lot: UTSR1418



Reagent

UNAT Ampoule_00001

New Brunswick Laboratory
U.S. Department of Energy

Certificate of Analysis

CRM 145

Uranyl (Normal) Nitrate Assay and Isotopic Solution

Uranium Mass Fraction: **0.0101356 g U/g solution ± 0.0000011 g U/g solution**
[10.1356 mg U/g solution ± 0.0011 mg U/g solution]

	$^{234}U/^{238}U$	$^{235}U/^{238}U$
Atom Ratio:	**0.000052841**	**0.0072543**
Atom Ratio Uncertainty:	**0.000000082**	**0.0000040**

	^{234}U	^{235}U	^{238}U
Atom Percent:	**0.0052458**	**0.72017**	**99.27458**
Atom Percent Uncertainty:	**0.0000081**	**0.00039**	**0.00039**
Weight Percent:	**0.0051579**	**0.71114**	**99.28370**
Weight Percent Uncertainty:	**0.0000080**	**0.00038**	**0.00038**

Relative Atomic Weight: **238.028918**
Relative Atomic Weight Uncertainty: **0.000012**

Note: ^{233}U and ^{236}U were not detected. The detection limit of uranium ratios for the technique used is 5×10^{-9}.

This Certified Reference Material (CRM) is a uranium concentration and isotopic solution standard intended for use in calibration of and/or quality control for uranium analysis methods. Each unit of CRM 145 consists of approximately 20-mL of uranyl nitrate solution in 1M nitric acid, contained in a sealed glass ampoule.

NOTE: The vial should be handled under proper radiologically-controlled conditions at all times.

The certified uranium content value is based on the mass of high-purity metal dissolved and diluted to a known solution mass. The stated uranium concentration was calculated as the prepared value and verified experimentally by the NBL-modified Davies and Gray titration. The certified uranium isotopic composition and atomic weight is based upon measurements performed on multiple samples by two different measurement techniques on a Thermal Ionization Mass Spectrometer (TIMS), calibrated using CRM U030-A as primary comparator and CRM 129-A as a quality control sample. The isotopic values are shared with CRM 112-A, uranium (normal) metal standard which was the source of uranium used to produce the solutions.

RAD13-0018
UNAT Spike
marrss
None
Prep/Opened: 5/3/2013
Exp(1): 5/10/2014
Exp(2): 5/10/2014

All uncertainties for the certified values are expressed as expanded uncertainties (U) where $U = k*u_c$, where u_c is the

September 30, 2010
Argonne, Illinois

www.nbl.doe.gov

Jon Neuhoff, Director
New Brunswick Laboratory

(Revision of Certificate dated March 30, 2008)

127971
ID: UNAT_00008
Exp: 05/10/14 Prpd: SB Crt: 05/03/13
UNAT spike

combined standard uncertainty and the coverage factor k = 2. Uncertainties were determined according to the JCGM 100:2008 *Guide to the Expression of Uncertainty in Measurement*. The coverage factor of 2 was chosen to provide an approximate 95% level of confidence. The input quantities associated with the uranium content included uncertainties due to weighing, CRM 112-A purity, and buoyancy factors. The input quantities associated with the uranium isotopic composition included uncertainties from the certified value for CRM U030-A, measurement precision, and background corrections associated with the analytical techniques.

The CRM was produced by dissolving uranium metal in a single batch and container, with extensive mixing of the resultant solution followed by dispensation into individual bottles. Subsequent measurements of a random sampling of the total lot produced did not indicate any inhomogeneity in uranium concentration or isotopic composition. The minimum sample sizes taken from packaged units and measured were 30 mg U by titration and 1 μg U by TIMS. The NBL makes no recommendation as to the minimum sample size to be used to ensure concentration or isotopic homogeneity.

Users are cautioned that once the vial is opened, the uranium concentration and/or isotopic composition of the material may be affected by evaporative losses or environmental contamination. User's should take appropriate precautions to safeguard the material before, during and after use to ensure valid certificate values.

Recommended Procedure for Ampoule Handling and Dispensing of Solution

1. The ampoule contains a strongly acidic solution of uranium. Appropriate precautions should be taken.

2. Before opening the ampoule, ensure that any dried uranium or condensed liquid in the neck or body of the ampoule is re-dissolved into solution. This can be accomplished by inverting the ampoule repeatedly.

3. The glass ampoules are scored at the neck for ease of opening. However, glass burrs and fragments pose a cut hazard to anyone opening the ampoules. Appropriate precautions should be taken.

4. Lightly moisten the scored line on the neck with distilled water to help ensure a clean break at the score.

5. Because of the narrow neck of the ampoule it may be difficult or impossible to pour the solution out. Here is one possible method:

    a. Obtain approximately 12-cm length of plastic capillary tubing (e.g. i.d. 0f 0.1", o.d. of 0.16").
    b. Insert one end of the capillary tubing fully into the ampoule
    c. Fold the remaining length of tubing along the outside of the ampoule, ensuring that the tube is not crimped and will allow the free flow of air through the tube and into the ampoule.
    d. Holding the ampoule and tubing in one hand, and a beaker or dispensing bottle in another, invert the ampoule over the container allowing the solution to drain into it.
    e. The capillary tubing allows air to flow into the ampoule, eliminating the "airlock" created by the narrow neck of the open ampoule.

6. The user should be wary of evaporative losses once the ampoule is opened, and prevent uranium contamination of the sample. It is recommended that the entire solution be accurately weighed and aliquanted as soon as possible after opening the sample. Precautions should be taken (clean glass/plastic ware, air filtration, etc) to prevent uranium contamination of the CRM with subsequent perturbation of the isotopic composition.

Reagent

UNAT Spike_00001

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

UNAT Spike_00001

Reagent ID: UNAT Spike_00001

Description:	UNAT_spike UNAT_00009	Expiration Date:	11/13/2014
No. of Bottles:	1	Laboratory:	TestAmerica St. Louis
Storage Location:	RAD Actinide STDs	Prepared By:	Bramblett, Megan L
Reagent Volume:	200.000 mL	Solvent:	1M HNO3
Creation Date:	11/11/2013	Solvent Lot:	n/a
Container(s):	243735		
Comment:			

243735
ID: UNAT Spike_00001
Exp: 11/13/14 Prpd: MLM Crt: 11/11/13
UNAT_spike UNAT_00009

Reagent Analyte Information

Analyte	Source ID	Source Expiration Date	Source Conc.	Source Conc. Units	Final Conc.	Final Conc. Units
U-234	UNAT Parent_00001	03/30/2058	706.91200	dpm/mL	70.69123	dpm/mL
U-235	UNAT Parent_00001	03/30/2058	33.70600	dpm/mL	3.37064	dpm/mL
U-238	UNAT Parent_00001	03/30/2058	722.65000	dpm/mL	72.26499	dpm/mL

Source Reagents

Reagent	Description	Type	Expiration	Vendor	Vendor Lot #	Vendor Cat Lot #	Volume Used	Volume Units
UNAT Parent_00001	UNAT Parent		03/30/58				20.00000	mL

St. Louis Radiological Standard Reverification Form

Standard ID Number: UNAT_00009
True Value = 70.69123 DPM/L or g
Date Analyzed: 11/13/2013

Radionuclide: U-234

	Replicates	
#1	72.62	DPM/L or g
#2	68.99	DPM/L or g
#3	71.84	DPM/L or g

Mean = 71.15

1 sigma = 1.910838 1.96 sigma = 3.745242

True Value minus 5% = 67.15667 (True Value - 5%)
True Value plus 5% = 74.22579 (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: RTM 11/14/2013

SOP Reference: STL-QA-0002, Current Revision

St. Louis Radiological Standard Reverification Form

Standard ID Number: UNAT_00009
True Value = 72.264991 DPM/L or g
Date Analyzed: 11/13/2013

Radionuclide: U-238

	Replicates	
#1	75.65	DPM/L or g
#2	69.41	DPM/L or g
#3	72.64	DPM/L or g

Mean = 72.56667

1 sigma = 3.120646 1.96 sigma = 6.116467

True Value minus 5% = 68.65174 (True Value - 5%)
True Value plus 5% = 75.87824 (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: RTM 11/14/2013

SOP Reference: STL-QA-0002, Current Revision

Sample

Sample Name: Verification 1 Type: Sample
Spectrum #2 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: UNATSpike_00001
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

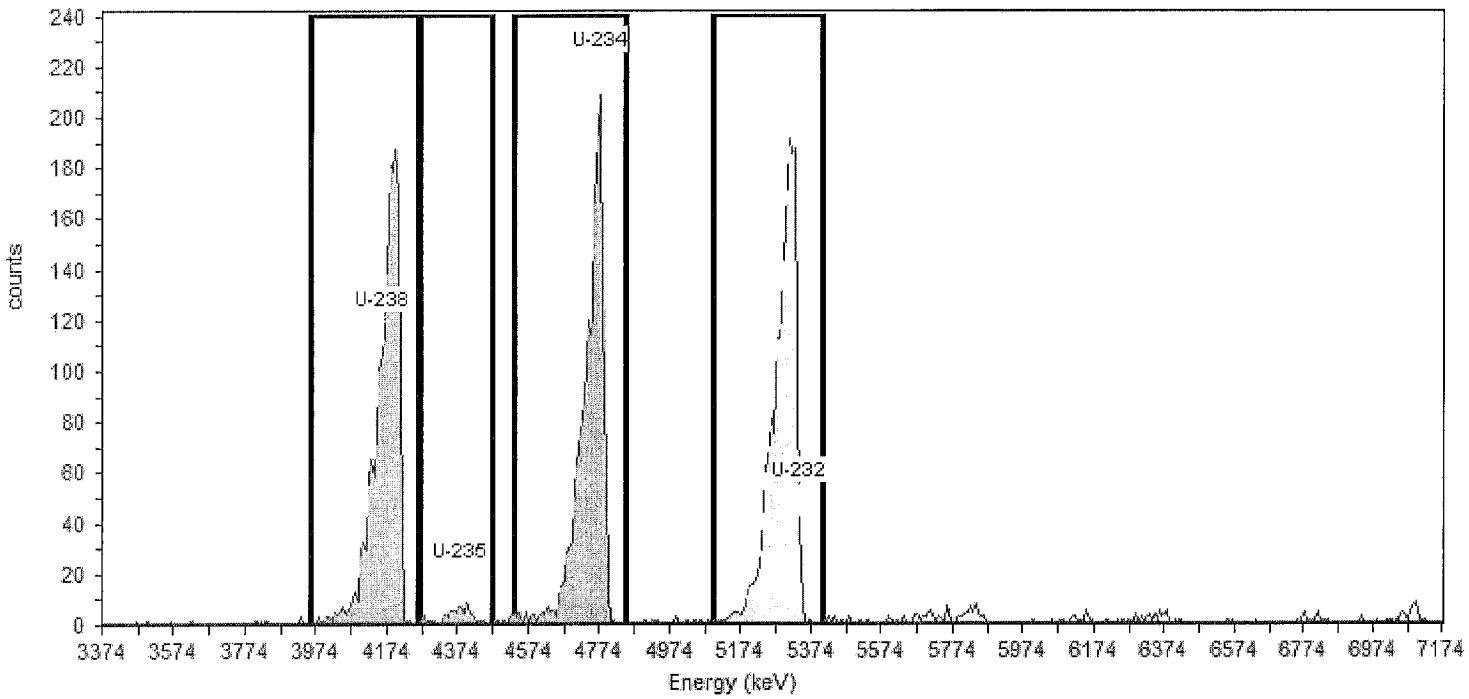
Tracer Name: U-232_00020
Tracer Activity: 82.25 DPM / mL x (Vol.) 0.10 mL = 8.22 DPM
Tracer Ref. Date: 8/25/2011 4:56:42PM

Tracer Nuclide: U-232
Tracer Recovery: 89.79%

Acquisition

Detector: AV248 SN: 51-005P4
Acquisition Start Date: 11/13/2013 9:57:05PM
Live Time: 960.00 min.
Real Time: 960.00 min.
Background Date: 10/17/2013 1:19:22AM
Bkgd Info: Sample: ICB;AV248; Det: AV248; Spectrum #1; 10/17/2013 1:19:22 AM

Energy Calibration: IC-8877;AV248-20130620
Efficiency Calibration:IC-8877;AV248-20130620
Calibration Date: 6/20/2013 11:03:01PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.38% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:11/13/2013 1:51:53AM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity DPM/mL	2.00Sigma TPU DPM/mL	Critical Level DPM/mL	MDA DPM/mL
U-238	4157.453	3956.099	4261.858	64.114	100.0	1,720.00	0.0000	1,720	7.565E+001	9.204E+000	0.000E+000	1.190E-001
U-235	4381.179	4269.316	4470.670	66.924	80.2	66.00	0.0000	66	3.619E+000	9.846E-001	0.000E+000	1.484E-001
U-234	4776.430	4530.331	4851.005	65.069	99.8	1,654.00	6.0000	1,648	7.262E+001	8.872E+000	2.511E-001	6.215E-001
U-232	5343.203	5097.104	5410.321	69.400	100.1	1,837.00	5.0000	1,832	7.385E+001	8.202E+000	2.335E-001	5.886E-001

Sample

Sample Name: Verification 2 Type: Sample
Spectrum #2 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: UNATSpike_00001
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

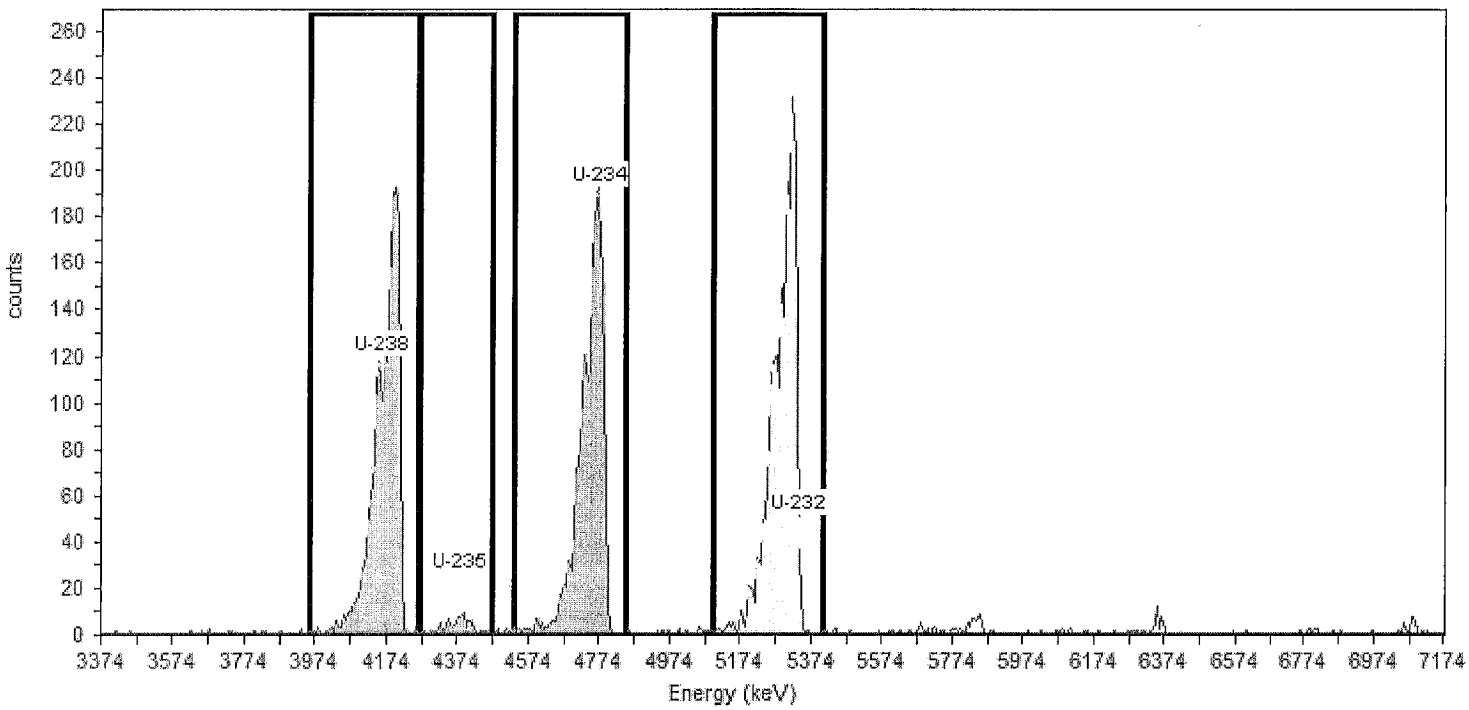
Tracer Name: U-232_00020
Tracer Activity: 82.25 DPM / mL x (Vol.) 0.10 mL = 8.22 DPM
Tracer Ref. Date: 8/25/2011 4:56:42PM

Tracer Nuclide: U-232
Tracer Recovery: 94.44%

Acquisition

Detector: AV249 SN: 51-005EE5
Acquisition Start Date: 11/13/2013 9:57:05PM
Live Time: 960.00 min.
Real Time: 960.00 min.
Background Date: 10/17/2013 1:19:22AM
Bkgd Info: Sample: ICB;AV249; Det: AV249; Spectrum #1; 10/17/2013 1:19:22 AM

Energy Calibration: IC-9520;AV249-20130620
Efficiency Calibration:IC-9520;AV249-20130620
Calibration Date: 6/20/2013 11:03:06PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.78% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:11/13/2013 1:51:53AM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity DPM/mL	2.00Sigma TPU DPM/mL	Critical Level DPM/mL	MDA DPM/mL
U-238	4157.453	3956.099	4261.858	74.002	100.0	1,748.00	0.0000	1,748	6.941E+001	8.399E+000	0.000E+000	1.075E-001
U-235	4381.179	4269.316	4470.670	60.410	80.2	68.00	1.0000	67	3.317E+000	9.014E-001	1.152E-001	3.644E-001
U-234	4776.430	4530.331	4851.005	68.212	99.8	1,738.00	4.0000	1,734	6.899E+001	8.357E+000	1.851E-001	4.779E-001
U-232	5343.203	5097.104	5410.321	74.844	100.1	2,035.00	6.0000	2,029	7.767E+001	8.568E+000	2.310E-001	5.717E-001

Sample

Sample Name: Verification 3 Type: Sample
Spectrum #2 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 0.10 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: UNATSpike_00001
:
Description:

Client Name: Undefined
Client Contact:
Analyst: 60040

Tracer

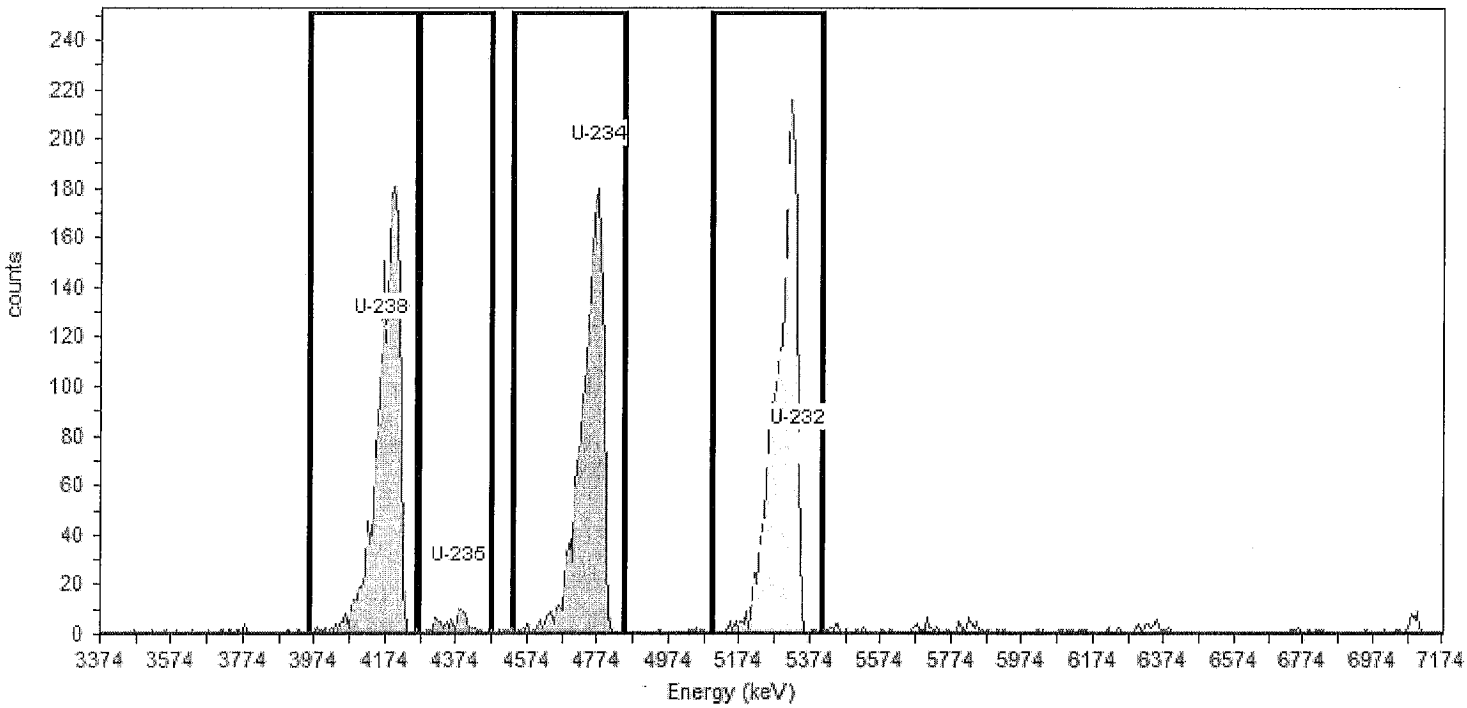
Tracer Name: U-232_00020
Tracer Activity: 82.25 DPM / mL x (Vol.) 0.10 mL = 8.22 DPM
Tracer Ref. Date: 8/25/2011 4:56:42PM

Tracer Nuclide: U-232
Tracer Recovery: 91.57%

Acquisition

Detector: AV250 SN: 51-027F2
Acquisition Start Date: 11/13/2013 9:57:05PM
Live Time: 960.00 min.
Real Time: 960.01 min.
Background Date: 10/17/2013 1:19:23AM
Bkgd Info: Sample: ICB;AV250; Det: AV250; Spectrum #1; 10/17/2013 1:19:23 AM

Energy Calibration: IC-8879;AV250-20130620
Efficiency Calibration:IC-8879;AV250-20130620
Calibration Date: 6/20/2013 11:03:10PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.67% +/- 0.35% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction:11/13/2013 1:51:53AM
MDA Constants: Kα = 1.64 , Kβ = 1.64

Nuclide Library: Uranium
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity DPM/mL	2.00Sigma TPU DPM/mL	Critical Level DPM/mL	MDA DPM/mL
U-238	4157.453	3956.099	4261.858	67.349	100.0	1,706.00	3.0000	1,703	7.264E+001	8.844E+000	1.719E-001	4.592E-001
U-235	4381.179	4269.316	4470.670	90.510	80.2	73.00	0.0000	73	3.882E+000	1.012E+000	0.000E+000	1.439E-001
U-234	4776.430	4530.331	4851.005	67.867	99.8	1,683.00	2.0000	1,681	7.184E+001	8.755E+000	1.406E-001	3.969E-001
U-232	5343.203	5097.104	5410.321	70.227	100.1	1,893.00	4.0000	1,889	7.532E+001	8.352E+000	2.026E-001	5.230E-001

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Actinide Prep

UNAT

Batch No. : —

Balance ID : —

No.	Sample Number	Aliquot (g / mL)	MS	Initials shift
1	Verification 1	0.1	147	RC = 248
2	2	1	148	RC = 249
3	3		149	RC = 250
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Note: If a section below is not used, marked the N/A box and initial & date next to the N/A. i.e. Mark the N/A box if a tracer is not added to the sample(s) then initial and date next to the N/A

Tracer ☐ N/A

Initials / Date

Isotope : U-232

Std Sol'n No. : U-232-00020

Vol (mL) : 0.1

Ref Activity (dpm/mL) : 82.247 dpm/mL

Act Ref Date : 8.25.11

Samples Spiked and Traced By: MB 11/11/13 (Initials / Date)

Verification Signature & Date: LM 11-11-13 (Initials / Date)

LCS Standard ☐ N/A

Initials / Date

Isotope : UNAT

Std Sol'n ID. : UNATSPIKE-0001

Vol (mL) : 0.1

Ref Activity (dpm/mL) : U234=70.000 dpm/mL U238=72.200 dpm/mL U235=3.370 dpm/mL

Act Ref Date : 3.30.08

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

☐ ST-RC-0003 Rev.	☐ ST-RC-0040 Rev.	☐ ST-RC-0110 Rev.
☐ ST-RC-0004 Rev.	☐ ST-RC-0041 Rev.	☐ ST-RC-0120 Rev.
☐ ST-RC-0014 Rev.	☐ ST-RC-0050 Rev.	☐ ST-RC-0232 Rev.
☐ ST-RC-0020 Rev.	☐ ST-RC-0090 Rev.	☑ ST-RC-0238 Rev.
☐ ST-RC-0021 Rev.	☑ ST-RC-0100 Rev.	☐ ST-RC-0240 Rev.
		☐ ST-RC-0241 Rev.
		☐ ST-RC-0242 Rev.
		☐ ST-RC-5016 Rev.
		☐
		☐

Isotope(s)

αβ ☐	Iso Pu ☐	Tc-99 ☐	Iso Cm ☐
Iso Am ☐	Ra ☐	Iso Th ☐	Pu-241 ☐
KPA ☐	Sr ☐	Iso U ☑	Th-229 ☐
Np ☐	TAR ☐	C-14 ☑	Cl-36 ☐

Count Time	Matrix
Long Count ☐	Soil ☐
Short Count ☐	H_2O ☐

Prepared By : MB

Date : 11/11/13

Reviewed by: _____

Date: _____

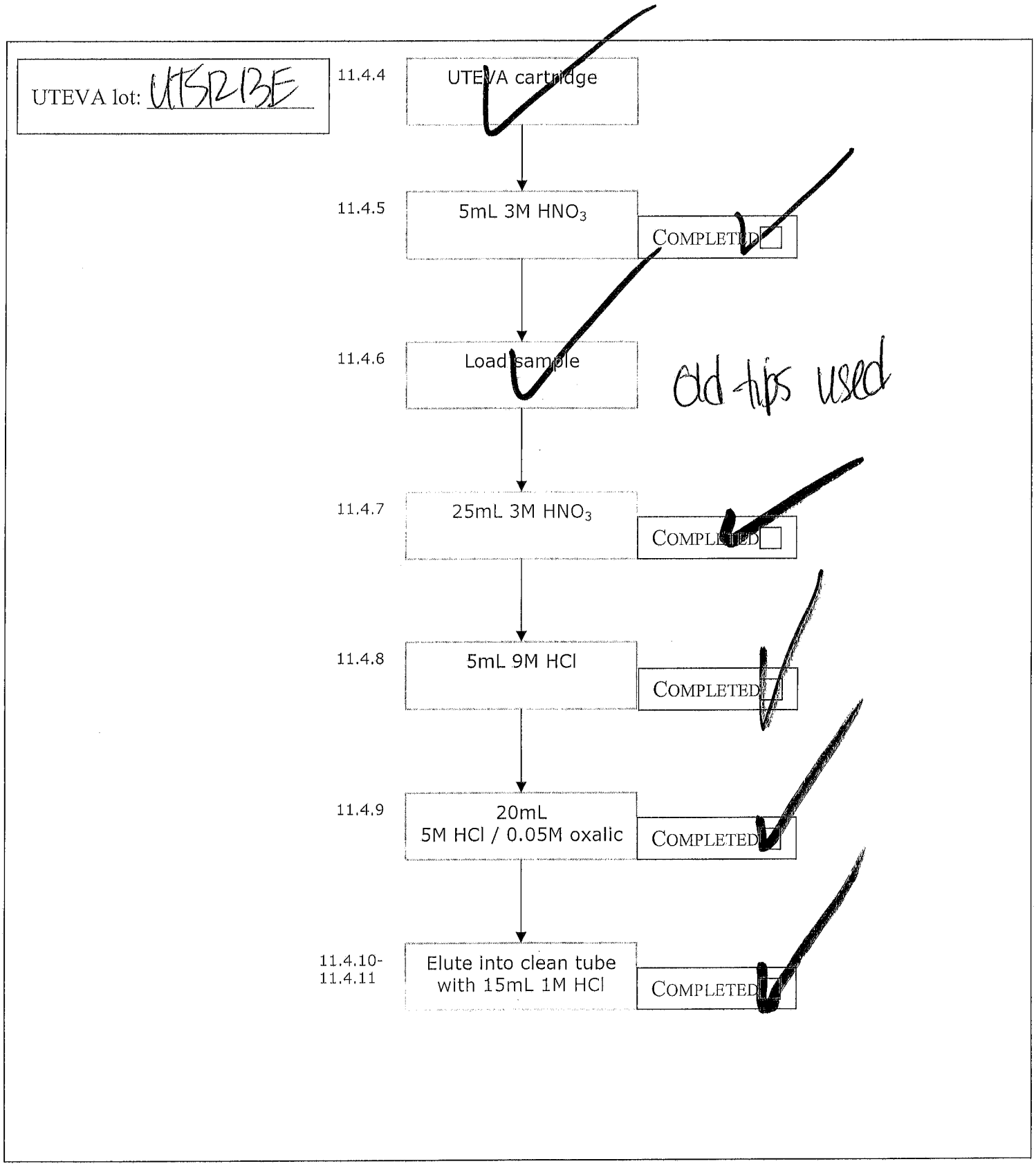
\\Slsvr01\RAD\MasterForms\RAD-0045 Rev(3)

Uranium only via UTEVA

Batch: UNAT Verification

ST-RC-0238

*All rinses should flow at 1 mL/minute (only 3M HNO_3 may be done at 3 mL/minute)



METALS

COVER PAGE
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG No.:

Project: EPA Region 5 START 3 Contract

Client Sample ID	Lab Sample ID
2222-SD01	160-6694-1
2222-SD02	160-6694-2
2222-SD03	160-6694-3
2222-SD04	160-6694-4
2222-SD05	160-6694-5
2222-SD06	160-6694-6
2222-RIN-01	160-6694-7

Comments:

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD01 Lab Sample ID: 160-6694-1

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 08:25

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 72.3

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	10000	270	57	mg/Kg			10	6010C
7440-36-0	Antimony	4.1	13	4.1	mg/Kg	U		10	6010C
7440-38-2	Arsenic	4.2	13	3.1	mg/Kg	J		10	6010C
7440-39-3	Barium	150	66	1.5	mg/Kg			10	6010C
7440-41-7	Beryllium	1.0	6.6	1.0	mg/Kg	U		10	6010C
7440-43-9	Cadmium	0.80	6.6	0.45	mg/Kg	J		10	6010C
7440-70-2	Calcium	5200	3300	89	mg/Kg			10	6010C
7440-47-3	Chromium	44	13	1.8	mg/Kg			10	6010C
7440-48-4	Cobalt	10	66	1.9	mg/Kg	J		10	6010C
7440-50-8	Copper	41	33	3.3	mg/Kg			10	6010C
7439-89-6	Iron	16000	130	26	mg/Kg			10	6010C
7439-92-1	Lead	120	13	1.7	mg/Kg			10	6010C
7439-95-4	Magnesium	5000	1300	42	mg/Kg			10	6010C
7439-96-5	Manganese	220	13	1.1	mg/Kg			10	6010C
7440-02-0	Nickel	20	53	1.5	mg/Kg	J		10	6010C
7440-09-7	Potassium	1100	6600	960	mg/Kg	J		10	6010C
7782-49-2	Selenium	2.7	20	2.7	mg/Kg	U		10	6010C
7440-22-4	Silver	0.93	13	0.93	mg/Kg	U		10	6010C
7440-23-5	Sodium	150	1300	100	mg/Kg	J		10	6010C
7440-28-0	Thallium	2.5	27	2.5	mg/Kg	U		10	6010C
7440-62-2	Vanadium	24	66	6.7	mg/Kg	J		10	6010C
7440-66-6	Zinc	170	66	7.5	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.097	0.041	0.014	mg/Kg			1	7471B

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD02 Lab Sample ID: 160-6694-2

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 09:45

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 71.9

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	5000	240	51	mg/Kg			10	6010C
7440-36-0	Antimony	3.7	12	3.7	mg/Kg	U		10	6010C
7440-38-2	Arsenic	2.8	12	2.8	mg/Kg	U		10	6010C
7440-39-3	Barium	41	60	1.3	mg/Kg	J		10	6010C
7440-41-7	Beryllium	0.89	6.0	0.89	mg/Kg	U		10	6010C
7440-43-9	Cadmium	0.40	6.0	0.40	mg/Kg	U		10	6010C
7440-70-2	Calcium	26000	3000	80	mg/Kg			10	6010C
7440-47-3	Chromium	26	12	1.6	mg/Kg			10	6010C
7440-48-4	Cobalt	8.3	60	1.7	mg/Kg	J		10	6010C
7440-50-8	Copper	42	30	2.9	mg/Kg			10	6010C
7439-89-6	Iron	12000	120	24	mg/Kg			10	6010C
7439-92-1	Lead	71	12	1.5	mg/Kg			10	6010C
7439-95-4	Magnesium	10000	1200	38	mg/Kg			10	6010C
7439-96-5	Manganese	150	12	0.95	mg/Kg			10	6010C
7440-02-0	Nickel	16	48	1.4	mg/Kg	J		10	6010C
7440-09-7	Potassium	1000	6000	860	mg/Kg	J		10	6010C
7782-49-2	Selenium	2.5	18	2.5	mg/Kg	U		10	6010C
7440-22-4	Silver	0.83	12	0.83	mg/Kg	U		10	6010C
7440-23-5	Sodium	140	1200	91	mg/Kg	J		10	6010C
7440-28-0	Thallium	2.3	24	2.3	mg/Kg	U		10	6010C
7440-62-2	Vanadium	14	60	6.0	mg/Kg	J		10	6010C
7440-66-6	Zinc	140	60	6.7	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.043	0.050	0.017	mg/Kg	J		1	7471B

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD03 Lab Sample ID: 160-6694-3

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 08:50

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 52.4

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	11000	350	76	mg/Kg			10	6010C
7440-36-0	Antimony	5.7	18	5.5	mg/Kg	J		10	6010C
7440-38-2	Arsenic	5.7	18	4.2	mg/Kg	J		10	6010C
7440-39-3	Barium	100	89	1.9	mg/Kg			10	6010C
7440-41-7	Beryllium	1.3	8.9	1.3	mg/Kg	U		10	6010C
7440-43-9	Cadmium	1.2	8.9	0.60	mg/Kg	J		10	6010C
7440-70-2	Calcium	17000	4400	120	mg/Kg			10	6010C
7440-47-3	Chromium	610	18	2.4	mg/Kg			10	6010C
7440-48-4	Cobalt	16	89	2.6	mg/Kg	J		10	6010C
7440-50-8	Copper	140	44	4.3	mg/Kg			10	6010C
7439-89-6	Iron	23000	180	35	mg/Kg			10	6010C
7439-92-1	Lead	290	18	2.3	mg/Kg			10	6010C
7439-95-4	Magnesium	7900	1800	56	mg/Kg			10	6010C
7439-96-5	Manganese	300	18	1.4	mg/Kg			10	6010C
7440-02-0	Nickel	40	71	2.1	mg/Kg	J		10	6010C
7440-09-7	Potassium	1800	8900	1300	mg/Kg	J		10	6010C
7782-49-2	Selenium	3.7	27	3.7	mg/Kg	U		10	6010C
7440-22-4	Silver	1.2	18	1.2	mg/Kg	U		10	6010C
7440-23-5	Sodium	180	1800	140	mg/Kg	J		10	6010C
7440-28-0	Thallium	3.4	35	3.4	mg/Kg	U		10	6010C
7440-62-2	Vanadium	33	89	9.0	mg/Kg	J		10	6010C
7440-66-6	Zinc	430	89	10	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.18	0.061	0.020	mg/Kg			1	7471B

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD04 Lab Sample ID: 160-6694-4

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 09:05

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 28.6

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	9100	690	150	mg/Kg			10	6010C
7440-36-0	Antimony	11	35	11	mg/Kg	U		10	6010C
7440-38-2	Arsenic	26	35	8.2	mg/Kg	J		10	6010C
7440-39-3	Barium	100	170	3.8	mg/Kg	J		10	6010C
7440-41-7	Beryllium	2.6	17	2.6	mg/Kg	U		10	6010C
7440-43-9	Cadmium	3.5	17	1.2	mg/Kg	J		10	6010C
7440-70-2	Calcium	17000	8600	230	mg/Kg			10	6010C
7440-47-3	Chromium	70	35	4.8	mg/Kg			10	6010C
7440-48-4	Cobalt	19	170	5.0	mg/Kg	J		10	6010C
7440-50-8	Copper	210	86	8.5	mg/Kg			10	6010C
7439-89-6	Iron	28000	350	69	mg/Kg			10	6010C
7439-92-1	Lead	520	35	4.5	mg/Kg			10	6010C
7439-95-4	Magnesium	7000	3500	110	mg/Kg			10	6010C
7439-96-5	Manganese	320	35	2.8	mg/Kg			10	6010C
7440-02-0	Nickel	58	140	4.0	mg/Kg	J		10	6010C
7440-09-7	Potassium	2500	17000	2500	mg/Kg	U		10	6010C
7782-49-2	Selenium	7.1	52	7.1	mg/Kg	U		10	6010C
7440-22-4	Silver	2.4	35	2.4	mg/Kg	U		10	6010C
7440-23-5	Sodium	900	3500	260	mg/Kg	J		10	6010C
7440-28-0	Thallium	6.6	69	6.6	mg/Kg	U		10	6010C
7440-62-2	Vanadium	23	170	18	mg/Kg	J		10	6010C
7440-66-6	Zinc	760	170	19	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.045	0.10	0.035	mg/Kg	J		1	7471B

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD05 Lab Sample ID: 160-6694-5

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 09:15

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 76.9

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	4200	260	55	mg/Kg			10	6010C
7440-36-0	Antimony	4.0	13	4.0	mg/Kg	U		10	6010C
7440-38-2	Arsenic	3.1	13	3.1	mg/Kg	U		10	6010C
7440-39-3	Barium	16	65	1.4	mg/Kg	J		10	6010C
7440-41-7	Beryllium	0.97	6.5	0.97	mg/Kg	U		10	6010C
7440-43-9	Cadmium	0.44	6.5	0.44	mg/Kg	U		10	6010C
7440-70-2	Calcium	16000	3200	87	mg/Kg			10	6010C
7440-47-3	Chromium	18	13	1.8	mg/Kg			10	6010C
7440-48-4	Cobalt	9.0	65	1.9	mg/Kg	J		10	6010C
7440-50-8	Copper	38	32	3.2	mg/Kg			10	6010C
7439-89-6	Iron	15000	130	26	mg/Kg			10	6010C
7439-92-1	Lead	42	13	1.7	mg/Kg			10	6010C
7439-95-4	Magnesium	6500	1300	41	mg/Kg			10	6010C
7439-96-5	Manganese	130	13	1.0	mg/Kg			10	6010C
7440-02-0	Nickel	17	52	1.5	mg/Kg	J		10	6010C
7440-09-7	Potassium	940	6500	940	mg/Kg	U		10	6010C
7782-49-2	Selenium	2.7	19	2.7	mg/Kg	U		10	6010C
7440-22-4	Silver	0.91	13	0.91	mg/Kg	U		10	6010C
7440-23-5	Sodium	110	1300	99	mg/Kg	J		10	6010C
7440-28-0	Thallium	2.5	26	2.5	mg/Kg	U		10	6010C
7440-62-2	Vanadium	13	65	6.6	mg/Kg	J		10	6010C
7440-66-6	Zinc	130	65	7.3	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.11	0.038	0.013	mg/Kg			1	7471B

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD06 Lab Sample ID: 160-6694-6

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 08:45

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 54.9

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	10000	310	66	mg/Kg			10	6010C
7440-36-0	Antimony	5.3	15	4.8	mg/Kg	J		10	6010C
7440-38-2	Arsenic	5.6	15	3.6	mg/Kg	J		10	6010C
7440-39-3	Barium	99	77	1.7	mg/Kg			10	6010C
7440-41-7	Beryllium	1.2	7.7	1.2	mg/Kg	U		10	6010C
7440-43-9	Cadmium	2.0	7.7	0.53	mg/Kg	J		10	6010C
7440-70-2	Calcium	29000	3900	100	mg/Kg			10	6010C
7440-47-3	Chromium	510	15	2.1	mg/Kg			10	6010C
7440-48-4	Cobalt	18	77	2.2	mg/Kg	J		10	6010C
7440-50-8	Copper	180	39	3.8	mg/Kg			10	6010C
7439-89-6	Iron	22000	150	31	mg/Kg			10	6010C
7439-92-1	Lead	390	15	2.0	mg/Kg			10	6010C
7439-95-4	Magnesium	8500	1500	49	mg/Kg			10	6010C
7439-96-5	Manganese	260	15	1.2	mg/Kg			10	6010C
7440-02-0	Nickel	38	62	1.8	mg/Kg	J		10	6010C
7440-09-7	Potassium	1600	7700	1100	mg/Kg	J		10	6010C
7782-49-2	Selenium	3.2	23	3.2	mg/Kg	U		10	6010C
7440-22-4	Silver	1.1	15	1.1	mg/Kg	U		10	6010C
7440-23-5	Sodium	170	1500	120	mg/Kg	J		10	6010C
7440-28-0	Thallium	2.9	31	2.9	mg/Kg	U		10	6010C
7440-62-2	Vanadium	31	77	7.8	mg/Kg	J		10	6010C
7440-66-6	Zinc	550	77	8.7	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.24	0.056	0.019	mg/Kg			1	7471B

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-RIN-01 Lab Sample ID: 160-6694-7

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Water Date Sampled: 05/15/2014 08:10

Reporting Basis: WET Date Received: 05/16/2014 06:45

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	22	200	22	ug/L	U		1	6010C
7440-36-0	Antimony	3.7	10	3.7	ug/L	U		1	6010C
7440-38-2	Arsenic	1.8	10	1.8	ug/L	U		1	6010C
7440-39-3	Barium	2.1	50	2.1	ug/L	U		1	6010C
7440-41-7	Beryllium	0.28	5.0	0.28	ug/L	U		1	6010C
7440-43-9	Cadmium	0.34	5.0	0.34	ug/L	U		1	6010C
7440-70-2	Calcium	54	1000	54	ug/L	U		1	6010C
7440-47-3	Chromium	3.4	10	3.4	ug/L	U		1	6010C
7440-48-4	Cobalt	2.7	50	2.7	ug/L	U		1	6010C
7440-50-8	Copper	2.1	25	2.1	ug/L	U		1	6010C
7439-89-6	Iron	13	100	13	ug/L	U		1	6010C
7439-92-1	Lead	0.60	10	0.60	ug/L	U		1	6010C
7439-95-4	Magnesium	51	1000	51	ug/L	U		1	6010C
7439-96-5	Manganese	1.0	15	1.0	ug/L	U		1	6010C
7440-02-0	Nickel	2.6	40	2.6	ug/L	U		1	6010C
7440-09-7	Potassium	460	5000	460	ug/L	U		1	6010C
7782-49-2	Selenium	2.1	15	2.1	ug/L	U		1	6010C
7440-22-4	Silver	0.99	10	0.99	ug/L	U		1	6010C
7440-23-5	Sodium	110	1000	110	ug/L	U		1	6010C
7440-28-0	Thallium	2.4	20	2.4	ug/L	U		1	6010C
7440-62-2	Vanadium	4.4	50	4.4	ug/L	U		1	6010C
7440-66-6	Zinc	9.2	20	8.3	ug/L	J		1	6010C
7439-97-6	Mercury	0.060	0.20	0.060	ug/L	U		1	7470A

2A-IN
CALIBRATION VERIFICATIONS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

ICV Source: ICP ICV_00008 Concentration Units: ug/L

CCV Source: ICP CAL2/CCV_00018

Analyte	ICV 160-123642/5 05/22/2014 10:40				CCV 160-123642/11 05/22/2014 11:03				CCV 160-123642/34 05/22/2014 12:37			
	Found	C	True	%R	Found	C	True	%R	Found	C	True	%R
Aluminum	50800		50000	102	51000		50000	102	50900		50000	102
Antimony	1000		1000	100	1020		1000	102	1010		1000	101
Arsenic	4930		5000	99	5060		5000	101	4990		5000	100
Barium	4980		5000	100	5090		5000	102	5100		5000	102
Beryllium	4990		5000	100	4990		5000	100	5050		5000	101
Cadmium	5010		5000	100	5120		5000	102	5050		5000	101
Calcium	50400		50000	101	50600		50000	101	50100		50000	100
Chromium	5060		5000	101	5030		5000	101	4990		5000	100
Cobalt	5120		5000	102	5020		5000	100	4970		5000	99
Copper	5000		5000	100	5140		5000	103	5090		5000	102
Iron	49500		50000	99	49000		50000	98	49700		50000	99
Lead	5050		5000	101	5150		5000	103	5080		5000	102
Magnesium	48800		50000	98	48000		50000	96	48500		50000	97
Manganese	4970		5000	99	4950		5000	99	5020		5000	100
Nickel	5070		5000	101	5150		5000	103	5080		5000	102
Potassium	51400		50000	103	52800		50000	106	51900		50000	104
Selenium	998		1000	100	1010		1000	101	999		1000	100
Silver	987		1000	99	983		1000	98	986		1000	99
Sodium	51900		50000	104	52900		50000	106	52100		50000	104
Thallium	1040		1000	104	1030		1000	103	1020		1000	102
Vanadium	4930		5000	99	4850		5000	97	4920		5000	98
Zinc	4990		5000	100	5100		5000	102	5040		5000	101

Note! Calculations are performed before rounding to avoid round-off errors in calculated results.
Italicized analytes were not requested for this sequence.

2A-IN
CALIBRATION VERIFICATIONS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

ICV Source: ICP ICV_00008 Concentration Units: ug/L

CCV Source: ICP CAL2/CCV_00018

Analyte	CCV 160-123642/46 05/22/2014 13:23				CCV 160-123642/70 05/22/2014 14:56				CCV 160-123642/82 05/22/2014 15:43			
	Found	C	True	%R	Found	C	True	%R	Found	C	True	%R
Aluminum	49500		50000	99	48400		50000	97	48800		50000	98
Antimony	1010		1000	101	1030		1000	103	1030		1000	103
Arsenic	5040		5000	101	5160		5000	103	5160		5000	103
Barium	4940		5000	99	5000		5000	100	5050		5000	101
Beryllium	5050		5000	101	5020		5000	100	5090		5000	102
Cadmium	5110		5000	102	5260		5000	105	5220		5000	104
Calcium	51600		50000	103	53900		50000	108	54200		50000	108
Chromium	5080		5000	102	5280		5000	106	5300		5000	106
Cobalt	5110		5000	102	5290		5000	106	5340		5000	107
Copper	5110		5000	102	5210		5000	104	5170		5000	103
Iron	50200		50000	100	49300		50000	99	50400		50000	101
Lead	5180		5000	104	5370		5000	107	5360		5000	107
Magnesium	49100		50000	98	49300		50000	99	49700		50000	99
Manganese	5030		5000	101	4960		5000	99	5030		5000	101
Nickel	5150		5000	103	5350		5000	107	5320		5000	106
Potassium	50400		50000	101	49100		50000	98	49800		50000	100
Selenium	1010		1000	101	1020		1000	102	1030		1000	103
Silver	996		1000	100	1020		1000	102	1030		1000	103
Sodium	50400		50000	101	48600		50000	97	49600		50000	99
Thallium	1050		1000	105	1080		1000	108	1090		1000	109
Vanadium	5000		5000	100	4920		5000	98	5060		5000	101
Zinc	5120		5000	102	5280		5000	106	5280		5000	106

Note! Calculations are performed before rounding to avoid round-off errors in calculated results.
Italicized analytes were not requested for this sequence.

2A-IN
CALIBRATION VERIFICATIONS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

ICV Source: ICP ICV_00008 Concentration Units: ug/L

CCV Source: ICP CAL2/CCV_00018

Analyte	CCV 160-123642/94 05/22/2014 16:29											
	Found	C	True	%R	Found	C	True	%R	Found	C	True	%R
Aluminum	49300		50000	99								
Antimony	1020		1000	102								
Arsenic	5070		5000	101								
Barium	5070		5000	101								
Beryllium	4960		5000	99								
Cadmium	5150		5000	103								
Calcium	52800		50000	106								
Chromium	5200		5000	104								
Cobalt	5230		5000	105								
Copper	5140		5000	103								
Iron	49000		50000	98								
Lead	5240		5000	105								
Magnesium	47800		50000	96								
Manganese	4900		5000	98								
Nickel	5200		5000	104								
Potassium	50800		50000	102								
Selenium	1010		1000	101								
Silver	1020		1000	102								
Sodium	50900		50000	102								
Thallium	1070		1000	107								
Vanadium	4930		5000	99								
Zinc	5180		5000	104								

Note! Calculations are performed before rounding to avoid round-off errors in calculated results.
Italicized analytes were not requested for this sequence.

2A-IN
CALIBRATION VERIFICATIONS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

ICV Source: Hg Curve Int._00404 Concentration Units: ug/L

CCV Source: Hg Curve Int._00403

Analyte	ICV 160-123936/7 05/27/2014 10:10				CCV 160-123936/19 05/27/2014 10:12							
	Found	C	True	%R	Found	C	True	%R	Found	C	True	%R
Mercury	5.02		5.00	100	4.91		5.00	98				

Note! Calculations are performed before rounding to avoid round-off errors in calculated results.
Italicized analytes were not requested for this sequence.

2A-IN
CALIBRATION VERIFICATIONS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

ICV Source: Hg QC Int._00388 Concentration Units: ug/L

CCV Source: Hg Curve Int._00405

Analyte	ICV 160-124146/7 05/28/2014 09:14				CCV 160-124146/19 05/28/2014 09:51				CCV 160-124146/22 05/28/2014 09:58			
	Found	C	True	%R	Found	C	True	%R	Found	C	True	%R
Mercury	5.15		5.00	103	5.01		5.00	100	5.02		5.00	100

Note! Calculations are performed before rounding to avoid round-off errors in calculated results.
Italicized analytes were not requested for this sequence.

2B-IN
CRQL CHECK STANDARD
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Method: 6010C Instrument ID: ICP6500

Lab Sample ID: CRI 160-123642/7 Concentration Units: ug/L

CRQL Check Standard Source: ICP CAL1/LLC_00012

Analyte	CRQL Check Standard				
	True	Found	Qualifiers	%R(1)	Limits
Aluminum	200	206		103	70-130
Antimony	10.0	10.7		107	70-130
Arsenic	10.0	9.20	J	92	70-130
Barium	50.0	51.2		102	70-130
Beryllium	5.00	5.10		102	70-130
Cadmium	5.00	5.20		104	70-130
Calcium	1000	1120		112	70-130
Chromium	10.0	10.4		104	70-130
Cobalt	50.0	55.1		110	70-130
Copper	25.0	25.5		102	70-130
Iron	100	106		106	70-130
Lead	10.0	11.1		111	70-130
Magnesium	1000	935	J	93	70-130
Manganese	15.0	15.5		103	70-130
Nickel	40.0	44.8		112	70-130
Potassium	5000	5230		105	70-130
Selenium	15.0	14.5	J	97	70-130
Silver	10.0	10.0		100	70-130
Sodium	1000	1050		105	70-130
Thallium	20.0	24.0		120	70-130
Vanadium	50.0	47.4	J	95	70-130
Zinc	20.0	21.1		106	70-130

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

FORM IIB-IN

3-IN
INSTRUMENT BLANKS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Concentration Units: ug/L

Analyte	RL	ICB 160-123642/6 05/22/2014 10:44		CCB 160-123642/12 05/22/2014 11:07		CCB 160-123642/35 05/22/2014 12:41		CCB 160-123642/47 05/22/2014 13:27	
		Found	C	Found	C	Found	C	Found	C
Aluminum	200	22	U	22	U	22	U	22	U
Antimony	10	3.7	U	3.7	U	3.7	U	3.7	U
Arsenic	10	1.8	U	1.8	U	1.8	U	1.8	U
Barium	50	2.1	U	2.1	U	2.1	U	2.1	U
Beryllium	5.0	0.28	U	0.28	U	0.800	J	0.28	U
Cadmium	5.0	0.34	U	0.34	U	0.34	U	0.34	U
Calcium	1000	54	U	54	U	54	U	54	U
Chromium	10	3.4	U	3.4	U	3.4	U	3.4	U
Cobalt	50	2.7	U	2.7	U	2.7	U	2.7	U
Copper	25	2.1	U	2.1	U	2.1	U	2.1	U
Iron	100	13	U	13	U	13	U	13	U
Lead	10	0.900	J	0.600	J	1.30	J	0.60	U
Magnesium	1000	51	U	51	U	51	U	51	U
Manganese	15	1.0	U	1.0	U	1.00	J	1.0	U
Nickel	40	2.6	U	2.6	U	2.6	U	2.6	U
Potassium	5000	460	U	460	U	460	U	460	U
Selenium	15	2.1	U	2.1	U	2.1	U	2.10	J
Silver	10	0.99	U	0.99	U	0.99	U	0.99	U
Sodium	1000	110	U	110	U	110	U	110	U
Thallium	20	2.4	U	2.4	U	2.4	U	2.4	U
Vanadium	50	4.4	U	4.4	U	4.4	U	4.4	U
Zinc	20	8.3	U	8.3	U	8.3	U	8.3	U

Italicized analytes were not requested for this sequence.

3-IN
INSTRUMENT BLANKS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Concentration Units: ug/L

Analyte	RL	CCB 160-123642/71 05/22/2014 15:00		CCB 160-123642/83 05/22/2014 15:46		CCB 160-123642/95 05/22/2014 16:33			
		Found	C	Found	C	Found	C	Found	C
Aluminum	200	22	U	22	U	22	U		
Antimony	10	3.7	U	3.7	U	3.7	U		
Arsenic	10	1.8	U	1.8	U	1.8	U		
Barium	50	2.1	U	2.1	U	2.1	U		
Beryllium	5.0	0.28	U	0.28	U	0.28	U		
Cadmium	5.0	0.400	J	0.34	U	0.34	U		
Calcium	1000	54	U	54	U	54	U		
Chromium	10	3.4	U	3.4	U	3.4	U		
Cobalt	50	2.7	U	2.7	U	2.7	U		
Copper	25	2.1	U	2.1	U	2.1	U		
Iron	100	13	U	13	U	13	U		
Lead	10	0.800	J	0.800	J	0.600	J		
Magnesium	1000	51	U	51	U	51	U		
Manganese	15	1.0	U	1.0	U	1.0	U		
Nickel	40	2.6	U	2.6	U	2.6	U		
Potassium	5000	460	U	460	U	460	U		
Selenium	15	2.1	U	2.1	U	2.1	U		
Silver	10	0.99	U	0.99	U	0.99	U		
Sodium	1000	110	U	110	U	110	U		
Thallium	20	2.4	U	2.4	U	2.4	U		
Vanadium	50	4.4	U	4.4	U	4.4	U		
Zinc	20	8.3	U	8.3	U	8.3	U		

Italicized analytes were not requested for this sequence.

3-IN
INSTRUMENT BLANKS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Concentration Units: ug/L

Analyte	RL	ICB 160-123936/8 05/27/2014 10:10		CCB 160-123936/20 05/27/2014 10:13					
		Found	C	Found	C	Found	C	Found	C
Mercury	0.20	0.060	U	0.060	U				

Italicized analytes were not requested for this sequence.

3-IN
INSTRUMENT BLANKS
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Concentration Units: ug/L

Analyte	RL	ICB 160-124146/8 05/28/2014 09:17		CCB 160-124146/20 05/28/2014 09:53		CCB 160-124146/23 05/28/2014 10:00			
		Found	C	Found	C	Found	C	Found	C
Mercury	0.20	0.060	U	0.060	U	0.060	U		

Italicized analytes were not requested for this sequence.

3-IN
METHOD BLANK
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Concentration Units: mg/Kg Lab Sample ID: MB 160-122752/1-A

Instrument Code: ICP6500 Batch No.: 123642

CAS No.	Analyte	Concentration	C	Q	Method
7429-90-5	Aluminum	3.8	U		6010C
7440-36-0	Antimony	0.27	U		6010C
7440-38-2	Arsenic	0.21	U		6010C
7440-39-3	Barium	0.097	U		6010C
7440-41-7	Beryllium	0.066	U		6010C
7440-43-9	Cadmium	0.030	U		6010C
7440-70-2	Calcium	5.9	U		6010C
7440-47-3	Chromium	0.12	U		6010C
7440-48-4	Cobalt	0.13	U		6010C
7440-50-8	Copper	0.22	U		6010C
7439-89-6	Iron	1.8	U		6010C
7439-92-1	Lead	0.11	U		6010C
7439-95-4	Magnesium	2.8	U		6010C
7439-96-5	Manganese	0.071	U		6010C
7440-02-0	Nickel	0.10	U		6010C
7440-09-7	Potassium	64	U		6010C
7782-49-2	Selenium	0.18	U		6010C
7440-22-4	Silver	0.062	U		6010C
7440-23-5	Sodium	6.7	U		6010C
7440-28-0	Thallium	0.17	U		6010C
7440-62-2	Vanadium	0.45	U		6010C
7440-66-6	Zinc	1.49	J		6010C

3-IN
METHOD BLANK
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Concentration Units: ug/L Lab Sample ID: MB 160-122863/1-A

Instrument Code: ICP6500 Batch No.: 123642

CAS No.	Analyte	Concentration	C	Q	Method
7429-90-5	Aluminum	22	U		6010C
7440-36-0	Antimony	3.7	U		6010C
7440-38-2	Arsenic	1.8	U		6010C
7440-39-3	Barium	2.1	U		6010C
7440-41-7	Beryllium	0.28	U		6010C
7440-43-9	Cadmium	0.34	U		6010C
7440-70-2	Calcium	54	U		6010C
7440-47-3	Chromium	3.4	U		6010C
7440-48-4	Cobalt	2.7	U		6010C
7440-50-8	Copper	2.1	U		6010C
7439-89-6	Iron	13	U		6010C
7439-92-1	Lead	0.60	U		6010C
7439-95-4	Magnesium	51	U		6010C
7439-96-5	Manganese	1.0	U		6010C
7440-02-0	Nickel	2.6	U		6010C
7440-09-7	Potassium	460	U		6010C
7782-49-2	Selenium	2.1	U		6010C
7440-22-4	Silver	0.99	U		6010C
7440-23-5	Sodium	110	U		6010C
7440-28-0	Thallium	2.4	U		6010C
7440-62-2	Vanadium	4.4	U		6010C
7440-66-6	Zinc	8.3	U		6010C

3-IN
METHOD BLANK
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Concentration Units: ug/L Lab Sample ID: MB 160-123407/1-A

Instrument Code: HAA2 Batch No.: 123936

CAS No.	Analyte	Concentration	C	Q	Method
7439-97-6	Mercury	0.060	U		7470A

3-IN
METHOD BLANK
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Concentration Units: mg/Kg Lab Sample ID: MB 160-123919/1-A

Instrument Code: HAA2 Batch No.: 124146

CAS No.	Analyte	Concentration	C	Q	Method
7439-97-6	Mercury	0.010	U		7471B

4A-IN
INTERFERENCE CHECK STANDARD
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Lab Sample ID: ICSA 160-123642/8 Instrument ID: ICP6500

Lab File ID: 052214C1a.asc ICS Source: ICPC MIX ICSA_00037

Concentration Units: ug/L

Analyte	True Solution A	Found Solution A	Percent Recovery
Aluminum	**100000**	**102300**	**102**
Antimony		**5.40**	
Arsenic		**0.0000**	
Barium		**0.500**	
Beryllium		**0.0000**	
Cadmium		**0.0000**	
Calcium	**100000**	**98980**	**99**
Chromium		**9.20**	
Cobalt		**2.20**	
Copper		**0.0000**	
Iron	**100000**	**99200**	**99**
Lead		**2.40**	
Magnesium	**100000**	**100700**	**101**
Manganese		**5.00**	
Nickel		**1.60**	
Potassium	**100000**	**102500**	**103**
Selenium		**0.600**	
Silver		**0.200**	
Sodium	**100000**	**97390**	**97**
Thallium		**0.0000**	
Vanadium		**0.0000**	
Zinc		**0.0000**	

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

FORM IVA-IN

4A-IN
INTERFERENCE CHECK STANDARD
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Lab Sample ID: ICSAB 160-123642/9 Instrument ID: ICP6500

Lab File ID: 052214C1a.asc ICS Source: ICPC MIX AB_00041

Concentration Units: ug/L

Analyte	True Solution AB	Found Solution AB	Percent Recovery
Aluminum	**100000**	**103200**	**103**
Antimony	**500**	**496**	**99**
Arsenic	**2500**	**2503**	**100**
Barium	**2500**	**2581**	**103**
Beryllium	**2500**	**2564**	**103**
Cadmium	**2500**	**2524**	**101**
Calcium	**100000**	**96300**	**96**
Chromium	**2500**	**2462**	**98**
Cobalt	**2500**	**2435**	**97**
Copper	**2500**	**2505**	**100**
Iron	**100000**	**97360**	**97**
Lead	**2500**	**2472**	**99**
Magnesium	**100000**	**98640**	**99**
Manganese	**2500**	**2470**	**99**
Nickel	**2500**	**2468**	**99**
Potassium	**100000**	**103600**	**104**
Selenium	**500**	**506**	**101**
Silver	**500**	**492**	**98**
Sodium	**100000**	**102600**	**103**
Thallium	**500**	**492**	**98**
Vanadium	**2500**	**2458**	**98**
Zinc	**2500**	**2534**	**101**

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

FORM IVA-IN

5A-IN
MATRIX SPIKE SAMPLE RECOVERY
METALS

Client ID: 2222-SD01 MS
Lab ID: 160-6694-1 MS
Lab Name: TestAmerica St. Louis
Job No.: 160-6694-1
SDG No.:
Matrix: Solid
Concentration Units: mg/Kg
% Solids: 72.3

Analyte	SSR	C	Sample Result (SR)	C	Spike Added (SA)	%R	Control Limit %R	Q	Method
Aluminum	13800		10000		1200	299	75-125	4	6010C
Antimony	36.2		4.1	U	60.0	60	75-125	F1	6010C
Arsenic	127		4.2	J	120	103	75-125		6010C
Barium	236		150		120	71	75-125	F1	6010C
Beryllium	122		1.0	U	120	101	75-125		6010C
Cadmium	131		0.80	J	120	108	75-125		6010C
Calcium	6280		5200		1200	90	75-125	4	6010C
Chromium	169		44		120	104	75-125		6010C
Cobalt	146		10	J	120	113	75-125		6010C
Copper	169		41		120	106	75-125		6010C
Iron	17000		16000		1200	54	75-125	4	6010C
Lead	234		120		120	92	75-125		6010C
Magnesium	5850		5000		1200	69	75-125	4	6010C
Manganese	327		220		120	93	75-125		6010C
Nickel	157		20	J	120	114	75-125		6010C
Potassium	2450	J	1100	J	1200	114	75-125		6010C
Selenium	60.6		2.7	U	60.0	101	75-125		6010C
Silver	25.9		0.93	U	24.0	108	75-125		6010C
Sodium	1380		150	J	1200	102	75-125		6010C
Thallium	27.7		2.5	U	24.0	116	75-125		6010C
Vanadium	154		24	J	120	109	75-125		6010C
Zinc	267		170		120	80	75-125		6010C

SSR = Spiked Sample Result

Calculations are performed before rounding to avoid round-off errors in calculated results.
Note - Results and Reporting Limits have been adjusted for dry weight.

FORM VA - IN

5A-IN
MATRIX SPIKE SAMPLE RECOVERY
METALS

Client ID: 2222-SD06 MS
Lab ID: 160-6694-6 MS
Lab Name: TestAmerica St. Louis
Job No.: 160-6694-1
SDG No.:
Matrix: Solid
Concentration Units: mg/Kg
% Solids: 54.9

Analyte	SSR C		Sample Result (SR) C		Spike Added (SA)	%R	Control Limit %R	Q	Method
Mercury	1.59		0.24		1.47	92	80-120		7471B

SSR = Spiked Sample Result

Calculations are performed before rounding to avoid round-off errors in calculated results.
Note - Results and Reporting Limits have been adjusted for dry weight.

FORM VA - IN

5A-IN
MATRIX SPIKE SAMPLE RECOVERY
METALS

Client ID: 2222-RIN-01 MS
Lab ID: 160-6694-7 MS
Lab Name: TestAmerica St. Louis
Job No.: 160-6694-1
SDG No.:
Matrix: Water
Concentration Units: ug/L
% Solids:

Analyte	SSR	C	Sample Result (SR)	C	Spike Added (SA)	%R	Control Limit %R	Q	Method
Mercury	5.11		0.060	U	5.00	102	80-120		7470A

SSR = Spiked Sample Result

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

FORM VA - IN

5A-IN
MATRIX SPIKE DUPLICATE SAMPLE RECOVERY
METALS

Client ID: 2222-SD01 MSD
Lab ID: 160-6694-1 MSD
Lab Name: TestAmerica St. Louis
Job No.: 160-6694-1
SDG No.:
Matrix: Solid
Concentration Units: mg/Kg
% Solids: 72.3

Analyte	(SDR)	C	Spike Added (SA)	%R	Control Limit %R	RPD	RPD Limit	Q	Method
Aluminum	15500		1360	388	75-125	12	30	4	6010C
Antimony	41.1		68.2	60	75-125	12	30	F1	6010C
Arsenic	149		136	106	75-125	15	30		6010C
Barium	268		136	86	75-125	13	30		6010C
Beryllium	141		136	103	75-125	15	30		6010C
Cadmium	149		136	108	75-125	13	30		6010C
Calcium	4860		1360	-25	75-125	25	30	F1	6010C
Chromium	184		136	103	75-125	8	30		6010C
Cobalt	164		136	112	75-125	11	30		6010C
Copper	184		136	105	75-125	9	30		6010C
Iron	17000		1360	44	75-125	0	30	4	6010C
Lead	245		136	88	75-125	4	30		6010C
Magnesium	5780		1360	56	75-125	1	30	F1	6010C
Manganese	325		136	81	75-125	1	30		6010C
Nickel	177		136	115	75-125	12	30		6010C
Potassium	2650	J	1360	116	75-125	8	30		6010C
Selenium	72.4		68.2	106	75-125	18	30		6010C
Silver	28.8		27.3	106	75-125	10	30		6010C
Sodium	1570		1360	104	75-125	13	30		6010C
Thallium	32.6		27.3	120	75-125	16	30		6010C
Vanadium	173		136	110	75-125	12	30		6010C
Zinc	278		136	78	75-125	4	30		6010C

SDR = Sample Duplicate Result

Calculations are performed before rounding to avoid round-off errors in calculated results.
Note - Results and Reporting Limits have been adjusted for dry weight.

FORM VD - IN

5A-IN
MATRIX SPIKE DUPLICATE SAMPLE RECOVERY
METALS

Client ID: 2222-SD06 MSD
Lab ID: 160-6694-6 MSD
Lab Name: TestAmerica St. Louis
Job No.: 160-6694-1
SDG No.:
Matrix: Solid
Concentration Units: mg/Kg
% Solids: 54.9

Analyte	(SDR) C		Spike Added (SA)	%R	Control Limit %R	RPD	RPD Limit	Q	Method
Mercury	1.36		1.32	84	80-120	16	30		7471B

SDR = Sample Duplicate Result

Calculations are performed before rounding to avoid round-off errors in calculated results.
Note - Results and Reporting Limits have been adjusted for dry weight.

FORM VD - IN

5A-IN
MATRIX SPIKE DUPLICATE SAMPLE RECOVERY
METALS

Client ID: 2222-RIN-01 MSD
Lab ID: 160-6694-7 MSD
Lab Name: TestAmerica St. Louis
Job No.: 160-6694-1
SDG No.:
Matrix: Water
Concentration Units: ug/L
% Solids:

Analyte	(SDR) C		Spike Added (SA)	%R	Control Limit %R	RPD	RPD Limit	Q	Method
Mercury	5.05		5.00	101	80-120	1	20		7470A

SDR = Sample Duplicate Result

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

FORM VD - IN

LINEAR RANGE CHECK STANDARD
METALS -

Lab ID: LRC 160-123642/10

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

Sample Matrix: Water LCS Source: ICP CAL3\LRC_00010

Analyte	Water(ug/L)							
	True	Found	C	%R	Limits		Q	Method
Aluminum	100000	104000		104	90	110		6010C
Antimony	2000	2040		102	90	110		6010C
Arsenic	10000	10100		101	90	110		6010C
Barium	10000	10100		101	90	110		6010C
Beryllium	10000	9940		99	90	110		6010C
Cadmium	10000	10200		102	90	110		6010C
Calcium	100000	98400		98	90	110		6010C
Chromium	10000	9930		99	90	110		6010C
Cobalt	10000	9810		98	90	110		6010C
Copper	10000	10200		102	90	110		6010C
Iron	100000	99000		99	90	110		6010C
Lead	10000	9980		100	90	110		6010C
Magnesium	100000	101000		101	90	110		6010C
Manganese	10000	10000		100	90	110		6010C
Nickel	10000	10000		100	90	110		6010C
Potassium	100000	104000		104	90	110		6010C
Selenium	2000	2030		101	90	110		6010C
Silver	2000	2000		100	90	110		6010C
Sodium	100000	102000		102	90	110		6010C
Thallium	2000	1950		98	90	110		6010C
Vanadium	10000	9870		99	90	110		6010C
Zinc	10000	10000		100	90	110		6010C

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

7A-IN
LAB CONTROL SAMPLE
METALS

Lab ID: LCS 160-122863/2-A

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

Sample Matrix: Water LCS Source: PREP 1 and 2_00002

Analyte	Water(ug/L)							
	True	Found	C	%R	Limits		Q	Method
Aluminum	10000	11000		110	80	120		6010C
Antimony	500	540		108	80	120		6010C
Arsenic	1000	1080		108	80	120		6010C
Barium	1000	1090		109	80	120		6010C
Beryllium	1000	1070		107	80	120		6010C
Cadmium	1000	1110		111	80	120		6010C
Calcium	10000	11100		111	80	120		6010C
Chromium	1000	1110		111	80	120		6010C
Cobalt	1000	1110		111	80	120		6010C
Copper	1000	1150		115	80	120		6010C
Iron	10000	10800		108	80	120		6010C
Lead	1000	1140		114	80	120		6010C
Magnesium	10000	9980		100	80	120		6010C
Manganese	1000	1080		108	80	120		6010C
Nickel	1000	1150		115	80	120		6010C
Potassium	10000	11500		115	80	120		6010C
Selenium	500	542		108	80	120		6010C
Silver	200	211		106	80	120		6010C
Sodium	10000	11700		117	80	120		6010C
Thallium	200	238		119	80	120		6010C
Vanadium	1000	1060		106	80	120		6010C
Zinc	1000	1110		111	80	120		6010C

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

FORM VIIA - IN

7A-IN
LCS-CERTIFIED REFERENCE MATERIAL
METALS

Lab ID: LCSSRM 160-122752/2-A

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

Sample Matrix: Solid LCS Source: PR_LCSSRM_00004

Analyte	Solid(mg/Kg)							
	True	Found	C	%R	Limits		Q	Method
Aluminum	9390	6720		71.6	43.5	156.5		6010C
Antimony	129	80.3		62.2	22.4	249.6		6010C
Arsenic	88.4	87.7		99.3	69.0	131.2		6010C
Barium	210	190		90.7	73.3	126.7		6010C
Beryllium	55.8	54.0		96.8	73.1	127.1		6010C
Cadmium	142	148		104.3	73.2	128.2		6010C
Calcium	7530	8030		106.6	74.6	125.4		6010C
Chromium	86.8	90.8		104.6	69.1	131.3		6010C
Cobalt	199	217		109.1	74.4	125.6		6010C
Copper	268	271		101.2	76.1	123.9		6010C
Iron	12800	10400		81.4	31.6	168.0		6010C
Lead	97.9	104		105.9	70.8	128.7		6010C
Magnesium	2850	2480		86.9	65.3	134.7		6010C
Manganese	425	413		97.1	76.2	123.5		6010C
Nickel	236	256		108.7	74.2	128.0		6010C
Potassium	2570	2110		82.2	61.1	138.9		6010C
Selenium	127	126		99.4	66.6	133.9		6010C
Silver	66.2	65.3		98.6	67.1	132.9		6010C
Sodium	1040	965		92.8	60.4	139.4		6010C
Thallium	140	162		115.9	68.3	132.1		6010C
Vanadium	156	145		92.7	71.8	129.5		6010C
Zinc	130	130		99.9	66.9	133.1		6010C

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

FORM VIIA - IN

7A-IN
LAB CONTROL SAMPLE
METALS

Lab ID: LCS 160-123407/2-A

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

Sample Matrix: Water LCS Source: Hg Curve Int._00401

Analyte	Water(ug/L)							
	True	Found	C	%R	Limits		Q	Method
Mercury	5.00	4.74		95	80	120		7470A

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

FORM VIIA - IN

7A-IN
LCS-CERTIFIED REFERENCE MATERIAL
METALS

Lab ID: LCSSRM 160-123919/2-A

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

Sample Matrix: Solid LCS Source: PR_LCSSRM_00006

Analyte	Solid(mg/Kg)							
	True	Found	C	%R	Limits		Q	Method
Mercury	9.03	7.70		85.3	51.3	148.4		7471B

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

FORM VIIA - IN

8-IN
ICP-AES AND ICP-MS SERIAL DILUTIONS
METALS

Lab ID: 160-6694-1

SDG No:

Lab Name: TestAmerica St. Louis Job No: 160-6694-1

Matrix: Solid Concentration Units: mg/Kg

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	Method
Aluminum	10000		9590		6.0		6010C
Antimony	4.1	U	21	U	NC		6010C
Arsenic	4.2	J	16	U	NC		6010C
Barium	150		142	J	6.4		6010C
Beryllium	1.0	U	5.0	U	NC		6010C
Cadmium	0.80	J	2.3	U	NC		6010C
Calcium	5200		4920	J	5.3		6010C
Chromium	44		48.4	J	NC		6010C
Cobalt	10	J	11.3	J	NC		6010C
Copper	41		27.9	J	NC		6010C
Iron	16000		15500		5.8		6010C
Lead	120		118		5.1		6010C
Magnesium	5000		4760	J	5.1		6010C
Manganese	220		201		6.7		6010C
Nickel	20	J	18.6	J	NC		6010C
Potassium	1100	J	4800	U	NC		6010C
Selenium	2.7	U	14	U	NC		6010C
Silver	0.93	U	4.6	U	NC		6010C
Sodium	150	J	510	U	NC		6010C
Thallium	2.5	U	13	U	NC		6010C
Vanadium	24	J	34	U	NC		6010C
Zinc	170		189	J	NC		6010C

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

FORM VIII-IN

8-IN
ICP-AES AND ICP-MS SERIAL DILUTIONS
METALS

Lab ID: 160-6694-6

SDG No:

Lab Name: TestAmerica St. Louis Job No: 160-6694-1

Matrix: Solid Concentration Units: mg/Kg

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	Method
Mercury	0.24		0.197	J	NC		7471B

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

FORM VIII-IN

8-IN
ICP-AES AND ICP-MS SERIAL DILUTIONS
METALS

Lab ID: 160-6694-7

SDG No:

Lab Name: TestAmerica St. Louis Job No: 160-6694-1

Matrix: Water Concentration Units: ug/L

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	Method
Mercury	0.060	U	0.30	U	NC		7470A

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

FORM VIII-IN

9-IN
DETECTION LIMITS
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Water Instrument ID: ICP6500

Method: 6010C MDL Date: 03/19/2014 10:27

Prep Method: 3010A

Analyte	Wavelength/ Mass	RL (ug/L)	MDL (ug/L)
Aluminum		200	22.4
Antimony		10	3.74
Arsenic		10	1.78
Barium		50	2.12
Beryllium		5	0.283
Cadmium		5	0.336
Calcium		1000	54.2
Chromium		10	3.35
Cobalt		50	2.72
Copper		25	2.1
Iron		100	12.8
Lead		10	0.598
Magnesium		1000	50.5
Manganese		15	1
Nickel		40	2.57
Potassium		5000	456
Selenium		15	2.08
Silver		10	0.994
Sodium		1000	105
Thallium		20	2.38
Vanadium		50	4.39
Zinc		20	8.32

9-IN
CALIBRATION BLANK DETECTION LIMITS
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Water Instrument ID: ICP6500

Method: 6010C XMDL Date: 03/19/2014 10:24

Analyte	Wavelength/ Mass	XRL (ug/L)	XMDL (ug/L)
Aluminum		200	22.4
Antimony		10	3.74
Arsenic		10	1.78
Barium		50	2.12
Beryllium		5	0.283
Cadmium		5	0.336
Calcium		1000	54.2
Chromium		10	3.35
Cobalt		50	2.72
Copper		25	2.1
Iron		100	12.8
Lead		10	0.598
Magnesium		1000	50.5
Manganese		15	1
Nickel		40	2.57
Potassium		5000	456
Selenium		15	2.08
Silver		10	0.994
Sodium		1000	105
Thallium		20	2.38
Vanadium		50	4.39
Zinc		20	8.32

9-IN
DETECTION LIMITS
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Solid Instrument ID: ICP6500

Method: 6010C MDL Date: 03/19/2014 11:22

Prep Method: 3050B

Analyte	Wavelength/ Mass	RL (mg/Kg)	MDL (mg/Kg)
Aluminum		20	4.26
Antimony		1	0.309
Arsenic		1	0.236
Barium		5	0.11
Beryllium		0.5	0.075
Cadmium		0.5	0.034
Calcium		250	6.73
Chromium		1	0.138
Cobalt		5	0.144
Copper		2.5	0.245
Iron		10	1.99
Lead		1	0.129
Magnesium		100	3.16
Manganese		1	0.08
Nickel		4	0.116
Potassium		500	72.4
Selenium		1.5	0.206
Silver		1	0.07
Sodium		100	7.62
Thallium		2	0.19
Vanadium		5	0.507
Zinc		5	0.562

9-IN
CALIBRATION BLANK DETECTION LIMITS
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Solid Instrument ID: ICP6500

Method: 6010C XMDL Date: 03/19/2014 10:24

Analyte	Wavelength/ Mass	XRL (ug/L)	XMDL (ug/L)
Aluminum		200	22.4
Antimony		10	3.74
Arsenic		10	1.78
Barium		50	2.12
Beryllium		5	0.283
Cadmium		5	0.336
Calcium		1000	54.2
Chromium		10	3.35
Cobalt		50	2.72
Copper		25	2.1
Iron		100	12.8
Lead		10	0.598
Magnesium		1000	50.5
Manganese		15	1
Nickel		40	2.57
Potassium		5000	456
Selenium		15	2.08
Silver		10	0.994
Sodium		1000	105
Thallium		20	2.38
Vanadium		50	4.39
Zinc		20	8.32

9-IN
DETECTION LIMITS
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Water Instrument ID: HAA2

Method: 7470A MDL Date: 06/28/2011 19:17

Prep Method: 7470A

Analyte	Wavelength/ Mass	RL (ug/L)	MDL (ug/L)
Mercury		0.2	0.06

9-IN
CALIBRATION BLANK DETECTION LIMITS
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Water Instrument ID: HAA2

Method: 7470A XMDL Date: 06/28/2011 19:19

Analyte	Wavelength/ Mass	XRL (ug/L)	XMDL (ug/L)
Mercury		0.2	0.06

9-IN
DETECTION LIMITS
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Solid Instrument ID: HAA2

Method: 7471B MDL Date: 01/15/2011 19:21

Prep Method: 7471B

Analyte	Wavelength/ Mass	RL (mg/Kg)	MDL (mg/Kg)
Mercury		0.033	0.011

9-IN
CALIBRATION BLANK DETECTION LIMITS
METALS

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Solid Instrument ID: HAA2

Method: 7471B XMDL Date: 06/28/2011 19:19

Analyte	Wavelength/ Mass	XRL (ug/L)	XMDL (ug/L)
Mercury		0.2	0.06

11-IN
LINEAR RANGES
METALS

Lab Name: TestAmerica St. Louis Job No: 160-6694-1

SDG No.:

Instrument ID: ICP6500 Date: 09/25/2013 10:39

Analyte	Integ. Time (Sec.)	Concentration (mg/L)	Method
Aluminum		100	6010C
Antimony		2.0	6010C
Arsenic		10	6010C
Barium		10	6010C
Beryllium		10	6010C
Cadmium		10	6010C
Calcium		100	6010C
Chromium		10	6010C
Cobalt		10	6010C
Copper		10	6010C
Iron		100	6010C
Lead		10	6010C
Magnesium		100	6010C
Manganese		10	6010C
Nickel		10	6010C
Potassium		100	6010C
Selenium		2	6010C
Silver		4.0	6010C
Sodium		100	6010C
Thallium		2	6010C
Vanadium		10	6010C
Zinc		10	6010C

11-IN
LINEAR RANGES
METALS

Lab Name: TestAmerica St. Louis Job No: 160-6694-1

SDG No.:

Instrument ID: HAA2 Date: 03/14/2012 13:48

Analyte	Integ. Time (Sec.)	Concentration (ug/L)	Method
Mercury		10	7470A
Mercury		10	7471B

12-IN
PREPARATION LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Prep Method: 3050B

Lab Sample ID	Preparation Date	Prep Batch	Initial Weight (g)	Initial Volume	Final Volume (mL)
MB 160-122752/1-A	05/19/2014 08:37	122752	0.5661		50
LCSSRM 160-122752/2-A	05/19/2014 08:37	122752	0.5603		50
160-6694-1	05/19/2014 08:37	122752	0.5210		50
160-6694-1 MS	05/19/2014 08:37	122752	0.5764		50
160-6694-1 MSD	05/19/2014 08:37	122752	0.5070		50
160-6694-2	05/19/2014 08:37	122752	0.5838		50
160-6694-3	05/19/2014 08:37	122752	0.5380		50
160-6694-4	05/19/2014 08:37	122752	0.5054		50
160-6694-5	05/19/2014 08:37	122752	0.5003		50
160-6694-6	05/19/2014 08:37	122752	0.5887		50

12-IN
PREPARATION LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Prep Method: 3010A

Lab Sample ID	Preparation Date	Prep Batch	Initial Weight	Initial Volume (mL)	Final Volume (mL)
MB 160-122863/1-A	05/19/2014 10:57	122863		50	50
LCS 160-122863/2-A	05/19/2014 10:57	122863		50	50
160-6694-7	05/19/2014 10:57	122863		50	50

12-IN
PREPARATION LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Prep Method: 7470A

Lab Sample ID	Preparation Date	Prep Batch	Initial Weight	Initial Volume (mL)	Final Volume (mL)
MB 160-123407/1-A	05/22/2014 07:51	123407		30	30
LCS 160-123407/2-A	05/22/2014 07:51	123407		30	30
160-6694-7	05/22/2014 07:51	123407		30	30
160-6694-7 MS	05/22/2014 07:51	123407		30	30
160-6694-7 MSD	05/22/2014 07:51	123407		30	30

12-IN
PREPARATION LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Prep Method: 7471B

Lab Sample ID	Preparation Date	Prep Batch	Initial Weight (g)	Initial Volume	Final Volume (mL)
MB 160-123919/1-A	05/27/2014 10:17	123919	0.6630		100
LCSSRM 160-123919/2-A	05/27/2014 10:17	123919	0.6576		100
160-6694-1	05/27/2014 10:17	123919	0.6750		100
160-6694-2	05/27/2014 10:17	123919	0.5543		100
160-6694-3	05/27/2014 10:17	123919	0.6151		100
160-6694-4	05/27/2014 10:17	123919	0.6591		100
160-6694-5	05/27/2014 10:17	123919	0.6784		100
160-6694-6	05/27/2014 10:17	123919	0.6474		100
160-6694-6 MS	05/27/2014 10:17	123919	0.6210		100
160-6694-6 MSD	05/27/2014 10:17	123919	0.6881		100

13-IN
ANALYSIS RUN LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Instrument ID: ICP6500 Analysis Method: 6010C

Start Date: 05/22/2014 10:24 End Date: 05/22/2014 20:41

Lab Sample Id	D/F	Type	Time	Analytes																													
				Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Tl	V	Zn								
ICIS 160-123642/1	1		10:24	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
IC 160-123642/2			10:28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
IC 160-123642/3			10:32	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
IC 160-123642/4			10:36	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
ICV 160-123642/5	1		10:40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
ICB 160-123642/6	1		10:44	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
CRI 160-123642/7	1		10:48	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
ICSA 160-123642/8	1		10:51	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
ICSAB 160-123642/9	1		10:55	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
LRC 160-123642/10	1		10:59	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
CCV 160-123642/11	1		11:03	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
CCB 160-123642/12	1		11:07	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
ZZZZZZ			11:11																														
ZZZZZZ			11:15																														
ZZZZZZ			11:19																														
ZZZZZZ			11:22																														
ZZZZZZ			11:26																														
ZZZZZZ			11:30																														
ZZZZZZ			11:34																														
ZZZZZZ			11:37																														
ZZZZZZ			11:41																														
CCV 160-123642/22			11:45																														
CCB 160-123642/23			11:48																														
ZZZZZZ			12:00																														
ZZZZZZ			12:04																														
ZZZZZZ			12:07																														
ZZZZZZ			12:11																														
ZZZZZZ			12:15																														
ZZZZZZ			12:19																														
ZZZZZZ			12:22																														
ZZZZZZ			12:26																														
ZZZZZZ			12:30																														
ZZZZZZ			12:34																														
CCV 160-123642/34	1		12:37	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
CCB 160-123642/35	1		12:41	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
MB 160-122863/1-A	1	T	12:45	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
LCS 160-122863/2-A	1	T	12:49	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
ZZZZZZ			12:53																														
ZZZZZZ			12:56																														
ZZZZZZ			13:00																														
ZZZZZZ			13:04																														
ZZZZZZ			13:07																														

FORM XIII-IN

13-IN
ANALYSIS RUN LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Instrument ID: ICP6500 Analysis Method: 6010C

Start Date: 05/22/2014 10:24 End Date: 05/22/2014 20:41

Lab Sample Id	D/F	Type	Time	Analytes																											
				Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Tl	V	Zn						
ZZZZZZ			13:11																												
160-6694-7	1	T	13:15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
ZZZZZZ			13:19																												
CCV 160-123642/46	1		13:23	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
CCB 160-123642/47	1		13:27	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
ZZZZZZ			13:31																												
ZZZZZZ			13:34																												
ZZZZZZ			13:38																												
ZZZZZZ			13:42																												
ZZZZZZ			13:46																												
ZZZZZZ			13:50																												
ZZZZZZ			13:54																												
ZZZZZZ			13:58																												
ZZZZZZ			14:02																												
ZZZZZZ			14:06																												
CCV 160-123642/58			14:10																												
CCB 160-123642/59			14:14																												
ZZZZZZ			14:18																												
ZZZZZZ			14:22																												
ZZZZZZ			14:26																												
ZZZZZZ			14:29																												
ZZZZZZ			14:33																												
ZZZZZZ			14:37																												
ZZZZZZ			14:41																												
ZZZZZZ			14:44																												
ZZZZZZ			14:48																												
ZZZZZZ			14:52																												
CCV 160-123642/70	1		14:56	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
CCB 160-123642/71	1		15:00	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
ZZZZZZ			15:04																												
ZZZZZZ			15:08																												
ZZZZZZ			15:12																												
ZZZZZZ			15:16																												
ZZZZZZ			15:20																												
MB 160-122752/1-A	1	T	15:24	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
LCSSRM 160-122752/2-A	2	T	15:28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
160-6694-1	10	T	15:31	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
160-6694-1 SD	50	T	15:35	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
160-6694-1 MS	10	T	15:39	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
CCV 160-123642/82	1		15:43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
CCB 160-123642/83	1		15:46	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
160-6694-1 MSD	10	T	15:50	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						

FORM XIII-IN

13-IN
ANALYSIS RUN LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Instrument ID: ICP6500 Analysis Method: 6010C

Start Date: 05/22/2014 10:24 End Date: 05/22/2014 20:41

Lab Sample Id	D/F	Type	Time	Analytes																											
				Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Tl	V	Zn				
160-6694-2	10	T	15:54	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
160-6694-3	10	T	15:58	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
160-6694-4	10	T	16:02	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
160-6694-5	10	T	16:06	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
160-6694-6	10	T	16:10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
ZZZZZZ			16:13																												
ZZZZZZ			16:17																												
ZZZZZZ			16:21																												
ZZZZZZ			16:25																												
CCV 160-123642/94	1		16:29	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
CCB 160-123642/95	1		16:33	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
ZZZZZZ			16:37																												
ZZZZZZ			16:41																												
ZZZZZZ			16:44																												
ZZZZZZ			16:48																												
ZZZZZZ			16:52																												
ZZZZZZ			16:55																												
ZZZZZZ			16:59																												
ZZZZZZ			17:03																												
ZZZZZZ			17:06																												
ZZZZZZ			17:10																												
CCV 160-123642/106			17:14																												
CCB 160-123642/107			17:18																												
ZZZZZZ			17:22																												
ZZZZZZ			17:25																												
ZZZZZZ			17:29																												
ZZZZZZ			17:33																												
ZZZZZZ			17:37																												
ZZZZZZ			17:40																												
ZZZZZZ			17:44																												
ZZZZZZ			17:48																												
ZZZZZZ			17:52																												
ZZZZZZ			17:55																												
CCV 160-123642/118			17:59																												
CCB 160-123642/119			18:03																												
ZZZZZZ			18:07																												
ZZZZZZ			18:10																												
ZZZZZZ			18:14																												
ZZZZZZ			18:18																												
ZZZZZZ			18:22																												
ZZZZZZ			18:25																												
ZZZZZZ			18:29																												

FORM XIII-IN

13-IN
ANALYSIS RUN LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Instrument ID: ICP6500 Analysis Method: 6010C

Start Date: 05/22/2014 10:24 End Date: 05/22/2014 20:41

Lab Sample Id	D/F	Type	Time	Analytes																											
				Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Tl	V	Zn				
ZZZZZZ			18:33																												
ZZZZZZ			18:36																												
ZZZZZZ			18:40																												
CCV 160-123642/130			18:44																												
CCB 160-123642/131			18:48																												
ZZZZZZ			18:52																												
ZZZZZZ			18:56																												
ZZZZZZ			19:00																												
ZZZZZZ			19:03																												
ZZZZZZ			19:07																												
ZZZZZZ			19:11																												
ZZZZZZ			19:15																												
ZZZZZZ			19:18																												
ZZZZZZ			19:22																												
ZZZZZZ			19:26																												
CCV 160-123642/142			19:30																												
CCB 160-123642/143			19:33																												
ZZZZZZ			19:37																												
ZZZZZZ			19:41																												
ZZZZZZ			19:45																												
ZZZZZZ			19:49																												
ZZZZZZ			19:53																												
ZZZZZZ			19:56																												
ZZZZZZ			20:00																												
ZZZZZZ			20:04																												
ZZZZZZ			20:08																												
ZZZZZZ			20:11																												
CCV 160-123642/154			20:15																												
CCB 160-123642/155			20:19																												
ZZZZZZ			20:23																												
ZZZZZZ			20:27																												
ZZZZZZ			20:30																												
ZZZZZZ			20:34																												
CCV 160-123642/160			20:38																												
CCB 160-123642/161			20:41																												

Prep Types:
T = Total/NA

FORM XIII-IN

13-IN
ANALYSIS RUN LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Instrument ID: HAA2 Analysis Method: 7470A

Start Date: 05/27/2014 10:10 End Date: 05/27/2014 10:13

Lab Sample Id	D/F	Type	Time	Analytes																								
				Hg																								
IC 160-123936/1			10:10	X																								
IC 160-123936/2			10:10	X																								
IC 160-123936/3			10:10	X																								
IC 160-123936/4			10:10	X																								
IC 160-123936/5			10:10	X																								
IC 160-123936/6			10:10	X																								
ICV 160-123936/7	1		10:10	X																								
ICB 160-123936/8	1		10:10	X																								
MB 160-123407/1-A	1	T	10:12	X																								
LCS 160-123407/2-A	1	T	10:12	X																								
160-6694-7	1	T	10:12	X																								
160-6694-7 SD	5	T	10:12	X																								
160-6694-7 MS	1	T	10:12	X																								
160-6694-7 MSD	1	T	10:12	X																								
ZZZZZZ			10:12																									
ZZZZZZ			10:12																									
ZZZZZZ			10:12																									
ZZZZZZ			10:12																									
CCV 160-123936/19	1		10:12	X																								
CCB 160-123936/20	1		10:13	X																								
ZZZZZZ			10:13																									
ZZZZZZ			10:13																									
ZZZZZZ			10:13																									
ZZZZZZ			10:13																									
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ZZZZZZ			10:13																									
ZZZZZZ			10:13																									
CCV 160-123936/31			10:13																									
CCB 160-123936/32			10:13																									
ZZZZZZ			10:13																									
ZZZZZZ			10:13																									
CCV 160-123936/35			10:13																									
CCB 160-123936/36			10:13																									

Prep Types:
T = Total/NA

FORM XIII-IN

13-IN
ANALYSIS RUN LOG
METALS

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Instrument ID: HAA2 Analysis Method: 7471B

Start Date: 05/28/2014 09:02 End Date: 05/28/2014 10:00

Lab Sample Id	D/F	Type	Time	Analytes																								
				Hg																								
IC 160-124146/1			09:02	X																								
IC 160-124146/2			09:04	X																								
IC 160-124146/3			09:05	X																								
IC 160-124146/4			09:07	X																								
IC 160-124146/5			09:10	X																								
IC 160-124146/6			09:12	X																								
ICV 160-124146/7	1		09:14	X																								
ICB 160-124146/8	1		09:17	X																								
MB 160-123919/1-A	1	T	09:31	X																								
LCSSRM 160-123919/2-A	10	T	09:33	X																								
160-6694-1	1	T	09:35	X																								
160-6694-2	1	T	09:37	X																								
160-6694-3	1	T	09:39	X																								
160-6694-4	1	T	09:41	X																								
160-6694-5	1	T	09:43	X																								
160-6694-6	1	T	09:45	X																								
160-6694-6 SD	5	T	09:47	X																								
160-6694-6 MS	1	T	09:49	X																								
CCV 160-124146/19	1		09:51	X																								
CCB 160-124146/20	1		09:53	X																								
160-6694-6 MSD	1	T	09:56	X																								
CCV 160-124146/22	1		09:58	X																								
CCB 160-124146/23	1		10:00	X																								

Prep Types:
T = Total/NA

FORM XIII-IN

FC 5/23/14

ABATCH: 123642

File: 052214C1

	Pos ID	Rack	Row	Col	Type	Samplename	Comment	Custom ID1	Custom ID2	Custom ID3
1	1001	3	1	1	Unk	~~160-6588-D-7-A~~	~~DF=2~~			
2	1002	3	1	2	Unk	MB 160-119594/1-A				
3	1003	3	1	3	Unk	LCS 160-119594/2-				
4	1004	3	1	4	Unk	160-6426-A-1-B	DF=5			
5	1005	3	1	5	Unk	160-6426-A-1-B SD	DF=25			
6	1006	3	1	6	Unk	160-6426-A-1-C MS	DF=5			
7	1007	3	1	7	Unk	160-6426-A-1-D MS	DF=5			
8	1008	3	1	8	Unk	160-6426-A-2-B	DF=5			
9	1009	3	1	9	Unk	~~160-6426-A-2-B PD~~	~~DF=5~~			
10	1010	3	1	10	Unk	MB 160-122861/1-A				
11	1011	3	1	11	Unk	~~LCS 160-122861/2-~~				
12	1012	3	1	12	Unk	160-6677-D-2-A				
13	1013	3	1	13	Unk	160-6677-D-2-A SD	DF=5			
14	1014	3	1	14	Unk	160-6677-D-2-B MS				
15	1015	3	1	15	Unk	160-6677-D-2-C MS				
16	1016	3	2	1	Unk	160-6677-A-3-A				
17	1017	3	2	2	Unk	160-6677-D-6-A				
18	1018	3	2	3	Unk	160-6677-D-8-A				
19	1019	3	2	4	Unk	160-6677-C-11-A				
20	1020	3	2	5	Unk	MB 160-122863/1-A				
21	1021	3	2	6	Unk	LCS 160-122863/2-				
22	1022	3	2	7	Unk	160-6679-E-2-A				
23	1023	3	2	8	Unk	160-6679-E-2-A SD	DF=5			
24	1024	3	2	9	Unk	160-6679-E-2-B MS				
25	1025	3	2	10	Unk	160-6679-E-2-C MS				
26	1026	3	2	11	Unk	160-6679-E-4-A				
27	1027	3	2	12	Unk	160-6679-E-6-A				
28	1028	3	2	13	Unk	160-6694-F-7-A				
29	1029	3	2	14	Unk	LB 160-122888/1-B				
30	1030	3	2	15	Unk	LCS 160-123177/2-				
31	1031	3	3	1	Unk	160-6690-A-1-C				
32	1032	3	3	2	Unk	160-6690-A-1-C SD	DF=5			
33	1033	3	3	3	Unk	160-6690-A-1-D MS				
34	1034	3	3	4	Unk	160-6690-A-1-E MS				
35	1035	3	3	5	Unk	160-6690-A-2-C				
36	1036	3	3	6	Unk	160-6690-A-3-C				
37	1037	3	3	7	Unk	160-6690-A-4-C				
38	1038	3	3	8	Unk	160-6690-A-5-C				
39	1039	3	3	9	Unk	160-6690-A-6-C				
40	1040	3	3	10	Unk	160-6690-A-7-C				
41	1041	3	3	11	Unk	MB 160-122875/1-A				
42	1042	3	3	12	Unk	LCS 160-122875/2-				
43	1043	3	3	13	Unk	160-6714-D-1-A	DF=10			
44	1044	3	3	14	Unk	160-6714-D-1-A SD	DF=50			
45	1045	3	3	15	Unk	160-6714-D-1-B MS	DF=10			
46	1046	3	4	1	Unk	160-6714-D-1-C MS	DF=10			
47	1047	3	4	2	Unk	~~160-6714-H-2-A~~	~~DF=10~~			
48	1048	3	4	3	Unk	160-6714-H-3-A	DF=10			
49	1049	3	4	4	Unk	160-6714-H-4-A	DF=10			
50	1050	3	4	5	Unk	160-6714-H-5-A	DF=10			
51	1051	3	4	6	Unk	160-6714-H-6-A	DF=10			
52	1052	3	4	7	Unk	~~160-6714-H-7-A~~	~~DF=10~~			
53	1053	3	4	8	Unk	160-6714-H-8-A	DF=10			
54	1054	3	4	9	Unk	160-6714-H-9-A	DF=10			
55	1055	3	4	10	Unk	MB 160-122752/1-A				
56	1056	3	4	11	Unk	LCSSRM 160-12275	DF=2			
57	1057	3	4	12	Unk	160-6694-C-1-A	DF=10			
58	1058	3	4	13	Unk	160-6694-C-1-A SD	DF=50			
59	1059	3	4	14	Unk	160-6694-C-1-B MS	DF=10			
60	1060	3	4	15	Unk	160-6694-C-1-C MS	DF=10			
61	1061	3	5	1	Unk	160-6694-C-2-A	DF=10			
62	1062	3	5	2	Unk	160-6694-C-3-A	DF=10			
63	1063	3	5	3	Unk	160-6694-C-4-A	DF=10			

Already reported

-All

No Rerun

-All

-All

-All

rerun w/o Dilution

-All

rerun w/ Dilution

-All

-All

	Pos ID	Rack	Row	Col	Type	Samplename	Comment	Custom ID1	Custom ID2	Custom ID3
64	1064	3	5	4	Unk	160-6694-C-5-A	DF=10			
65	1065	3	5	5	Unk	160-6694-C-6-A	DF=10			
66	1066	3	5	6	Unk	160-6681-D-1-B	DF=10			
67	1067	3	5	7	Unk	LB 160-122248/1-B				
68	1068	3	5	8	Unk	LCS 160-122858/2-				
69	1069	3	5	9	Unk	160-6629-A-1-C				
70	1070	3	5	10	Unk	160-6629-A-1-C SD	DF=5			
71	1071	3	5	11	Unk	160-6629-A-1-D MS				
72	1072	3	5	12	Unk	160-6629-A-1-E MS				
73	1073	3	5	13	Unk	MB 160-123123/1-A				
74	1074	3	5	14	Unk	LCSSRM 160-12312	DF=2			
75	1075	3	5	15	Unk	160-6669-A-1-E	DF=10			
76	1076	3	6	1	Unk	160-6669-A-1-E SD	DF=50			
77	1077	3	6	2	Unk	160-6669-A-2-D	DF=10			
78	1078	3	6	3	Unk	160-6669-A-3-D	DF=10			
79	1079	3	6	4	Unk	160-6669-A-4-D	DF=10			
80	1080	3	6	5	Unk	160-6669-A-5-D	DF=10			
81	1081	3	6	6	Unk	160-6669-A-6-D	DF=10			
82	1082	3	6	7	Unk	160-6669-A-7-D	DF=10			
83	1083	3	6	8	Unk	160-6669-A-8-D	DF=10			
84	1084	3	6	9	Unk	160-6669-A-9-D	DF=10			
85	1085	3	6	10	Unk	160-6669-A-10-D	DF=10			
86	1086	3	6	11	Unk	160-6669-A-11-D	DF=10			
87	1087	3	6	12	Unk	160-6669-A-12-D	DF=10			
88	1088	3	6	13	Unk	160-6669-A-13-D	DF=10			
89	1089	3	6	14	Unk	160-6669-A-14-D	DF=10			
90	1090	3	6	15	Unk	160-6669-A-15-D	DF=10			
91	2001	4	1	1	Unk	160-6669-A-16-D	DF=10			
92	2002	4	1	2	Unk	160-6669-A-17-D	DF=10			
93	2003	4	1	3	Unk	160-6669-A-18-D	DF=10			
94	2004	4	1	4	Unk	160-6669-A-19-D	DF=10			
95	2005	4	1	5	Unk	160-6669-A-20-D	DF=10			
96	2006	4	1	6	Unk	MB 160-122573/1-A				
97	2007	4	1	7	Unk	LCSSRM 160-12257	DF=2			
98	2008	4	1	8	Unk	160-6651-H-1-A	DF=2			
99	2009	4	1	9	Unk	160-6651-H-1-A SD	DF=10			
100	2010	4	1	10	Unk	160-6651-H-3-A	DF=2			
101	2011	4	1	11	Unk	160-6672-A-8-A	DF=20			
102	2012	4	1	12	Unk	160-6672-A-9-A	DF=20			
103	2013	4	1	13	Unk	160-6672-A-10-A	DF=20			
104	2014	4	1	14	Unk	160-6672-A-11-A	DF=20			
105	2015	4	1	15	Unk	MB 160-122574/1-A				
106	2016	4	2	1	Unk	LCSSRM 160-12257	DF=2			
107	2017	4	2	2	Unk	160-6672-A-1-A	DF=20			
108	2018	4	2	3	Unk	160-6672-A-1-A SD	DF=100			
109	2019	4	2	4	Unk	160-6672-A-1-B MS	DF=20			
110	2020	4	2	5	Unk	160-6672-A-1-C MS	DF=20			
111	2021	4	2	6	Unk	160-6672-A-2-A	DF=20			
112	2022	4	2	7	Unk	160-6672-A-3-A	DF=20			
113	2023	4	2	8	Unk	160-6672-A-4-A	DF=20			
114	2024	4	2	9	Unk	160-6672-A-5-A	DF=20			
115	2025	4	2	10	Unk	160-6672-A-6-A	DF=20			
116	2026	4	2	11	Unk	160-6672-A-7-A	DF=20			
117	2027	4	2	12	Unk	MB 160-123259/1-A				
118	2028	4	2	13	Unk	LCSSRM 160-12325	DF=2			
119	2029	4	2	14	Unk	160-6698-D-1-B	DF=2			
120	2030	4	2	15	Unk	160-6698-D-1-B SD	DF=10			
121	2031	4	3	1	Unk	160-6698-D-1-C MS	DF=2			
122	2032	4	3	2	Unk	160-6698-D-1-D MS	DF=2			
123	2033	4	3	3	Unk	160-6698-D-2-B	DF=2			

Element, Wavelength and Order	Date of Fit	Date of Cal.	Type of Fit	Weighting	A0	A1	A2	n (Exponent)
Ag 328.068 {103}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000260	1.175092	0.000000	1.000000
Al 396.152 { 85}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000346	0.221598	0.000000	1.000000
As 189.042 {478}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000054	0.053376	0.000000	1.000000
B 249.678 {135}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000544	0.116070	0.000000	1.000000
Ba 455.403 { 74}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.019573	14.980559	0.000000	1.000000
Be 313.042 {108}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000591	13.564703	0.000000	1.000000
Bi 223.061 {451}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000101	0.060177	0.000000	1.000000
Ca 184.006 {483}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000080	0.089777	0.000000	1.000000
Cd 228.802 {447}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000028	0.945001	0.000000	1.000000
Co 228.616 {448}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000096	0.325702	0.000000	1.000000
Cr 283.563 {119}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.001339	0.153639	0.000000	1.000000
Cu 217.894 {455}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000151	0.080356	0.000000	1.000000
Fe 259.940 {130}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000166	0.200482	0.000000	1.000000
K 766.490 { 44}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.001608	0.161371	0.000000	1.000000
Li 670.784 { 50}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.010541	5.034046	0.000000	1.000000
Mg 279.806 {121}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000903	0.030621	0.000000	1.000000
Mn 257.610 {131}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000140	1.223193	0.000000	1.000000
Mo 202.030 {467}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000017	0.398520	0.000000	1.000000
Na 589.592 { 57}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.035893	0.557215	0.000000	1.000000
Ni 221.647 {452}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000148	0.487103	0.000000	1.000000
P 177.495 {490}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000034	0.052522	0.000000	1.000000
Pb 220.353 {453}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000280	0.104911	0.000000	1.000000
S 182.034 {485}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000050	0.030111	0.000000	1.000000
Sb 206.833 {463}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000222	0.068821	0.000000	1.000000
Se 196.090 {472}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000100	0.038173	0.000000	1.000000
Si 251.611 {134}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.001872	0.060034	0.000000	1.000000
Sn 189.989 {478}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000048	0.109727	0.000000	1.000000
Sr 407.771 { 83}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.002959	20.915485	0.000000	1.000000
Th 283.231 {119}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.001851	0.078060	0.000000	1.000000
Ti 334.941 {101}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.002039	1.207626	0.000000	1.000000
Tl 190.856 {477}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000165	0.060274	0.000000	1.000000
U 367.007 { 92}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.021812	0.082120	0.000000	1.000000
V 290.882 {116}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	-0.000524	0.200259	0.000000	1.000000
Y 371.030 { 91}*	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	1.000000	0.000000	0.000000	1.000000
Zn 213.856 {458}	5/22/2014 10:40:09	5/22/2014 10:40:09	Linear	1/Conc	0.000529	0.483150	0.000000	1.000000

Element, Wavelength and Order	Correlation	Std Error of Est	Predicted MDL	Predicted MQL	Status	Reslope		QC Norm	
						Slope	Y-int	Slope factor	Offset
Ag 328.068 {103}	0.999858	0.000155	0.000514	0.001714	OK.	1.000000	0.000000	1	0
Al 396.152 { 85}	0.999672	0.001393	0.005530	0.018433	OK.	1.000000	0.000000	1	0
As 189.042 {478}	0.999977	0.000006	0.001248	0.004160	OK.	1.000000	0.000000	1	0
B 249.678 {135}	0.999100	0.000269	0.002647	0.008824	OK.	1.000000	0.000000	1	0
Ba 455.403 { 74}	0.999774	0.012349	0.000109	0.000362	OK.	1.000000	0.000000	1	0
Be 313.042 {108}	0.999994	0.000566	0.000036	0.000121	OK.	1.000000	0.000000	1	0
Bi 223.061 {451}	0.999902	0.000066	0.001851	0.006170	OK.	1.000000	0.000000	1	0
Ca 184.006 {483}	0.999774	0.001048	0.000732	0.002442	OK.	1.000000	0.000000	1	0
Cd 228.802 {447}	0.999994	0.000039	0.000118	0.000394	OK.	1.000000	0.000000	1	0
Co 228.616 {448}	0.999903	0.000176	0.000270	0.000902	OK.	1.000000	0.000000	1	0
Cr 283.563 {119}	0.999973	0.000020	0.000736	0.002454	OK.	1.000000	0.000000	1	0
Cu 217.894 {455}	0.999976	0.000015	0.001315	0.004385	OK.	1.000000	0.000000	1	0
Fe 259.940 {130}	0.999993	0.000128	0.001531	0.005105	OK.	1.000000	0.000000	1	0
K 766.490 { 44}	0.999637	0.005412	0.015663	0.052209	OK.	1.000000	0.000000	1	0
Li 670.784 { 50}	0.999412	0.006698	0.000526	0.001753	OK.	1.000000	0.000000	1	0
Mg 279.806 {121}	0.999892	0.000246	0.012176	0.040586	OK.	1.000000	0.000000	1	0
Mn 257.610 {131}	0.999995	0.000085	0.000271	0.000903	OK.	1.000000	0.000000	1	0
Mo 202.030 {467}	0.999936	0.000070	0.000197	0.000658	OK.	1.000000	0.000000	1	0
Na 589.592 { 57}	0.999584	0.008832	0.004755	0.015851	OK.	1.000000	0.000000	1	0
Ni 221.647 {452}	0.999881	0.000260	0.000246	0.000821	OK.	1.000000	0.000000	1	0
P 177.495 {490}	0.999771	0.000308	0.001249	0.004165	OK.	1.000000	0.000000	1	0
Pb 220.353 {453}	0.999899	0.000026	0.000986	0.003288	OK.	1.000000	0.000000	1	0
S 182.034 {485}	0.999953	0.000364	0.002081	0.006938	OK.	1.000000	0.000000	1	0
Sb 206.833 {463}	0.999957	0.000005	0.001438	0.004792	OK.	1.000000	0.000000	1	0
Se 196.090 {472}	0.999936	0.000004	0.001920	0.006401	OK.	1.000000	0.000000	1	0
Si 251.611 {134}	0.999913	0.000088	0.005301	0.017671	OK.	1.000000	0.000000	1	0
Sn 189.989 {478}	0.999878	0.000094	0.000543	0.001809	OK.	1.000000	0.000000	1	0
Sr 407.771 { 83}	1.000000	0.000155	0.000049	0.000163	OK.	1.000000	0.000000	1	0
Th 283.231 {119}	0.999985	0.000033	0.003391	0.011304	OK.	1.000000	0.000000	1	0
Ti 334.941 {101}	0.999989	0.000136	0.000571	0.001904	OK.	1.000000	0.000000	1	0
Tl 190.856 {477}	0.999708	0.000016	0.001281	0.004270	OK.	1.000000	0.000000	1	0
U 367.007 { 92}	0.999966	0.000099	0.008891	0.029637	OK.	1.000000	0.000000	1	0
V 290.882 {116}	0.999996	0.000023	0.002718	0.009060	OK.	1.000000	0.000000	1	0
Y 371.030 { 91}*	0.000000	0.000000	-1.000000	-1.000000	Warnin	1.000000	0.000000	1	0
Zn 213.856 {458}	0.999975	0.000085	0.000135	0.000450	OK.	1.000000	0.000000	1	0

Sample Name: CALBLK1 Acquired: 5/22/2014 10:24:42 Type: Cal
Method: 2014v3(v93) Mode: IR Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**-.0003**	**.0003**	**-.0001**	**.0006**	**.0196**	**.0006**	**.0001**	**.0001**	**.0000**
Stddev	.0005	.0007	.0001	.0003	.0019	.0002	.0001	.0001	.000
%RSD	205.8	213.0	225.4	50.03	9.828	28.05	146.3	109.9	270.1
#1	.0004	.0002	.0001	.0008	.0184	.0005	.0002	.0000	.0000
#2	-.0006	-.0003	-.0002	.0005	.0185	.0008	.0002	.0000	.0001
#3	-.0005	.0012	.0000	.0003	.0218	.0005	-.0001	.0001	-.0001

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**-.0001**	**.0013**	**.0002**	**.0002**	**.0017**	**-.0105**	**-.0009**	**-.0001**	**.0000**
Stddev	.0001	.0000	.0001	.0000	.0021	.0014	.0004	.0001	.0000
%RSD	71.23	.9805	52.87	16.48	128.4	12.87	44.68	102.1	162.7
#1	.0000	.0013	.0002	.0002	.0038	-.0116	-.0010	-.0002	.0000
#2	-.0002	.0013	.0001	.0001	-.0005	-.0090	-.0012	-.0003	.0000
#3	-.0001	.0014	.0002	.0002	.0017	-.0110	-.0005	.0000	.0000

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**-.0358**	**.0001**	**.0000**	**-.0003**	**.0000**	**.0002**	**.0001**	**.0019**	**.0000**
Stddev	.0032	.0000	.0000	.0001	.0000	.0001	.0000	.0004	.0001
%RSD	9.001	10.02	107.1	34.54	89.55	47.53	8.859	21.52	183.6
#1	-.0392	.0001	.0001	-.0003	.0001	.0001	.0001	.0021	.0000
#2	-.0356	.0002	.0000	-.0004	.0000	.0003	.0001	.0014	.0000
#3	-.0328	.0001	.0000	-.0002	.0000	.0003	.0001	.0021	.0001

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**-.0030**	**.0019**	**.0020**	**-.0002**	**.0218**	**-.0005**	**.0005**
Stddev	.0014	.0001	.0005	.0001	.0008	.0001	.0000
%RSD	46.47	6.277	23.03	44.77	3.707	15.97	5.640
#1	-.0045	.0017	.0023	-.0001	.0220	-.0005	.0005
#2	-.0025	.0019	.0015	-.0002	.0225	-.0004	.0005
#3	-.0019	.0019	.0024	-.0002	.0209	-.0006	.0005

Sample Name: CALBLK1 Acquired: 5/22/2014 10:24:42 Type: Cal
Method: 2014v3(v93) Mode: IR Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Int. Std.	Y_3710
Units	Cts/S
Avg	5869.3
Stddev	4.6
%RSD	.07889
#1	5874.6
#2	5866.3
#3	5866.9

Sample Name: CAL 1 Acquired: 5/22/2014 10:28:38 Type: Cal
Method: 2014v3(v93) Mode: IR Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**.0124**	**.0427**	**.0004**	**.0064**	**.7697**	**.0720**	**.0134**	**.1056**	**.0048**
Stddev	.0007	.0006	.0001	.0003	.0009	.0008	.0001	.0002	.0001
%RSD	5.356	1.427	13.88	4.270	.1124	1.173	.7073	.1901	2.982
#1	.0129	.0431	.0004	.0062	.7698	.0710	.0133	.1054	.0047
#2	.0117	.0420	.0005	.0067	.7687	.0726	.0135	.1057	.0048
#3	.0128	.0429	.0005	.0062	.7704	.0723	.0135	.1057	.0050

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**.0187**	**.0030**	**.0022**	**.0221**	**.7738**	**.2366**	**.0291**	**.0200**	**.0173**
Stddev	.0002	.0000	.0000	.0001	.0024	.0016	.0005	.0004	.0003
%RSD	.9058	1.228	.6001	.6049	.3155	.6629	1.683	2.137	1.808
#1	.0187	.0030	.0023	.0220	.7732	.2353	.0291	.0195	.0170
#2	.0186	.0031	.0022	.0222	.7716	.2361	.0286	.0202	.0172
#3	.0189	.0031	.0022	.0222	.7764	.2384	.0296	.0203	.0176

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**.4883**	**.0230**	**.0148**	**.0010**	**.1532**	**.0008**	**.0006**	**.0249**	**.0124**
Stddev	.0052	.0002	.0002	.0000	.0020	.0001	.0001	.0001	.0001
%RSD	1.066	1.008	1.040	.4046	1.297	7.852	16.72	.4737	.6711
#1	.4880	.0227	.0147	.0010	.1512	.0008	.0006	.0250	.0124
#2	.4833	.0230	.0148	.0010	.1532	.0008	.0005	.0248	.0123
#3	.4937	.0232	.0150	.0010	.1551	.0009	.0008	.0248	.0124

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**.1056**	**.0179**	**.0264**	**.0013**	**.0671**	**.0091**	**.0112**
Stddev	.0006	.0003	.0003	.0000	.0013	.0003	.0001
%RSD	.6023	1.675	1.061	3.564	1.869	2.959	.8692
#1	.1049	.0176	.0265	.0014	.0660	.0088	.0112
#2	.1062	.0178	.0261	.0013	.0669	.0094	.0111
#3	.1057	.0182	.0266	.0013	.0684	.0092	.0113

Sample Name: CAL 1 Acquired: 5/22/2014 10:28:38 Type: Cal
Method: 2014v3(v93) Mode: IR Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Int. Std.	Y_3710
Units	Cts/S
Avg	5779.7
Stddev	24.6
%RSD	.42618
#1	5799.4
#2	5752.1
#3	5787.6

Sample Name: Cal 2 Acquired: 5/22/2014 10:32:31 Type: Cal
Method: 2014v3(v93) Mode: IR Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**1.156**	**10.69**	**.2641**	**.5696**	**72.67**	**68.12**	**.2976**	**4.584**	**4.707**
Stddev	.005	.03	.0009	.0028	.21	.17	.0016	.014	.017
%RSD	.4449	.2468	.3579	.4891	.2908	.2426	.5252	.3067	.3635
#1	1.160	10.67	.2652	.5728	72.86	68.12	.2994	4.597	4.727
#2	1.159	10.72	.2634	.5678	72.69	68.28	.2969	4.569	4.697
#3	1.150	10.68	.2638	.5681	72.44	67.95	.2965	4.584	4.697

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**1.655**	**.7811**	**.3981**	**10.06**	**7.783**	**23.94**	**1.493**	**6.125**	**.4014**
Stddev	.004	.0005	.0020	.03	.034	.22	.010	.027	.0017
%RSD	.2510	.0662	.4939	.3273	.4410	.8992	.6678	.4472	.4331
#1	1.659	.7812	.4003	10.10	7.754	23.73	1.504	6.157	.4033
#2	1.654	.7806	.3973	10.04	7.821	24.16	1.485	6.111	.4011
#3	1.651	.7816	.3966	10.05	7.773	23.92	1.489	6.107	.3998

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**26.71**	**2.478**	**2.703**	**.5347**	**1.485**	**.0691**	**.0375**	**.2975**	**.5577**
Stddev	.15	.008	.008	.0022	.007	.0005	.0001	.0016	.0016
%RSD	.5760	.3122	.3001	.4025	.5014	.7388	.1881	.5355	.2876
#1	26.56	2.487	2.712	.5371	1.493	.0696	.0376	.2978	.5590
#2	26.87	2.472	2.698	.5337	1.480	.0691	.0375	.2990	.5559
#3	26.70	2.475	2.698	.5332	1.481	.0686	.0375	.2958	.5581

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**104.7**	**.3914**	**6.001**	**.0630**	**.5036**	**1.003**	**2.462**
Stddev	.6	.0027	.002	.0004	.0019	.005	.009
%RSD	.5543	.6774	.0256	.6810	.3791	.5483	.3657
#1	104.1	.3942	6.002	.0634	.5047	1.008	2.472
#2	105.3	.3911	6.002	.0630	.5046	1.003	2.459
#3	104.7	.3889	5.999	.0625	.5014	.9971	2.455

Sample Name: Cal 2 Acquired: 5/22/2014 10:32:31 Type: Cal
Method: 2014v3(v93) Mode: IR Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Int. Std.	Y_3710
Units	Cts/S
Avg	5748.2
Stddev	3.4
%RSD	.05866
#1	5744.7
#2	5748.5
#3	5751.4

Sample Name: Cal 3 Acquired: 5/22/2014 10:36:21 Type: Cal
Method: 2014v3(v93) Mode: IR Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**2.398**	**22.58**	**.5357**	**1.166**	**152.1**	**135.3**	**.6040**	**8.867**	**9.479**
Stddev	.011	.11	.0006	.004	.6	1.7	.0007	.017	.020
%RSD	.4646	.5055	.1137	.3388	.4179	1.232	.1110	.1929	.2071
#1	2.392	22.64	.5352	1.162	152.2	136.8	.6046	8.858	9.467
#2	2.391	22.66	.5355	1.170	151.4	133.5	.6033	8.857	9.469
#3	2.411	22.45	.5364	1.166	152.7	135.6	.6042	8.887	9.502

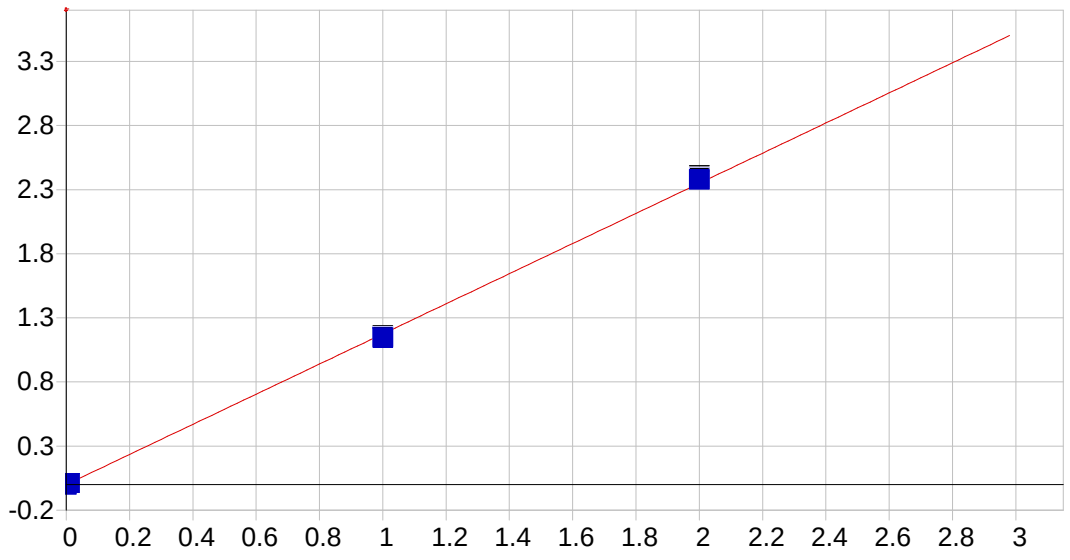
Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**3.236**	**1.540**	**.8075**	**20.01**	**16.46**	**51.56**	**3.082**	**12.22**	**.7929**
Stddev	.004	.004	.0010	.03	.08	.44	.007	.01	.0010
%RSD	.1211	.2560	.1178	.1327	.4981	.8598	.2234	.1078	.1208
#1	3.239	1.537	.8071	19.99	16.47	51.61	3.086	12.24	.7929
#2	3.232	1.540	.8068	19.99	16.54	51.97	3.074	12.21	.7919
#3	3.237	1.545	.8086	20.04	16.38	51.09	3.086	12.22	.7938

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**56.83**	**4.826**	**5.174**	**1.039**	**3.029**	**.1405**	**.0766**	**.6077**	**1.087**
Stddev	1.43	.010	.012	.002	.005	.0003	.0002	.0014	.001
%RSD	2.508	.2008	.2240	.1916	.1528	.1939	.2514	.2298	.1302
#1	58.40	4.818	5.183	1.038	3.028	.1403	.0767	.6091	1.086
#2	56.47	4.823	5.161	1.039	3.026	.1406	.0764	.6078	1.087
#3	55.62	4.836	5.178	1.041	3.035	.1408	.0768	.6063	1.089

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**209.2**	**.7848**	**12.12**	**.1218**	**.9944**	**2.010**	**4.858**
Stddev	1.0	.0034	.02	.0004	.0046	.004	.005
%RSD	.4609	.4393	.1651	.3344	.4601	.2130	.0986
#1	209.4	.7824	12.14	.1223	.9897	2.006	4.858
#2	208.2	.7833	12.11	.1215	.9945	2.010	4.853
#3	210.1	.7888	12.10	.1217	.9989	2.015	4.862

Sample Name: Cal 3 Acquired: 5/22/2014 10:36:21 Type: Cal
Method: 2014v3(v93) Mode: IR Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Int. Std.	Y_3710
Units	Cts/S
Avg	5521.2
Stddev	13.2
%RSD	.23943
#1	5531.1
#2	5526.3
#3	5506.2

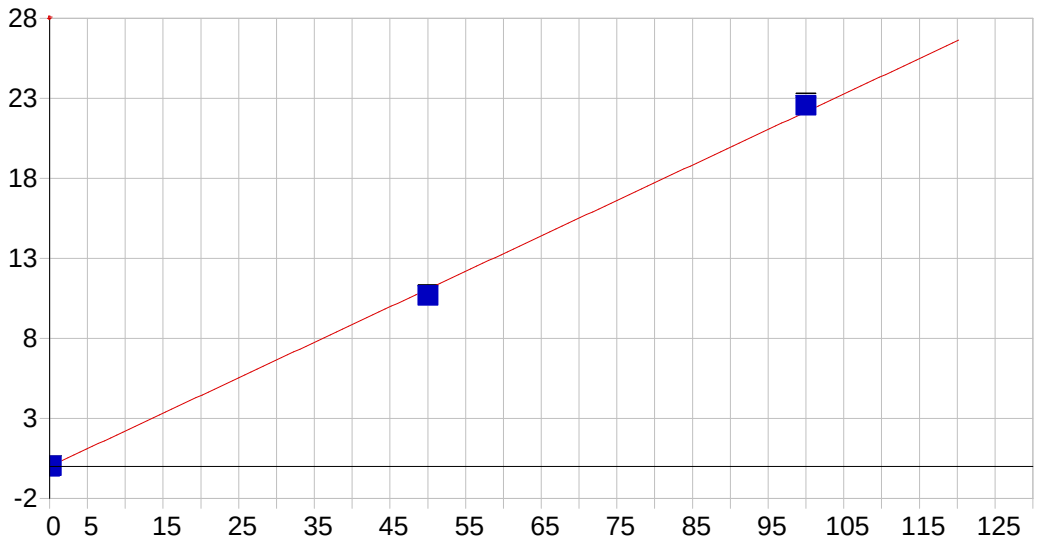


Ag 328.068 {103}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000260	Re-Slope:	1.000000
A1 (Gain):	1.175092	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999858	Status:	OK.
Std Error of Est:	0.000155		
Predicted MDL:	0.000514		
Predicted MQL:	0.001714		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.00026	.001	1
CAL 1	.01000	.00997	.000	-.306	.01243	.001	1
Cal 2	1.0000	.97596	-.024	-2.40	1.1564	.005	1
Cal 3	2.0000	2.0241	.024	1.20	2.3977	.011	1



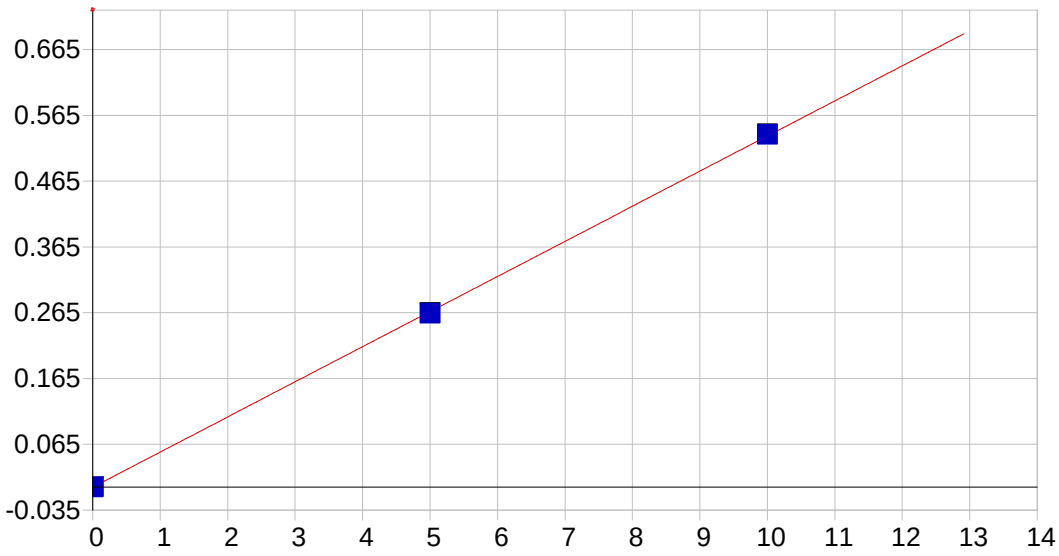
Al 396.152 { 85}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000346	Re-Slope:	1.000000

A1 (Gain):	0.221598	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999672	Status:	OK.
Std Error of Est:	0.001393		
Predicted MDL:	0.005530		
Predicted MQL:	0.018433		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00001	.000	.000	.00035	.001	1
CAL 1	.20000	.18942	-.011	-5.29	.04267	.001	1
Cal 2	50.000	48.194	-1.81	-3.61	10.689	.026	1
Cal 3	100.00	101.82	1.82	1.82	22.580	.114	1

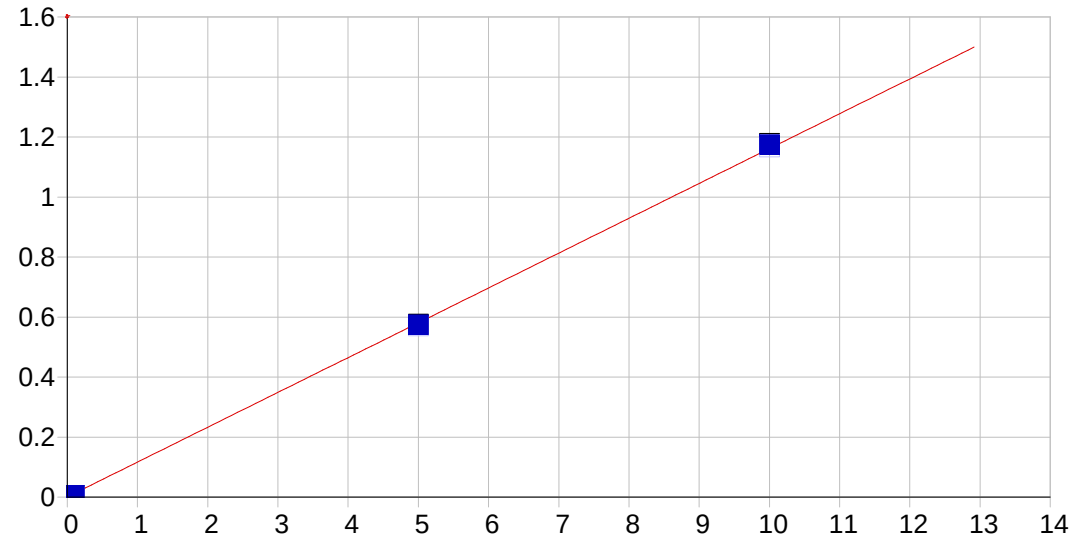


As 189.042 {478}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000054	Re-Slope:	1.000000
A1 (Gain):	0.053376	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999977	Status:	OK.
Std Error of Est:	0.000006		
Predicted MDL:	0.001248		
Predicted MQL:	0.004160		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.00005	.000	1
CAL 1	.01000	.00941	-.001	-5.87	.00045	.000	1
Cal 2	5.0000	4.9538	-.046	-.923	.26412	.001	1
Cal 3	10.000	10.047	.047	.468	.53571	.001	1

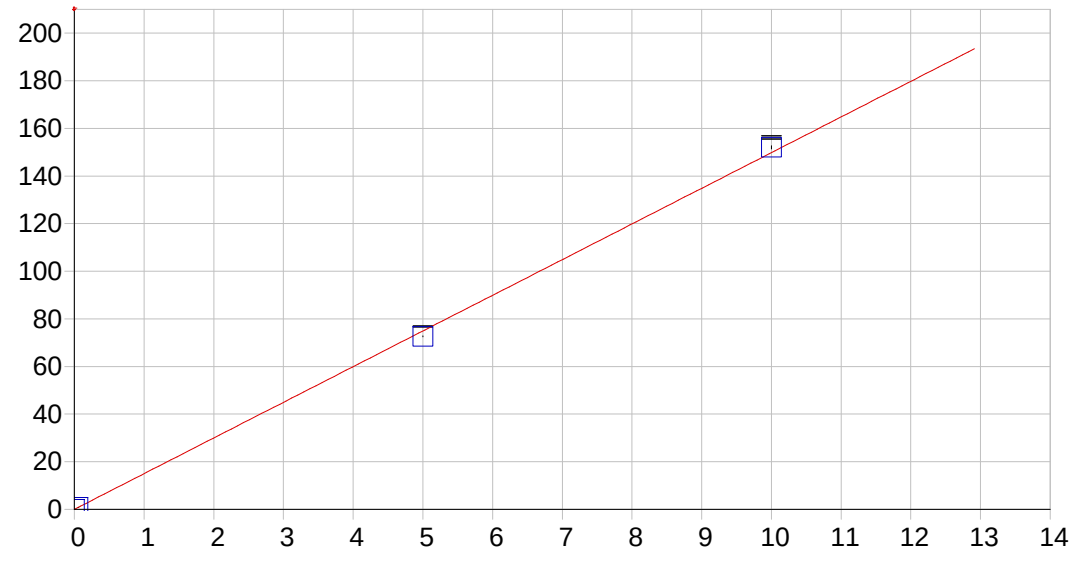


B 249.678 {135}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000544	Re-Slope:	1.000000
A1 (Gain):	0.116070	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999100	Status:	OK.
Std Error of Est:	0.000269		
Predicted MDL:	0.002647		
Predicted MQL:	0.008824		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00005	.000	.000	.00055	.000	1
CAL 1	.10000	.05025	-.050	-49.8	.00637	.000	1
Cal 2	5.0000	4.9373	-.063	-1.25	.56958	.003	1
Cal 3	10.000	10.113	.113	1.13	1.1662	.004	1



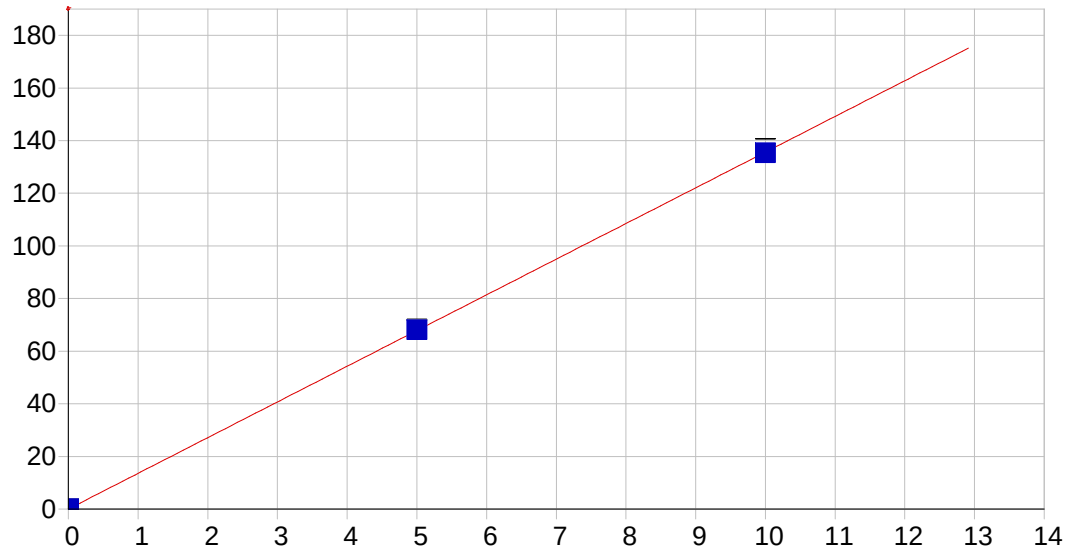
Ba 455.403 { 74}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.019573	Re-Slope:	1.000000
A1 (Gain):	14.980559	Y-int:	0.000000

A2 (Curvature):	0.000000						
n (Exponent):	1.000000						
Correlation:	0.999774			Status:	OK.		
Std Error of Est:	0.012349						
Predicted MDL:	0.000109						
Predicted MQL:	0.000362						

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	.01958	.002	1
CAL 1	.05000	.05007	.000	.144	.76968	.001	1
Cal 2	5.0000	4.8494	-.151	-3.01	72.666	.211	1
Cal 3	10.000	10.151	.151	1.51	152.08	.636	1

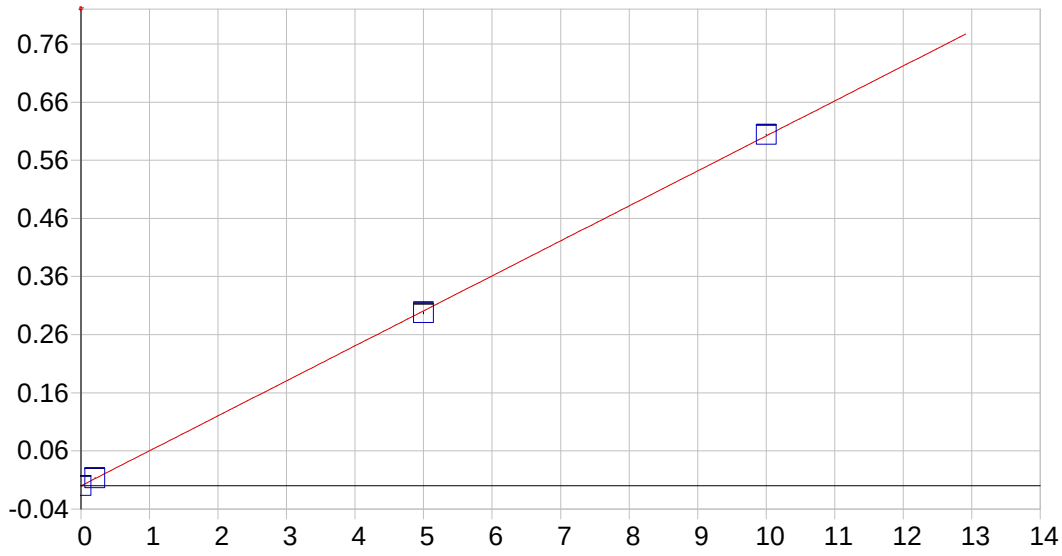


Be 313.042 {108}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000591	Re-Slope:	1.000000
A1 (Gain):	13.564703	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999994	Status:	OK.
Std Error of Est:	0.000566		
Predicted MDL:	0.000036		
Predicted MQL:	0.000121		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	.00059	.000	1
CAL 1	.00500	.00527	.000	5.36	.07196	.001	1
Cal 2	5.0000	5.0230	.023	.460	68.115	.165	1
Cal 3	10.000	9.9767	-.023	-.233	135.29	1.67	1

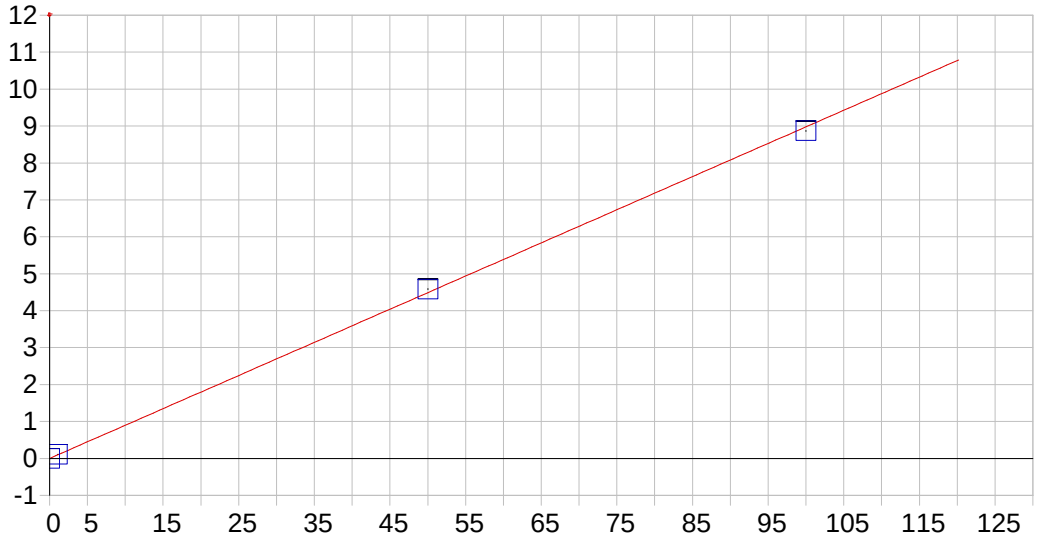


Bi 223.061 {451}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000101	Re-Slope:	1.000000
A1 (Gain):	0.060177	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999902	Status:	OK.
Std Error of Est:	0.000066		
Predicted MDL:	0.001851		
Predicted MQL:	0.006170		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00002	.000	.000	.00010	.000	1
CAL 1	.20000	.22103	.021	10.5	.01340	.000	1
Cal 2	5.0000	4.9432	-.057	-1.14	.29757	.002	1
Cal 3	10.000	10.036	.036	.358	.60402	.001	1



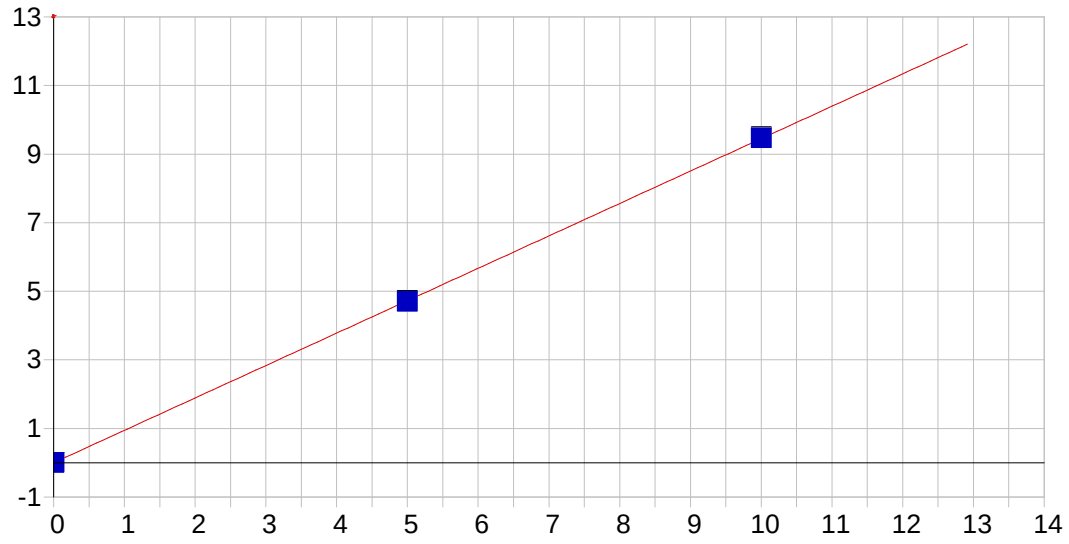
Ca 184.006 {483}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000080	Re-Slope:	1.000000
A1 (Gain):	0.089777	Y-int:	0.000000

A2 (Curvature):		0.000000					
n (Exponent):		1.000000					
Correlation:		0.999774		Status:	OK.		
Std Error of Est:		0.001048					
Predicted MDL:		0.000732					
Predicted MQL:		0.002442					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00018	.000	.000	.00006	.000	1
CAL 1	1.0000	1.1753	.175	17.5	.10559	.000	1
Cal 2	50.000	51.056	1.06	2.11	4.5837	.014	1
Cal 3	100.00	98.769	-1.23	-1.23	8.8672	.017	1

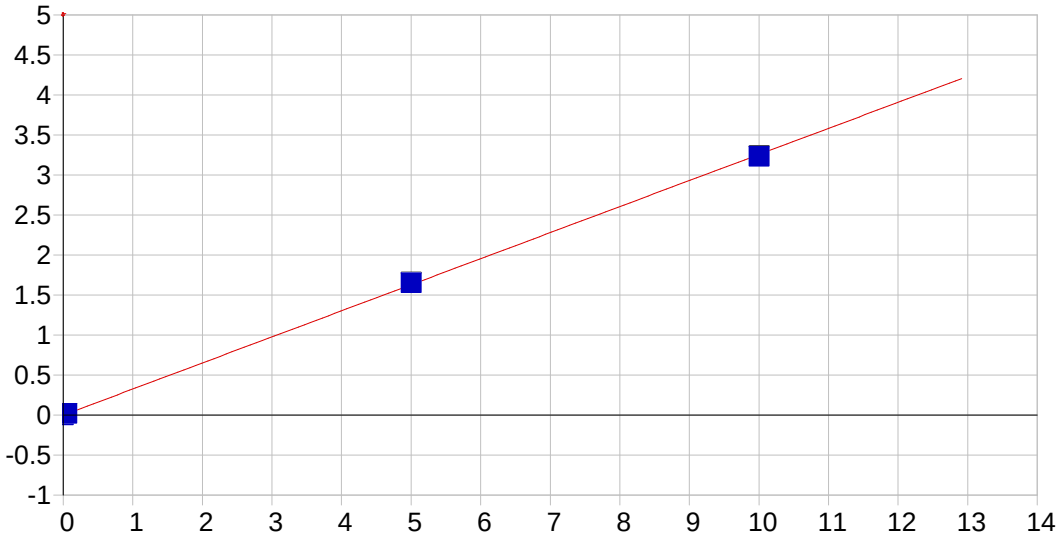


Cd 228.802 {447}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000028	Re-Slope:	1.000000
A1 (Gain):	0.945001	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999994	Status:	OK.
Std Error of Est:	0.000039		
Predicted MDL:	0.000118		
Predicted MQL:	0.000394		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.00003	.000	1
CAL 1	.00500	.00520	.000	3.91	.00481	.000	1
Cal 2	5.0000	4.9767	-.023	-.465	4.7068	.017	1
Cal 3	10.000	10.023	.023	.231	9.4794	.020	1

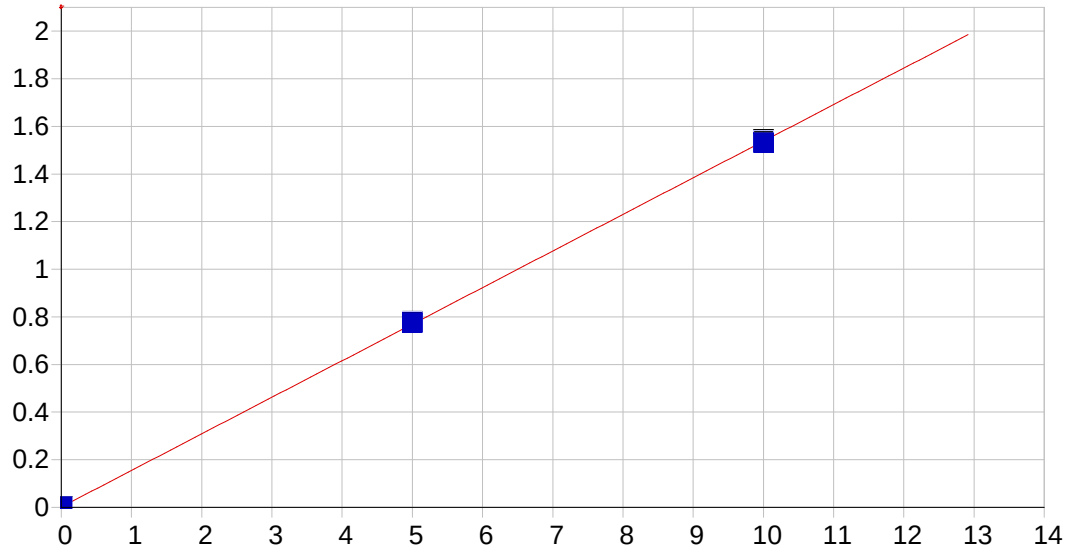


Co 228.616 {448}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000096	Re-Slope:	1.000000
A1 (Gain):	0.325702	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999903	Status:	OK.
Std Error of Est:	0.000176		
Predicted MDL:	0.000270		
Predicted MQL:	0.000902		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00001	.000	.000	-.00010	.000	1
CAL 1	.05000	.05774	.008	15.5	.01872	.000	1
Cal 2	5.0000	5.0733	.073	1.47	1.6549	.004	1
Cal 3	10.000	9.9190	-.081	-.810	3.2358	.004	1



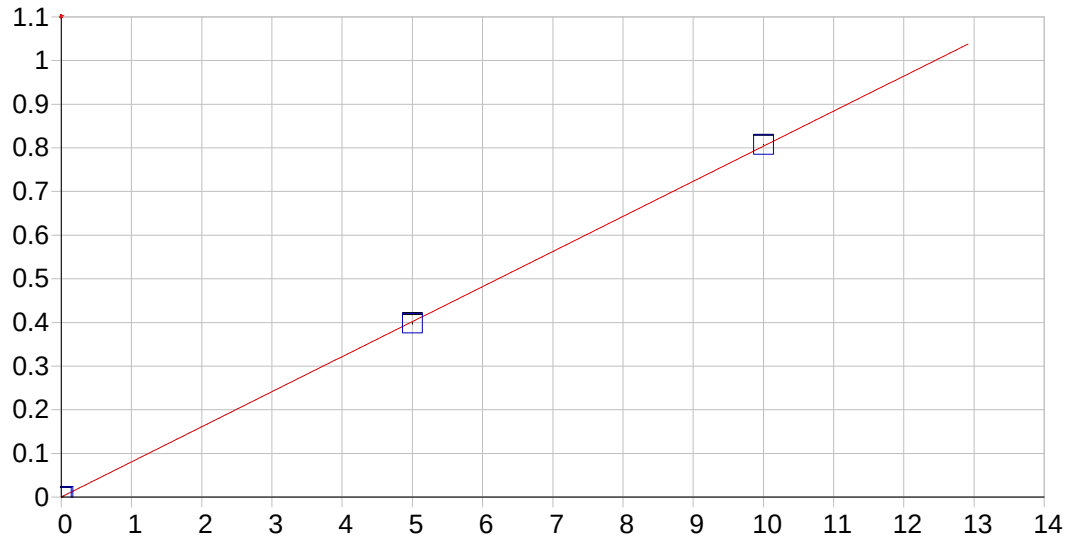
Cr 283.563 {119}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.001339	Re-Slope:	1.000000
A1 (Gain):	0.153639	Y-int:	0.000000

A2 (Curvature):		0.000000					
n (Exponent):		1.000000					
Correlation:		0.999973		Status:	OK.		
Std Error of Est:		0.000020					
Predicted MDL:		0.000736					
Predicted MQL:		0.002454					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	.00134	.000	1
CAL 1	.01000	.01155	.002	15.5	.00304	.000	1
Cal 2	5.0000	5.0441	.044	.882	.78112	.001	1
Cal 3	10.000	9.9544	-.046	-.456	1.5404	.004	1

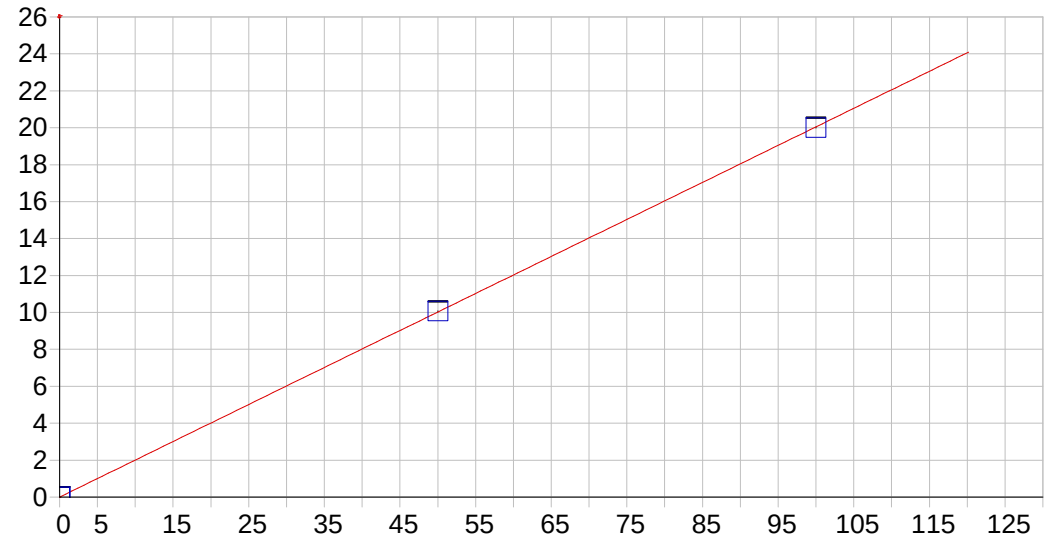


Cu 217.894 {455}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000151	Re-Slope:	1.000000
A1 (Gain):	0.080356	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999976	Status:	OK.
Std Error of Est:	0.000015		
Predicted MDL:	0.001315		
Predicted MQL:	0.004385		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	.00015	.000	1
CAL 1	.02500	.02603	.001	4.13	.00224	.000	1
Cal 2	5.0000	4.9517	-.048	-.965	.39805	.002	1
Cal 3	10.000	10.047	.047	.472	.80750	.001	1

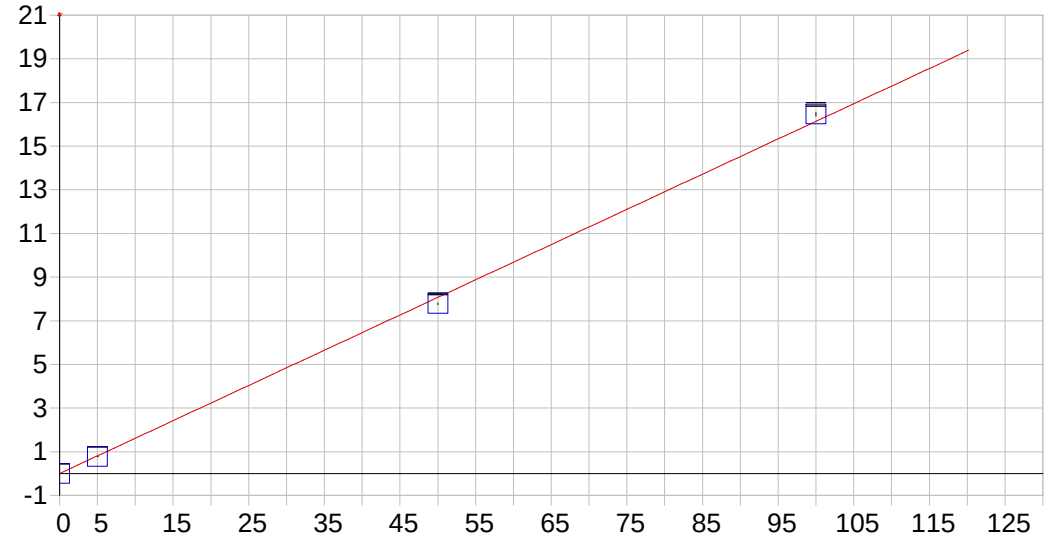


Fe 259.940 {130}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000166	Re-Slope:	1.000000
A1 (Gain):	0.200482	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999993	Status:	OK.
Std Error of Est:	0.000128		
Predicted MDL:	0.001531		
Predicted MQL:	0.005105		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00001	.000	.000	.00016	.000	1
CAL 1	.10000	.10950	.009	9.50	.02212	.000	1
Cal 2	50.000	50.192	.192	.385	10.063	.033	1
Cal 3	100.00	99.798	-.202	-.202	20.008	.027	1



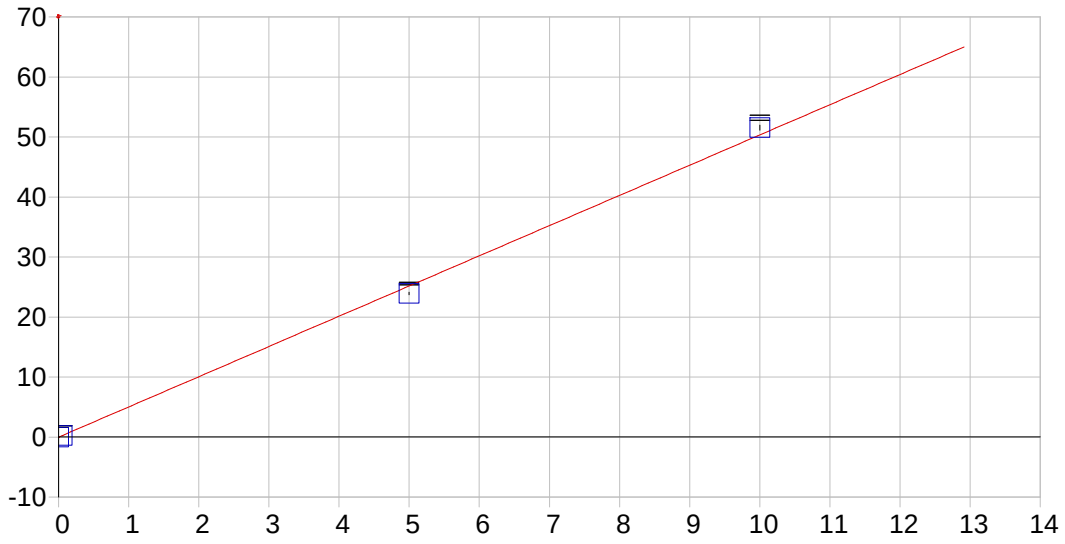
K 766.490 { 44}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.001608	Re-Slope:	1.000000
A1 (Gain):	0.161371	Y-int:	0.000000

A2 (Curvature):		0.000000					
n (Exponent):		1.000000					
Correlation:		0.999637		Status:	OK.		
Std Error of Est:		0.005412					
Predicted MDL:		0.015663					
Predicted MQL:		0.052209					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00029	.000	.000	.00166	.002	1
CAL 1	5.0000	4.7850	-.215	-4.30	.77377	.002	1
Cal 2	50.000	48.219	-1.78	-3.56	7.7827	.034	1
Cal 3	100.00	102.00	2.00	2.00	16.461	.082	1

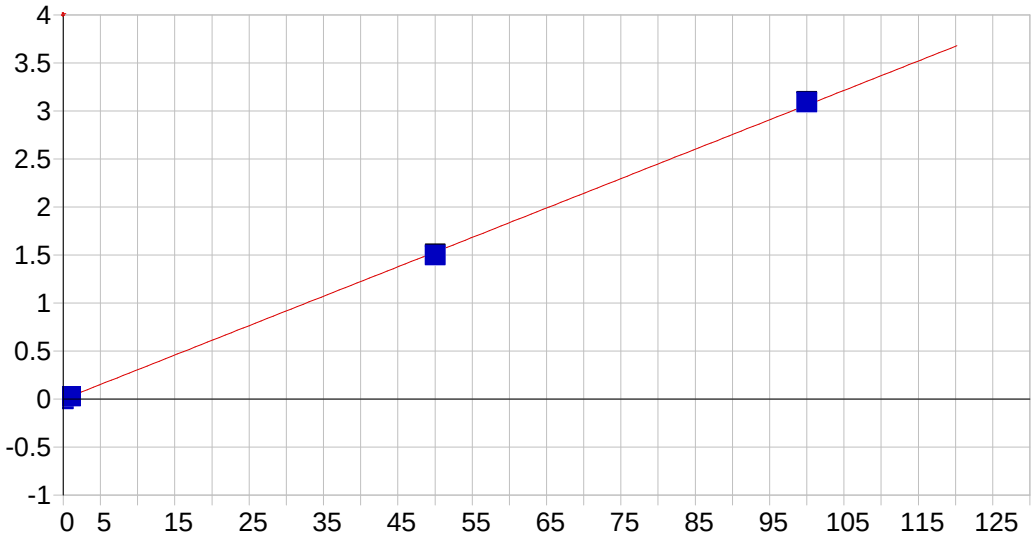


Li 670.784 { 50}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.010541	Re-Slope:	1.000000
A1 (Gain):	5.034046	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999412	Status:	OK.
Std Error of Est:	0.006698		
Predicted MDL:	0.000526		
Predicted MQL:	0.001753		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.01053	.001	1
CAL 1	.05000	.04909	-.001	-1.81	.23660	.002	1
Cal 2	5.0000	4.7574	-.243	-4.85	23.938	.215	1
Cal 3	10.000	10.244	.244	2.44	51.556	.443	1

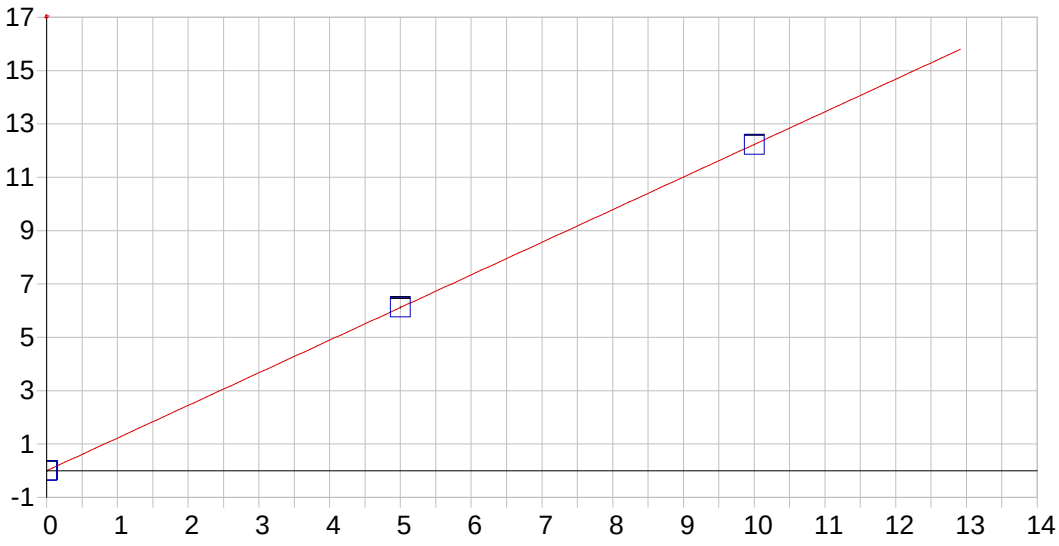


Mg 279.806 {121}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000903	Re-Slope:	1.000000
A1 (Gain):	0.030621	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999892	Status:	OK.
Std Error of Est:	0.000246		
Predicted MDL:	0.012176		
Predicted MQL:	0.040586		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00002	.000	.000	-.00090	.000	1
CAL 1	1.0000	.98642	-.014	-1.36	.02908	.000	1
Cal 2	50.000	48.969	-1.03	-2.06	1.4930	.010	1
Cal 3	100.00	101.04	1.04	1.04	3.0819	.007	1



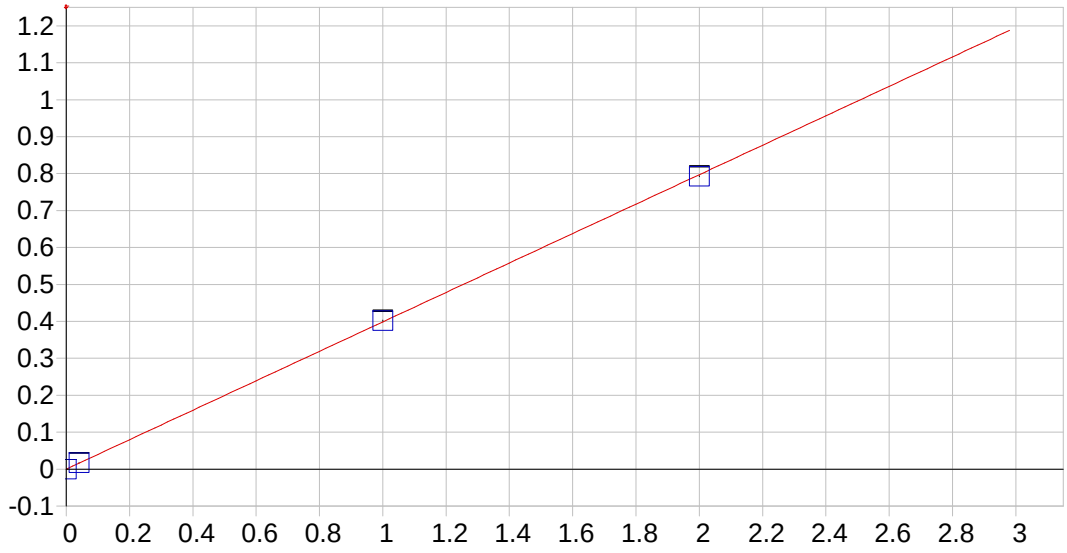
Mn 257.610 {131}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000140	Re-Slope:	1.000000
A1 (Gain):	1.223193	Y-int:	0.000000

A2 (Curvature):	0.000000					
n (Exponent):	1.000000					
Correlation:	0.999995		Status:	OK.		
Std Error of Est:	0.000085					
Predicted MDL:	0.000271					
Predicted MQL:	0.000903					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.00014	.000	1
CAL 1	.01500	.01647	.001	9.77	.02000	.000	1
Cal 2	5.0000	5.0075	.008	.151	6.1251	.027	1
Cal 3	10.000	9.9910	-.009	-.090	12.221	.013	1

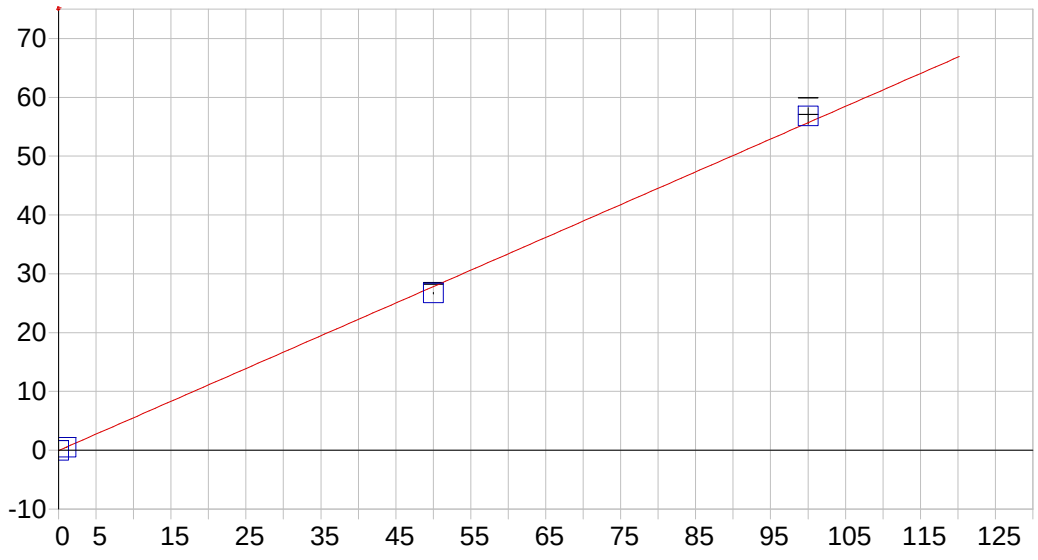


Mo 202.030 {467}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000017	Re-Slope:	1.000000
A1 (Gain):	0.398520	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999936	Status:	OK.
Std Error of Est:	0.000070		
Predicted MDL:	0.000197		
Predicted MQL:	0.000658		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	.00002	.000	1
CAL 1	.04000	.04337	.003	8.43	.01730	.000	1
Cal 2	1.0000	1.0072	.007	.718	.40140	.002	1
Cal 3	2.0000	1.9895	-.011	-.527	.79285	.001	1

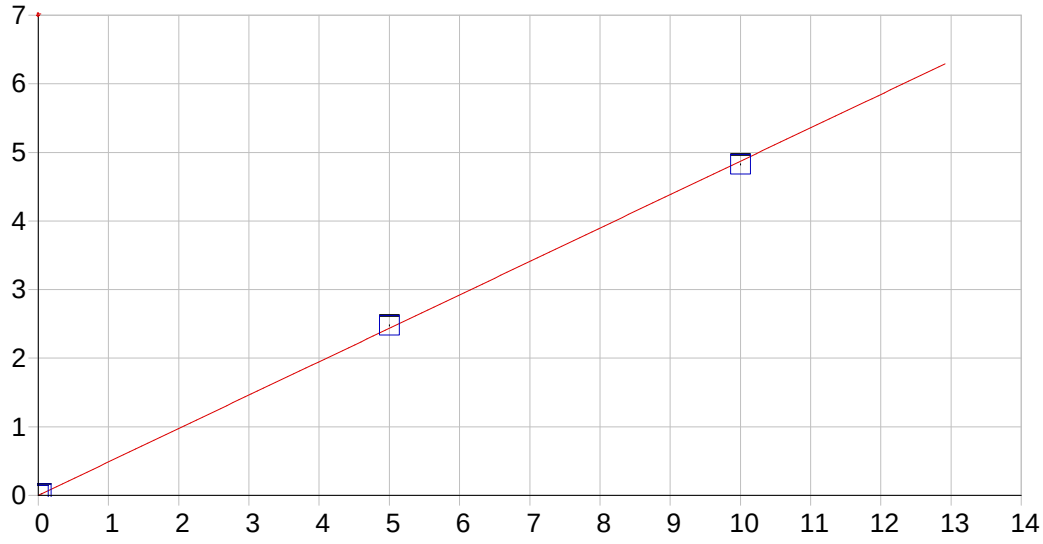


Na 589.592 { 57}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.035893	Re-Slope:	1.000000
A1 (Gain):	0.557215	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999584	Status:	OK.
Std Error of Est:	0.008832		
Predicted MDL:	0.004755		
Predicted MQL:	0.015851		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00008	.000	.000	-.03585	.003	1
CAL 1	1.0000	.94079	-.059	-5.92	.48833	.005	1
Cal 2	50.000	48.001	-2.00	-4.00	26.711	.154	1
Cal 3	100.00	102.06	2.06	2.06	56.832	1.43	1



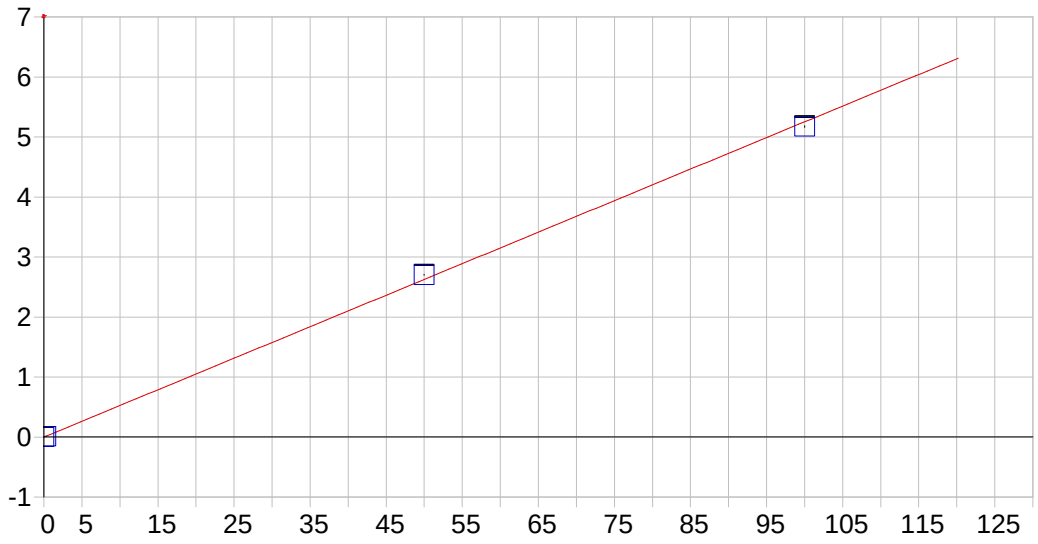
Ni 221.647 {452}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000148	Re-Slope:	1.000000
A1 (Gain):	0.487103	Y-int:	0.000000

A2 (Curvature):	0.000000					
n (Exponent):	1.000000					
Correlation:	0.999881		Status:	OK.		
Std Error of Est:	0.000260					
Predicted MDL:	0.000246					
Predicted MQL:	0.000821					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00001	.000	.000	.00014	.000	1
CAL 1	.04000	.04689	.007	17.2	.02299	.000	1
Cal 2	5.0000	5.0868	.087	1.74	2.4780	.008	1
Cal 3	10.000	9.9063	-.094	-.937	4.8255	.010	1

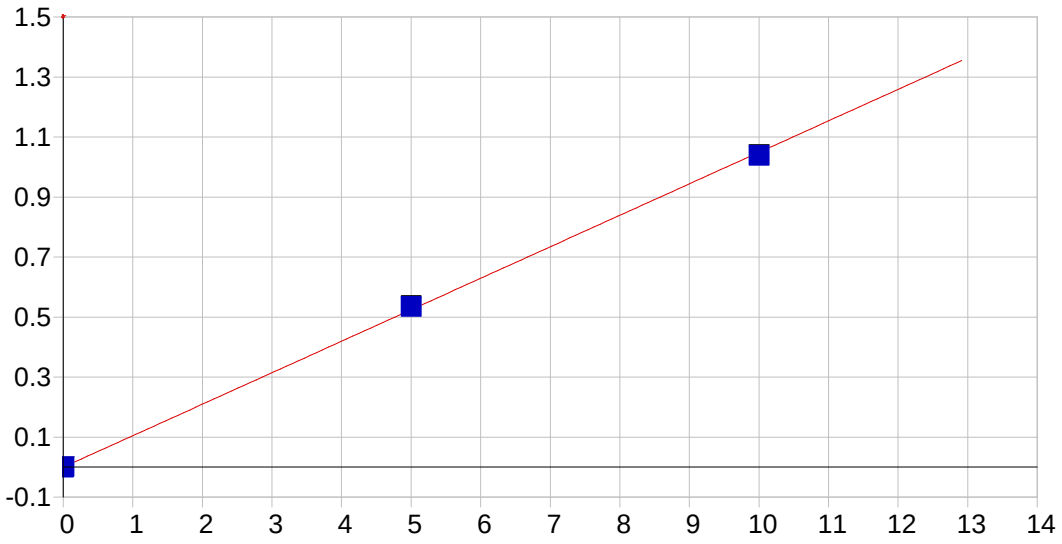


P 177.495 {490}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000034	Re-Slope:	1.000000
A1 (Gain):	0.052522	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999771	Status:	OK.
Std Error of Est:	0.000308		
Predicted MDL:	0.001249		
Predicted MQL:	0.004165		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00003	.000	.000	.00003	.000	1
CAL 1	.25000	.28137	.031	12.5	.01481	.000	1
Cal 2	50.000	51.459	1.46	2.92	2.7027	.008	1
Cal 3	100.00	98.510	-1.49	-1.49	5.1740	.012	1

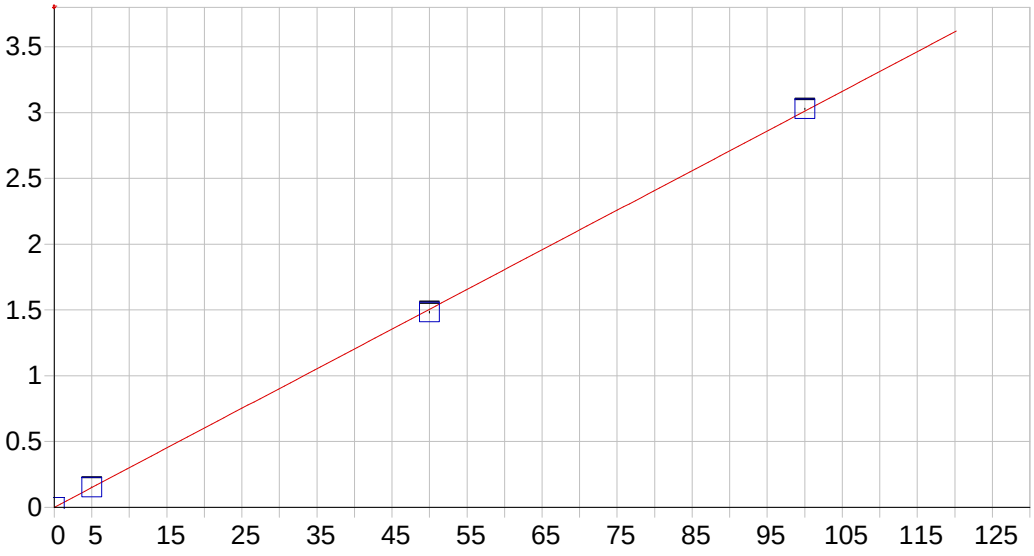


Pb 220.353 {453}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000280	Re-Slope:	1.000000
A1 (Gain):	0.104911	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999899	Status:	OK.
Std Error of Est:	0.000026		
Predicted MDL:	0.000986		
Predicted MQL:	0.003288		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.00028	.000	1
CAL 1	.01000	.01154	.002	15.4	.00098	.000	1
Cal 2	5.0000	5.0962	.096	1.92	.53468	.002	1
Cal 3	10.000	9.9022	-.098	-.978	1.0392	.002	1



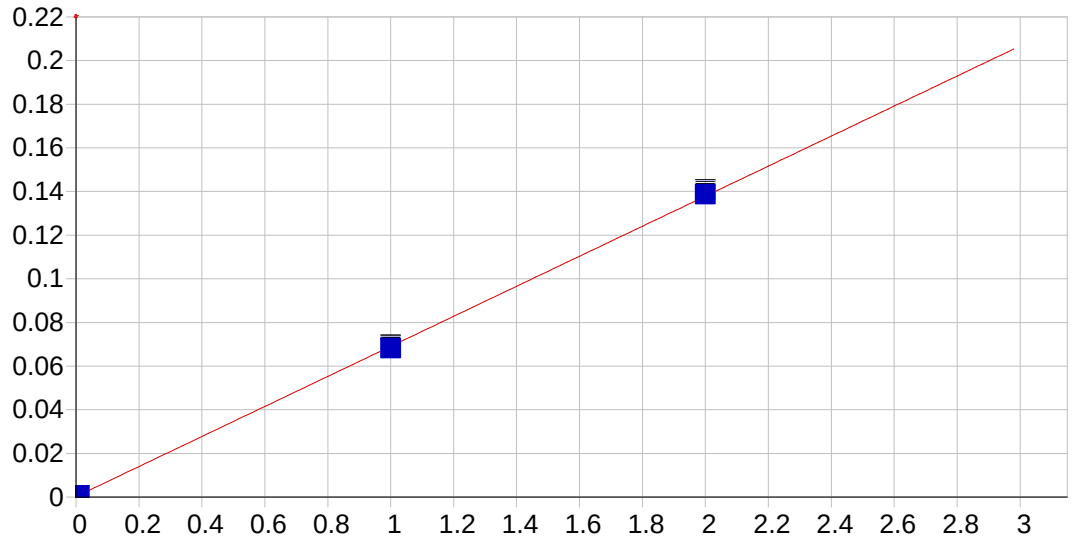
S 182.034 {485}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000050	Re-Slope:	1.000000
A1 (Gain):	0.030111	Y-int:	0.000000

A2 (Curvature):		0.000000					
n (Exponent):		1.000000					
Correlation:		0.999953		Status:	OK.		
Std Error of Est:		0.000364					
Predicted MDL:		0.002081					
Predicted MQL:		0.006938					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00005	.000	.000	.00005	.000	1
CAL 1	5.0000	5.0846	.085	1.69	.15315	.002	1
Cal 2	50.000	49.310	-.690	-1.38	1.4848	.007	1
Cal 3	100.00	100.61	.606	.606	3.0294	.005	1

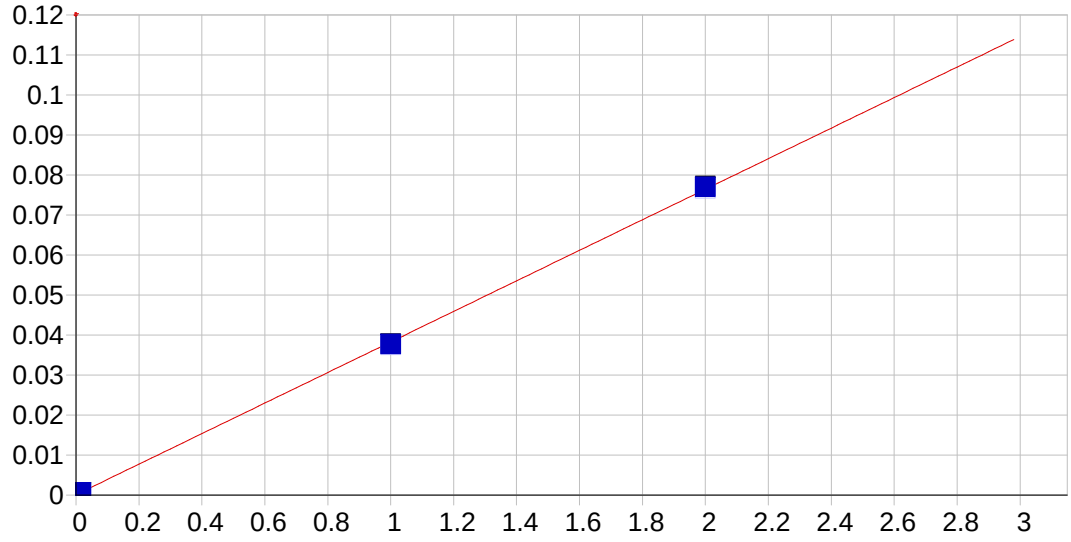


Sb 206.833 {463}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000222	Re-Slope:	1.000000
A1 (Gain):	0.068821	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999957	Status:	OK.
Std Error of Est:	0.000005		
Predicted MDL:	0.001438		
Predicted MQL:	0.004792		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	.00022	.000	1
CAL 1	.01000	.00943	-.001	-5.72	.00083	.000	1
Cal 2	1.0000	.98779	-.012	-1.22	.06910	.001	1
Cal 3	2.0000	2.0127	.013	.637	.14054	.000	1

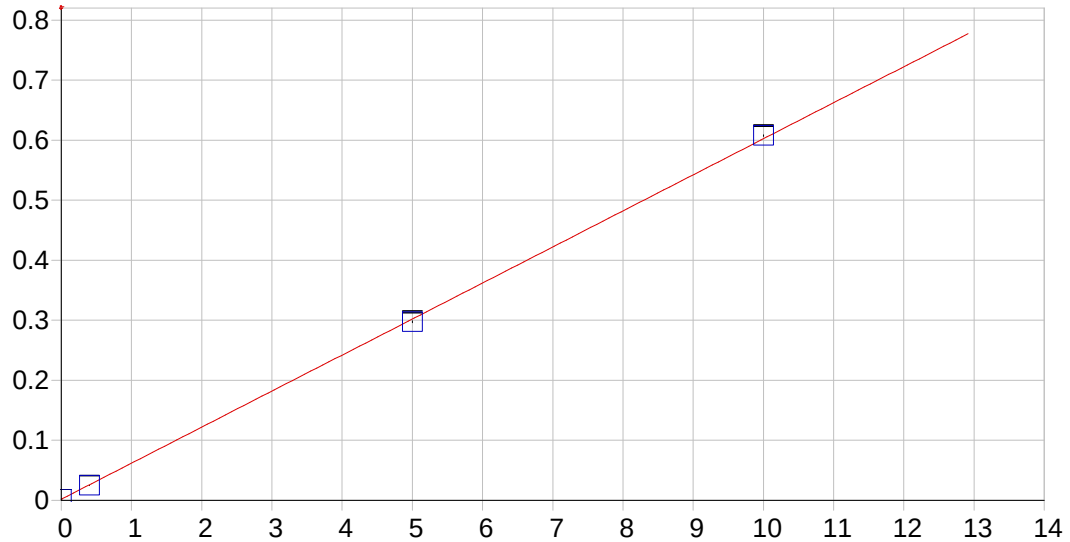


Se 196.090 {472}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000100	Re-Slope:	1.000000
A1 (Gain):	0.038173	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999936	Status:	OK.
Std Error of Est:	0.000004		
Predicted MDL:	0.001920		
Predicted MQL:	0.006401		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	.00010	.000	1
CAL 1	.01500	.01410	-.001	-5.98	.00064	.000	1
Cal 2	1.0000	.98557	-.014	-1.44	.03752	.000	1
Cal 3	2.0000	2.0153	.015	.766	.07663	.000	1



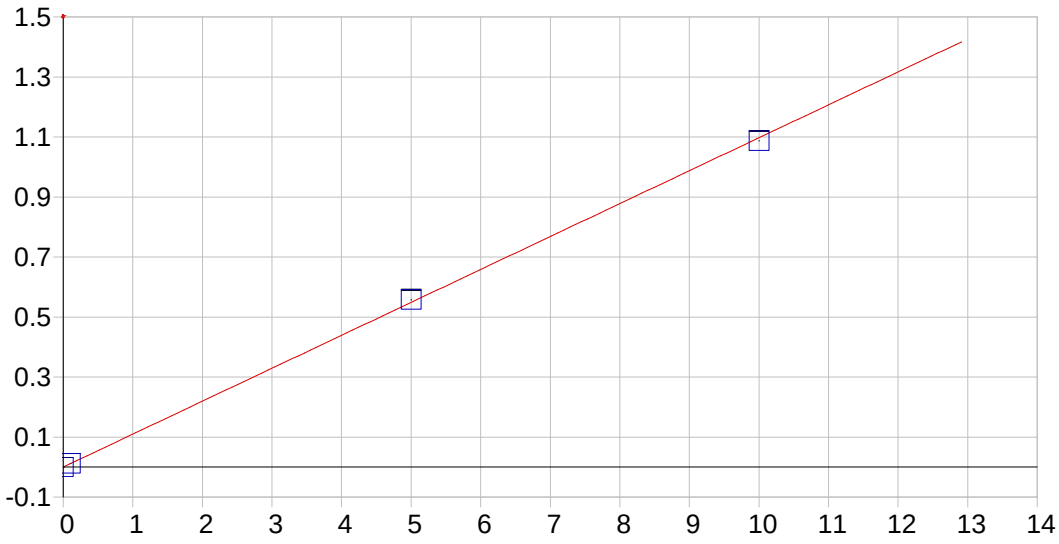
Si 251.611 {134}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.001872	Re-Slope:	1.000000
A1 (Gain):	0.060034	Y-int:	0.000000

A2 (Curvature):		0.000000					
n (Exponent):		1.000000					
Correlation:		0.999913		Status:	OK.		
Std Error of Est:		0.000088					
Predicted MDL:		0.005301					
Predicted MQL:		0.017671					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00002	.000	.000	.00187	.000	1
CAL 1	.40000	.38319	-.017	-4.20	.02488	.000	1
Cal 2	5.0000	4.9251	-.075	-1.50	.29754	.002	1
Cal 3	10.000	10.092	.092	.918	.60772	.001	1

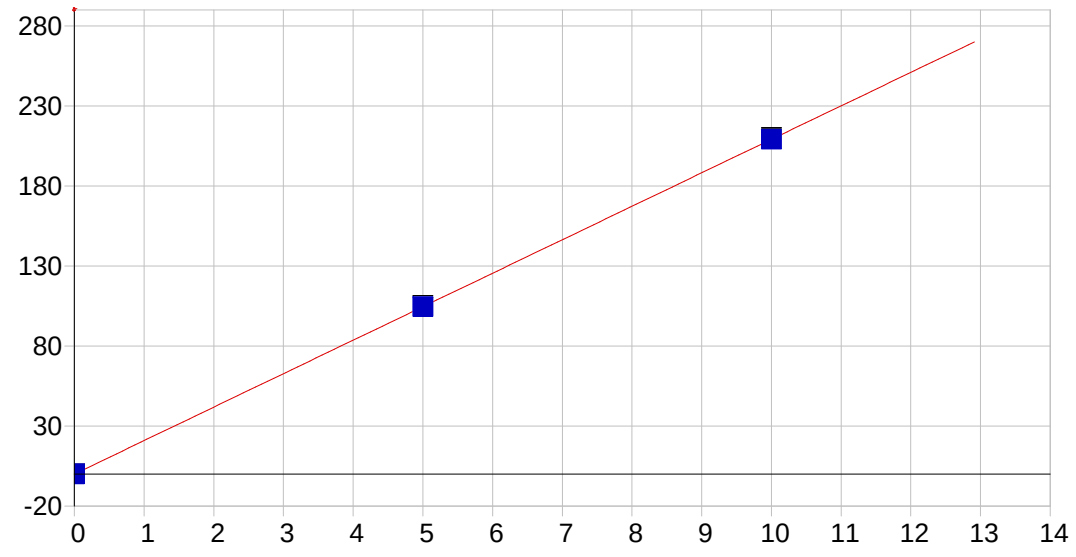


Sn 189.989 {478}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000048	Re-Slope:	1.000000
A1 (Gain):	0.109727	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999878	Status:	OK.
Std Error of Est:	0.000094		
Predicted MDL:	0.000543		
Predicted MQL:	0.001809		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00001	.000	.000	.00005	.000	1
CAL 1	.10000	.11212	.012	12.1	.01235	.000	1
Cal 2	5.0000	5.0817	.082	1.63	.55765	.002	1
Cal 3	10.000	9.9062	-.094	-.938	1.0870	.001	1

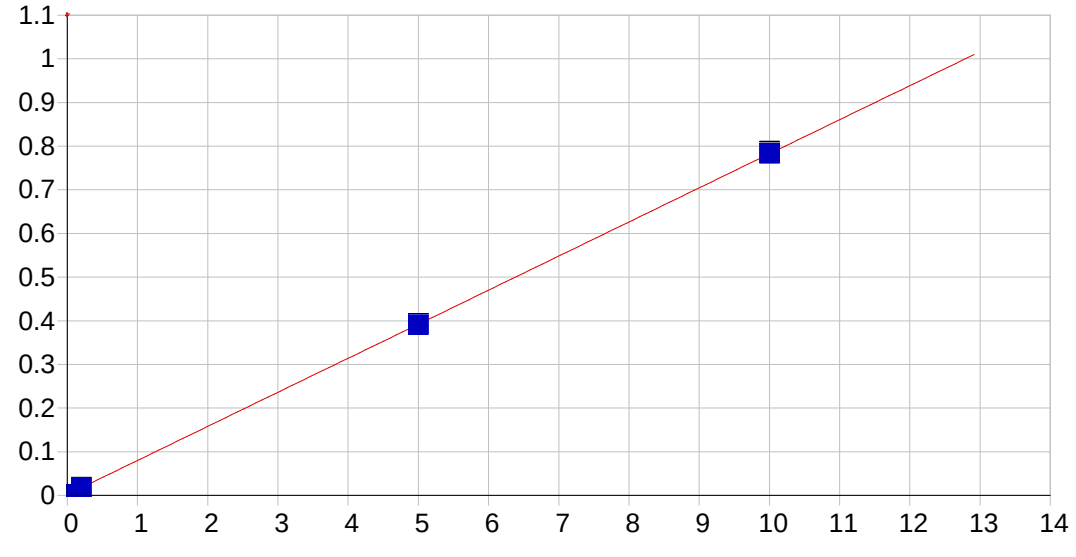


Sr 407.771 { 83}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.002959	Re-Slope:	1.000000
A1 (Gain):	20.915485	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	1.000000	Status:	OK.
Std Error of Est:	0.000155		
Predicted MDL:	0.000049		
Predicted MQL:	0.000163		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.00296	.001	1
CAL 1	.00500	.00514	.000	2.75	.10558	.001	1
Cal 2	5.0000	5.0023	.002	.047	104.68	.580	1
Cal 3	10.000	9.9975	-.002	-.025	209.21	.964	1



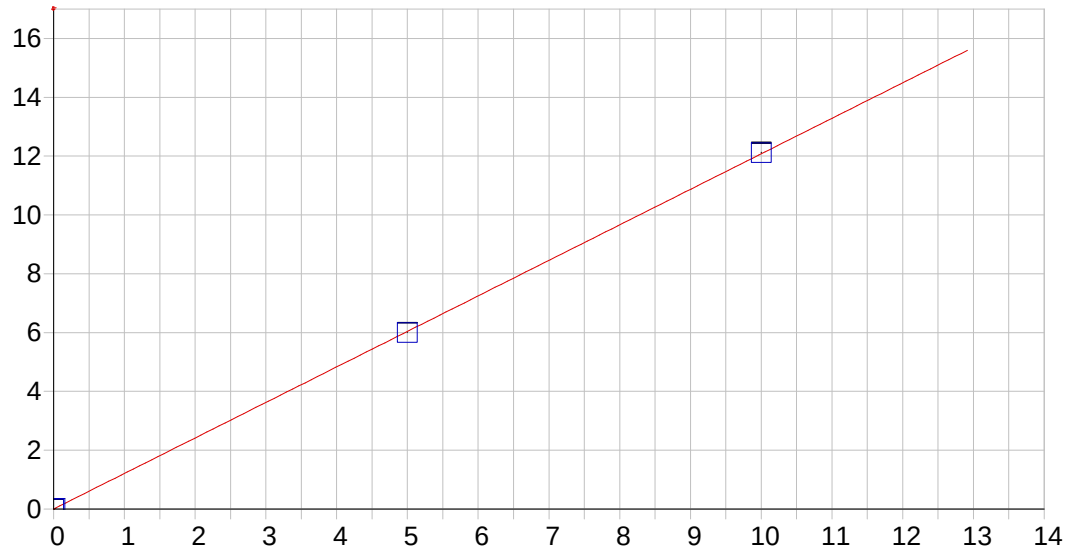
Th 283.231 {119}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.001851	Re-Slope:	1.000000
A1 (Gain):	0.078060	Y-int:	0.000000

A2 (Curvature):		0.000000					
n (Exponent):		1.000000					
Correlation:		0.999985		Status:	OK.		
Std Error of Est:		0.000033					
Predicted MDL:		0.003391					
Predicted MQL:		0.011304					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00001	.000	.000	.00185	.000	1
CAL 1	.20000	.20863	.009	4.31	.01791	.000	1
Cal 2	5.0000	4.9806	-.019	-.388	.39139	.003	1
Cal 3	10.000	10.011	.011	.109	.78482	.003	1

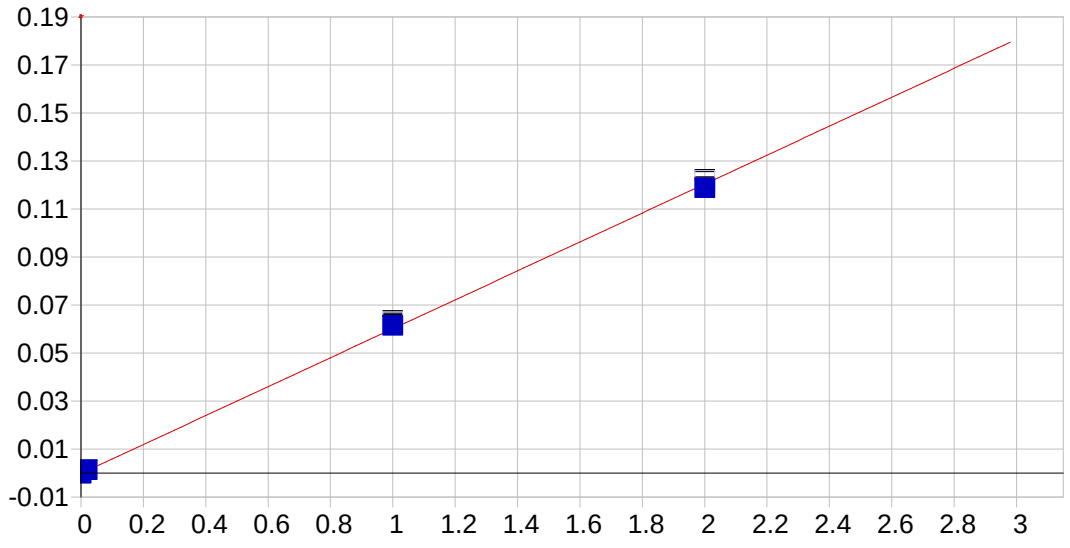


Ti 334.941 {101}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.002039	Re-Slope:	1.000000
A1 (Gain):	1.207626	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999989	Status:	OK.
Std Error of Est:	0.000136		
Predicted MDL:	0.000571		
Predicted MQL:	0.001904		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	.00204	.000	1
CAL 1	.02000	.02017	.000	.848	.02640	.000	1
Cal 2	5.0000	4.9676	-.032	-.648	6.0010	.002	1
Cal 3	10.000	10.032	.032	.322	12.117	.020	1

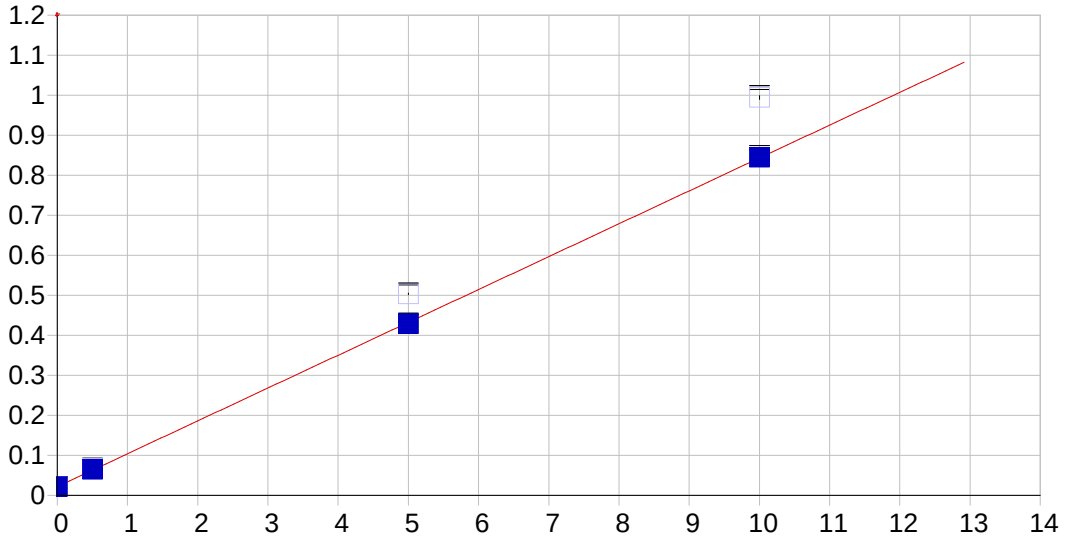


Tl 190.856 {477}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000165	Re-Slope:	1.000000
A1 (Gain):	0.060274	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999708	Status:	OK.
Std Error of Est:	0.000016		
Predicted MDL:	0.001281		
Predicted MQL:	0.004270		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.00017	.000	1
CAL 1	.02000	.02447	.004	22.3	.00132	.000	1
Cal 2	1.0000	1.0224	.022	2.24	.06299	.000	1
Cal 3	2.0000	1.9733	-.027	-1.34	.12183	.000	1



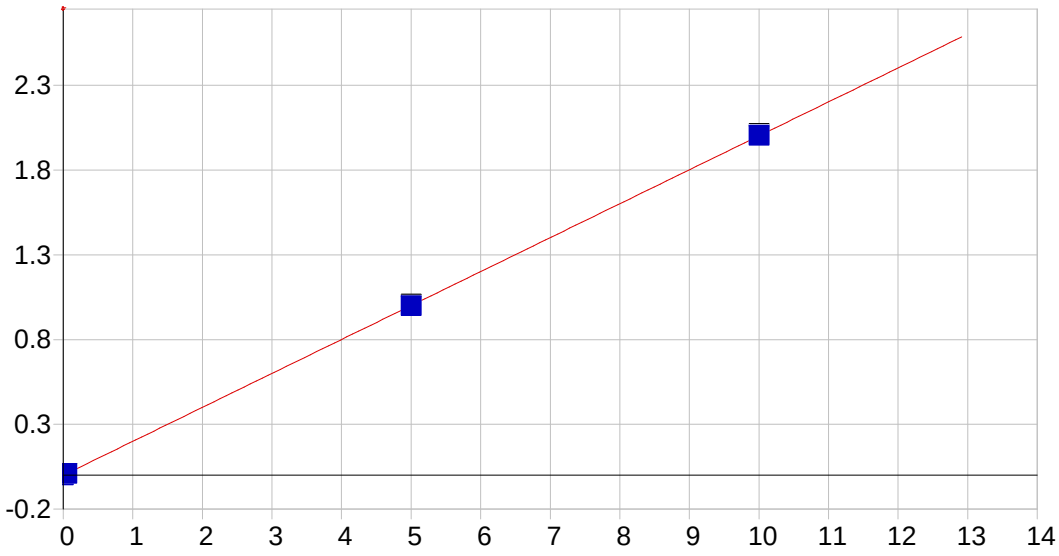
U 367.007 { 92}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.021812	Re-Slope:	1.000000
A1 (Gain):	0.082120	Y-int:	0.000000

A2 (Curvature):		0.000000					
n (Exponent):		1.000000					
Correlation:		0.999966		Status:	OK.		
Std Error of Est:		0.000099					
Predicted MDL:		0.008891					
Predicted MQL:		0.029637					

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	-.00002	.000	.000	.02181	.001	1
CAL 1	.50000	.52259	.023	4.52	.06710	.001	1
Cal 2	5.0000	4.9565	-.044	-.870	.50356	.002	1
Cal 3	10.000	10.023	.023	.233	.99437	.005	1

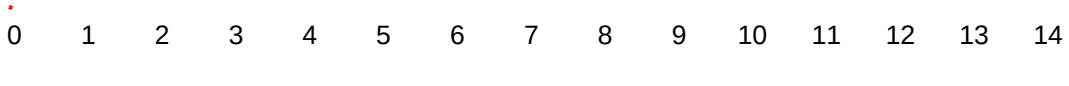


V 290.882 {116}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	-0.000524	Re-Slope:	1.000000
A1 (Gain):	0.200259	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.999996	Status:	OK.
Std Error of Est:	0.000023		
Predicted MDL:	0.002718		
Predicted MQL:	0.009060		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CALBLK1	.00000	.00000	.000	.000	-.00052	.000	1
CAL 1	.05000	.04766	-.002	-4.69	.00914	.000	1
Cal 2	5.0000	4.9934	-.007	-.132	1.0026	.005	1
Cal 3	10.000	10.009	.009	.090	2.0102	.004	1

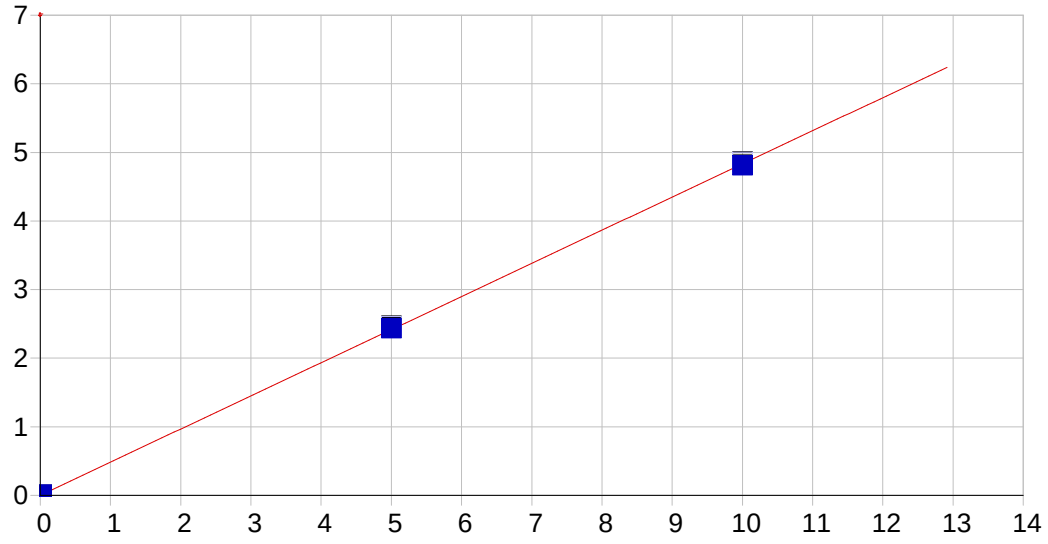


Y 371.030 { 91}*

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	1.000000	Re-Slope:	1.000000
A1 (Gain):	0.000000	Y-int:	0.000000
A2 (Curvature):	0.000000		
n (Exponent):	1.000000		
Correlation:	0.000000	Status:	Warning Zero Gain
Std Error of Est:	0.000000		
Predicted MDL:	n/a		
Predicted MQL:	n/a		

Std. Name	Stated Conc.	Found Conc.	Difference	% Diff.	(S)IR	Std Dev	Emphasis
CAL 1	1.0000	.00000	-1.00	-100.	1.0000	.000	1
CALBLK1	.00000	.00000	.000	.000	1.0000	.000	1
Cal 2	5.0000	.00000	-5.00	-100.	1.0000	.000	1
Cal 3	10.000	.00000	-10.0	-100.	1.0000	.000	1



Zn 213.856 {458}

Date of Fit:	5/22/2014 10:40:09	Type of Fit:	Linear	Weighting:	1/Conc

A0 (Offset):	0.000529	Re-Slope:	1.000000
A1 (Gain):	0.483150	Y-int:	0.000000

A2 (Curvature):		0.000000					
n (Exponent):		1.000000					
Correlation:		0.999975		Status:	OK.		
Std Error of Est:		0.000085					
Predicted MDL:		0.000135					
Predicted MQL:		0.000450					
Std. Name	**Stated Conc.**	**Found Conc.**	**Difference**	**% Diff.**	**(S)IR**	**Std Dev**	**Emphasis**
CALBLK1	.00000	.00000	.000	.000	.00053	.000	1
CAL 1	.02000	.02178	.002	8.92	.01121	.000	1
Cal 2	5.0000	5.0448	.045	.896	2.4619	.009	1
Cal 3	10.000	9.9534	-.047	-.466	4.8575	.005	1

Sample Name: ICV Acquired: 5/22/2014 10:40:17 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.9874**	**50.80**	**4.929**	**5.071**	**4.978**	**4.987**	**5.000**	**50.43**	**5.005**
Stddev	.0143	.22	.073	.007	.084	.017	.079	.75	.075
%RSD	1.448	.4373	1.485	.1338	1.682	.3384	1.575	1.480	1.493
#1	1.004	50.56	5.014	5.064	4.881	4.987	5.091	51.29	5.091
#2	.9789	50.85	4.892	5.077	5.025	4.970	4.957	50.00	4.959
#3	.9795	50.99	4.882	5.073	5.028	5.004	4.952	50.00	4.965
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.117**	**5.057**	**4.996**	**49.49**	**51.39**	**5.325**	**48.80**	**4.971**	**1.020**
Stddev	.078	.075	.072	.37	.34	.065	.53	.042	.016
%RSD	1.531	1.477	1.437	.7501	.6707	1.218	1.080	.8370	1.586
#1	5.207	5.143	5.079	49.92	51.01	5.250	49.39	5.014	1.038
#2	5.074	5.016	4.960	49.28	51.46	5.359	48.39	4.931	1.010
#3	5.069	5.011	4.949	49.28	51.69	5.366	48.61	4.967	1.011
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**51.89**	**5.066**	F **5.541**	**5.047**	**49.50**	**1.001**	**.9976**	F **5.590**	**5.041**
Stddev	.45	.075	.086	.073	.77	.013	.0113	.007	.069
%RSD	.8686	1.474	1.561	1.440	1.550	1.322	1.132	.1267	1.377
#1	51.37	5.152	5.640	5.130	50.39	1.016	1.010	5.596	5.122
#2	52.16	5.018	5.492	4.999	49.07	.9920	.9890	5.591	5.002
#3	52.13	5.027	5.489	5.011	49.05	.9946	.9933	5.582	5.001
Check ?	Chk Pass	Chk Pass	Chk Fail	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Fail	Chk Pass
Value			5.000					5.000	
Range			10.00%					10.00%	

Sample Name: ICV Acquired: 5/22/2014 10:40:17 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**4.991**	**5.054**	**4.991**	**1.039**	**5.026**	**4.925**	**4.993**
Stddev	.040	.086	.014	.016	.077	.034	.075
%RSD	.8007	1.707	.2797	1.559	1.538	.6866	1.495
#1	4.964	5.153	5.007	1.058	5.115	4.958	5.079
#2	4.973	4.995	4.981	1.029	4.991	4.890	4.948
#3	5.037	5.013	4.987	1.031	4.973	4.926	4.951
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5847.6**
Stddev	77.6
%RSD	1.3266
#1	5758.7
#2	5901.5
#3	5882.5

Sample Name: ICB Acquired: 5/22/2014 10:44:06 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0055	.0006	.0117	.0003	.0002	<.0000	<.0000	.0002
Stddev	.0001	.0031	.0003	.0003	.0004	.0003	.0019	.0009	.0002
%RSD	38.19	55.99	55.51	2.844	114.9	101.0	127.8	93.94	93.22
#1	-.0004	.0086	.0005	.0115	.0007	.0005	.0006	-.0001	.0004
#2	-.0003	.0024	.0003	.0114	.0002	.0002	-.0021	-.0018	.0001
#3	-.0002	.0056	.0009	.0120	.0000	.0000	-.0030	-.0009	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0003	.0002	.0026	.0037	.0011	.0025	.0002	.0002
Stddev	.0001	.0011	.0005	.0027	.0122	.0009	.0017	.0003	.0002
%RSD	87.88	307.4	286.0	102.3	331.4	75.04	68.16	127.8	100.7
#1	.0002	-.0008	.0000	.0057	.0178	.0017	.0041	.0005	.0003
#2	.0000	.0006	-.0002	.0006	-.0034	.0016	.0025	.0003	.0000
#3	.0002	.0013	.0007	.0016	-.0034	.0002	.0008	-.0001	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0089	.0002	<.0000	.0009	.0040	.0019	<.0000	.0016	.0000
Stddev	.0034	.0001	.0003	.0011	.0019	.0005	.0021	.0017	.0006
%RSD	38.45	31.08	111.8	125.1	46.03	27.05	162.4	107.0	8163.
#1	.0128	.0002	-.0003	.0021	.0062	.0024	-.0033	.0028	-.0002
#2	.0070	.0002	.0000	.0006	.0029	.0014	.0009	-.0004	-.0005
#3	.0068	.0001	-.0006	.0000	.0031	.0019	-.0014	.0025	.0007
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: ICB Acquired: 5/22/2014 10:44:06 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0003	.0010	.0003	<.0000	<.0000	<.0000	.0001
Stddev	.0002	.0058	.0004	.0012	.0014	.0007	.0001
%RSD	90.85	555.6	113.9	49.04	89.74	307.3	121.8
#1	.0005	-.0013	.0006	-.0019	-.0007	-.0008	.0002
#2	.0002	-.0033	-.0001	-.0039	-.0008	.0006	.0002
#3	.0000	.0077	.0005	-.0016	-.0031	-.0005	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	6051.1
Stddev	14.9
%RSD	.24691
#1	6037.5
#2	6067.1
#3	6048.6

Sample Name: LLC Acquired: 5/22/2014 10:48:02 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0100**	**.2057**	**.0092**	**.0518**	**.0512**	**.0051**	**.2120**	**1.119**
Stddev	.0003	.0028	.0006	.0010	.0002	.0000	.0031	.002
%RSD	2.776	1.356	6.906	1.972	.4159	.6945	1.473	.1716
#1	.0103	.2046	.0090	.0523	.0511	.0050	.2150	1.121
#2	.0098	.2035	.0087	.0506	.0510	.0050	.2123	1.119
#3	.0098	.2088	.0099	.0524	.0514	.0051	.2088	1.117
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value								
Range								

Elem	Cd2288	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0052**	**.0551**	**.0104**	**.0255**	**.1056**	**5.228**	**.0570**	**.9347**
Stddev	.0000	.0003	.0007	.0001	.0015	.030	.0002	.0112
%RSD	.3741	.5765	7.078	.5148	1.399	.5788	.3941	1.200
#1	.0052	.0548	.0102	.0256	.1072	5.194	.0571	.9377
#2	.0052	.0554	.0098	.0255	.1042	5.237	.0567	.9441
#3	.0052	.0550	.0112	.0253	.1054	5.253	.0571	.9223
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value								
Range								

Elem	Mn2576	Mo2020	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0155**	**.0415**	**1.053**	**.0448**	**.2688**	**.0111**	**4.900**	**.0107**
Stddev	.0003	.0003	.003	.0001	.0013	.0002	.030	.0014
%RSD	1.641	.6093	.2883	.2612	.4660	1.377	.6176	12.69
#1	.0155	.0418	1.050	.0448	.2674	.0111	4.902	.0102
#2	.0158	.0414	1.056	.0449	.2699	.0110	4.929	.0123
#3	.0153	.0414	1.052	.0447	.2691	.0113	4.869	.0097
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value								
Range								

Sample Name: LLC Acquired: 5/22/2014 10:48:02 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Se1960	Si2516	Sn1899	Sr4077	Th2832	Ti3349	Tl1908	U_3670
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0145**	**.3815**	**.1070**	**.0051**	**.1974**	**.0193**	W **.0240**	**.5164**
Stddev	.0030	.0035	.0001	.0000	.0019	.0004	.0006	.0143
%RSD	20.81	.9109	.1175	.8751	.9541	1.850	2.327	2.767
#1	.0129	.3783	.1069	.0051	.1991	.0196	.0234	.5244
#2	.0180	.3810	.1069	.0051	.1978	.0189	.0241	.5249
#3	.0126	.3852	.1071	.0051	.1954	.0194	.0245	.4999
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Warn	Chk Pass
Value							.0200	
Range							20.00%	

Elem	V_2908	Zn2138
Units	ppm	ppm
Avg	**.0474**	**.0211**
Stddev	.0003	.0001
%RSD	.5500	.4273
#1	.0472	.0211
#2	.0477	.0210
#3	.0473	.0212
Check ?	Chk Pass	Chk Pass
Value		
Range		

Int. Std.	Y_3710
Units	Cts/S
Avg	**6020.6**
Stddev	11.1
%RSD	.18449
#1	6029.8
#2	6008.3
#3	6023.9

Sample Name: ICSA Acquired: 5/22/2014 10:51:55 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	102.3	<.0000	.0076	.0005	<.0000	.0130
Stddev	.0008	.4	.0006	.0024	.0001	.0000	.0004
%RSD	339.0	.3502	192.2	31.08	21.39	191.7	3.184
#1	-.0007	101.9	.0004	.0053	.0004	.0000	.0130
#2	.0009	102.6	-.0006	.0075	.0004	.0000	.0134
#3	.0005	102.3	-.0008	.0100	.0006	.0000	.0126
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Elem	Ca1840	Cd2288	Co2286	Cr2835	Cu2178	Fe2599	K_7664
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	98.98	<.0000	.0022	W .0092	<.0000	99.20	102.5
Stddev	.29	.0001	.0001	.0001	.0007	.13	.5
%RSD	.2934	35.19	2.394	.6166	48.31	.1342	.4641
#1	99.31	-.0003	.0022	.0093	-.0013	99.35	102.0
#2	98.80	-.0001	.0022	.0092	-.0023	99.11	103.0
#3	98.82	-.0002	.0021	.0092	-.0009	99.13	102.4
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Warn	Chk Pass	Chk Pass	Chk Pass
High Limit				.0061			
Low Limit				-.0061			

Elem	Li6707	Mg2798	Mn2576	Mo2020	Na5895	Ni2216	P_1774
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0016	100.7	W .0050	<.0000	97.39	.0016	99.03
Stddev	.0004	.2	.0001	.0003	.88	.0002	.38
%RSD	23.53	.2028	1.417	122.5	.9077	13.66	.3882
#1	.0018	100.9	.0050	-.0004	96.90	.0018	99.41
#2	.0012	100.6	.0051	-.0005	96.86	.0016	99.03
#3	.0019	100.5	.0050	.0001	98.41	.0014	98.65
Check ?	Chk Pass	Chk Pass	Chk Warn	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit			.0031				
Low Limit			-.0031				

Sample Name: ICSA Acquired: 5/22/2014 10:51:55 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899	Sr4077
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0024	102.4	.0054	.0006	.0019	<.0000	W<.0000
Stddev	.0013	.4	.0003	.0015	.0046	.0001	.0000
%RSD	53.03	.4090	6.183	253.8	238.5	13.32	.9399
#1	.0019	102.9	.0055	.0011	-.0019	-.0011	-.0046
#2	.0038	102.3	.0050	-.0011	.0007	-.0011	-.0047
#3	.0014	102.0	.0056	.0017	.0070	-.0009	-.0046
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Warn
High Limit							.0011
Low Limit							-.0011

Elem	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm
Avg	F .2805	.0020	<.0000	.0211	<.0000	<.0000
Stddev	.0055	.0004	.0008	.0117	.0047	.0000
%RSD	1.964	22.12	21.56	55.60	519.5	.4801
#1	.2778	.0025	-.0030	.0092	-.0009	-.0067
#2	.2868	.0017	-.0040	.0326	-.0055	-.0068
#3	.2767	.0017	-.0046	.0214	.0038	-.0067
Check ?	Chk Fail	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit	.2000					
Low Limit	-.2000					

Int. Std.	Y_3710
Units	Cts/S
Avg	5595.1
Stddev	10.4
%RSD	.18551
#1	5583.2
#2	5602.3
#3	5599.9

Sample Name: ICSAB Acquired: 5/22/2014 10:55:51 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.4922**	**103.2**	**2.503**	**2.510**	**2.581**	**2.564**	**2.496**	**96.30**	**2.524**
Stddev	.0051	.8	.016	.013	.010	.009	.015	.61	.018
%RSD	1.043	.7768	.6343	.5236	.3776	.3417	.6109	.6307	.7015
#1	.4867	104.1	2.484	2.523	2.590	2.554	2.479	95.68	2.504
#2	.4931	103.0	2.511	2.512	2.583	2.570	2.506	96.31	2.531
#3	.4968	102.5	2.513	2.496	2.571	2.569	2.504	96.90	2.537
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**2.435**	**2.462**	**2.505**	**97.36**	**103.6**	**2.714**	**98.64**	**2.470**	**.4907**
Stddev	.018	.022	.020	.45	1.3	.053	.61	.011	.0031
%RSD	.7414	.9156	.7931	.4587	1.270	1.960	.6192	.4315	.6249
#1	2.414	2.438	2.482	96.86	105.0	2.771	98.02	2.461	.4875
#2	2.444	2.469	2.514	97.48	103.5	2.706	98.66	2.466	.4910
#3	2.447	2.481	2.519	97.73	102.4	2.666	99.24	2.482	.4936
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**102.6**	**2.468**	**95.66**	**2.472**	**98.37**	**.4959**	**.5055**	**2.514**	**2.477**
Stddev	2.0	.015	.80	.017	.73	.0047	.0053	.005	.014
%RSD	1.905	.5962	.8345	.7031	.7391	.9400	1.047	.1846	.5451
#1	101.6	2.452	94.76	2.453	97.55	.4905	.4994	2.510	2.462
#2	104.8	2.473	95.92	2.477	98.62	.4980	.5082	2.513	2.481
#3	101.3	2.480	96.29	2.487	98.94	.4991	.5088	2.519	2.489
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: ICSAB Acquired: 5/22/2014 10:55:51 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**2.610**	**2.640**	**2.507**	**.4917**	**2.513**	**2.458**	**2.534**
Stddev	.003	.025	.002	.0032	.038	.007	.018
%RSD	.1253	.9535	.0855	.6601	1.498	.2668	.7285
#1	2.611	2.612	2.505	.4880	2.471	2.453	2.513
#2	2.606	2.647	2.507	.4932	2.523	2.456	2.542
#3	2.613	2.660	2.510	.4940	2.545	2.466	2.548
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5661.3**
Stddev	45.2
%RSD	.79802
#1	5710.4
#2	5652.1
#3	5621.4

Sample Name: LDR Acquired: 5/22/2014 10:59:35 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.999**	**104.0**	**10.14**	**10.06**	**10.11**	**9.935**	**10.10**	**98.41**	**10.17**
Stddev	.000	.1	.02	.01	.04	.063	.02	.17	.02
%RSD	.0182	.1300	.1865	.0849	.4018	.6364	.2210	.1777	.1513
#1	1.999	104.1	10.16	10.06	10.08	9.995	10.12	98.50	10.19
#2	2.000	103.9	10.13	10.05	10.15	9.869	10.08	98.53	10.17
#3	1.999	104.1	10.13	10.07	10.08	9.942	10.10	98.21	10.15
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**9.807**	**9.932**	**10.19**	**98.99**	**104.3**	**10.70**	**100.9**	**10.02**	**1.997**
Stddev	.023	.004	.02	.04	.2	.03	.2	.01	.005
%RSD	.2369	.0383	.2035	.0435	.1782	.2698	.1662	.0679	.2738
#1	9.832	9.935	10.22	98.94	104.2	10.70	100.8	10.03	2.004
#2	9.802	9.933	10.18	99.01	104.2	10.68	100.9	10.01	1.995
#3	9.787	9.927	10.18	99.02	104.5	10.74	101.1	10.02	1.994
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**101.9**	**10.04**	**97.57**	**9.977**	**100.8**	**2.035**	**2.026**	**10.22**	**10.00**
Stddev	2.7	.01	.26	.008	.2	.005	.006	.01	.01
%RSD	2.616	.1169	.2635	.0846	.1903	.2320	.2831	.0896	.1205
#1	99.81	10.05	97.87	9.987	101.0	2.041	2.031	10.22	10.01
#2	101.1	10.05	97.46	9.974	100.8	2.032	2.020	10.22	10.01
#3	104.9	10.03	97.39	9.971	100.6	2.033	2.028	10.23	9.988
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: LDR Acquired: 5/22/2014 10:59:35 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**10.06**	**9.754**	**10.10**	**1.954**	**10.08**	**9.871**	**9.998**
Stddev	.08	.011	.01	.007	.02	.026	.017
%RSD	.7903	.1087	.0854	.3808	.2100	.2655	.1665
#1	10.11	9.766	10.10	1.962	10.07	9.870	10.02
#2	9.969	9.753	10.09	1.948	10.10	9.898	9.994
#3	10.10	9.745	10.10	1.951	10.06	9.845	9.984
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5447.2**
Stddev	6.1
%RSD	.11122
#1	5440.5
#2	5449.1
#3	5452.1

Sample Name: CCV Acquired: 5/22/2014 11:03:33 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.9825**	**51.01**	**5.056**	**4.925**	**5.088**	**4.989**	**5.110**	**50.64**	**5.115**
Stddev	.0055	.11	.037	.013	.090	.026	.030	.20	.027
%RSD	.5618	.2238	.7264	.2643	1.767	.5161	.5802	.3885	.5281
#1	.9828	50.97	5.028	4.913	5.143	4.976	5.088	50.57	5.095
#2	.9879	50.92	5.097	4.939	5.136	5.019	5.144	50.86	5.146
#3	.9769	51.14	5.041	4.923	4.984	4.974	5.100	50.48	5.103
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.023**	**5.030**	**5.144**	**49.02**	**52.81**	F **5.519**	**48.04**	**4.951**	**1.014**
Stddev	.033	.032	.031	.18	.21	.036	.21	.019	.006
%RSD	.6596	.6359	.6006	.3679	.3995	.6555	.4399	.3755	.6307
#1	5.001	5.025	5.120	48.91	52.69	5.513	48.04	4.957	1.009
#2	5.061	5.064	5.179	49.22	52.68	5.486	48.25	4.965	1.021
#3	5.006	5.001	5.132	48.92	53.05	5.558	47.83	4.930	1.013
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Fail	Chk Pass	Chk Pass	Chk Pass
Value						5.000			
Range						10.00%			

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**52.86**	**5.154**	**51.43**	**5.151**	**50.20**	**1.019**	**1.014**	**5.003**	**5.145**
Stddev	.30	.024	.35	.026	.32	.008	.007	.013	.026
%RSD	.5595	.4611	.6883	.4967	.6380	.8062	.6804	.2545	.5003
#1	52.65	5.135	51.22	5.138	49.94	1.011	1.008	5.010	5.128
#2	52.73	5.181	51.84	5.180	50.55	1.027	1.022	4.989	5.175
#3	53.20	5.146	51.23	5.135	50.09	1.019	1.012	5.011	5.133
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 11:03:33 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.133**	**4.884**	**5.003**	**1.025**	**5.109**	**4.848**	**5.097**
Stddev	.068	.014	.013	.006	.035	.008	.031
%RSD	1.319	.2770	.2560	.6300	.6889	.1564	.6121
#1	5.126	4.884	4.990	1.025	5.122	4.841	5.076
#2	5.069	4.898	5.015	1.032	5.136	4.856	5.133
#3	5.204	4.870	5.003	1.019	5.069	4.848	5.083
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5679.0**
Stddev	21.5
%RSD	.37868
#1	5684.0
#2	5655.5
#3	5697.6

Sample Name: CCB Acquired: 5/22/2014 11:07:22 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**<.0000**	**<.0000**	**.0118**	**.0000**	**.0000**	**.0012**	**<.0000**	**.0001**
Stddev	.0006	.0034	.0013	.0007	.0000	.0000	.0009	.0009	.0001
%RSD	443.8	52.65	832.1	5.881	211.1	31.52	73.37	87.68	114.0
#1	.0005	-.0038	-.0011	.0122	.0000	.0001	.0002	-.0016	.0001
#2	.0005	-.0052	.0013	.0110	.0000	.0000	.0015	-.0014	.0000
#3	-.0006	-.0102	-.0006	.0121	.0001	.0000	.0018	.0000	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0005**	**.0010**	**.0000**	**.0001**	**.0110**	**.0011**	**.0111**	**.0004**	**.0002**
Stddev	.0002	.0008	.0002	.0007	.0162	.0001	.0045	.0002	.0001
%RSD	43.40	78.87	1484.	731.6	147.8	8.958	40.87	59.11	37.20
#1	.0003	.0002	.0002	.0007	.0225	.0011	.0107	.0005	.0001
#2	.0005	.0017	-.0002	.0003	.0180	.0009	.0159	.0005	.0002
#3	.0007	.0009	.0001	-.0007	-.0076	.0011	.0068	.0001	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0125**	**.0001**	**.0018**	**.0006**	**.0038**	**.0007**	**.0017**	**<.0000**	**.0000**
Stddev	.0030	.0002	.0018	.0011	.0016	.0009	.0013	.0050	.0001
%RSD	23.65	314.0	102.2	174.9	41.03	117.0	72.69	443.8	653.9
#1	.0111	.0003	-.0001	-.0004	.0054	.0013	.0017	-.0064	-.0001
#2	.0105	-.0002	.0020	.0005	.0023	-.0002	.0030	.0036	.0000
#3	.0159	.0001	.0035	.0018	.0037	.0011	.0005	-.0006	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 11:07:22 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	.0001	.0007	<.0000	.0014	.0000
Stddev	.0000	.0011	.0003	.0008	.0093	.0009	.0001
%RSD	220.6	55.23	372.6	123.5	60.23	59.36	216.7
#1	.0000	-.0028	-.0002	.0004	-.0073	.0023	.0000
#2	-.0001	-.0007	.0003	.0016	-.0134	.0006	.0002
#3	.0000	-.0022	.0001	.0000	-.0255	.0015	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	6016.5
Stddev	23.0
%RSD	.38200
#1	5999.2
#2	6007.7
#3	6042.6

Sample Name: 160-6588-D-7-A Acquired: 5/22/2014 11:11:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0126	<.0000	.0348	.3127	.0001	<.0000	41.92	.0001
Stddev	.0004	.0038	.0017	.0021	.0022	.0003	.0015	1.03	.0001
%RSD	208.6	30.64	104.8	5.949	.7040	205.4	354.8	2.455	66.17
#1	-.0001	.0102	.0003	.0326	.3132	.0000	-.0018	42.93	.0002
#2	-.0006	.0105	-.0027	.0351	.3147	.0000	-.0007	41.96	.0000
#3	.0001	.0170	-.0026	.0367	.3103	.0005	.0012	40.87	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0003	.0015	<.0000	.0142	1.322	.0057	17.44	.0035	.0013
Stddev	.0003	.0004	.0006	.0034	.015	.0013	.10	.0002	.0002
%RSD	99.00	22.96	32.24	23.72	1.098	22.89	.5496	4.390	16.62
#1	.0004	.0019	-.0012	.0123	1.308	.0054	17.55	.0034	.0013
#2	.0000	.0014	-.0017	.0122	1.337	.0045	17.40	.0035	.0011
#3	.0004	.0013	-.0023	.0181	1.321	.0071	17.37	.0037	.0015
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	12.92	.0015	.0071	.0012	1.544	.0013	.0005	4.862	<.0000
Stddev	.31	.0002	.0012	.0005	.040	.0008	.0025	.024	.0003
%RSD	2.365	10.72	16.88	46.10	2.585	64.43	504.4	.5012	44.98
#1	12.93	.0017	.0059	.0009	1.583	.0017	.0029	4.882	-.0003
#2	13.23	.0014	.0083	.0018	1.545	.0019	.0006	4.870	-.0008
#3	12.61	.0015	.0071	.0008	1.503	.0003	-.0020	4.835	-.0007
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6588-D-7-A Acquired: 5/22/2014 11:11:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0718	.0014	.0006	<.0000	<.0000	.0013	.0107
Stddev	.0003	.0018	.0011	.0006	.0056	.0035	.0003
%RSD	.4359	125.9	181.4	36.39	39.20	261.6	3.135
#1	.0715	.0014	.0000	-.0016	-.0079	-.0007	.0111
#2	.0721	.0032	.0000	-.0012	-.0185	-.0007	.0106
#3	.0716	-.0004	.0019	-.0025	-.0161	.0053	.0104
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5932.4
Stddev	6.5
%RSD	.10893
#1	5930.2
#2	5927.3
#3	5939.7

Sample Name: MB 160-119594/1-A Acquired: 5/22/2014 11:15:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0102	<.0000	.0126	.0002	<.0000	.0003	.0631	.0001
Stddev	.0001	.0010	.0018	.0036	.0001	.0000	.0007	.0054	.0002
%RSD	64.96	10.00	285.8	28.72	55.62	146.7	223.6	8.545	118.0
#1	.0000	.0091	-.0024	.0085	.0002	.0000	-.0002	.0694	.0003
#2	-.0003	.0112	.0012	.0140	.0001	.0000	.0012	.0598	.0000
#3	-.0002	.0102	-.0007	.0153	.0001	.0000	.0000	.0602	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	.0007	.0002	.0121	.0092	.0008	.0203	.0001	.0001
Stddev	.0003	.0001	.0008	.0015	.0261	.0001	.0168	.0003	.0001
%RSD	707.3	12.49	504.0	12.81	284.8	14.31	82.49	283.2	55.06
#1	.0004	.0007	.0006	.0105	.0101	.0008	.0272	-.0003	.0001
#2	.0000	.0006	-.0008	.0135	.0348	.0007	.0012	.0002	.0001
#3	-.0002	.0007	.0008	.0122	-.0174	.0009	.0326	.0004	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0377	.0005	.0031	.0002	.0059	.0011	.0024	.0915	.0002
Stddev	.0020	.0001	.0005	.0002	.0006	.0008	.0033	.0003	.0003
%RSD	5.268	18.96	17.19	85.14	10.99	73.87	136.3	.3625	157.6
#1	.0399	.0004	.0037	.0001	.0058	.0010	-.0013	.0915	.0005
#2	.0360	.0006	.0026	.0004	.0066	.0020	.0037	.0912	-.0001
#3	.0373	.0005	.0031	.0001	.0053	.0004	.0050	.0919	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-119594/1-A Acquired: 5/22/2014 11:15:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	<.0000	<.0000	<.0000	<.0000	<.0000	.0144
Stddev	.0000	.0044	.0006	.0008	.0084	.0011	.0001
%RSD	75.98	360.8	123.8	113.2	96.62	32.32	.5780
#1	.0001	.0013	.0001	-.0008	.0009	-.0046	.0143
#2	.0000	.0014	-.0005	.0001	-.0126	-.0025	.0145
#3	.0001	-.0063	-.0010	-.0014	-.0144	-.0030	.0144
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6019.9
Stddev	9.3
%RSD	.15368
#1	6027.1
#2	6009.4
#3	6023.1

Sample Name: LCS 160-119594/2-A Acquired: 5/22/2014 11:19:09 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2096	10.75	1.026	2.549	1.068	1.043	1.061	10.77	1.064
Stddev	.0007	.03	.002	.001	.001	.003	.006	.03	.003
%RSD	.3429	.2788	.2215	.0390	.1293	.3099	.5621	.2831	.2969
#1	.2089	10.71	1.028	2.550	1.066	1.047	1.068	10.81	1.068
#2	.2103	10.77	1.025	2.548	1.068	1.043	1.060	10.75	1.064
#3	.2096	10.75	1.024	2.550	1.069	1.041	1.056	10.76	1.061
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.069	1.077	1.103	10.34	10.94	1.173	9.610	1.040	.5316
Stddev	.005	.004	.004	.05	.06	.010	.035	.002	.0029
%RSD	.4416	.3474	.3559	.4470	.5127	.8672	.3619	.2313	.5489
#1	1.074	1.079	1.107	10.39	10.88	1.161	9.626	1.042	.5345
#2	1.069	1.080	1.103	10.33	10.95	1.177	9.635	1.040	.5316
#3	1.065	1.073	1.099	10.30	10.99	1.180	9.570	1.037	.5286
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	11.42	1.116	1.076	1.096	10.07	.5287	.5202	5.153	1.093
Stddev	.07	.003	.003	.002	.03	.0016	.0023	.013	.006
%RSD	.6225	.2497	.2555	.2185	.2813	.3108	.4414	.2578	.5257
#1	11.33	1.120	1.076	1.098	10.10	.5305	.5225	5.149	1.100
#2	11.45	1.115	1.079	1.098	10.06	.5276	.5203	5.168	1.089
#3	11.47	1.115	1.073	1.094	10.05	.5279	.5179	5.142	1.090
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCS 160-119594/2-A Acquired: 5/22/2014 11:19:09 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.112	1.015	1.051	.2238	1.108	1.012	1.059
Stddev	.000	.009	.001	.0005	.018	.005	.004
%RSD	.0334	.9263	.0500	.2120	1.595	.4593	.3473
#1	1.112	1.017	1.052	.2243	1.095	1.015	1.063
#2	1.112	1.023	1.051	.2235	1.128	1.014	1.058
#3	1.113	1.005	1.051	.2235	1.101	1.007	1.055
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5863.5
Stddev	21.2
%RSD	.36131
#1	5839.7
#2	5870.5
#3	5880.3

Sample Name: 160-6426-A-1-B Acquired: 5/22/2014 11:22:39 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0000**	**21.22**	**.0102**	**.0103**	**.2961**	**.0015**	**<.0000**	**4.558**	**<.0000**
Stddev	.0006	.09	.0004	.0040	.0019	.0008	.0003	.055	.0001
%RSD	1289.	.4119	3.968	38.31	.6349	53.26	339.4	1.206	559.5
#1	.0006	21.15	.0106	.0075	.2940	.0011	-.0003	4.500	.0000
#2	.0001	21.19	.0098	.0149	.2969	.0024	.0003	4.564	.0000
#3	-.0005	21.32	.0102	.0087	.2975	.0010	-.0003	4.609	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0176**	**.0321**	**.0227**	**27.69**	**1.722**	**.0143**	**3.853**	**.5154**	**.0003**
Stddev	.0004	.0008	.0013	.13	.006	.0009	.018	.0011	.0003
%RSD	2.302	2.469	5.921	.4671	.3784	6.351	.4737	.2206	129.0
#1	.0171	.0312	.0231	27.61	1.715	.0133	3.832	.5147	.0003
#2	.0177	.0324	.0212	27.62	1.723	.0151	3.865	.5148	-.0001
#3	.0179	.0327	.0237	27.84	1.727	.0144	3.862	.5167	.0006
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.7018**	**.0318**	**.5888**	**.0212**	**.2610**	**.0006**	**<.0000**	**5.274**	**.0012**
Stddev	.0104	.0003	.0076	.0008	.0040	.0012	.0014	.011	.0005
%RSD	1.485	1.094	1.292	3.614	1.530	214.6	538.9	.2053	42.04
#1	.6923	.0317	.5819	.0214	.2569	-.0006	-.0018	5.274	.0017
#2	.7129	.0315	.5876	.0218	.2611	.0017	.0008	5.262	.0007
#3	.7001	.0322	.5970	.0204	.2649	.0006	.0003	5.284	.0012
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6426-A-1-B Acquired: 5/22/2014 11:22:39 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0259	.0848	.3678	<.0000	<.0000	.0488	.0769
Stddev	.0009	.0032	.0020	.0007	.0032	.0047	.0010
%RSD	3.278	3.729	.5339	15.95	26.68	9.566	1.328
#1	.0253	.0880	.3655	-.0039	-.0129	.0534	.0758
#2	.0269	.0816	.3689	-.0047	-.0143	.0490	.0771
#3	.0257	.0849	.3689	-.0053	-.0083	.0441	.0778
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6361.2
Stddev	15.3
%RSD	.24089
#1	6349.3
#2	6355.8
#3	6378.5

Sample Name: 160-6426-A-1-B SD Acquired: 5/22/2014 11:26:29 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=25

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	4.349	.0018	.0023	.0601	.0002	.0010	.9185	.0000
Stddev	.0005	.027	.0003	.0018	.0002	.0000	.0021	.0030	.0001
%RSD	279.3	.6118	15.08	78.78	.3831	8.002	202.9	.3267	662.1
#1	.0002	4.341	.0021	.0040	.0602	.0002	.0016	.9160	.0002
#2	-.0007	4.379	.0015	.0003	.0603	.0002	-.0013	.9218	-.0001
#3	.0000	4.328	.0018	.0027	.0599	.0002	.0028	.9176	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0039	.0068	.0015	5.720	.3378	.0033	.7853	.1053	<.0000
Stddev	.0003	.0008	.0006	.003	.0076	.0003	.0123	.0003	.0000
%RSD	6.637	12.21	36.00	.0574	2.255	10.29	1.565	.3159	36.44
#1	.0042	.0078	.0010	5.719	.3376	.0029	.7911	.1050	-.0001
#2	.0037	.0063	.0021	5.719	.3455	.0036	.7937	.1053	-.0001
#3	.0039	.0064	.0015	5.724	.3302	.0034	.7712	.1056	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1534	.0064	.1193	.0051	.0537	<.0000	<.0000	1.064	.0005
Stddev	.0009	.0001	.0006	.0007	.0013	.0013	.0009	.011	.0000
%RSD	.6111	2.286	.4770	13.08	2.420	309.1	209.2	1.014	2.020
#1	.1544	.0065	.1195	.0058	.0550	-.0002	-.0002	1.052	.0005
#2	.1525	.0063	.1197	.0045	.0524	-.0018	-.0015	1.068	.0005
#3	.1532	.0065	.1186	.0051	.0535	.0008	.0003	1.073	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6426-A-1-B SD Acquired: 5/22/2014 11:26:29 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=25

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0051	.0207	.0742	<.0000	.0029	.0113	.0192
Stddev	.0000	.0045	.0003	.0009	.0090	.0018	.0001
%RSD	.8929	21.56	.4508	95.82	305.3	15.48	.6544
#1	.0052	.0159	.0740	-.0010	-.0073	.0093	.0194
#2	.0051	.0246	.0746	.0000	.0095	.0121	.0192
#3	.0051	.0216	.0741	-.0018	.0067	.0126	.0192
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5994.2
Stddev	12.5
%RSD	.20861
#1	6006.9
#2	5993.6
#3	5982.0

Sample Name: 160-6426-A-1-C MS Acquired: 5/22/2014 11:30:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0405**	**37.04**	**.2120**	**.3669**	**.5324**	**.1925**	**.2111**	**7.746**	**.2088**
Stddev	.0006	.33	.0056	.0034	.0024	.0009	.0046	.183	.0050
%RSD	1.407	.8925	2.645	.9143	.4478	.4831	2.202	2.364	2.418
#1	.0400	37.02	.2055	.3659	.5326	.1915	.2075	7.566	.2037
#2	.0404	36.72	.2151	.3641	.5300	.1927	.2095	7.740	.2088
#3	.0411	37.38	.2154	.3706	.5347	.1933	.2164	7.932	.2138
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.2370**	**.2479**	**.2359**	**37.20**	**5.110**	**.2290**	**6.813**	**2.232**	**.1008**
Stddev	.0057	.0010	.0051	.17	.060	.0033	.037	.012	.0025
%RSD	2.397	.3916	2.151	.4437	1.177	1.446	.5373	.5511	2.464
#1	.2311	.2470	.2306	37.02	5.086	.2297	6.772	2.220	.0984
#2	.2373	.2477	.2363	37.23	5.065	.2254	6.823	2.232	.1007
#3	.2425	.2490	.2407	37.35	5.178	.2319	6.843	2.245	.1033
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**2.743**	**.2559**	**.9084**	**.2456**	**2.297**	**.0402**	**.1001**	**5.211**	**.2059**
Stddev	.039	.0066	.0251	.0069	.064	.0016	.0033	.032	.0044
%RSD	1.414	2.591	2.766	2.825	2.785	3.944	3.259	.6211	2.152
#1	2.741	.2496	.8827	.2389	2.230	.0394	.0964	5.193	.2014
#2	2.706	.2553	.9096	.2452	2.304	.0392	.1027	5.191	.2061
#3	2.783	.2628	.9329	.2527	2.357	.0420	.1011	5.248	.2103
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6426-A-1-C MS Acquired: 5/22/2014 11:30:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2325	.2976	.7629	.0425	.2118	.2656	.2997
Stddev	.0010	.0034	.0024	.0012	.0036	.0045	.0074
%RSD	.4165	1.150	.3196	2.907	1.707	1.713	2.461
#1	.2321	.2939	.7616	.0429	.2080	.2650	.2923
#2	.2317	.2981	.7614	.0412	.2121	.2614	.2997
#3	.2335	.3007	.7657	.0436	.2152	.2704	.3070
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6325.9
Stddev	18.3
%RSD	.28987
#1	6343.5
#2	6327.3
#3	6306.9

Sample Name: 160-6426-A-1-D MSD Acquired: 5/22/2014 11:34:03 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0382	35.72	.2024	.3590	.5208	.1877	.1993	6.846	.1971
Stddev	.0006	.24	.0044	.0027	.0021	.0002	.0023	.125	.0028
%RSD	1.581	.6624	2.182	.7584	.4057	.1258	1.140	1.824	1.414
#1	.0381	35.52	.2013	.3620	.5185	.1880	.1978	6.762	.1952
#2	.0376	35.65	.1986	.3582	.5214	.1877	.1982	6.786	.1958
#3	.0388	35.98	.2073	.3567	.5226	.1875	.2020	6.989	.2003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2204	.2359	.2238	35.06	5.062	.2320	6.522	1.131	.0940
Stddev	.0025	.0016	.0018	.12	.040	.0039	.045	.006	.0009
%RSD	1.147	.6806	.7945	.3343	.7918	1.675	.6966	.5311	1.000
#1	.2188	.2360	.2221	35.18	5.019	.2279	6.574	1.136	.0937
#2	.2191	.2342	.2236	34.94	5.068	.2323	6.497	1.124	.0933
#3	.2234	.2375	.2256	35.05	5.098	.2357	6.494	1.133	.0951
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	2.759	.2432	.8860	.2347	2.176	.0431	.0950	6.119	.1936
Stddev	.019	.0045	.0104	.0036	.028	.0007	.0021	.005	.0027
%RSD	.6961	1.839	1.171	1.539	1.264	1.660	2.242	.0811	1.407
#1	2.740	.2401	.8812	.2324	2.155	.0436	.0928	6.121	.1911
#2	2.758	.2412	.8789	.2328	2.165	.0435	.0949	6.113	.1934
#3	2.778	.2483	.8979	.2388	2.207	.0423	.0971	6.122	.1965
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6426-A-1-D MSD Acquired: 5/22/2014 11:34:03 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2284	.2819	.7393	.0406	.2040	.2617	.2809
Stddev	.0007	.0050	.0011	.0021	.0115	.0051	.0041
%RSD	.3114	1.775	.1494	5.093	5.648	1.968	1.468
#1	.2276	.2827	.7389	.0387	.1908	.2655	.2780
#2	.2288	.2766	.7385	.0404	.2091	.2558	.2791
#3	.2289	.2865	.7406	.0428	.2121	.2637	.2856
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6400.8
Stddev	36.9
%RSD	.57679
#1	6372.1
#2	6442.4
#3	6387.8

Sample Name: 160-6426-A-2-B Acquired: 5/22/2014 11:37:44 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	13.73	.0100	.0056	.3025	.0008	<.0000	4.382	.0004
Stddev	.0001	.09	.0007	.0004	.0018	.0000	.0013	.043	.0000
%RSD	49.87	.6717	6.701	7.240	.5915	2.792	100.6	.9850	6.990
#1	.0002	13.73	.0093	.0054	.3028	.0008	-.0005	4.334	.0005
#2	.0001	13.82	.0101	.0053	.3041	.0008	-.0029	4.394	.0004
#3	.0001	13.63	.0106	.0060	.3006	.0008	-.0007	4.418	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0143	.0237	.0195	21.92	1.642	.0099	2.717	.7928	.0004
Stddev	.0004	.0000	.0013	.09	.039	.0005	.009	.0044	.0001
%RSD	3.069	.1110	6.827	.3941	2.355	5.353	.3200	.5605	18.77
#1	.0139	.0237	.0210	21.83	1.667	.0093	2.719	.7883	.0004
#2	.0143	.0237	.0192	21.93	1.662	.0101	2.708	.7929	.0005
#3	.0147	.0237	.0184	22.01	1.598	.0104	2.725	.7972	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.731	.0227	1.347	.0328	.5466	.0008	<.0000	5.850	.0011
Stddev	.026	.0003	.015	.0010	.0066	.0008	.0022	.013	.0004
%RSD	1.483	1.342	1.081	2.948	1.208	100.7	149.3	.2284	39.98
#1	1.753	.0224	1.332	.0318	.5397	.0013	.0010	5.846	.0007
#2	1.736	.0229	1.349	.0338	.5471	-.0001	-.0031	5.865	.0011
#3	1.703	.0228	1.361	.0327	.5529	.0012	-.0023	5.839	.0015
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6426-A-2-B Acquired: 5/22/2014 11:37:44 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0316	.0630	.3572	<.0000	<.0000	.0362	.0844
Stddev	.0002	.0027	.0015	.0009	.0034	.0012	.0007
%RSD	.7401	4.271	.4195	26.90	56.95	3.341	.8175
#1	.0315	.0631	.3559	-.0024	-.0094	.0366	.0838
#2	.0318	.0602	.3588	-.0034	-.0027	.0348	.0843
#3	.0314	.0656	.3568	-.0042	-.0057	.0371	.0852
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6399.7
Stddev	11.6
%RSD	.18200
#1	6413.1
#2	6394.0
#3	6392.0

Sample Name: 160-6426-A-2-B PDS Acquired: 5/22/2014 11:41:31 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0813**	**15.72**	**.1048**	**.4697**	**.7893**	**.0483**	**1.937**	**14.32**	**.0491**
Stddev	.0005	.13	.0012	.0029	.0075	.0002	.002	.06	.0003
%RSD	.5820	.8244	1.181	.6271	.9484	.3377	.0914	.4401	.5505
#1	.0809	15.58	.1062	.4683	.7827	.0481	1.937	14.25	.0488
#2	.0818	15.75	.1042	.4678	.7879	.0483	1.936	14.33	.0493
#3	.0811	15.84	.1039	.4731	.7974	.0484	1.939	14.38	.0492
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.5150**	**.1138**	**.2684**	**21.73**	**55.87**	**.6134**	**11.24**	**.8928**	**.3861**
Stddev	.0022	.0006	.0009	.05	.88	.0122	.07	.0040	.0009
%RSD	.4280	.5115	.3397	.2168	1.582	1.996	.6439	.4461	.2292
#1	.5125	.1133	.2684	21.68	54.93	.6007	11.31	.8974	.3857
#2	.5156	.1136	.2674	21.75	55.98	.6144	11.17	.8906	.3856
#3	.5168	.1144	.2693	21.76	56.69	.6251	11.24	.8903	.3872
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**12.89**	**.4355**	**3.861**	**.1324**	**46.61**	**.0940**	**.1444**	**9.356**	**.9827**
Stddev	.25	.0012	.011	.0006	.01	.0012	.0023	.033	.0022
%RSD	1.964	.2865	.2957	.4178	.0188	1.324	1.583	.3549	.2193
#1	12.62	.4341	3.854	.1325	46.60	.0953	.1470	9.363	.9802
#2	12.91	.4363	3.856	.1317	46.61	.0940	.1435	9.321	.9840
#3	13.13	.4361	3.874	.1328	46.61	.0928	.1427	9.386	.9838
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6426-A-2-B PDS Acquired: 5/22/2014 11:41:31 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0798	1.847	.5300	.2103	4.971	.4869	.2798
Stddev	.0007	.017	.0019	.0013	.038	.0022	.0007
%RSD	.8658	.9307	.3607	.6007	.7657	.4569	.2360
#1	.0791	1.845	.5295	.2097	4.983	.4860	.2791
#2	.0798	1.865	.5283	.2095	5.002	.4853	.2799
#3	.0805	1.830	.5321	.2118	4.929	.4895	.2804
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6210.0
Stddev	11.3
%RSD	.18204
#1	6202.1
#2	6205.0
#3	6223.0

Sample Name: CCV Acquired: 5/22/2014 11:45:05 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.9884**	**50.80**	**5.006**	**4.958**	**5.127**	**5.043**	**5.081**	**50.82**	**5.105**
Stddev	.0007	.27	.001	.008	.018	.016	.009	.12	.003
%RSD	.0731	.5380	.0266	.1654	.3569	.3232	.1788	.2415	.0661
#1	.9882	50.77	5.008	4.951	5.147	5.053	5.074	50.95	5.102
#2	.9892	50.54	5.006	4.967	5.121	5.024	5.078	50.79	5.104
#3	.9877	51.08	5.005	4.955	5.113	5.051	5.091	50.71	5.109
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.020**	**5.044**	**5.123**	**49.70**	**51.87**	**5.391**	**48.75**	**5.027**	**1.012**
Stddev	.009	.018	.008	.11	.72	.097	.09	.016	.001
%RSD	.1720	.3465	.1644	.2208	1.392	1.795	.1797	.3141	.0558
#1	5.028	5.052	5.114	49.79	51.78	5.366	48.83	5.041	1.013
#2	5.021	5.055	5.131	49.73	51.19	5.309	48.76	5.031	1.011
#3	5.011	5.024	5.123	49.58	52.63	5.498	48.65	5.010	1.012
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**51.91**	**5.135**	**51.25**	**5.135**	**49.75**	**1.010**	**.9983**	**5.057**	**5.133**
Stddev	.80	.006	.07	.007	.02	.003	.0038	.026	.009
%RSD	1.538	.1145	.1396	.1276	.0314	.3229	.3817	.5191	.1845
#1	51.74	5.142	51.32	5.142	49.74	1.008	1.002	5.077	5.144
#2	51.20	5.134	51.25	5.130	49.75	1.008	.9985	5.066	5.129
#3	52.78	5.131	51.17	5.132	49.77	1.014	.9944	5.027	5.126
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value Range									

Sample Name: CCV Acquired: 5/22/2014 11:45:05 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.156**	**4.902**	**5.038**	**1.026**	**5.106**	**4.908**	**5.084**
Stddev	.027	.022	.003	.002	.016	.013	.002
%RSD	.5161	.4498	.0576	.2246	.3219	.2712	.0352
#1	5.167	4.881	5.041	1.028	5.105	4.910	5.086
#2	5.125	4.925	5.038	1.024	5.123	4.920	5.082
#3	5.175	4.901	5.035	1.024	5.090	4.894	5.084
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5630.6**
Stddev	8.6
%RSD	.15218
#1	5620.7
#2	5635.0
#3	5636.1

Sample Name: CCB Acquired: 5/22/2014 11:48:54 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0051	<.0000	.0070	.0002	.0002	.0010	<.0000	.0001
Stddev	.0002	.0057	.0011	.0014	.0000	.0000	.0013	.0005	.0001
%RSD	85.61	112.4	90.81	20.43	20.50	9.256	126.1	184.3	60.33
#1	-.0004	.0031	-.0004	.0070	.0003	.0002	.0026	-.0007	.0001
#2	.0000	.0006	-.0007	.0084	.0002	.0002	.0005	-.0004	.0001
#3	-.0001	.0115	-.0024	.0056	.0002	.0002	.0001	.0003	.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0009	<.0000	.0037	<.0000	.0011	.0142	.0003	.0002
Stddev	.0005	.0004	.0010	.0011	.0064	.0006	.0037	.0002	.0001
%RSD	533.0	46.30	94.30	30.28	87.55	53.04	25.89	59.93	77.53
#1	-.0004	.0005	-.0019	.0039	-.0010	.0017	.0130	.0004	.0003
#2	.0001	.0013	.0000	.0047	-.0137	.0011	.0184	.0004	.0000
#3	.0006	.0008	-.0010	.0025	-.0071	.0005	.0113	.0001	.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0127	<.0000	.0013	.0010	.0035	.0007	<.0000	.0050	.0003
Stddev	.0030	.0002	.0012	.0013	.0020	.0008	.0013	.0028	.0003
%RSD	23.51	4081.	95.93	129.5	58.57	115.7	196.0	56.83	109.4
#1	.0099	.0000	.0021	.0018	.0034	.0012	-.0003	.0018	.0005
#2	.0158	-.0003	.0019	-.0005	.0015	-.0002	.0004	.0057	.0004
#3	.0123	.0002	-.0001	.0018	.0055	.0010	-.0021	.0074	-.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 11:48:54 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	<.0000	.0003	.0002	<.0000	.0000	<.0000
Stddev	.0000	.0034	.0006	.0005	.0052	.0005	.0001
%RSD	20.49	176.0	167.0	185.2	63.50	3259.	586.9
#1	.0003	.0003	.0004	-.0001	-.0142	.0001	-.0001
#2	.0002	-.0058	-.0003	.0008	-.0054	-.0005	.0001
#3	.0002	-.0002	.0008	.0001	-.0050	.0005	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	6098.9
Stddev	22.9
%RSD	.37574
#1	6098.7
#2	6076.0
#3	6121.9

Sample Name: MB 160-122861/1-A Acquired: 5/22/2014 12:00:32 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	<.0000	.0031	.0000	<.0000	<.0000	.0111	<.0000
Stddev	.0001	.0006	.0005	.0055	.0000	.0000	.0010	.0003	.0002
%RSD	19.47	29.65	31120.	177.7	707.5	118.0	102.8	2.700	1140.
#1	-.0005	-.0017	.0006	-.0007	.0000	.0000	.0001	.0112	-.0002
#2	-.0004	-.0025	-.0001	.0006	.0000	.0000	-.0018	.0114	.0002
#3	-.0004	-.0014	-.0005	.0094	.0001	.0000	-.0012	.0108	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.0010	<.0000	.0017	<.0000	.0010	.0030	.0002	<.0000
Stddev	.0001	.0002	.0019	.0012	.0205	.0004	.0070	.0003	.0001
%RSD	26.71	20.41	152.0	70.60	163.4	44.25	231.7	118.0	41.21
#1	.0003	.0012	.0006	.0021	-.0290	.0010	.0105	.0005	-.0001
#2	.0001	.0009	-.0032	.0004	.0104	.0005	.0020	.0000	-.0001
#3	.0002	.0008	-.0011	.0027	-.0191	.0013	-.0034	.0001	-.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0129	.0001	.0003	.0001	.0040	<.0000	.0017	.0060	<.0000
Stddev	.0032	.0002	.0003	.0008	.0010	.0005	.0014	.0057	.0004
%RSD	25.07	184.1	96.23	825.3	25.66	51.72	85.67	94.63	103.2
#1	.0092	.0000	.0002	.0009	.0036	-.0016	.0006	.0023	-.0001
#2	.0144	.0003	.0005	.0001	.0052	-.0005	.0033	.0031	-.0002
#3	.0150	-.0001	.0001	-.0007	.0033	-.0010	.0011	.0125	-.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-122861/1-A Acquired: 5/22/2014 12:00:32 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	<.0000	<.0000	<.0000	.0009	.0060
Stddev	.0000	.0035	.0002	.0006	.0017	.0010	.0001
%RSD	20.32	431.9	153.0	29.70	7.154	113.0	1.211
#1	.0001	.0009	-.0002	-.0014	-.0212	.0012	.0060
#2	.0001	.0016	-.0003	-.0023	-.0237	-.0002	.0059
#3	.0001	-.0049	.0001	-.0025	-.0244	.0018	.0060
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6094.3
Stddev	23.6
%RSD	.38708
#1	6105.4
#2	6110.3
#3	6067.2

Sample Name: LCS 160-122861/2-A Acquired: 5/22/2014 12:04:26 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.2080**	**10.99**	**1.066**	**2.027**	**1.081**	**1.043**	**1.077**	**10.90**	**1.095**
Stddev	.0012	.03	.004	.005	.003	.003	.003	.06	.006
%RSD	.5661	.3009	.4038	.2334	.2465	.2352	.2939	.5403	.5584
#1	.2073	10.96	1.071	2.031	1.081	1.046	1.081	10.96	1.101
#2	.2093	10.99	1.065	2.030	1.078	1.041	1.076	10.91	1.096
#3	.2073	11.03	1.063	2.022	1.084	1.043	1.075	10.84	1.088
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.095**	**1.088**	**1.141**	**10.45**	**11.84**	**1.284**	**9.784**	**1.052**	**.5271**
Stddev	.007	.007	.005	.04	.08	.011	.045	.005	.0024
%RSD	.6616	.6600	.4369	.4026	.6959	.8498	.4604	.4894	.4491
#1	1.102	1.094	1.146	10.50	11.75	1.271	9.824	1.057	.5295
#2	1.095	1.089	1.141	10.43	11.90	1.288	9.735	1.046	.5271
#3	1.088	1.080	1.136	10.42	11.88	1.292	9.793	1.052	.5248
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**12.07**	**1.135**	**1.123**	**1.125**	**10.29**	**.5333**	**.5423**	**.0352**	**1.086**
Stddev	.11	.005	.009	.005	.05	.0035	.0033	.0016	.006
%RSD	.8859	.4874	.7695	.4547	.4856	.6652	.6078	4.412	.5870
#1	11.95	1.141	1.131	1.129	10.33	.5339	.5459	.0351	1.092
#2	12.15	1.135	1.125	1.126	10.31	.5365	.5396	.0369	1.086
#3	12.11	1.130	1.114	1.119	10.23	.5295	.5413	.0338	1.079
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCS 160-122861/2-A Acquired: 5/22/2014 12:04:26 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.123	1.031	1.030	.2337	1.101	1.033	1.092
Stddev	.002	.002	.002	.0021	.010	.006	.006
%RSD	.1663	.1577	.2229	.8921	.8853	.5908	.5156
#1	1.123	1.032	1.032	.2358	1.091	1.032	1.097
#2	1.121	1.030	1.027	.2337	1.109	1.028	1.092
#3	1.125	1.033	1.030	.2316	1.104	1.040	1.086
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5878.7
Stddev	24.6
%RSD	.41804
#1	5855.1
#2	5877.0
#3	5904.1

Sample Name: 160-6677-D-2-A Acquired: 5/22/2014 12:07:54 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0104**	**.0003**	**.0464**	**.0653**	**.0001**	**.0020**	**62.42**	**.0001**
Stddev	.0010	.0055	.0012	.0004	.0001	.0001	.0021	.12	.0001
%RSD	480.9	52.44	350.0	.8976	.1533	181.2	109.4	.1946	69.06
#1	-.0009	.0124	.0015	.0460	.0654	.0002	.0025	62.29	.0001
#2	.0006	.0146	.0003	.0464	.0652	.0000	-.0004	62.44	.0002
#3	.0009	.0042	-.0008	.0468	.0653	.0001	.0037	62.53	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0007**	**.0267**	**<.0000**	**.0113**	**5.844**	**.0079**	**20.43**	**.0006**	**.0040**
Stddev	.0002	.0004	.0004	.0012	.015	.0007	.05	.0000	.0002
%RSD	27.92	1.398	44.34	10.60	.2538	9.229	.2265	7.344	5.652
#1	.0009	.0266	-.0015	.0119	5.859	.0084	20.47	.0006	.0042
#2	.0008	.0272	-.0008	.0099	5.843	.0071	20.45	.0005	.0038
#3	.0005	.0265	-.0007	.0120	5.830	.0083	20.38	.0006	.0040
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**22.65**	**.0052**	**.0159**	**.0044**	**16.78**	**.0031**	**.0027**	**23.20**	**<.0000**
Stddev	.10	.0004	.0002	.0016	.02	.0011	.0016	.07	.0004
%RSD	.4234	7.004	1.465	36.67	.1405	36.73	58.15	.2912	45.18
#1	22.66	.0054	.0160	.0051	16.81	.0018	.0027	23.14	-.0009
#2	22.74	.0054	.0160	.0025	16.77	.0035	.0011	23.27	-.0005
#3	22.55	.0048	.0156	.0054	16.76	.0040	.0043	23.19	-.0013
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6677-D-2-A Acquired: 5/22/2014 12:07:54 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2784	<.0000	.0007	<.0000	<.0000	.0241	.0068
Stddev	.0007	.0023	.0006	.0010	.0103	.0014	.0001
%RSD	.2420	202.7	78.01	126.8	106.4	5.917	1.930
#1	.2788	-.0037	.0003	-.0016	.0022	.0225	.0067
#2	.2777	-.0003	.0005	.0003	-.0159	.0253	.0069
#3	.2788	.0006	.0014	-.0009	-.0155	.0246	.0067
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5900.1
Stddev	12.1
%RSD	.20477
#1	5905.6
#2	5908.5
#3	5886.3

Sample Name: 160-6677-D-2-A SD Acquired: 5/22/2014 12:11:45 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0096	<.0000	.0073	.0144	<.0000	.0009	13.26	.0000
Stddev	.0007	.0040	.0009	.0008	.0000	.0000	.0020	.00	.0001
%RSD	292.9	41.29	403.3	10.99	.1901	265.2	220.9	.0045	136.0
#1	.0003	.0061	-.0005	.0080	.0145	.0000	.0028	13.26	.0000
#2	.0000	.0139	-.0009	.0064	.0144	.0000	.0010	13.26	.0000
#3	-.0011	.0088	.0008	.0076	.0144	.0000	-.0011	13.26	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0003	.0059	<.0000	.0025	1.126	.0023	4.049	.0002	.0009
Stddev	.0001	.0002	.0007	.0004	.020	.0007	.022	.0001	.0001
%RSD	40.86	3.391	28.58	16.76	1.782	31.74	.5425	41.88	12.08
#1	.0004	.0062	-.0021	.0029	1.104	.0028	4.048	.0001	.0010
#2	.0002	.0058	-.0020	.0021	1.130	.0015	4.028	.0001	.0008
#3	.0003	.0059	-.0033	.0027	1.143	.0026	4.071	.0003	.0009
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	4.370	.0013	.0033	.0010	3.302	.0024	.0011	4.542	<.0000
Stddev	.075	.0001	.0018	.0011	.016	.0001	.0006	.017	.0003
%RSD	1.712	9.235	55.10	106.1	.4690	4.819	59.18	.3732	76.21
#1	4.284	.0012	.0052	.0020	3.317	.0025	.0007	4.523	-.0001
#2	4.422	.0012	.0016	-.0001	3.286	.0024	.0018	4.555	-.0005
#3	4.402	.0014	.0029	.0011	3.302	.0023	.0007	4.549	-.0007
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6677-D-2-A SD Acquired: 5/22/2014 12:11:45 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0549	<.0000	.0002	.0007	<.0000	.0054	.0050
Stddev	.0001	.0012	.0002	.0007	.0133	.0016	.0001
%RSD	.2517	71.10	113.0	111.8	57.03	28.77	2.039
#1	.0547	-.0006	.0002	.0015	-.0222	.0048	.0051
#2	.0549	-.0030	.0005	.0001	-.0107	.0072	.0049
#3	.0550	-.0016	.0000	.0004	-.0373	.0042	.0051
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5911.4
Stddev	10.9
%RSD	.18504
#1	5913.5
#2	5921.1
#3	5899.5

Sample Name: 160-6677-D-2-B MS Acquired: 5/22/2014 12:15:36 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2097	10.76	1.052	2.119	1.139	1.060	1.046	72.55	1.083
Stddev	.0024	.02	.008	.006	.003	.004	.006	.59	.008
%RSD	1.167	.1736	.7245	.2714	.2391	.3877	.6239	.8079	.7303
#1	.2078	10.76	1.052	2.115	1.137	1.055	1.045	72.16	1.080
#2	.2124	10.75	1.060	2.126	1.139	1.064	1.053	73.22	1.092
#3	.2088	10.78	1.045	2.117	1.143	1.061	1.040	72.26	1.077
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.066	1.102	1.106	10.57	16.88	1.190	30.50	1.048	.5238
Stddev	.009	.010	.009	.06	.09	.010	.22	.007	.0036
%RSD	.8437	.8940	.8275	.6144	.5097	.8404	.7329	.6902	.6892
#1	1.059	1.098	1.104	10.52	16.92	1.194	30.41	1.043	.5212
#2	1.076	1.113	1.117	10.64	16.78	1.179	30.76	1.056	.5279
#3	1.065	1.095	1.099	10.55	16.94	1.198	30.34	1.044	.5222
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	33.02	1.094	1.141	1.083	26.92	.5259	.5318	23.03	1.056
Stddev	.22	.008	.009	.011	.22	.0051	.0044	.05	.009
%RSD	.6627	.7315	.8111	.9884	.8109	.9738	.8258	.2355	.8167
#1	33.11	1.091	1.134	1.078	26.82	.5229	.5277	22.98	1.053
#2	32.77	1.104	1.152	1.096	27.17	.5318	.5365	23.09	1.066
#3	33.18	1.089	1.137	1.077	26.77	.5229	.5313	23.02	1.050
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6677-D-2-B MS Acquired: 5/22/2014 12:15:36 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.390	1.043	1.036	.2224	1.094	1.068	1.081
Stddev	.005	.015	.004	.0015	.008	.009	.009
%RSD	.3761	1.406	.4262	.6928	.7344	.8146	.7861
#1	1.385	1.041	1.031	.2239	1.102	1.062	1.076
#2	1.390	1.059	1.040	.2226	1.094	1.078	1.091
#3	1.396	1.030	1.035	.2208	1.086	1.064	1.077
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5755.4
Stddev	44.1
%RSD	.76607
#1	5785.9
#2	5704.8
#3	5775.4

Sample Name: 160-6677-D-2-C MSD Acquired: 5/22/2014 12:19:04 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2147	10.96	1.072	2.150	1.149	1.055	1.065	73.84	1.098
Stddev	.0016	.04	.017	.009	.003	.005	.013	.65	.011
%RSD	.7570	.3732	1.619	.4266	.2297	.4990	1.174	.8834	.9974
#1	.2129	11.01	1.052	2.146	1.151	1.049	1.051	73.10	1.085
#2	.2151	10.93	1.082	2.144	1.146	1.057	1.072	74.08	1.103
#3	.2161	10.95	1.083	2.161	1.150	1.059	1.073	74.34	1.106
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.083	1.112	1.125	10.57	17.54	1.243	30.63	1.049	.5336
Stddev	.009	.010	.014	.07	.08	.017	.16	.003	.0053
%RSD	.8687	.9024	1.252	.6521	.4390	1.338	.5104	.2469	.9857
#1	1.073	1.100	1.109	10.49	17.63	1.262	30.50	1.046	.5277
#2	1.087	1.117	1.133	10.62	17.47	1.232	30.58	1.051	.5354
#3	1.090	1.119	1.133	10.59	17.53	1.236	30.80	1.050	.5378
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	34.60	1.105	1.164	1.096	27.62	.5377	.5426	23.39	1.069
Stddev	.22	.012	.013	.012	.36	.0077	.0064	.03	.012
%RSD	.6240	1.065	1.083	1.109	1.298	1.430	1.180	.1444	1.138
#1	34.85	1.092	1.150	1.082	27.21	.5294	.5360	23.38	1.056
#2	34.46	1.111	1.168	1.102	27.77	.5390	.5430	23.37	1.074
#3	34.49	1.113	1.174	1.104	27.88	.5446	.5488	23.43	1.079
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6677-D-2-C MSD Acquired: 5/22/2014 12:19:04 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.398	1.071	1.037	.2274	1.112	1.078	1.096
Stddev	.002	.010	.003	.0030	.004	.003	.011
%RSD	.1356	.9382	.2707	1.319	.3542	.2795	1.023
#1	1.397	1.066	1.034	.2241	1.107	1.075	1.083
#2	1.396	1.065	1.038	.2298	1.114	1.080	1.101
#3	1.400	1.083	1.039	.2285	1.114	1.080	1.104
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5704.8
Stddev	32.1
%RSD	.56247
#1	5740.6
#2	5695.4
#3	5678.5

Sample Name: 160-6677-A-3-A Acquired: 5/22/2014 12:22:32 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0105	<.0000	.0648	.0323	.0001	.0009	60.66	.0002
Stddev	.0002	.0055	.0004	.0018	.0002	.0002	.0004	.18	.0001
%RSD	152.1	52.70	26.52	2.843	.5179	199.6	44.72	.2943	52.31
#1	.0003	.0059	-.0014	.0659	.0321	.0001	.0011	60.47	.0003
#2	.0001	.0089	-.0011	.0659	.0324	.0002	.0004	60.83	.0001
#3	.0000	.0166	-.0019	.0627	.0322	-.0001	.0010	60.69	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0012	.0082	.0059	.0068	5.606	.0063	19.58	.0038	.0299
Stddev	.0006	.0002	.0006	.0009	.036	.0004	.13	.0002	.0002
%RSD	53.17	2.148	9.716	12.54	.6457	6.217	.6470	6.578	.6927
#1	.0019	.0081	.0058	.0062	5.622	.0059	19.44	.0040	.0296
#2	.0008	.0084	.0065	.0078	5.564	.0067	19.66	.0039	.0300
#3	.0009	.0083	.0053	.0064	5.631	.0061	19.65	.0035	.0300
Check ?	None	None	None	None	None	None	None	None	None
Value Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	23.07	.0084	.1240	.0036	30.19	.0024	.0031	21.34	<.0000
Stddev	.16	.0003	.0014	.0005	.07	.0014	.0003	.06	.0007
%RSD	.6923	4.110	1.129	12.89	.2182	58.99	8.116	.2843	53.01
#1	23.15	.0088	.1246	.0037	30.13	.0013	.0028	21.27	-.0005
#2	22.88	.0082	.1250	.0031	30.26	.0019	.0033	21.37	-.0013
#3	23.16	.0082	.1224	.0040	30.19	.0041	.0031	21.37	-.0019
Check ?	None	None	None	None	None	None	None	None	None
Value Range									

Sample Name: 160-6677-A-3-A Acquired: 5/22/2014 12:22:32 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2572	.0024	<.0000	<.0000	<.0000	.0013	.0084
Stddev	.0016	.0009	.0002	.0013	.0079	.0018	.0000
%RSD	.6287	38.44	527.5	39.03	60.72	140.9	.5277
#1	.2557	.0019	-.0001	-.0022	-.0039	.0034	.0084
#2	.2569	.0018	.0002	-.0032	-.0178	.0004	.0084
#3	.2589	.0034	-.0002	-.0049	-.0175	.0001	.0084
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5874.6
Stddev	30.0
%RSD	.51152
#1	5909.3
#2	5857.5
#3	5856.9

Sample Name: 160-6677-D-6-A Acquired: 5/22/2014 12:26:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0031	<.0000	.0152	.0680	<.0000	.0024	63.44	.0001
Stddev	.0005	.0080	.0011	.0008	.0002	.0000	.0016	.07	.0001
%RSD	290.1	253.3	601.6	5.456	.2760	334.3	68.89	.1180	57.49
#1	.0002	.0027	-.0001	.0161	.0681	.0000	.0040	63.35	.0001
#2	-.0007	.0113	.0009	.0151	.0681	.0000	.0007	63.48	.0000
#3	.0000	-.0046	-.0014	.0145	.0678	.0000	.0025	63.48	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.0499	<.0000	.0045	5.876	.0068	19.75	.0002	.0039
Stddev	.0001	.0004	.0006	.0005	.063	.0005	.01	.0002	.0001
%RSD	51.96	.7485	22.76	11.10	1.076	7.971	.0392	64.11	2.074
#1	.0001	.0502	-.0019	.0043	5.865	.0063	19.76	.0001	.0040
#2	.0001	.0495	-.0030	.0042	5.944	.0073	19.74	.0004	.0039
#3	.0002	.0501	-.0028	.0051	5.820	.0069	19.76	.0002	.0038
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	33.20	.0049	.0168	.0048	12.98	.0019	.0027	22.22	<.0000
Stddev	.33	.0001	.0013	.0007	.05	.0019	.0017	.09	.0011
%RSD	.9832	2.336	7.976	13.65	.4165	98.22	61.32	.3894	72.08
#1	33.12	.0048	.0157	.0052	12.96	.0029	.0011	22.27	-.0005
#2	33.57	.0051	.0165	.0041	12.94	.0031	.0027	22.27	-.0027
#3	32.93	.0049	.0183	.0052	13.04	-.0003	.0044	22.12	-.0014
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6677-D-6-A Acquired: 5/22/2014 12:26:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2641	.0028	.0004	<.0000	<.0000	.0231	.0082
Stddev	.0011	.0005	.0004	.0006	.0039	.0022	.0001
%RSD	.4346	18.44	92.19	31.64	88.09	9.461	1.299
#1	.2643	.0028	.0003	-.0018	-.0061	.0243	.0083
#2	.2651	.0032	.0008	-.0024	.0000	.0244	.0081
#3	.2629	.0022	.0001	-.0013	-.0071	.0206	.0081
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5833.9
Stddev	11.5
%RSD	.19754
#1	5834.7
#2	5822.0
#3	5845.0

Sample Name: 160-6677-D-8-A Acquired: 5/22/2014 12:30:15 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0000**	**.0049**	**.0006**	**.0138**	**.0747**	**<.0000**	**<.0000**	**64.05**	**.0001**
Stddev	.0001	.0062	.0003	.0023	.0001	.0000	.0011	.12	.0001
%RSD	323.3	124.9	53.98	16.67	.1691	56.46	47.12	.1905	121.8
#1	-.0001	.0028	.0004	.0152	.0745	.0000	-.0012	64.18	.0002
#2	.0001	.0119	.0004	.0112	.0746	.0000	-.0026	64.05	.0000
#3	.0001	.0001	.0010	.0151	.0748	.0000	-.0035	63.93	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0007**	**.0426**	**<.0000**	**.0012**	**6.263**	**.0073**	**20.07**	**.0002**	**.0039**
Stddev	.0003	.0007	.0016	.0024	.046	.0004	.02	.0003	.0002
%RSD	41.32	1.625	93.71	196.0	.7326	5.015	.1006	138.3	4.519
#1	.0004	.0422	-.0007	.0006	6.217	.0069	20.07	.0006	.0040
#2	.0009	.0422	-.0009	.0040	6.264	.0075	20.08	.0001	.0037
#3	.0008	.0434	-.0035	-.0008	6.309	.0075	20.05	.0000	.0038
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**35.25**	**.0052**	**.0175**	**.0047**	**20.69**	**.0021**	**.0035**	**22.90**	**<.0000**
Stddev	.18	.0002	.0002	.0011	.05	.0009	.0015	.03	.0007
%RSD	.5111	3.352	1.224	24.49	.2485	45.20	44.23	.1340	61.17
#1	35.16	.0053	.0177	.0059	20.70	.0014	.0017	22.89	-.0015
#2	35.13	.0053	.0174	.0037	20.73	.0016	.0042	22.88	-.0003
#3	35.46	.0050	.0173	.0044	20.63	.0031	.0045	22.93	-.0014
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6677-D-8-A Acquired: 5/22/2014 12:30:15 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2746	.0001	<.0000	<.0000	<.0000	.0242	.0065
Stddev	.0003	.0016	.0003	.0008	.0053	.0027	.0002
%RSD	.1250	2298.	645.9	55.84	36.92	11.19	2.530
#1	.2742	.0015	.0003	-.0005	-.0195	.0221	.0066
#2	.2749	-.0016	-.0004	-.0019	-.0089	.0272	.0063
#3	.2747	.0004	-.0001	-.0019	-.0148	.0232	.0066
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5914.1
Stddev	2.5
%RSD	.04208
#1	5912.5
#2	5912.9
#3	5917.0

Sample Name: 160-6677-C-11-A Acquired: 5/22/2014 12:34:06 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0003	.0061	.0001	.0637	.0339	<.0000	<.0000	59.51	.0001
Stddev	.0004	.0050	.0008	.0001	.0002	.0000	.0007	.29	.0001
%RSD	127.0	81.41	1131.	.1007	.6641	174.7	41.70	.4830	77.37
#1	.0003	.0024	.0007	.0637	.0339	.0000	-.0023	59.82	.0000
#2	.0008	.0042	-.0008	.0637	.0341	.0000	-.0009	59.44	.0002
#3	-.0001	.0118	.0003	.0636	.0336	.0000	-.0019	59.25	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0209	.0076	.0078	.0318	5.761	.0077	19.40	.1619	.0285
Stddev	.0001	.0009	.0019	.0011	.053	.0003	.09	.0007	.0001
%RSD	.5470	11.43	24.50	3.537	.9151	4.509	.4689	.4377	.4266
#1	.0209	.0069	.0091	.0305	5.787	.0073	19.43	.1625	.0286
#2	.0210	.0074	.0056	.0326	5.796	.0079	19.31	.1611	.0284
#3	.0208	.0086	.0088	.0323	5.701	.0079	19.48	.1621	.0284
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	23.63	.0114	.1289	.0054	29.93	.0030	.0025	21.34	<.0000
Stddev	.21	.0004	.0007	.0011	.16	.0017	.0024	.04	.0003
%RSD	.9084	3.784	.5064	20.74	.5470	58.79	94.78	.2102	25.59
#1	23.68	.0115	.1294	.0043	30.10	.0013	.0051	21.39	-.0009
#2	23.82	.0110	.1281	.0065	29.77	.0048	.0018	21.30	-.0015
#3	23.40	.0118	.1292	.0054	29.91	.0028	.0005	21.33	-.0015
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6677-C-11-A Acquired: 5/22/2014 12:34:06 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2574	.0033	.0004	<.0000	<.0000	.0014	.0095
Stddev	.0007	.0013	.0005	.0015	.0008	.0004	.0001
%RSD	.2557	41.10	135.6	95.95	27.67	32.01	.7108
#1	.2581	.0020	.0008	-.0026	-.0024	.0009	.0095
#2	.2571	.0047	-.0002	.0001	-.0026	.0014	.0094
#3	.2569	.0032	.0005	-.0022	-.0040	.0018	.0096
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5919.8
Stddev	18.6
%RSD	.31392
#1	5898.4
#2	5932.0
#3	5928.9

Sample Name: CCV Acquired: 5/22/2014 12:37:57 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.9861**	**50.89**	**4.988**	**5.005**	**5.100**	**5.046**	**5.052**	**50.05**	**5.050**
Stddev	.0037	.20	.001	.006	.081	.040	.009	.14	.004
%RSD	.3769	.3980	.0153	.1117	1.594	.7891	.1734	.2768	.0736
#1	.9861	50.82	4.988	5.001	5.150	5.041	5.056	49.97	5.048
#2	.9823	51.12	4.989	5.011	5.006	5.009	5.059	49.97	5.047
#3	.9897	50.73	4.987	5.003	5.144	5.088	5.042	50.21	5.054
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**4.971**	**4.992**	**5.087**	**49.73**	**51.86**	**5.388**	**48.51**	**5.016**	**1.004**
Stddev	.009	.026	.003	.20	.32	.061	.28	.018	.001
%RSD	.1906	.5139	.0584	.4063	.6075	1.135	.5842	.3593	.0628
#1	4.975	4.979	5.088	49.78	51.96	5.402	48.54	5.012	1.005
#2	4.960	4.975	5.089	49.51	52.11	5.441	48.22	5.000	1.004
#3	4.978	5.021	5.083	49.91	51.51	5.321	48.78	5.035	1.005
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**52.06**	**5.075**	**51.17**	**5.076**	**49.63**	**1.007**	**.9988**	**5.069**	**5.068**
Stddev	.47	.007	.11	.010	.03	.003	.0005	.016	.006
%RSD	.9027	.1402	.2140	.1930	.0671	.2520	.0501	.3114	.1164
#1	52.20	5.068	51.23	5.073	49.62	1.005	.9985	5.073	5.065
#2	52.45	5.074	51.04	5.067	49.66	1.006	.9993	5.052	5.063
#3	51.54	5.082	51.24	5.086	49.60	1.010	.9985	5.083	5.074
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 12:37:57 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.147**	**4.899**	**5.035**	**1.016**	**5.097**	**4.923**	**5.035**
Stddev	.036	.018	.002	.003	.046	.029	.005
%RSD	.7014	.3676	.0445	.2454	.9027	.5981	.1097
#1	5.111	4.894	5.035	1.014	5.092	4.892	5.035
#2	5.148	4.884	5.033	1.014	5.054	4.926	5.029
#3	5.183	4.919	5.037	1.018	5.145	4.951	5.040
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5717.8**
Stddev	27.6
%RSD	.48287
#1	5727.9
#2	5739.0
#3	5686.6

Sample Name: CCB Acquired: 5/22/2014 12:41:46 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0070	<.0000	.0059	.0008	.0008	.0023	<.0000	.0000
Stddev	.0004	.0124	.0005	.0024	.0013	.0012	.0015	.0007	.0001
%RSD	178.0	176.9	82.66	40.70	150.9	151.3	65.77	207.0	211.4
#1	-.0008	.0046	-.0005	.0050	.0001	.0001	.0036	.0004	.0001
#2	.0000	.0204	-.0002	.0086	.0023	.0022	.0006	-.0003	.0000
#3	.0000	-.0040	-.0011	.0041	.0001	.0001	.0028	-.0011	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.0013	<.0000	.0069	<.0000	.0012	.0062	.0010	.0002
Stddev	.0002	.0005	.0019	.0116	.0190	.0014	.0042	.0012	.0002
%RSD	123.1	40.00	82.68	168.7	8092.	114.2	68.71	128.5	99.15
#1	.0005	.0010	-.0015	.0011	-.0206	.0003	.0018	.0002	.0004
#2	.0000	.0010	-.0009	.0202	.0170	.0028	.0103	.0024	.0003
#3	.0002	.0019	-.0045	-.0007	.0029	.0005	.0063	.0003	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0175	.0003	.0008	.0013	.0043	.0010	.0003	.0021	.0006
Stddev	.0172	.0001	.0008	.0003	.0017	.0013	.0013	.0020	.0004
%RSD	98.26	45.86	98.59	20.23	39.77	133.3	441.9	95.90	68.22
#1	.0070	.0004	.0017	.0012	.0053	.0014	.0016	.0002	.0006
#2	.0373	.0003	.0003	.0011	.0052	.0020	.0004	.0018	.0002
#3	.0081	.0001	.0003	.0016	.0023	-.0005	-.0011	.0042	.0009
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 12:41:46 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0008	<.0000	.0011	<.0000	<.0000	<.0000	.0000
Stddev	.0013	.0010	.0014	.0009	.0062	.0018	.0001
%RSD	161.6	62.77	124.9	454.4	49.41	888.7	1346.
#1	.0001	-.0006	.0002	-.0012	-.0064	.0012	.0001
#2	.0022	-.0025	.0028	.0004	-.0189	.0004	-.0001
#3	.0000	-.0016	.0004	.0002	-.0125	-.0022	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5927.7
Stddev	11.0
%RSD	.18558
#1	5935.6
#2	5932.3
#3	5915.1

Sample Name: MB 160-122863/1-A Acquired: 5/22/2014 12:45:42 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0034	<.0000	.0020	<.0000	<.0000	.0002	.0235	.0001
Stddev	.0002	.0045	.0001	.0013	.0001	.0000	.0014	.0001	.0001
%RSD	76.53	134.1	8.930	68.15	471.9	381.6	844.5	.5725	91.73
#1	-.0001	.0061	-.0009	.0035	.0001	.0000	.0012	.0237	.0001
#2	-.0003	.0059	-.0011	.0009	.0000	.0000	-.0014	.0234	.0000
#3	-.0006	-.0019	-.0011	.0016	-.0002	.0000	.0007	.0235	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0005	<.0000	.0001	<.0000	.0009	<.0000	.0002	<.0000
Stddev	.0001	.0008	.0006	.0014	.0201	.0005	.0129	.0002	.0002
%RSD	264.6	144.4	109.3	1094.	116.1	54.71	258.5	126.9	146.5
#1	.0000	-.0003	.0001	.0011	-.0175	.0009	-.0162	.0004	.0001
#2	-.0002	.0012	-.0006	-.0015	.0029	.0013	-.0080	.0001	-.0003
#3	.0001	.0008	-.0010	.0008	-.0372	.0004	.0092	.0000	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0189	.0002	.0010	.0004	.0040	.0004	<.0000	.0052	<.0000
Stddev	.0038	.0001	.0011	.0007	.0011	.0006	.0020	.0038	.0001
%RSD	19.93	54.36	115.2	195.2	26.39	150.1	476.4	71.98	33.80
#1	.0165	.0004	.0010	.0012	.0053	.0002	.0019	.0088	-.0005
#2	.0169	.0001	.0021	-.0001	.0034	-.0001	-.0016	.0056	-.0005
#3	.0232	.0002	-.0002	.0000	.0035	.0011	-.0015	.0013	-.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-122863/1-A Acquired: 5/22/2014 12:45:42 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	<.0000	<.0000	<.0000	.0011	.0068
Stddev	.0000	.0024	.0003	.0004	.0057	.0023	.0000
%RSD	50.50	166.4	219.1	55.43	29.82	204.4	.6363
#1	.0001	-.0001	-.0003	-.0007	-.0135	.0036	.0068
#2	.0000	.0000	.0002	-.0003	-.0249	.0004	.0069
#3	.0001	-.0041	-.0004	-.0011	-.0188	-.0007	.0069
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6123.8
Stddev	14.7
%RSD	.23967
#1	6117.0
#2	6140.7
#3	6113.8

Sample Name: LCS 160-122863/2-A Acquired: 5/22/2014 12:49:37 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2113	10.97	1.078	2.068	1.093	1.069	1.088	11.14	1.110
Stddev	.0016	.05	.004	.006	.004	.001	.004	.03	.004
%RSD	.7592	.4397	.3385	.2895	.3744	.0926	.4119	.2748	.3926
#1	.2109	11.01	1.074	2.064	1.096	1.070	1.088	11.11	1.108
#2	.2100	10.97	1.078	2.075	1.094	1.070	1.084	11.12	1.107
#3	.2131	10.91	1.081	2.065	1.088	1.068	1.093	11.17	1.115
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.113	1.109	1.153	10.75	11.54	1.236	9.978	1.079	.5360
Stddev	.007	.006	.005	.01	.11	.014	.023	.002	.0028
%RSD	.6009	.5334	.4541	.0952	.9214	1.117	.2313	.1646	.5178
#1	1.112	1.104	1.149	10.74	11.63	1.246	9.994	1.080	.5350
#2	1.107	1.108	1.151	10.75	11.57	1.243	9.952	1.077	.5339
#3	1.120	1.116	1.159	10.76	11.42	1.220	9.989	1.080	.5391
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	11.73	1.152	1.142	1.142	10.40	.5397	.5420	.0423	1.104
Stddev	.11	.005	.006	.005	.04	.0030	.0029	.0077	.005
%RSD	.9405	.4282	.5356	.4121	.3937	.5593	.5262	18.18	.4963
#1	11.79	1.150	1.144	1.142	10.39	.5370	.5435	.0354	1.101
#2	11.81	1.149	1.136	1.138	10.37	.5392	.5387	.0506	1.100
#3	11.61	1.158	1.148	1.147	10.45	.5430	.5437	.0410	1.110
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCS 160-122863/2-A Acquired: 5/22/2014 12:49:37 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.139	1.046	1.054	.2375	1.121	1.055	1.105
Stddev	.004	.002	.001	.0018	.007	.004	.005
%RSD	.3549	.1934	.0924	.7738	.5986	.3635	.4794
#1	1.142	1.047	1.055	.2380	1.119	1.051	1.102
#2	1.140	1.043	1.053	.2354	1.116	1.059	1.101
#3	1.134	1.046	1.054	.2390	1.128	1.056	1.111
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5833.2
Stddev	17.1
%RSD	.29320
#1	5847.7
#2	5837.4
#3	5814.3

Sample Name: 160-6679-E-2-A Acquired: 5/22/2014 12:53:06 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0000**	**.0025**	**.0002**	**.0181**	**.0715**	**.0000**	**.0024**	**73.86**	**.0001**
Stddev	.0003	.0026	.0031	.0019	.0003	.0001	.0022	.44	.0001
%RSD	640.3	104.9	1566.	10.36	.3833	127.1	90.71	.5933	215.5
#1	.0000	-.0005	.0036	.0179	.0717	.0001	.0022	73.36	.0001
#2	-.0002	.0038	-.0005	.0162	.0712	.0000	.0003	74.05	-.0001
#3	.0003	.0042	-.0025	.0200	.0715	.0000	.0047	74.17	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0005**	**.0213**	**<.0000**	**.0028**	**6.154**	**.0069**	**24.55**	**.0001**	**.0025**
Stddev	.0001	.0010	.0007	.0021	.059	.0000	.11	.0003	.0001
%RSD	26.60	4.738	22.14	73.94	.9525	.4944	.4522	188.7	5.298
#1	.0004	.0213	-.0024	.0050	6.202	.0069	24.48	.0004	.0023
#2	.0005	.0203	-.0037	.0009	6.089	.0069	24.50	.0002	.0025
#3	.0007	.0223	-.0037	.0026	6.172	.0070	24.68	-.0002	.0026
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**17.04**	**.0053**	**.0123**	**.0049**	**16.26**	**.0026**	**.0034**	**23.33**	**<.0000**
Stddev	.15	.0002	.0013	.0004	.08	.0008	.0029	.03	.0005
%RSD	.8681	3.981	10.42	7.636	.4886	30.75	85.62	.1417	27.81
#1	17.17	.0052	.0133	.0053	16.18	.0017	.0031	23.29	-.0018
#2	16.88	.0056	.0128	.0045	16.25	.0032	.0006	23.35	-.0011
#3	17.07	.0052	.0108	.0050	16.34	.0028	.0065	23.35	-.0020
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6679-E-2-A Acquired: 5/22/2014 12:53:06 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.3280	.0038	.0005	<.0000	<.0000	.0229	.0080
Stddev	.0012	.0029	.0004	.0002	.0124	.0029	.0001
%RSD	.3710	78.49	68.14	5.192	269.6	12.75	1.762
#1	.3287	.0066	.0007	-.0030	.0049	.0230	.0082
#2	.3266	.0007	.0007	-.0032	-.0187	.0258	.0080
#3	.3286	.0040	.0001	-.0029	-.0001	.0200	.0080
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5800.2
Stddev	19.9
%RSD	.34257
#1	5806.5
#2	5816.3
#3	5778.0

Sample Name: 160-6679-E-2-A SD Acquired: 5/22/2014 12:56:57 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0026	<.0000	.0055	.0144	<.0000	.0007	15.30	.0000
Stddev	.0005	.0107	.0006	.0015	.0001	.0000	.0008	.08	.0001
%RSD	84.12	410.4	41.78	27.49	.8579	126.8	119.4	.5415	146.2
#1	-.0011	.0099	-.0021	.0062	.0143	.0000	.0015	15.21	.0001
#2	-.0004	-.0097	-.0010	.0038	.0144	.0000	.0006	15.33	.0001
#3	-.0002	.0076	-.0011	.0065	.0146	.0000	-.0001	15.37	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.0046	<.0000	.0014	1.194	.0018	4.736	.0002	.0006
Stddev	.0002	.0004	.0011	.0007	.008	.0003	.015	.0003	.0002
%RSD	91.86	9.472	46.37	47.60	.6774	17.97	.3228	204.7	41.44
#1	.0000	.0047	-.0016	.0016	1.191	.0015	4.721	-.0002	.0009
#2	.0003	.0042	-.0035	.0006	1.203	.0022	4.751	.0005	.0004
#3	.0003	.0050	-.0018	.0019	1.187	.0019	4.737	.0001	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	3.354	.0011	.0021	.0012	3.100	.0005	.0016	4.560	<.0000
Stddev	.009	.0001	.0016	.0004	.026	.0006	.0006	.019	.0001
%RSD	.2680	10.03	78.55	32.27	.8476	115.5	39.50	.4169	31.61
#1	3.354	.0011	.0030	.0009	3.074	-.0001	.0023	4.538	-.0003
#2	3.346	.0011	.0031	.0016	3.099	.0011	.0014	4.572	-.0004
#3	3.364	.0013	.0002	.0010	3.127	.0005	.0011	4.570	-.0006
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6679-E-2-A SD Acquired: 5/22/2014 12:56:57 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0657	<.0000	<.0000	<.0000	<.0000	.0041	.0064
Stddev	.0002	.0024	.0005	.0004	.0086	.0002	.0002
%RSD	.2456	233.2	144.2	13.25	42.61	5.191	3.826
#1	.0657	-.0036	-.0008	-.0029	-.0106	.0039	.0065
#2	.0655	-.0007	.0002	-.0025	-.0273	.0042	.0065
#3	.0659	.0012	-.0005	-.0033	-.0230	.0042	.0061
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5995.6
Stddev	35.7
%RSD	.59553
#1	6033.7
#2	5990.3
#3	5962.8

Sample Name: 160-6679-E-2-B MS Acquired: 5/22/2014 13:00:49 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.2098**	**11.02**	**1.073**	**2.106**	**1.163**	**1.071**	**1.062**	**84.18**	**1.101**
Stddev	.0012	.05	.003	.009	.005	.003	.007	.09	.003
%RSD	.5605	.4828	.2900	.4217	.4610	.2833	.6693	.1060	.2264
#1	.2092	11.08	1.075	2.116	1.169	1.072	1.068	84.19	1.101
#2	.2111	11.02	1.075	2.104	1.163	1.073	1.064	84.26	1.103
#3	.2089	10.97	1.070	2.099	1.158	1.067	1.054	84.08	1.098
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.065**	**1.093**	**1.126**	**10.65**	**17.96**	**1.236**	**35.16**	**1.064**	**.5266**
Stddev	.004	.005	.005	.03	.12	.012	.12	.003	.0022
%RSD	.3818	.4760	.4474	.2979	.6471	.9809	.3299	.3104	.4215
#1	1.068	1.091	1.124	10.67	18.09	1.250	35.05	1.060	.5271
#2	1.067	1.099	1.132	10.66	17.91	1.229	35.28	1.067	.5285
#3	1.060	1.089	1.122	10.61	17.87	1.228	35.14	1.065	.5241
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**29.28**	**1.108**	**1.150**	**1.093**	**26.83**	**.5366**	**.5433**	**24.02**	**1.066**
Stddev	.26	.002	.008	.004	.09	.0007	.0006	.06	.004
%RSD	.8713	.2072	.6738	.3546	.3529	.1246	.1060	.2352	.3465
#1	29.57	1.108	1.153	1.092	26.88	.5359	.5432	24.06	1.068
#2	29.17	1.110	1.156	1.098	26.87	.5372	.5439	24.06	1.069
#3	29.09	1.106	1.141	1.090	26.72	.5366	.5427	23.96	1.062
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6679-E-2-B MS Acquired: 5/22/2014 13:00:49 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.470	1.032	1.048	.2223	1.100	1.068	1.093
Stddev	.007	.002	.003	.0014	.010	.004	.004
%RSD	.4512	.1761	.2429	.6306	.8738	.3505	.3381
#1	1.476	1.030	1.049	.2225	1.091	1.064	1.095
#2	1.471	1.033	1.050	.2208	1.110	1.071	1.096
#3	1.463	1.033	1.045	.2236	1.099	1.069	1.089
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5700.7
Stddev	3.1
%RSD	.05480
#1	5702.7
#2	5697.1
#3	5702.3

Sample Name: 160-6679-E-2-C MSD Acquired: 5/22/2014 13:04:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2125	11.00	1.078	2.134	1.168	1.079	1.054	84.98	1.104
Stddev	.0014	.08	.006	.017	.009	.009	.007	.44	.006
%RSD	.6798	.6825	.5454	.8117	.7741	.8022	.6779	.5169	.5111
#1	.2109	10.99	1.077	2.119	1.167	1.076	1.055	84.56	1.104
#2	.2137	11.09	1.084	2.153	1.177	1.089	1.061	85.44	1.110
#3	.2130	10.94	1.072	2.129	1.159	1.072	1.047	84.93	1.099
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.080	1.109	1.122	10.77	17.63	1.210	35.00	1.070	.5278
Stddev	.005	.004	.009	.08	.09	.003	.33	.007	.0025
%RSD	.4354	.3112	.7866	.7142	.5116	.2608	.9493	.6203	.4691
#1	1.077	1.105	1.120	10.72	17.59	1.209	34.81	1.067	.5261
#2	1.085	1.112	1.131	10.86	17.74	1.214	35.39	1.078	.5306
#3	1.078	1.110	1.114	10.73	17.57	1.208	34.81	1.066	.5266
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	28.74	1.115	1.162	1.101	26.60	.5329	.5422	23.79	1.068
Stddev	.15	.006	.009	.006	.16	.0035	.0076	.22	.006
%RSD	.5362	.5136	.7281	.5274	.5960	.6582	1.401	.9449	.5213
#1	28.66	1.114	1.157	1.100	26.61	.5311	.5447	23.74	1.065
#2	28.92	1.122	1.172	1.107	26.76	.5370	.5482	24.03	1.074
#3	28.65	1.111	1.157	1.096	26.44	.5307	.5337	23.59	1.065
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6679-E-2-C MSD Acquired: 5/22/2014 13:04:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.471	1.055	1.049	.2279	1.120	1.081	1.100
Stddev	.012	.003	.009	.0017	.011	.012	.005
%RSD	.8080	.2830	.8958	.7277	.9917	1.085	.4539
#1	1.469	1.057	1.047	.2290	1.109	1.070	1.098
#2	1.484	1.057	1.060	.2286	1.121	1.094	1.105
#3	1.461	1.052	1.042	.2260	1.131	1.079	1.095
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5656.4
Stddev	33.6
%RSD	.59331
#1	5691.7
#2	5624.9
#3	5652.5

Sample Name: 160-6679-E-4-A Acquired: 5/22/2014 13:07:45 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0108	<.0000	.0169	.0799	.0000	.0011	95.11	.0000
Stddev	.0002	.0042	.0008	.0028	.0001	.0000	.0004	.14	.0001
%RSD	56.94	38.39	56.96	16.31	.1838	59.50	39.03	.1446	158.1
#1	-.0002	.0111	-.0006	.0138	.0800	.0000	.0012	94.97	.0000
#2	-.0002	.0148	-.0015	.0180	.0798	.0001	.0015	95.25	.0001
#3	-.0005	.0065	-.0023	.0190	.0798	.0001	.0006	95.10	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0004	.0590	<.0000	.0084	6.933	.0073	31.89	.0028	.0021
Stddev	.0001	.0011	.0002	.0018	.021	.0004	.06	.0003	.0002
%RSD	28.39	1.879	6.668	21.03	.3030	6.083	.1937	12.07	9.937
#1	.0004	.0602	-.0033	.0104	6.957	.0074	31.90	.0030	.0022
#2	.0006	.0580	-.0037	.0071	6.924	.0068	31.95	.0029	.0023
#3	.0004	.0588	-.0037	.0076	6.918	.0077	31.83	.0024	.0019
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	19.50	.0051	.0131	.0045	18.97	.0029	.0034	23.44	<.0000
Stddev	.04	.0001	.0008	.0005	.12	.0009	.0011	.07	.0004
%RSD	.1834	2.161	5.784	11.04	.6587	31.75	30.95	.3129	28.43
#1	19.52	.0052	.0135	.0051	19.00	.0018	.0040	23.48	-.0017
#2	19.53	.0050	.0135	.0041	19.07	.0035	.0022	23.48	-.0018
#3	19.46	.0050	.0122	.0045	18.83	.0033	.0041	23.35	-.0010
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6679-E-4-A Acquired: 5/22/2014 13:07:45 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.4145	.0049	.0010	<.0000	.0030	.0241	.0075
Stddev	.0017	.0023	.0001	.0008	.0069	.0013	.0002
%RSD	.4084	46.36	12.39	66.14	233.6	5.592	2.214
#1	.4164	.0071	.0009	-.0008	-.0050	.0242	.0077
#2	.4139	.0050	.0010	-.0008	.0068	.0254	.0074
#3	.4131	.0026	.0012	-.0022	.0070	.0227	.0074
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5771.2
Stddev	10.6
%RSD	.18385
#1	5783.0
#2	5768.2
#3	5762.4

Sample Name: 160-6679-E-6-A Acquired: 5/22/2014 13:11:35 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0100	<.0000	.0167	.0881	.0001	.0023	81.31	.0001
Stddev	.0002	.0021	.0012	.0016	.0003	.0002	.0011	.25	.0002
%RSD	1363.	20.83	210.2	9.701	.3661	209.4	47.35	.3042	139.1
#1	-.0003	.0100	.0007	.0186	.0878	.0000	.0020	81.59	.0003
#2	.0001	.0080	-.0007	.0157	.0882	.0003	.0014	81.20	.0000
#3	.0001	.0121	-.0017	.0158	.0884	.0000	.0034	81.13	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0004	.0326	<.0000	.0178	6.903	.0079	25.12	.0003	.0028
Stddev	.0003	.0003	.0012	.0006	.103	.0009	.08	.0004	.0000
%RSD	76.95	.8527	49.71	3.366	1.487	10.92	.3296	116.7	1.041
#1	.0007	.0324	-.0016	.0175	6.790	.0081	25.21	.0000	.0028
#2	.0001	.0325	-.0038	.0185	6.931	.0086	25.11	.0007	.0028
#3	.0006	.0329	-.0018	.0173	6.989	.0069	25.05	.0002	.0028
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	27.68	.0054	.0117	.0047	15.00	.0021	.0051	24.16	<.0000
Stddev	.39	.0000	.0005	.0002	.13	.0015	.0003	.05	.0001
%RSD	1.401	.8546	4.646	3.316	.8626	73.27	4.975	.2119	5.404
#1	27.26	.0054	.0116	.0046	15.15	.0032	.0049	24.17	-.0021
#2	27.76	.0054	.0112	.0046	14.91	.0004	.0054	24.20	-.0021
#3	28.02	.0054	.0123	.0048	14.94	.0027	.0052	24.10	-.0023
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6679-E-6-A Acquired: 5/22/2014 13:11:35 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.3356	.0062	.0005	<.0000	.0052	.0249	.0081
Stddev	.0008	.0023	.0004	.0010	.0066	.0007	.0001
%RSD	.2402	37.15	77.09	54.51	128.4	2.710	1.290
#1	.3352	.0077	.0001	-.0017	-.0025	.0252	.0082
#2	.3350	.0073	.0007	-.0029	.0086	.0241	.0080
#3	.3365	.0035	.0009	-.0009	.0094	.0253	.0080
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5726.3
Stddev	25.7
%RSD	.44955
#1	5698.0
#2	5748.2
#3	5732.7

Sample Name: 160-6694-F-7-A Acquired: 5/22/2014 13:15:26 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	<.0000	.0008	.0000	<.0000	.0013	.0267	.0001
Stddev	.0008	.0058	.0008	.0015	.0001	.0000	.0027	.0003	.0001
%RSD	236.1	318.4	85.15	183.6	180.6	128.0	205.2	1.280	189.7
#1	.0006	-.0062	-.0017	.0020	.0000	.0000	.0040	.0271	.0000
#2	-.0009	.0048	-.0008	-.0008	.0000	.0000	-.0013	.0266	.0000
#3	-.0007	-.0040	-.0002	.0013	.0001	.0000	.0011	.0264	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0009	.0008	.0014	<.0000	.0010	.0038	.0006	.0000
Stddev	.0002	.0007	.0007	.0003	.0127	.0003	.0138	.0002	.0001
%RSD	151.8	83.26	93.89	23.19	120.7	28.31	363.8	31.26	297.6
#1	.0002	.0008	.0008	.0017	.0041	.0007	.0159	.0006	.0001
#2	.0003	.0002	.0015	.0013	-.0172	.0012	-.0113	.0007	-.0001
#3	-.0001	.0016	.0000	.0011	-.0185	.0011	.0068	.0004	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0319	.0005	.0006	<.0000	.0057	.0007	.0002	.0103	.0006
Stddev	.0062	.0000	.0007	.0003	.0008	.0012	.0017	.0018	.0003
%RSD	19.58	3.906	118.2	64.81	13.29	168.2	695.4	16.97	59.64
#1	.0295	.0006	.0004	-.0009	.0056	-.0006	.0021	.0115	.0009
#2	.0272	.0005	.0014	-.0002	.0050	.0009	-.0012	.0112	.0006
#3	.0390	.0005	.0000	-.0004	.0065	.0019	-.0002	.0083	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-F-7-A Acquired: 5/22/2014 13:15:26 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	.0007	.0004	<.0000	.0116	.0009	.0092
Stddev	.0000	.0018	.0002	.0018	.0083	.0017	.0002
%RSD	121.8	269.4	60.06	100.7	71.90	196.9	1.787
#1	.0001	-.0014	.0002	-.0004	.0021	-.0003	.0090
#2	.0000	.0016	.0006	-.0011	.0149	.0001	.0094
#3	.0000	.0018	.0004	-.0038	.0178	.0028	.0093
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5936.5
Stddev	18.4
%RSD	.30950
#1	5945.7
#2	5915.3
#3	5948.4

Sample Name: LB 160-122888/1-B Acquired: 5/22/2014 13:19:20 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0304**	**<.0000**	**.0691**	**.0098**	**.0000**	**.0005**	**.6241**	**.0003**
Stddev	.0005	.0066	.0005	.0019	.0001	.0000	.0015	.0011	.0000
%RSD	291.0	21.65	46.07	2.814	.6168	101.2	325.9	.1843	9.289
#1	.0007	.0247	-.0005	.0713	.0098	.0000	.0019	.6247	.0003
#2	.0001	.0376	-.0015	.0684	.0097	.0000	-.0010	.6228	.0003
#3	-.0003	.0290	-.0013	.0676	.0099	.0000	.0004	.6249	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0024**	**.0009**	**.1675**	**.1642**	**.0010**	**.1562**	**.0015**	**.0005**
Stddev	.0000	.0001	.0015	.0012	.0029	.0007	.0069	.0001	.0002
%RSD	19.60	5.053	167.9	.7418	1.772	71.25	4.450	7.594	32.61
#1	.0001	.0025	.0010	.1681	.1674	.0002	.1626	.0014	.0004
#2	.0001	.0025	.0022	.1684	.1634	.0016	.1488	.0016	.0006
#3	.0001	.0023	-.0007	.1661	.1618	.0012	.1571	.0015	.0007
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**509.5**	**.0006**	**.0073**	**.0009**	**.1838**	**.0002**	**.0001**	**.0614**	**.0003**
Stddev	.7	.0000	.0008	.0007	.0007	.0021	.0016	.0044	.0008
%RSD	.1427	4.259	11.28	78.32	.3711	948.4	2357.	7.237	294.3
#1	509.7	.0006	.0065	.0017	.1842	.0002	.0001	.0638	-.0001
#2	508.8	.0006	.0072	.0009	.1842	-.0019	-.0016	.0641	-.0002
#3	510.2	.0006	.0082	.0002	.1830	.0023	.0017	.0563	.0011
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LB 160-122888/1-B Acquired: 5/22/2014 13:19:20 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0012	.0013	.0002	<.0000	<.0000	<.0000	.0140
Stddev	.0000	.0023	.0005	.0011	.0050	.0027	.0001
%RSD	2.451	181.0	208.6	30.78	15.72	192.8	.7698
#1	.0011	-.0014	-.0001	-.0029	-.0367	.0008	.0138
#2	.0012	.0029	.0000	-.0031	-.0323	-.0007	.0140
#3	.0012	.0023	.0008	-.0050	-.0267	-.0043	.0140
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5681.6
Stddev	14.8
%RSD	.25960
#1	5677.1
#2	5698.1
#3	5669.7

Sample Name: CCV Acquired: 5/22/2014 13:23:26 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.9958**	**49.49**	**5.039**	**4.962**	**4.940**	**5.047**	**5.082**	**51.57**	**5.105**
Stddev	.0081	.15	.043	.011	.070	.032	.044	.38	.050
%RSD	.8171	.2942	.8614	.2186	1.423	.6239	.8684	.7274	.9711
#1	.9920	49.33	4.999	4.952	4.864	5.021	5.050	51.22	5.059
#2	.9902	49.60	5.033	4.974	5.003	5.039	5.065	51.52	5.099
#3	1.005	49.56	5.085	4.960	4.953	5.082	5.133	51.97	5.157
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.108**	**5.083**	**5.109**	**50.20**	**50.39**	**5.100**	**49.06**	**5.033**	**1.022**
Stddev	.037	.043	.043	.09	.10	.018	.20	.017	.008
%RSD	.7322	.8423	.8353	.1859	.2077	.3636	.4132	.3295	.7804
#1	5.072	5.050	5.072	50.10	50.39	5.082	48.82	5.013	1.015
#2	5.107	5.069	5.100	50.24	50.28	5.098	49.15	5.042	1.021
#3	5.146	5.131	5.156	50.28	50.49	5.119	49.20	5.043	1.031
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**50.41**	**5.145**	**52.63**	**5.175**	**50.20**	**1.012**	**1.008**	**4.991**	**5.156**
Stddev	.10	.045	.41	.048	.42	.010	.011	.029	.040
%RSD	.1973	.8845	.7736	.9293	.8372	1.012	1.100	.5814	.7718
#1	50.34	5.102	52.24	5.130	49.82	1.006	1.002	4.958	5.117
#2	50.37	5.141	52.59	5.171	50.13	1.007	1.002	5.013	5.153
#3	50.52	5.193	53.05	5.225	50.65	1.024	1.021	5.002	5.197
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 13:23:26 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.062**	**4.994**	**5.016**	**1.047**	**5.089**	**4.996**	**5.119**
Stddev	.049	.030	.020	.005	.048	.008	.040
%RSD	.9578	.6021	.3899	.4898	.9428	.1687	.7864
#1	5.010	4.968	4.995	1.043	5.069	4.990	5.081
#2	5.105	4.988	5.021	1.045	5.055	4.993	5.113
#3	5.072	5.027	5.033	1.053	5.144	5.006	5.161
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5553.9**
Stddev	41.9
%RSD	.75472
#1	5592.4
#2	5560.2
#3	5509.2

Sample Name: CCB Acquired: 5/22/2014 13:27:15 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	<.0000	.0067	.0001	.0001	<.0000	<.0000	.0001
Stddev	.0002	.0078	.0012	.0027	.0001	.0001	.0014	.0009	.0000
%RSD	166.8	4904.	156.7	40.28	122.8	52.67	88.64	80.81	55.10
#1	-.0004	-.0082	-.0020	.0086	.0001	.0001	-.0027	-.0002	.0001
#2	-.0001	.0004	-.0008	.0078	.0003	.0002	-.0021	-.0010	.0001
#3	.0000	.0073	.0005	.0036	.0000	.0001	.0000	-.0020	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0001	<.0000	.0024	<.0000	.0010	<.0000	.0002	<.0000
Stddev	.0002	.0007	.0003	.0003	.0065	.0004	.0145	.0002	.0001
%RSD	123.6	822.4	29.22	14.04	203.5	37.96	214.3	99.28	266.2
#1	-.0001	-.0006	-.0010	.0028	.0026	.0013	-.0042	.0005	.0000
#2	.0003	.0001	-.0015	.0021	-.0020	.0011	.0063	.0000	-.0001
#3	.0002	.0007	-.0009	.0024	-.0102	.0006	-.0225	.0002	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0190	.0001	.0011	<.0000	.0036	<.0000	.0021	.0041	.0003
Stddev	.0058	.0001	.0008	.0006	.0027	.0015	.0007	.0045	.0004
%RSD	30.61	99.80	70.58	166.6	74.69	245.5	33.22	107.9	112.2
#1	.0152	.0000	.0017	-.0006	.0044	-.0017	.0013	.0081	.0004
#2	.0257	.0002	.0003	-.0008	.0058	.0011	.0025	-.0007	.0007
#3	.0161	.0002	.0012	.0003	.0006	-.0012	.0024	.0050	-.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 13:27:15 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	<.0000	<.0000	<.0000	<.0000	<.0000
Stddev	.0001	.0012	.0003	.0005	.0079	.0022	.0001
%RSD	106.9	218.5	177.1	90.35	519.8	155.4	218.2
#1	.0000	-.0002	.0002	.0000	-.0008	-.0033	.0000
#2	.0002	.0004	-.0004	-.0008	-.0097	.0010	.0000
#3	.0000	-.0019	-.0004	-.0008	.0060	-.0020	-.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	6001.6
Stddev	15.7
%RSD	.26162
#1	5989.6
#2	6019.4
#3	5995.8

Sample Name: LCS 160-123177/2-A Acquired: 5/22/2014 13:31:11 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2058	10.05	1.050	2.049	1.005	1.036	.9863	10.66	1.046
Stddev	.0006	.05	.004	.006	.001	.004	.0042	.03	.003
%RSD	.2868	.4887	.3986	.3146	.1202	.4007	.4279	.2941	.3077
#1	.2061	9.997	1.052	2.052	1.004	1.041	.9905	10.64	1.047
#2	.2061	10.09	1.053	2.053	1.006	1.034	.9864	10.70	1.047
#3	.2051	10.08	1.046	2.041	1.006	1.035	.9821	10.64	1.042
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.008	1.017	1.043	10.40	10.10	1.010	9.653	1.024	.5063
Stddev	.002	.006	.004	.03	.08	.012	.053	.002	.0011
%RSD	.2189	.5826	.3485	.2835	.8223	1.170	.5478	.2171	.2125
#1	1.009	1.015	1.048	10.44	10.01	.9970	9.710	1.026	.5070
#2	1.010	1.024	1.042	10.38	10.17	1.020	9.646	1.023	.5069
#3	1.006	1.013	1.041	10.39	10.11	1.012	9.605	1.022	.5051
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	486.3	1.040	1.129	.9986	10.53	.5133	.5400	.1210	1.015
Stddev	2.5	.002	.004	.0048	.04	.0025	.0014	.0012	.003
%RSD	.5221	.1611	.3390	.4802	.4079	.4927	.2652	.9928	.3348
#1	487.0	1.040	1.133	.9992	10.58	.5127	.5388	.1207	1.016
#2	483.5	1.041	1.127	1.003	10.52	.5111	.5416	.1200	1.018
#3	488.4	1.038	1.127	.9936	10.49	.5160	.5396	.1223	1.011
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCS 160-123177/2-A Acquired: 5/22/2014 13:31:11 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.045	.9818	1.028	.1947	.9360	1.030	1.067
Stddev	.001	.0037	.003	.0014	.0065	.002	.002
%RSD	.0785	.3767	.2557	.7102	.6910	.1539	.1625
#1	1.046	.9780	1.031	.1963	.9434	1.031	1.068
#2	1.044	.9854	1.027	.1941	.9315	1.028	1.069
#3	1.045	.9820	1.027	.1937	.9330	1.030	1.066
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5553.4
Stddev	7.1
%RSD	.12832
#1	5555.6
#2	5545.4
#3	5559.2

Sample Name: 160-6690-A-1-C Acquired: 5/22/2014 13:34:50 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0752**	**<.0000**	**.0330**	**.1238**	**.0002**	**<.0000**	**16.82**	**.0004**
Stddev	.0003	.0024	.0002	.0004	.0006	.0000	.0007	.06	.0002
%RSD	263.2	3.243	21.66	1.166	.4863	20.31	83.50	.3761	51.02
#1	.0002	.0738	-.0011	.0328	.1236	.0003	.0000	16.78	.0003
#2	-.0002	.0781	-.0007	.0334	.1245	.0002	-.0014	16.78	.0003
#3	.0004	.0738	-.0010	.0327	.1233	.0002	-.0012	16.89	.0007
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0137**	**.0020**	**.0013**	**.0423**	**.4146**	**.0019**	**3.230**	**1.343**	**.0003**
Stddev	.0006	.0009	.0019	.0016	.0110	.0005	.026	.005	.0002
%RSD	4.608	45.49	148.9	3.826	2.656	29.17	.7921	.3399	55.62
#1	.0133	.0027	.0034	.0408	.4084	.0023	3.217	1.341	.0005
#2	.0135	.0024	-.0004	.0441	.4274	.0013	3.214	1.340	.0003
#3	.0145	.0010	.0008	.0421	.4081	.0020	3.260	1.348	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**512.9**	**.0035**	**.0051**	**.0039**	**.2326**	**.0016**	**.0018**	**1.286**	**.0002**
Stddev	3.7	.0003	.0016	.0011	.0064	.0009	.0011	.003	.0002
%RSD	.7165	9.837	30.37	29.49	2.739	53.16	65.09	.2214	113.4
#1	511.6	.0038	.0051	.0043	.2272	.0026	.0031	1.283	.0000
#2	517.1	.0032	.0036	.0047	.2311	.0010	.0010	1.288	.0002
#3	510.0	.0037	.0067	.0026	.2397	.0012	.0012	1.287	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-1-C Acquired: 5/22/2014 13:34:50 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0518	.0012	.0009	<.0000	<.0000	<.0000	.0117
Stddev	.0001	.0044	.0005	.0009	.0063	.0015	.0001
%RSD	.2584	380.4	55.65	16.21	16.03	72.90	.9240
#1	.0517	.0056	.0012	-.0054	-.0353	-.0013	.0116
#2	.0519	.0011	.0011	-.0046	-.0466	-.0038	.0116
#3	.0517	-.0032	.0003	-.0063	-.0360	-.0011	.0118
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5549.8
Stddev	38.4
%RSD	.69139
#1	5583.5
#2	5557.8
#3	5508.0

Sample Name: 160-6690-A-1-C SD Acquired: 5/22/2014 13:38:53 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0147	.0001	.0075	.0254	.0000	<.0000	3.642	.0001
Stddev	.0002	.0076	.0007	.0019	.0002	.0000	.0021	.005	.0000
%RSD	162.4	51.26	585.5	25.45	.6827	152.4	713.4	.1465	30.53
#1	-.0001	.0101	.0009	.0082	.0254	.0000	.0018	3.647	.0001
#2	.0003	.0107	-.0001	.0054	.0252	.0000	-.0002	3.637	.0001
#3	.0002	.0235	-.0004	.0090	.0255	.0000	-.0024	3.643	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0028	.0014	<.0000	.0088	.0713	.0012	.6555	.2727	.0000
Stddev	.0003	.0006	.0012	.0019	.0091	.0003	.0062	.0013	.0001
%RSD	11.21	42.10	127.5	21.09	12.70	27.13	.9471	.4721	217.9
#1	.0026	.0008	-.0012	.0108	.0807	.0011	.6484	.2726	.0000
#2	.0031	.0014	-.0020	.0072	.0626	.0016	.6581	.2740	.0000
#3	.0027	.0019	.0004	.0084	.0705	.0010	.6600	.2714	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	105.2	.0006	.0010	.0015	.0487	.0006	.0002	.2565	.0004
Stddev	1.5	.0001	.0007	.0007	.0005	.0007	.0011	.0034	.0004
%RSD	1.412	13.96	69.24	49.29	.9873	119.9	610.5	1.320	123.2
#1	104.9	.0006	.0017	.0010	.0492	.0009	.0014	.2559	.0006
#2	103.9	.0005	.0007	.0011	.0488	-.0002	-.0002	.2601	-.0001
#3	106.8	.0007	.0005	.0023	.0482	.0010	-.0006	.2534	.0006
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-1-C SD Acquired: 5/22/2014 13:38:53 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0106	.0016	<.0000	<.0000	<.0000	<.0000	.0070
Stddev	.0001	.0073	.0005	.0012	.0051	.0006	.0001
%RSD	.5479	456.6	162.0	33.21	15.47	31.33	.7482
#1	.0106	.0087	-.0008	-.0024	-.0278	-.0013	.0071
#2	.0105	-.0059	-.0004	-.0047	-.0380	-.0016	.0070
#3	.0106	.0019	.0002	-.0037	-.0330	-.0024	.0070
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5605.3
Stddev	9.0
%RSD	.16085
#1	5603.0
#2	5597.7
#3	5615.3

Sample Name: 160-6690-A-1-D MS Acquired: 5/22/2014 13:42:55 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.2005**	**9.878**	**1.006**	**1.906**	**1.100**	**.9892**	**.9686**	**26.80**	**.9969**
Stddev	.0012	.006	.003	.007	.001	.0020	.0024	.07	.0024
%RSD	.6204	.0647	.2656	.3613	.0669	.2024	.2455	.2630	.2388
#1	.2006	9.883	1.006	1.909	1.100	.9890	.9683	26.81	.9962
#2	.1992	9.871	1.003	1.899	1.101	.9873	.9664	26.72	.9949
#3	.2017	9.881	1.008	1.912	1.101	.9913	.9711	26.86	.9995
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.9643**	**.9690**	**.9918**	**9.672**	**10.21**	**1.004**	**12.35**	**2.348**	**.4947**
Stddev	.0012	.0044	.0042	.028	.05	.009	.08	.011	.0009
%RSD	.1281	.4585	.4226	.2927	.4741	.8479	.6493	.4659	.1823
#1	.9647	.9692	.9898	9.673	10.25	1.009	12.42	2.353	.4942
#2	.9629	.9644	.9889	9.644	10.24	1.008	12.26	2.335	.4941
#3	.9652	.9733	.9966	9.700	10.16	.9941	12.35	2.354	.4957
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**545.0**	**.9866**	**1.081**	**.9448**	**10.39**	**.5038**	**.5179**	**1.435**	**.9873**
Stddev	9.1	.0028	.007	.0061	.04	.0021	.0035	.002	.0027
%RSD	1.672	.2800	.6624	.6493	.3862	.4095	.6798	.1024	.2694
#1	555.4	.9886	1.080	.9503	10.39	.5014	.5147	1.435	.9863
#2	541.6	.9835	1.075	.9382	10.35	.5051	.5174	1.437	.9852
#3	538.2	.9879	1.089	.9459	10.43	.5049	.5217	1.435	.9903
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-1-D MS Acquired: 5/22/2014 13:42:55 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.065	.9273	1.019	.1799	.8957	.9684	1.017
Stddev	.001	.0059	.002	.0013	.0057	.0027	.003
%RSD	.1009	.6346	.1858	.7170	.6371	.2809	.2756
#1	1.064	.9328	1.019	.1792	.9016	.9669	1.017
#2	1.066	.9211	1.016	.1814	.8902	.9667	1.014
#3	1.065	.9279	1.020	.1791	.8953	.9715	1.019
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5595.4
Stddev	18.4
%RSD	.32909
#1	5598.1
#2	5612.4
#3	5575.8

Sample Name: 160-6690-A-1-E MSD Acquired: 5/22/2014 13:46:34 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.2040**	**10.19**	**1.070**	**1.982**	**1.132**	**1.037**	**.9885**	**27.49**	**1.066**
Stddev	.0017	.04	.007	.002	.004	.003	.0093	.03	.003
%RSD	.8539	.3443	.6628	.1172	.3372	.2549	.9401	.1191	.2642
#1	.2030	10.15	1.062	1.980	1.128	1.036	.9785	27.45	1.063
#2	.2060	10.22	1.074	1.982	1.134	1.035	.9968	27.51	1.066
#3	.2030	10.19	1.074	1.984	1.134	1.040	.9902	27.50	1.069
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.026**	**1.029**	**1.055**	**10.16**	**10.49**	**1.019**	**12.81**	**2.374**	**.5068**
Stddev	.003	.003	.003	.02	.04	.006	.03	.001	.0014
%RSD	.2974	.2557	.3252	.2182	.4215	.5892	.2458	.0583	.2859
#1	1.023	1.026	1.052	10.16	10.45	1.012	12.83	2.375	.5056
#2	1.027	1.031	1.055	10.14	10.50	1.022	12.77	2.374	.5084
#3	1.029	1.030	1.058	10.18	10.53	1.023	12.81	2.373	.5063
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**529.5**	**1.058**	**1.141**	**1.014**	**10.62**	**.5163**	**.5493**	**1.384**	**1.019**
Stddev	3.4	.002	.003	.002	.04	.0004	.0030	.005	.003
%RSD	.6366	.2055	.2652	.1524	.3592	.0831	.5389	.3320	.2881
#1	526.5	1.056	1.138	1.013	10.58	.5158	.5459	1.381	1.016
#2	533.2	1.060	1.141	1.012	10.64	.5166	.5515	1.389	1.021
#3	528.8	1.059	1.144	1.015	10.64	.5164	.5505	1.381	1.021
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-1-E MSD Acquired: 5/22/2014 13:46:34 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.101	.9764	1.022	.1920	.9412	1.021	1.080
Stddev	.003	.0035	.001	.0011	.0080	.002	.002
%RSD	.2688	.3536	.0982	.5741	.8474	.2201	.1772
#1	1.098	.9726	1.022	.1933	.9403	1.023	1.077
#2	1.103	.9794	1.021	.1911	.9337	1.019	1.081
#3	1.103	.9773	1.023	.1917	.9496	1.020	1.080
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5473.4
Stddev	10.6
%RSD	.19443
#1	5483.9
#2	5473.8
#3	5462.6

Sample Name: 160-6690-A-2-C Acquired: 5/22/2014 13:50:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.1107**	**<.0000**	**.1058**	**.1256**	**.0001**	**.0015**	**52.95**	**.0002**
Stddev	.0005	.0021	.0017	.0007	.0002	.0000	.0014	.24	.0001
%RSD	627.4	1.918	250.9	.7048	.1888	28.75	95.08	.4620	53.00
#1	-.0004	.1119	-.0014	.1067	.1253	.0001	.0013	53.14	.0001
#2	.0002	.1082	-.0019	.1054	.1256	.0001	.0002	53.03	.0002
#3	.0005	.1119	.0013	.1054	.1258	.0000	.0030	52.67	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0004**	**.0024**	**<.0000**	**.0963**	**.7029**	**.0015**	**7.386**	**.0243**	**.0003**
Stddev	.0003	.0004	.0007	.0015	.0188	.0003	.050	.0005	.0000
%RSD	63.35	18.76	26.69	1.539	2.682	21.28	.6735	1.915	16.70
#1	.0006	.0024	-.0023	.0980	.6948	.0018	7.443	.0238	.0003
#2	.0001	.0028	-.0021	.0954	.7244	.0015	7.366	.0244	.0003
#3	.0006	.0019	-.0034	.0954	.6893	.0012	7.350	.0247	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**510.8**	**.0019**	**.0030**	**.0006**	**.2287**	**.0021**	**.0001**	**2.227**	**<.0000**
Stddev	7.3	.0002	.0021	.0017	.0016	.0007	.0004	.028	.0003
%RSD	1.424	11.03	72.10	286.3	.7142	31.01	312.2	1.270	48.81
#1	509.2	.0020	.0021	-.0004	.2298	.0023	-.0001	2.248	-.0004
#2	518.7	.0016	.0014	.0026	.2294	.0014	.0006	2.238	-.0005
#3	504.4	.0019	.0054	-.0004	.2268	.0027	-.0001	2.194	-.0009
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-2-C Acquired: 5/22/2014 13:50:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1133	.0025	.0017	<.0000	<.0000	.0002	.0160
Stddev	.0001	.0020	.0006	.0015	.0037	.0007	.0002
%RSD	.1202	79.36	32.12	47.15	11.49	401.3	1.110
#1	.1132	.0044	.0023	-.0027	-.0279	-.0006	.0162
#2	.1134	.0029	.0012	-.0050	-.0341	.0008	.0161
#3	.1134	.0004	.0016	-.0020	-.0344	.0003	.0158
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5508.5
Stddev	24.3
%RSD	.44037
#1	5485.2
#2	5506.7
#3	5533.6

Sample Name: 160-6690-A-3-C Acquired: 5/22/2014 13:54:15 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0374	<.0000	.0837	.1850	<.0000	<.0000	200.4	.0003
Stddev	.0005	.0052	.0016	.0018	.0004	.0000	.0017	.9	.0001
%RSD	336.1	13.85	100.2	2.181	.2186	50.20	146.7	.4659	21.08
#1	-.0001	.0343	-.0034	.0845	.1845	.0000	-.0027	199.9	.0003
#2	-.0006	.0434	-.0003	.0850	.1852	.0000	.0006	201.4	.0002
#3	.0003	.0344	-.0011	.0816	.1853	.0000	-.0013	199.7	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0009	.0030	<.0000	.0340	.7195	.0036	9.450	.0075	.0001
Stddev	.0002	.0003	.0013	.0005	.0035	.0006	.095	.0001	.0001
%RSD	21.95	10.40	44.11	1.362	.4804	15.99	1.001	1.054	113.6
#1	.0011	.0032	-.0025	.0344	.7155	.0037	9.528	.0075	.0001
#2	.0008	.0026	-.0020	.0335	.7219	.0030	9.476	.0075	.0003
#3	.0007	.0031	-.0045	.0340	.7210	.0041	9.345	.0076	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	506.1	.0006	.0021	.0012	.1637	.0034	.0013	1.472	<.0000
Stddev	4.4	.0001	.0009	.0010	.0015	.0002	.0006	.012	.0001
%RSD	.8750	19.59	40.36	82.31	.9099	6.562	45.67	.7869	10.38
#1	501.1	.0007	.0030	.0023	.1652	.0032	.0020	1.482	-.0014
#2	509.2	.0007	.0021	.0009	.1636	.0036	.0011	1.475	-.0014
#3	508.1	.0005	.0013	.0004	.1623	.0035	.0009	1.460	-.0012
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-3-C Acquired: 5/22/2014 13:54:15 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.3334	.0071	.0019	<.0000	.0137	<.0000	.0131
Stddev	.0005	.0037	.0003	.0004	.0121	.0036	.0001
%RSD	.1540	51.88	14.80	15.66	88.20	165.7	1.018
#1	.3337	.0063	.0021	-.0021	-.0002	-.0032	.0131
#2	.3338	.0112	.0020	-.0029	.0216	.0018	.0132
#3	.3329	.0040	.0016	-.0024	.0198	-.0052	.0129
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5452.8
Stddev	22.3
%RSD	.40856
#1	5438.0
#2	5442.1
#3	5478.5

Sample Name: 160-6690-A-4-C Acquired: 5/22/2014 13:58:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0619	<.0000	.0732	.1643	.0000	<.0000	90.88	.0002
Stddev	.0004	.0054	.0024	.0013	.0005	.0000	.0013	.80	.0001
%RSD	129.3	8.726	205.0	1.728	.3313	60.13	108.2	.8833	44.77
#1	.0001	.0570	-.0008	.0736	.1641	.0000	-.0018	90.56	.0002
#2	-.0005	.0610	.0010	.0742	.1638	.0000	.0003	91.80	.0001
#3	-.0005	.0677	-.0038	.0718	.1649	.0000	-.0023	90.29	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0007	.0036	<.0000	.0433	.7261	.0026	7.890	.0149	.0003
Stddev	.0003	.0002	.0006	.0009	.0087	.0005	.037	.0003	.0000
%RSD	40.85	5.130	27.70	2.192	1.203	20.55	.4666	1.858	13.92
#1	.0004	.0034	-.0018	.0440	.7161	.0024	7.890	.0151	.0002
#2	.0009	.0038	-.0021	.0437	.7301	.0032	7.927	.0150	.0003
#3	.0007	.0036	-.0031	.0422	.7322	.0022	7.854	.0146	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	514.6	.0021	.0041	.0018	.4326	.0038	.0024	1.813	<.0000
Stddev	8.7	.0002	.0006	.0005	.0030	.0005	.0005	.006	.0010
%RSD	1.693	8.333	13.61	25.75	.6920	13.87	21.10	.3341	149.4
#1	507.1	.0022	.0048	.0017	.4294	.0043	.0019	1.820	-.0015
#2	524.2	.0022	.0038	.0014	.4354	.0032	.0024	1.809	-.0008
#3	512.6	.0019	.0039	.0023	.4329	.0040	.0029	1.810	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-4-C Acquired: 5/22/2014 13:58:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1647	.0023	.0015	<.0000	<.0000	.0005	.0150
Stddev	.0007	.0050	.0008	.0006	.0152	.0018	.0002
%RSD	.4395	221.0	53.04	18.66	214.1	388.0	1.081
#1	.1643	.0048	.0013	-.0034	-.0234	.0008	.0151
#2	.1642	.0054	.0025	-.0028	-.0046	-.0015	.0151
#3	.1655	-.0035	.0009	-.0040	.0067	.0021	.0148
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5485.3
Stddev	41.8
%RSD	.76170
#1	5520.8
#2	5439.3
#3	5495.8

Sample Name: 160-6690-A-5-C Acquired: 5/22/2014 14:02:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0003**	**.0457**	**<.0000**	**.0678**	**.2089**	**.0000**	**<.0000**	**145.2**	**.0004**
Stddev	.0004	.0078	.0007	.0014	.0003	.0000	.0027	.3	.0002
%RSD	171.9	17.16	40.31	2.052	.1233	32.68	260.0	.2119	40.10
#1	.0007	.0381	-.0014	.0666	.2090	.0000	.0016	145.0	.0006
#2	-.0002	.0453	-.0026	.0674	.2086	.0000	-.0038	145.6	.0003
#3	.0003	.0537	-.0013	.0693	.2091	.0000	-.0010	145.1	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0013**	**.0026**	**<.0000**	**.0303**	**.7853**	**.0031**	**15.23**	**.5282**	**.0003**
Stddev	.0003	.0005	.0004	.0006	.0030	.0007	.05	.0033	.0002
%RSD	26.78	18.96	12.16	1.857	.3783	23.12	.3578	.6316	64.73
#1	.0016	.0023	-.0027	.0309	.7875	.0023	15.17	.5247	.0004
#2	.0013	.0032	-.0031	.0302	.7865	.0038	15.24	.5287	.0001
#3	.0009	.0024	-.0034	.0297	.7819	.0033	15.27	.5313	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**516.9**	**.0058**	**.0033**	**.0011**	**.3419**	**.0039**	**.0038**	**1.591**	**<.0000**
Stddev	6.4	.0005	.0010	.0007	.0004	.0024	.0003	.001	.0005
%RSD	1.239	8.627	29.58	62.38	.1312	62.80	8.072	.0543	35.11
#1	523.5	.0054	.0030	.0015	.3424	.0066	.0035	1.590	-.0017
#2	516.4	.0064	.0026	.0003	.3416	.0018	.0041	1.591	-.0016
#3	510.8	.0057	.0044	.0016	.3416	.0032	.0040	1.592	-.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-5-C Acquired: 5/22/2014 14:02:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2512	.0069	.0013	<.0000	<.0000	<.0000	.0154
Stddev	.0003	.0029	.0004	.0004	.0175	.0024	.0001
%RSD	.1073	42.25	29.72	9.689	175.4	91.62	.6743
#1	.2514	.0056	.0010	-.0043	-.0288	-.0029	.0154
#2	.2509	.0048	.0017	-.0040	-.0069	-.0001	.0154
#3	.2512	.0102	.0011	-.0049	.0058	-.0049	.0155
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5506.3
Stddev	17.1
%RSD	.30995
#1	5525.1
#2	5502.1
#3	5491.7

Sample Name: 160-6690-A-6-C Acquired: 5/22/2014 14:06:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0390	<.0000	.0610	.1778	<.0000	.0003	234.1	.0002
Stddev	.0001	.0073	.0006	.0010	.0012	.0000	.0011	1.2	.0001
%RSD	23.61	18.80	88.00	1.685	.6765	263.4	339.8	.5153	37.16
#1	-.0007	.0391	-.0006	.0602	.1792	.0000	.0016	232.9	.0001
#2	-.0005	.0317	-.0014	.0606	.1772	.0000	.0000	234.1	.0003
#3	-.0008	.0464	-.0002	.0621	.1770	.0000	-.0006	235.3	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0008	.0021	<.0000	.0222	.7918	.0033	10.26	.0689	.0009
Stddev	.0000	.0004	.0019	.0005	.0340	.0001	.09	.0009	.0002
%RSD	3.503	21.08	42.12	2.372	4.298	2.661	.9202	1.244	23.40
#1	.0008	.0018	-.0049	.0220	.7558	.0032	10.16	.0680	.0009
#2	.0008	.0026	-.0024	.0228	.7963	.0033	10.27	.0691	.0007
#3	.0008	.0020	-.0062	.0218	.8234	.0034	10.35	.0697	.0011
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	544.9	.0015	.0025	.0015	.4808	.0032	.0013	1.174	<.0000
Stddev	11.7	.0001	.0007	.0007	.0029	.0026	.0002	.010	.0001
%RSD	2.152	8.008	25.98	49.86	.6002	82.59	18.48	.8739	3.991
#1	547.7	.0013	.0018	.0011	.4777	.0022	.0010	1.162	-.0018
#2	555.0	.0015	.0027	.0010	.4813	.0012	.0014	1.178	-.0019
#3	532.0	.0016	.0031	.0023	.4834	.0062	.0014	1.181	-.0019
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-6-C Acquired: 5/22/2014 14:06:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.3824	.0011	.0014	<.0000	.0269	<.0000	.0132
Stddev	.0023	.0039	.0004	.0011	.0124	.0009	.0001
%RSD	.5945	363.1	28.15	31.64	46.12	49.73	.9593
#1	.3850	-.0033	.0018	-.0022	.0223	-.0027	.0131
#2	.3813	.0025	.0011	-.0040	.0175	-.0021	.0131
#3	.3808	.0041	.0013	-.0040	.0410	-.0009	.0133
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5444.9
Stddev	39.2
%RSD	.72075
#1	5483.2
#2	5446.6
#3	5404.8

Sample Name: CCV Acquired: 5/22/2014 14:10:22 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.022**	**49.47**	**5.206**	**4.729**	**5.103**	**4.984**	**5.235**	**53.08**	**5.256**
Stddev	.005	.06	.076	.006	.016	.023	.071	.54	.057
%RSD	.4577	.1307	1.463	.1367	.3149	.4590	1.355	1.025	1.093
#1	1.020	49.54	5.183	4.735	5.114	4.973	5.219	52.99	5.238
#2	1.020	49.46	5.144	4.731	5.084	4.968	5.173	52.58	5.210
#3	1.028	49.42	5.291	4.722	5.111	5.010	5.312	53.66	5.320
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.243**	**5.217**	**5.261**	**48.18**	**51.15**	**5.178**	**47.56**	**4.826**	**1.050**
Stddev	.065	.026	.059	.02	.17	.017	.03	.009	.013
%RSD	1.240	.5070	1.120	.0404	.3398	.3224	.0675	.1818	1.240
#1	5.231	5.199	5.249	48.18	51.08	5.182	47.52	4.824	1.047
#2	5.185	5.204	5.209	48.16	51.35	5.192	47.58	4.819	1.039
#3	5.313	5.247	5.325	48.20	51.03	5.160	47.57	4.836	1.065
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**50.96**	**5.323**	**54.07**	**5.329**	**51.86**	**1.045**	**1.041**	**4.782**	**5.315**
Stddev	.20	.066	.59	.054	.76	.018	.018	.015	.061
%RSD	.3830	1.246	1.099	1.009	1.472	1.684	1.697	.3217	1.155
#1	50.97	5.304	53.99	5.315	51.65	1.039	1.040	4.799	5.296
#2	51.16	5.268	53.52	5.284	51.22	1.031	1.024	4.775	5.266
#3	50.77	5.397	54.70	5.389	52.70	1.064	1.059	4.771	5.384
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 14:10:22 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.088**	**5.103**	**4.975**	**1.067**	**5.249**	**4.825**	**5.269**
Stddev	.039	.049	.007	.011	.026	.004	.064
%RSD	.7588	.9515	.1449	.9845	.4871	.0842	1.216
#1	5.093	5.074	4.983	1.066	5.219	4.820	5.252
#2	5.125	5.075	4.969	1.057	5.265	4.827	5.214
#3	5.048	5.159	4.973	1.078	5.261	4.828	5.339
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5404.8**
Stddev	17.2
%RSD	.31784
#1	5408.4
#2	5419.9
#3	5386.1

Sample Name: CCB Acquired: 5/22/2014 14:14:11 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**<.0000**	**<.0000**	**.0082**	**.0001**	**.0000**	**<.0000**	**<.0000**	**.0000**
Stddev	.0006	.0070	.0013	.0024	.0000	.0000	.0019	.0009	.0001
%RSD	601.9	314.6	365.4	29.39	52.56	87.30	135.3	1567.	119.8
#1	-.0005	-.0093	-.0015	.0109	.0001	.0000	.0008	.0009	.0001
#2	.0007	.0046	.0010	.0065	.0001	.0001	-.0026	-.0005	.0000
#3	.0002	-.0020	-.0005	.0071	.0000	.0000	-.0025	-.0006	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0014**	**<.0000**	**<.0000**	**.0211**	**.0002**	**<.0000**	**.0004**	**.0002**
Stddev	.0002	.0007	.0011	.0007	.0183	.0003	.0111	.0003	.0002
%RSD	90.37	52.09	86.10	105.6	86.67	169.2	319.7	80.52	95.21
#1	.0000	.0006	-.0003	-.0003	.0042	.0002	.0037	.0003	.0000
#2	.0004	.0017	-.0024	-.0003	.0187	.0006	-.0162	.0008	.0001
#3	.0002	.0020	-.0011	-.0015	.0405	-.0001	.0021	.0001	.0004
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0344**	**.0003**	**.0017**	**.0000**	**.0029**	**.0016**	**.0012**	**<.0000**	**.0007**
Stddev	.0033	.0002	.0013	.0007	.0006	.0006	.0012	.0089	.0002
%RSD	9.458	88.89	79.75	1673.	19.86	36.01	101.1	523.3	33.85
#1	.0315	.0001	.0017	.0008	.0023	.0020	-.0002	-.0110	.0004
#2	.0337	.0005	.0030	-.0006	.0035	.0018	.0020	.0066	.0008
#3	.0379	.0002	.0004	.0000	.0028	.0009	.0018	-.0007	.0008
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 14:14:11 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0027	<.0000	<.0000	<.0000	<.0000	.0002
Stddev	.0001	.0013	.0002	.0014	.0153	.0013	.0001
%RSD	90.59	46.34	97.78	48.44	76.31	280.0	79.59
#1	.0001	.0014	.0000	-.0014	-.0025	.0010	.0001
#2	.0001	.0039	-.0003	-.0031	-.0309	-.0009	.0003
#3	.0000	.0029	-.0001	-.0041	-.0269	-.0014	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5678.8
Stddev	8.2
%RSD	.14496
#1	5686.6
#2	5670.2
#3	5679.6

Sample Name: 160-6690-A-7-C Acquired: 5/22/2014 14:18:07 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0280	<.0000	.0529	.1683	<.0000	.0008	230.4	.0006
Stddev	.0004	.0042	.0006	.0036	.0005	.0000	.0016	1.8	.0002
%RSD	679.2	15.18	39.13	6.726	.2682	44.72	189.3	.7730	30.22
#1	-.0004	.0289	-.0017	.0496	.1678	.0000	.0018	232.4	.0008
#2	-.0001	.0316	-.0022	.0524	.1685	.0000	.0017	229.9	.0004
#3	.0004	.0233	-.0010	.0567	.1686	.0000	-.0010	228.9	.0006
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0013	.0029	<.0000	.0133	.4805	.0039	6.656	.5441	.0003
Stddev	.0002	.0003	.0008	.0008	.0169	.0007	.023	.0025	.0002
%RSD	12.54	11.79	13.47	5.878	3.521	17.80	.3454	.4579	92.84
#1	.0011	.0032	-.0048	.0138	.4610	.0037	6.682	.5469	.0005
#2	.0014	.0027	-.0063	.0137	.4902	.0034	6.644	.5421	.0000
#3	.0013	.0026	-.0058	.0124	.4903	.0047	6.641	.5435	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	477.0	.0016	.0022	.0006	.3100	.0030	.0002	1.079	<.0000
Stddev	2.5	.0001	.0023	.0005	.0015	.0012	.0039	.002	.0006
%RSD	.5214	8.250	103.6	94.57	.4700	39.97	2192.	.1345	38.32
#1	475.1	.0015	.0029	.0001	.3116	.0044	.0046	1.079	-.0010
#2	479.8	.0016	-.0003	.0012	.3088	.0026	-.0015	1.081	-.0023
#3	475.9	.0018	.0041	.0004	.3097	.0021	-.0026	1.078	-.0017
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6690-A-7-C Acquired: 5/22/2014 14:18:07 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.3564	.0037	.0007	<.0000	.0379	<.0000	.0129
Stddev	.0005	.0053	.0002	.0017	.0073	.0014	.0002
%RSD	.1490	144.2	31.68	45.19	19.17	70.68	1.687
#1	.3558	.0061	.0008	-.0027	.0461	-.0022	.0131
#2	.3568	-.0024	.0005	-.0056	.0321	-.0032	.0129
#3	.3567	.0073	.0009	-.0027	.0356	-.0005	.0127
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5347.6
Stddev	21.8
%RSD	.40700
#1	5322.5
#2	5359.6
#3	5360.8

Sample Name: MB 160-122875/1-A Acquired: 5/22/2014 14:22:07 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0004	<.0000	<.0000	.0008	.0004	.0000	.0001	.0303	.0001
Stddev	.0003	.0039	.0007	.0026	.0002	.0001	.0013	.0017	.0001
%RSD	81.01	209.6	139.2	345.1	37.09	469.5	1060.	5.479	81.27
#1	.0000	-.0006	.0002	-.0013	.0002	.0001	.0016	.0322	.0000
#2	.0006	-.0062	-.0006	.0037	.0005	-.0001	-.0009	.0291	.0002
#3	.0005	.0013	-.0012	-.0002	.0005	.0000	-.0003	.0296	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0008	<.0000	<.0000	.0584	.0007	.0056	.0001	.0000
Stddev	.0001	.0004	.0015	.0010	.0085	.0004	.0062	.0002	.0001
%RSD	73.81	53.93	776.4	331.0	14.57	53.76	110.8	171.5	423.4
#1	.0000	.0003	.0014	-.0011	.0662	.0009	.0079	.0003	.0001
#2	.0002	.0008	-.0016	-.0006	.0597	.0008	-.0014	-.0001	.0001
#3	.0001	.0012	-.0003	.0008	.0493	.0003	.0103	.0001	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1302	.0001	.0020	.0007	.0031	.0012	.0009	.0029	.0004
Stddev	.0105	.0002	.0010	.0011	.0009	.0005	.0006	.0031	.0003
%RSD	8.075	230.0	51.81	151.7	28.84	42.51	60.94	104.5	77.61
#1	.1412	-.0001	.0031	-.0005	.0042	.0011	.0016	.0048	.0001
#2	.1203	.0000	.0011	.0016	.0025	.0018	.0006	-.0006	.0003
#3	.1290	.0003	.0019	.0011	.0027	.0008	.0006	.0047	.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-122875/1-A Acquired: 5/22/2014 14:22:07 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0010	.0025	.0001	<.0000	.0083	<.0000	.0138
Stddev	.0001	.0013	.0004	.0008	.0042	.0032	.0002
%RSD	6.857	49.44	335.2	26.14	50.40	146.8	1.117
#1	.0010	.0038	.0005	-.0022	.0045	-.0025	.0137
#2	.0010	.0013	-.0002	-.0037	.0128	.0012	.0140
#3	.0009	.0025	.0000	-.0035	.0077	-.0053	.0137
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5776.2
Stddev	12.7
%RSD	.22049
#1	5785.8
#2	5761.7
#3	5781.0

Sample Name: LCS 160-122875/2-A Acquired: 5/22/2014 14:26:02 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2136	10.27	1.060	1.921	1.043	1.019	1.061	11.39	1.092
Stddev	.0015	.05	.008	.006	.002	.006	.007	.06	.007
%RSD	.6856	.5051	.7576	.2955	.1856	.6156	.7065	.4877	.6292
#1	.2137	10.24	1.067	1.927	1.045	1.023	1.067	11.45	1.099
#2	.2122	10.33	1.051	1.915	1.041	1.012	1.053	11.34	1.086
#3	.2151	10.24	1.063	1.921	1.044	1.022	1.062	11.39	1.093
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.137	1.123	1.125	10.23	11.02	1.133	9.486	1.005	.5315
Stddev	.009	.007	.006	.07	.12	.014	.044	.002	.0041
%RSD	.7578	.6031	.5105	.6447	1.054	1.260	.4614	.2008	.7728
#1	1.146	1.127	1.130	10.28	10.92	1.123	9.530	1.007	.5359
#2	1.130	1.115	1.119	10.15	11.15	1.149	9.443	1.003	.5278
#3	1.135	1.128	1.125	10.25	11.01	1.126	9.483	1.006	.5308
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	11.24	1.142	1.159	1.141	10.23	.5258	.5338	.0354	1.089
Stddev	.18	.007	.010	.006	.07	.0033	.0029	.0040	.005
%RSD	1.590	.6232	.8696	.5329	.6363	.6212	.5488	11.32	.4585
#1	11.13	1.148	1.171	1.147	10.29	.5295	.5347	.0378	1.094
#2	11.44	1.134	1.151	1.135	10.16	.5235	.5305	.0308	1.086
#3	11.15	1.144	1.157	1.140	10.24	.5243	.5361	.0376	1.086
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCS 160-122875/2-A Acquired: 5/22/2014 14:26:02 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.079	1.098	.9952	.2421	1.126	1.027	1.102
Stddev	.003	.006	.0031	.0029	.009	.003	.006
%RSD	.3127	.5292	.3072	1.215	.7942	.2666	.5495
#1	1.081	1.101	.9960	.2446	1.134	1.028	1.108
#2	1.075	1.092	.9918	.2429	1.127	1.029	1.096
#3	1.080	1.102	.9977	.2388	1.117	1.024	1.102
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5629.8
Stddev	23.1
%RSD	.41053
#1	5603.8
#2	5648.1
#3	5637.3

Sample Name: 160-6714-D-1-A Acquired: 5/22/2014 14:29:30 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0007	<.0000	.0259	.0162	.0003	.0010	5.758	.0001
Stddev	.0004	.0024	.0004	.0009	.0004	.0005	.0009	.014	.0002
%RSD	112.9	342.3	233.6	3.316	2.340	175.2	91.48	.2357	215.8
#1	-.0007	-.0014	-.0007	.0258	.0160	.0000	.0000	5.760	.0002
#2	.0000	.0034	.0000	.0268	.0167	.0008	.0013	5.770	.0002
#3	-.0003	.0002	.0001	.0251	.0160	.0000	.0016	5.743	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0004	.0015	<.0000	.0019	.8067	.0144	.7380	.0005	.0006
Stddev	.0003	.0003	.0012	.0045	.0106	.0005	.0165	.0006	.0002
%RSD	83.22	18.91	80.08	240.0	1.308	3.329	2.242	110.1	30.99
#1	.0007	.0012	-.0028	-.0015	.8128	.0141	.7336	.0004	.0004
#2	.0001	.0018	-.0003	.0070	.7945	.0150	.7563	.0012	.0007
#3	.0003	.0016	-.0015	.0001	.8128	.0142	.7241	.0000	.0007
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	12.41	.0013	.0001	.0002	1.266	.0020	.0006	1.427	<.0000
Stddev	.08	.0002	.0009	.0002	.005	.0009	.0024	.012	.0002
%RSD	.6218	18.45	1507.	93.00	.4251	46.32	426.9	.8158	148.4
#1	12.34	.0010	.0005	.0002	1.271	.0024	.0023	1.432	-.0003
#2	12.41	.0014	-.0010	.0003	1.267	.0009	-.0021	1.435	-.0002
#3	12.49	.0014	.0006	.0000	1.261	.0026	.0015	1.414	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-D-1-A Acquired: 5/22/2014 14:29:30 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1138	<.0000	.0005	<.0000	<.0000	.0005	.0061
Stddev	.0007	.0041	.0006	.0005	.0098	.0008	.0002
%RSD	.5906	425.5	130.0	27.36	936.9	164.5	2.537
#1	.1132	-.0038	.0000	-.0025	-.0056	-.0002	.0060
#2	.1146	.0038	.0012	-.0015	-.0077	.0014	.0063
#3	.1136	-.0029	.0002	-.0017	.0102	.0003	.0060
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5656.0
Stddev	17.4
%RSD	.30797
#1	5656.9
#2	5638.1
#3	5672.9

Sample Name: 160-6714-D-1-A SD Acquired: 5/22/2014 14:33:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=50

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	<.0000	.0063	.0031	<.0000	.0005	1.107	.0000
Stddev	.0002	.0028	.0004	.0005	.0000	.0000	.0020	.017	.0000
%RSD	225.9	1568.	120.2	8.166	1.028	64.01	414.7	1.545	53.93
#1	.0002	-.0033	.0001	.0057	.0031	.0000	.0028	1.126	.0000
#2	-.0001	.0006	-.0007	.0065	.0031	.0000	-.0005	1.095	.0000
#3	.0002	.0021	-.0005	.0067	.0030	-.0001	-.0008	1.099	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0003	.0003	.0004	.0023	.1475	.0032	.1452	.0003	.0002
Stddev	.0001	.0012	.0013	.0007	.0134	.0004	.0058	.0001	.0002
%RSD	32.86	413.9	355.4	31.06	9.096	12.84	4.011	37.54	86.62
#1	.0002	.0015	.0018	.0017	.1397	.0032	.1464	.0002	.0001
#2	.0004	.0003	-.0009	.0020	.1630	.0028	.1389	.0003	.0001
#3	.0003	-.0009	.0003	.0031	.1399	.0036	.1503	.0005	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	2.406	.0004	.0002	<.0000	.2406	.0014	.0013	.2710	.0003
Stddev	.022	.0002	.0004	.0005	.0043	.0011	.0022	.0066	.0002
%RSD	.9225	34.25	166.2	141.7	1.775	80.07	163.7	2.425	64.12
#1	2.393	.0003	.0000	-.0008	.2454	.0002	.0030	.2680	.0004
#2	2.432	.0006	.0000	-.0004	.2373	.0024	.0022	.2664	.0001
#3	2.393	.0005	.0007	.0002	.2390	.0015	-.0012	.2785	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-D-1-A SD Acquired: 5/22/2014 14:33:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=50

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0219	.0000	<.0000	<.0000	<.0000	<.0000	.0058
Stddev	.0000	.0006	.0003	.0003	.0122	.0013	.0001
%RSD	.1705	1667.	163.9	10.19	1016.	340.7	1.392
#1	.0218	.0007	.0000	-.0022	.0117	-.0007	.0058
#2	.0219	-.0004	-.0006	-.0027	-.0126	-.0015	.0057
#3	.0219	-.0002	-.0001	-.0025	-.0028	.0011	.0058
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5779.4
Stddev	80.3
%RSD	1.3891
#1	5687.5
#2	5835.8
#3	5814.8

Sample Name: 160-6714-D-1-B MS Acquired: 5/22/2014 14:37:16 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0209	1.007	.1051	.2140	.1191	.1035	.1044	6.597	.1088
Stddev	.0003	.003	.0012	.0018	.0002	.0002	.0011	.005	.0002
%RSD	1.473	.3279	1.100	.8330	.1261	.1862	1.010	.0803	.1633
#1	.0205	1.009	.1048	.2155	.1192	.1033	.1055	6.603	.1087
#2	.0210	1.009	.1063	.2143	.1192	.1035	.1043	6.595	.1090
#3	.0211	1.004	.1040	.2120	.1190	.1037	.1034	6.593	.1086
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1134	.1130	.1084	1.033	1.817	.1205	1.642	.1014	.0536
Stddev	.0004	.0005	.0004	.001	.020	.0017	.014	.0004	.0001
%RSD	.3093	.4757	.3420	.0967	1.083	1.442	.8788	.4102	.2212
#1	.1138	.1124	.1084	1.034	1.822	.1204	1.626	.1010	.0537
#2	.1134	.1131	.1088	1.033	1.833	.1223	1.646	.1017	.0536
#3	.1131	.1135	.1080	1.032	1.795	.1189	1.655	.1016	.0534
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	13.01	.1183	.1142	.1170	2.224	.0520	.0540	1.394	.1099
Stddev	.16	.0003	.0007	.0012	.004	.0009	.0019	.010	.0004
%RSD	1.227	.2866	.6516	1.043	.1638	1.672	3.577	.7009	.3447
#1	13.11	.1185	.1149	.1182	2.228	.0524	.0548	1.383	.1103
#2	13.08	.1179	.1134	.1170	2.225	.0527	.0555	1.402	.1096
#3	12.82	.1185	.1142	.1158	2.220	.0511	.0518	1.397	.1099
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-D-1-B MS Acquired: 5/22/2014 14:37:16 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2191	.1038	.1004	.0241	.0817	.1021	.1145
Stddev	.0005	.0023	.0003	.0004	.0034	.0022	.0001
%RSD	.2318	2.179	.2851	1.753	4.139	2.179	.0488
#1	.2196	.1018	.1007	.0246	.0781	.1030	.1145
#2	.2192	.1062	.1002	.0240	.0848	.0995	.1144
#3	.2186	.1034	.1002	.0238	.0823	.1037	.1145
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5744.6
Stddev	10.3
%RSD	.17884
#1	5756.2
#2	5741.1
#3	5736.5

Sample Name: 160-6714-D-1-C MSD Acquired: 5/22/2014 14:41:05 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0205**	**1.020**	**.1078**	**.2145**	**.1211**	**.1053**	**.1041**	**6.911**	**.1101**
Stddev	.0002	.007	.0017	.0016	.0005	.0002	.0015	.033	.0009
%RSD	1.108	.7248	1.589	.7560	.4186	.1695	1.473	.4759	.7957
#1	.0206	1.016	.1065	.2133	.1216	.1055	.1039	6.878	.1091
#2	.0203	1.015	.1073	.2137	.1206	.1052	.1027	6.944	.1107
#3	.0208	1.029	.1098	.2163	.1212	.1053	.1057	6.911	.1105
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.1144**	**.1156**	**.1124**	**1.048**	**1.891**	**.1216**	**1.718**	**.1029**	**.0539**
Stddev	.0004	.0006	.0014	.001	.013	.0007	.010	.0003	.0002
%RSD	.3714	.5293	1.228	.1067	.6661	.5405	.5985	.2740	.4258
#1	.1139	.1155	.1109	1.048	1.878	.1224	1.718	.1027	.0537
#2	.1146	.1163	.1137	1.047	1.903	.1211	1.708	.1028	.0542
#3	.1147	.1151	.1125	1.049	1.891	.1214	1.728	.1033	.0539
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**13.68**	**.1192**	**.1152**	**.1166**	**2.292**	**.0512**	**.0539**	**1.470**	**.1103**
Stddev	.02	.0009	.0004	.0004	.025	.0019	.0024	.009	.0002
%RSD	.1324	.7167	.3431	.3666	1.094	3.743	4.364	.6137	.1995
#1	13.69	.1183	.1155	.1162	2.264	.0519	.0516	1.479	.1101
#2	13.66	.1198	.1147	.1170	2.311	.0528	.0537	1.461	.1106
#3	13.68	.1197	.1154	.1166	2.302	.0491	.0563	1.469	.1103
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-D-1-C MSD Acquired: 5/22/2014 14:41:05 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2274	.1060	.1013	.0235	.0765	.1004	.1155
Stddev	.0008	.0022	.0011	.0006	.0141	.0013	.0007
%RSD	.3332	2.032	1.127	2.649	18.44	1.274	.6036
#1	.2281	.1036	.1002	.0229	.0628	.1005	.1148
#2	.2266	.1071	.1014	.0242	.0909	.1016	.1161
#3	.2273	.1074	.1025	.0235	.0758	.0990	.1158
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5623.3
Stddev	18.7
%RSD	.33282
#1	5637.3
#2	5602.1
#3	5630.6

Sample Name: 160-6714-H-2-A Acquired: 5/22/2014 14:44:52 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0004**	**<.0000**	**.0000**	**.0172**	**.0073**	**.0000**	**<.0000**	**2.098**	**.0001**
Stddev	.0003	.0081	.0002	.0039	.0001	.0000	.0014	.016	.0001
%RSD	82.11	673.1	664.2	22.35	1.231	237.2	208.2	.7644	81.15
#1	.0004	.0081	-.0002	.0129	.0073	.0000	-.0015	2.099	.0000
#2	.0001	-.0062	.0002	.0184	.0072	.0000	-.0014	2.081	.0002
#3	.0007	-.0055	.0000	.0204	.0074	.0000	.0009	2.113	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0036**	**<.0000**	**<.0000**	**.3264**	**.0021**	**1.389**	**.0002**	**.0029**
Stddev	.0002	.0003	.0014	.0009	.0151	.0004	.012	.0002	.0003
%RSD	107.5	8.884	156.0	75.68	4.621	17.69	.8563	109.1	10.43
#1	.0004	.0039	-.0024	-.0005	.3292	.0024	1.394	.0004	.0032
#2	.0004	.0034	-.0002	-.0008	.3101	.0017	1.376	.0001	.0026
#3	-.0001	.0034	.0000	-.0021	.3398	.0020	1.398	.0000	.0031
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.446**	**.0010**	**.0018**	**.0004**	**.9106**	**.0009**	**.0013**	**2.804**	**<.0000**
Stddev	.073	.0004	.0016	.0014	.0050	.0015	.0009	.033	.0005
%RSD	1.341	35.58	87.49	390.2	.5470	166.6	65.18	1.161	586.6
#1	5.416	.0009	.0001	-.0012	.9160	-.0003	.0005	2.787	-.0004
#2	5.393	.0007	.0020	.0006	.9062	.0026	.0013	2.785	.0005
#3	5.530	.0014	.0033	.0016	.9094	.0004	.0022	2.842	-.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-H-2-A Acquired: 5/22/2014 14:44:52 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0567	.0029	<.0000	<.0000	<.0000	.0000	.0040
Stddev	.0007	.0045	.0005	.0016	.0075	.0030	.0001
%RSD	1.261	155.5	193.1	413.6	92.55	14030.	3.023
#1	.0564	.0002	.0003	.0014	-.0168	.0032	.0039
#2	.0561	.0081	-.0005	-.0013	-.0039	-.0028	.0040
#3	.0575	.0004	-.0006	-.0012	-.0037	-.0003	.0041
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5622.2
Stddev	62.4
%RSD	1.1106
#1	5629.4
#2	5680.8
#3	5556.5

Sample Name: 160-6714-H-3-A Acquired: 5/22/2014 14:48:46 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0009**	**<.0000**	**.0259**	**.0170**	**.0000**	**.0017**	**3.698**	**.0001**
Stddev	.0004	.0032	.0003	.0025	.0001	.0000	.0010	.017	.0000
%RSD	293.8	363.0	26.98	9.445	.8226	305.0	60.73	.4511	22.81
#1	.0003	.0019	-.0014	.0262	.0171	.0000	.0016	3.706	.0001
#2	-.0003	-.0027	-.0012	.0234	.0170	.0001	.0007	3.710	.0001
#3	.0003	.0035	-.0008	.0282	.0168	.0000	.0027	3.679	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0013**	**<.0000**	**.0005**	**.6616**	**.0142**	**.6633**	**.0003**	**.0007**
Stddev	.0002	.0001	.0007	.0024	.0044	.0006	.0078	.0001	.0002
%RSD	371.8	9.401	53.03	472.7	.6584	3.941	1.172	22.90	23.42
#1	-.0001	.0014	-.0018	.0002	.6572	.0147	.6553	.0002	.0007
#2	.0003	.0012	-.0005	.0031	.6618	.0143	.6708	.0003	.0009
#3	.0000	.0014	-.0018	-.0017	.6659	.0136	.6637	.0003	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**12.79**	**.0004**	**.0011**	**.0001**	**.8374**	**.0007**	**<.0000**	**1.357**	**.0000**
Stddev	.25	.0001	.0007	.0005	.0061	.0018	.0027	.013	.0001
%RSD	1.959	20.65	64.69	347.5	.7327	268.5	448500.	.9863	439.4
#1	12.99	.0005	.0003	.0002	.8334	.0027	-.0023	1.344	.0001
#2	12.87	.0004	.0016	-.0004	.8445	-.0003	.0030	1.370	.0000
#3	12.51	.0004	.0016	.0005	.8343	-.0004	-.0007	1.358	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-H-3-A Acquired: 5/22/2014 14:48:46 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0935	<.0000	<.0000	<.0000	<.0000	.0019	.0041
Stddev	.0003	.0044	.0008	.0006	.0046	.0018	.0001
%RSD	.3699	449.3	2477.	23.32	36.49	94.32	1.970
#1	.0938	-.0060	.0008	-.0020	-.0086	-.0001	.0042
#2	.0936	.0020	-.0008	-.0032	-.0177	.0023	.0040
#3	.0931	.0011	-.0001	-.0026	-.0117	.0034	.0040
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5661.2
Stddev	25.5
%RSD	.44961
#1	5660.8
#2	5635.9
#3	5686.8

Sample Name: 160-6714-H-4-A Acquired: 5/22/2014 14:52:40 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	<.0000	.0252	.0125	<.0000	<.0000	4.146	.0000
Stddev	.0003	.0051	.0003	.0009	.0001	.0000	.0023	.009	.0000
%RSD	120.5	222.6	56.56	3.641	.6928	721.7	2016.	.2206	99.11
#1	-.0005	-.0019	-.0007	.0259	.0125	.0000	.0014	4.150	.0001
#2	.0001	.0026	-.0002	.0242	.0124	.0000	.0010	4.153	.0000
#3	-.0003	-.0075	-.0006	.0254	.0124	.0000	-.0027	4.136	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0024	<.0000	<.0000	.6994	.0159	.8488	.0003	.0004
Stddev	.0000	.0006	.0021	.0005	.0204	.0001	.0133	.0002	.0001
%RSD	27.67	26.31	437.9	170.2	2.914	.5341	1.565	85.15	35.50
#1	.0002	.0031	.0019	-.0005	.6761	.0158	.8398	.0005	.0004
#2	.0001	.0025	-.0014	.0003	.7083	.0160	.8641	.0001	.0005
#3	.0001	.0018	-.0019	-.0007	.7139	.0159	.8427	.0002	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	12.65	.0007	.0010	.0006	1.006	.0009	.0012	1.348	<.0000
Stddev	.06	.0002	.0011	.0003	.006	.0007	.0032	.018	.0004
%RSD	.5040	32.14	109.6	52.90	.5912	73.20	266.2	1.343	900.8
#1	12.65	.0007	-.0002	.0007	1.013	.0003	-.0025	1.329	.0000
#2	12.71	.0009	.0020	.0009	1.003	.0016	.0036	1.365	-.0004
#3	12.59	.0005	.0012	.0003	1.003	.0009	.0025	1.349	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-H-4-A Acquired: 5/22/2014 14:52:40 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1082	.0002	<.0000	<.0000	<.0000	<.0000	.0040
Stddev	.0001	.0017	.0006	.0007	.0095	.0020	.0000
%RSD	.0839	723.2	167.4	408.5	41.77	188.8	.5509
#1	.1083	-.0017	.0003	.0003	-.0175	-.0024	.0040
#2	.1081	.0009	-.0008	-.0010	-.0171	.0012	.0040
#3	.1083	.0015	-.0007	.0001	-.0337	-.0019	.0040
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5522.5
Stddev	16.7
%RSD	.30254
#1	5527.2
#2	5504.0
#3	5536.4

Sample Name: CCV Acquired: 5/22/2014 14:56:35 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.023**	**48.44**	**5.156**	**4.761**	**5.004**	**5.020**	**5.165**	**53.94**	**5.260**
Stddev	.001	.51	.015	.011	.023	.003	.016	.20	.018
%RSD	.0693	1.050	.2921	.2308	.4608	.0624	.3055	.3781	.3404
#1	1.023	48.80	5.160	4.773	5.024	5.024	5.160	53.92	5.252
#2	1.022	48.65	5.139	4.755	5.010	5.019	5.152	53.75	5.248
#3	1.023	47.86	5.168	4.754	4.979	5.018	5.182	54.16	5.281
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.294**	**5.281**	**5.209**	**49.32**	**49.13**	**4.854**	**49.25**	**4.958**	**1.058**
Stddev	.013	.022	.014	.13	.69	.114	.31	.016	.003
%RSD	.2531	.4091	.2737	.2735	1.394	2.354	.6303	.3290	.2809
#1	5.286	5.267	5.208	49.34	49.60	4.929	49.16	4.951	1.056
#2	5.286	5.271	5.195	49.18	49.45	4.911	48.99	4.946	1.057
#3	5.309	5.306	5.223	49.45	48.35	4.723	49.59	4.977	1.062
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**48.63**	**5.347**	**54.21**	**5.367**	**51.13**	**1.029**	**1.020**	**4.838**	**5.355**
Stddev	.83	.019	.16	.018	.22	.006	.006	.041	.012
%RSD	1.705	.3632	.2943	.3340	.4307	.5414	.6038	.8443	.2319
#1	49.25	5.348	54.09	5.366	51.13	1.028	1.026	4.884	5.351
#2	48.97	5.327	54.14	5.350	50.91	1.024	1.013	4.824	5.345
#3	47.69	5.366	54.39	5.386	51.35	1.035	1.020	4.806	5.369
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 14:56:35 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.064**	**5.148**	**5.000**	**1.075**	**5.227**	**4.922**	**5.284**
Stddev	.014	.021	.008	.001	.017	.007	.016
%RSD	.2779	.4124	.1575	.0603	.3283	.1520	.3109
#1	5.078	5.125	5.009	1.076	5.223	4.913	5.280
#2	5.050	5.154	4.997	1.075	5.212	4.924	5.270
#3	5.064	5.166	4.994	1.075	5.246	4.927	5.302
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5307.3**
Stddev	25.8
%RSD	.48580
#1	5324.8
#2	5319.3
#3	5277.7

Sample Name: CCB Acquired: 5/22/2014 15:00:23 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0000**	**<.0000**	**<.0000**	**.0079**	**.0001**	**.0001**	**<.0000**	**.0019**	**.0004**
Stddev	.0004	.0037	.0011	.0033	.0002	.0000	.0023	.0048	.0003
%RSD	4966.	111.3	178.7	41.69	287.8	14.91	179.6	248.5	72.49
#1	-.0004	-.0037	-.0009	.0112	-.0002	.0001	-.0011	-.0008	.0002
#2	.0002	-.0068	-.0016	.0046	.0001	.0001	-.0037	-.0009	.0003
#3	.0002	.0006	.0006	.0080	.0002	.0001	.0009	.0074	.0007
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0005**	**.0030**	**<.0000**	**.0004**	**<.0000**	**.0011**	**<.0000**	**.0001**	**.0002**
Stddev	.0003	.0027	.0016	.0013	.0080	.0004	.0094	.0003	.0002
%RSD	71.10	88.83	102.0	323.5	1727.	35.24	984.1	661.7	90.09
#1	.0006	.0017	-.0022	.0017	-.0045	.0012	.0098	-.0003	.0001
#2	.0001	.0013	-.0028	-.0009	-.0056	.0007	-.0073	.0001	.0001
#3	.0008	.0060	.0002	.0004	.0087	.0015	-.0054	.0004	.0004
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0139**	**.0004**	**.0038**	**.0008**	**.0054**	**.0000**	**.0009**	**.0009**	**.0003**
Stddev	.0039	.0006	.0048	.0012	.0047	.0021	.0021	.0048	.0008
%RSD	27.79	123.9	126.5	158.9	87.24	17100.	228.4	530.9	302.8
#1	.0095	.0003	.0017	.0022	.0045	-.0004	.0011	-.0026	-.0006
#2	.0155	.0000	.0004	.0001	.0012	-.0018	-.0013	.0063	.0009
#3	.0167	.0011	.0093	.0001	.0104	.0023	.0030	-.0011	.0005
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 15:00:23 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0018	<.0000	<.0000	.0055	<.0000	.0004
Stddev	.0001	.0028	.0004	.0018	.0095	.0022	.0005
%RSD	160.9	152.5	173.9	319.6	172.1	131.9	126.3
#1	-.0001	.0004	-.0004	-.0005	.0165	.0004	.0000
#2	.0000	.0001	.0002	-.0024	.0004	-.0040	.0002
#3	-.0001	.0051	-.0004	.0012	-.0003	-.0015	.0009
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5622.8
Stddev	35.1
%RSD	.62507
#1	5637.7
#2	5648.1
#3	5582.7

Sample Name: 160-6714-H-5-A Acquired: 5/22/2014 15:04:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0132	<.0000	.0284	.3275	.0000	<.0000	162.3	.0002
Stddev	.0001	.0046	.0014	.0013	.0094	.0000	.0017	13.4	.0000
%RSD	28.63	35.06	51.38	4.471	2.874	235.5	146.3	8.233	25.80
#1	-.0003	.0079	-.0042	.0291	.3187	.0000	-.0005	148.5	.0002
#2	-.0002	.0156	-.0026	.0270	.3265	.0000	.0001	163.3	.0001
#3	-.0003	.0162	-.0014	.0293	.3374	.0000	-.0031	175.2	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0009	.0025	<.0000	.0015	5.381	.0703	31.09	.0004	.0003
Stddev	.0003	.0006	.0010	.0014	.137	.0028	1.07	.0002	.0001
%RSD	28.33	25.50	38.21	93.43	2.542	4.042	3.437	64.81	29.15
#1	.0009	.0024	-.0018	.0007	5.300	.0680	30.06	.0004	.0003
#2	.0011	.0019	-.0037	.0031	5.305	.0693	31.03	.0001	.0002
#3	.0006	.0032	-.0022	.0006	5.539	.0735	32.19	.0005	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	78.17	.0012	<.0000	.0013	.4756	.0040	.0033	2.030	<.0000
Stddev	2.94	.0001	.0015	.0001	.0498	.0015	.0011	.059	.0002
%RSD	3.761	6.766	40.27	10.54	10.48	38.38	33.44	2.927	15.23
#1	74.84	.0012	-.0021	.0013	.4263	.0026	.0026	1.971	-.0016
#2	79.28	.0011	-.0051	.0012	.4746	.0037	.0046	2.029	-.0019
#3	80.39	.0013	-.0037	.0015	.5259	.0056	.0027	2.090	-.0014
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-H-5-A Acquired: 5/22/2014 15:04:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	3.819	.0048	.0004	<.0000	.0192	<.0000	.0045
Stddev	.112	.0034	.0005	.0007	.0099	.0026	.0003
%RSD	2.924	71.34	118.7	19.31	51.65	211.5	6.726
#1	3.701	.0012	.0009	-.0032	.0276	.0008	.0042
#2	3.833	.0051	.0005	-.0035	.0083	-.0042	.0045
#3	3.923	.0080	-.0001	-.0046	.0218	-.0003	.0048
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5384.2
Stddev	17.8
%RSD	.32998
#1	5404.4
#2	5371.1
#3	5377.2

Sample Name: 160-6714-H-6-A Acquired: 5/22/2014 15:08:26 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0028	<.0000	.0313	.0099	<.0000	<.0000	2.445	.0001
Stddev	.0006	.0014	.0006	.0015	.0001	.0000	.0019	.009	.0001
%RSD	275.1	50.32	81.90	4.723	.9383	100.2	872.5	.3843	209.1
#1	-.0007	.0013	-.0007	.0303	.0098	-.0001	-.0003	2.434	.0002
#2	.0004	.0029	-.0015	.0306	.0100	.0000	-.0021	2.450	.0000
#3	-.0003	.0041	-.0002	.0330	.0098	.0000	.0018	2.451	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0027	<.0000	.0017	.7548	.0112	.4422	.0004	.0010
Stddev	.0003	.0009	.0014	.0020	.0227	.0001	.0031	.0003	.0001
%RSD	276.8	33.19	121.5	117.3	3.008	.9943	.7015	92.59	12.42
#1	-.0002	.0030	-.0005	-.0006	.7760	.0113	.4429	.0006	.0010
#2	.0002	.0017	-.0002	.0029	.7309	.0111	.4388	.0000	.0008
#3	.0003	.0034	-.0028	.0029	.7575	.0112	.4449	.0004	.0011
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	12.23	.0008	.0013	.0015	1.517	.0003	.0013	2.254	.0002
Stddev	.14	.0001	.0003	.0006	.004	.0007	.0025	.011	.0004
%RSD	1.152	8.239	20.26	40.92	.2832	230.5	198.8	.4806	218.3
#1	12.37	.0009	.0012	.0011	1.518	.0004	.0036	2.252	-.0001
#2	12.21	.0008	.0011	.0022	1.521	.0009	.0017	2.245	.0007
#3	12.09	.0008	.0016	.0011	1.512	-.0004	-.0014	2.266	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-H-6-A Acquired: 5/22/2014 15:08:26 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0653	<.0000	<.0000	<.0000	<.0000	<.0000	.0045
Stddev	.0003	.0024	.0003	.0006	.0182	.0029	.0000
%RSD	.5180	1452.	421.5	33.88	160.0	423.3	.6678
#1	.0657	.0026	-.0003	-.0026	.0091	.0024	.0045
#2	.0651	-.0016	.0003	-.0014	-.0175	-.0033	.0045
#3	.0651	-.0015	-.0002	-.0015	-.0257	-.0011	.0045
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5671.5
Stddev	29.0
%RSD	.51168
#1	5695.3
#2	5680.1
#3	5639.2

Sample Name: 160-6714-H-7-A Acquired: 5/22/2014 15:12:20 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0010	<.0000	.0246	.0057	<.0000	.0004	2.616	.0000
Stddev	.0011	.0076	.0006	.0019	.0000	.0000	.0019	.011	.0001
%RSD	546.1	759.4	122.3	7.834	.5000	175.8	459.1	.4051	343.0
#1	-.0012	-.0077	-.0008	.0233	.0057	.0000	.0026	2.620	.0002
#2	-.0005	.0059	-.0009	.0238	.0057	.0000	-.0009	2.604	.0000
#3	.0010	.0048	.0002	.0268	.0057	.0000	-.0005	2.624	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.0031	<.0000	<.0000	.4905	.0077	.5040	.0002	.0009
Stddev	.0002	.0012	.0003	.0020	.0046	.0006	.0042	.0004	.0001
%RSD	98.37	37.75	13.56	196.3	.9317	7.705	.8406	148.8	12.44
#1	.0005	.0032	-.0021	-.0025	.4883	.0081	.4995	.0004	.0007
#2	.0001	.0019	-.0024	-.0018	.4958	.0070	.5079	-.0002	.0009
#3	.0001	.0043	-.0019	.0012	.4875	.0079	.5047	.0005	.0010
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	8.634	.0007	.0018	.0002	1.017	.0009	.0014	3.342	.0001
Stddev	.049	.0003	.0012	.0002	.005	.0017	.0005	.012	.0001
%RSD	.5711	41.88	64.11	123.6	.4932	185.8	35.74	.3722	125.8
#1	8.581	.0008	.0023	.0004	1.023	.0010	.0008	3.341	.0000
#2	8.642	.0010	.0005	.0002	1.013	.0025	.0018	3.329	.0002
#3	8.679	.0004	.0028	.0000	1.016	-.0008	.0015	3.354	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-H-7-A Acquired: 5/22/2014 15:12:20 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0513	<.0000	<.0000	<.0000	.0068	<.0000	.0042
Stddev	.0000	.0006	.0000	.0007	.0162	.0008	.0001
%RSD	.0964	46.06	44.80	21.84	237.6	95.18	1.645
#1	.0513	-.0012	.0000	-.0038	.0005	.0000	.0042
#2	.0514	-.0019	-.0001	-.0031	-.0053	-.0009	.0041
#3	.0513	-.0007	-.0001	-.0025	.0252	-.0016	.0042
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5637.8
Stddev	12.8
%RSD	.22713
#1	5633.0
#2	5652.3
#3	5628.1

Sample Name: 160-6714-H-8-A Acquired: 5/22/2014 15:16:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0016	<.0000	.0348	.0065	<.0000	<.0000	2.903	.0001
Stddev	.0003	.0031	.0008	.0019	.0001	.0001	.0011	.021	.0001
%RSD	453.7	197.6	54.91	5.350	.9504	1500.	82.62	.7133	81.51
#1	-.0004	.0044	-.0007	.0358	.0066	.0001	-.0025	2.926	.0000
#2	-.0001	-.0017	-.0022	.0327	.0065	.0000	-.0003	2.896	.0001
#3	.0003	.0020	-.0012	.0360	.0066	-.0001	-.0012	2.887	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	.0026	<.0000	<.0000	.8188	.0134	.4676	.0001	.0018
Stddev	.0001	.0006	.0013	.0006	.0222	.0005	.0164	.0001	.0002
%RSD	150.5	21.42	2973.	96.69	2.711	3.373	3.512	58.23	12.98
#1	.0001	.0024	.0015	-.0003	.8429	.0139	.4661	.0000	.0017
#2	.0000	.0022	-.0007	-.0003	.7991	.0133	.4520	.0001	.0017
#3	.0001	.0033	-.0009	-.0013	.8146	.0130	.4847	.0001	.0021
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	13.87	.0006	.0036	.0005	.9828	.0009	.0003	2.129	.0001
Stddev	.08	.0001	.0011	.0003	.0094	.0012	.0010	.002	.0006
%RSD	.5599	12.67	29.68	58.71	.9587	131.8	351.4	.1085	541.6
#1	13.96	.0006	.0025	.0008	.9936	.0018	.0007	2.132	-.0005
#2	13.82	.0006	.0046	.0002	.9780	-.0005	-.0008	2.128	.0002
#3	13.83	.0007	.0038	.0005	.9767	.0015	.0009	2.128	.0006
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-H-8-A Acquired: 5/22/2014 15:16:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0749	<.0000	<.0000	.0000	<.0000	.0025	.0038
Stddev	.0004	.0019	.0004	.0007	.0078	.0026	.0001
%RSD	.5860	331.4	180.1	10130.	59.66	105.4	2.775
#1	.0752	-.0027	-.0006	.0008	-.0042	.0035	.0038
#2	.0750	.0009	.0001	-.0004	-.0186	-.0005	.0040
#3	.0744	.0000	-.0001	-.0004	-.0167	.0045	.0038
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5635.7
Stddev	36.1
%RSD	.63991
#1	5598.2
#2	5638.8
#3	5670.2

Sample Name: 160-6714-H-9-A Acquired: 5/22/2014 15:20:06 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0031**	**<.0000**	**.0298**	**.3470**	**<.0000**	**<.0000**	**146.4**	**.0001**
Stddev	.0004	.0044	.0007	.0020	.0065	.0000	.0011	6.3	.0001
%RSD	555.5	139.8	109.9	6.831	1.874	621.0	173.7	4.300	134.6
#1	.0001	-.0012	.0001	.0275	.3397	.0000	-.0019	143.6	.0000
#2	-.0003	.0076	-.0013	.0304	.3491	.0000	.0003	142.0	.0001
#3	.0005	.0031	-.0006	.0314	.3522	.0000	-.0004	153.6	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0007**	**.0015**	**<.0000**	**<.0000**	**5.672**	**.0733**	**33.57**	**.0001**	**.0002**
Stddev	.0001	.0012	.0013	.0027	.081	.0019	.29	.0003	.0001
%RSD	14.93	81.70	39.38	5085.	1.422	2.559	.8525	378.9	31.81
#1	.0007	.0028	-.0039	-.0030	5.579	.0712	33.69	-.0002	.0001
#2	.0005	.0011	-.0040	.0022	5.729	.0746	33.25	.0004	.0002
#3	.0007	.0005	-.0018	.0006	5.707	.0741	33.78	.0000	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**82.01**	**.0008**	**<.0000**	**<.0000**	**.4269**	**.0050**	**.0027**	**2.175**	**<.0000**
Stddev	2.73	.0002	.0015	.0003	.0191	.0016	.0030	.028	.0009
%RSD	3.325	25.95	57.00	212.1	4.472	30.96	109.6	1.266	52.18
#1	79.14	.0007	-.0040	-.0005	.4245	.0038	.0055	2.144	-.0009
#2	82.33	.0008	-.0010	.0002	.4092	.0068	.0029	2.183	-.0016
#3	84.56	.0011	-.0029	-.0002	.4471	.0045	-.0004	2.197	-.0026
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6714-H-9-A Acquired: 5/22/2014 15:20:06 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	4.106	.0067	.0004	<.0000	.0006	<.0000	.0043
Stddev	.102	.0038	.0002	.0014	.0049	.0009	.0002
%RSD	2.492	57.12	53.73	56.64	839.4	24.61	3.627
#1	4.014	.0072	.0004	-.0030	.0048	-.0047	.0042
#2	4.088	.0103	.0002	-.0009	-.0047	-.0028	.0043
#3	4.216	.0027	.0007	-.0034	.0017	-.0039	.0045
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5349.8
Stddev	91.0
%RSD	1.7012
#1	5245.2
#2	5410.5
#3	5393.9

Sample Name: MB 160-122752/1-A Acquired: 5/22/2014 15:24:16 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0004**	**.0113**	**<.0000**	**.0119**	**.0004**	**.0000**	**<.0000**	**.0316**	**.0000**
Stddev	.0001	.0058	.0015	.0005	.0001	.0000	.0020	.0008	.0001
%RSD	26.67	50.87	308.5	4.268	19.83	921.2	220.8	2.537	356.6
#1	.0003	.0122	.0008	.0124	.0004	.0000	.0003	.0309	.0000
#2	.0003	.0052	-.0001	.0117	.0003	.0000	-.0032	.0325	.0001
#3	.0005	.0166	-.0021	.0114	.0004	.0000	.0002	.0313	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0012**	**.0015**	**.0053**	**.0208**	**.0003**	**.0226**	**.0001**	**<.0000**
Stddev	.0002	.0008	.0017	.0017	.0105	.0006	.0133	.0001	.0002
%RSD	147.4	68.20	112.6	32.89	50.40	226.1	58.90	157.6	238.9
#1	.0003	.0003	.0034	.0073	.0200	.0001	.0379	-.0001	-.0002
#2	.0002	.0018	.0005	.0046	.0108	.0009	.0158	.0001	-.0001
#3	-.0001	.0016	.0006	.0040	.0318	-.0002	.0140	.0002	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0608**	**.0003**	**.0018**	**<.0000**	**.0062**	**.0018**	**.0004**	**.0613**	**.0000**
Stddev	.0006	.0002	.0006	.0001	.0013	.0002	.0022	.0038	.0007
%RSD	1.012	71.16	34.48	23.00	21.44	11.31	519.7	6.189	1324.
#1	.0614	.0002	.0020	-.0005	.0070	.0019	.0028	.0593	-.0003
#2	.0609	.0005	.0011	-.0004	.0047	.0019	.0000	.0589	.0008
#3	.0602	.0002	.0024	-.0006	.0069	.0016	-.0015	.0657	-.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-122752/1-A Acquired: 5/22/2014 15:24:16 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0024	<.0000	<.0000	.0109	<.0000	.0169
Stddev	.0001	.0054	.0003	.0010	.0149	.0028	.0002
%RSD	55.57	218.9	980.8	21.82	137.6	82.40	1.351
#1	.0001	-.0024	.0002	-.0051	.0243	-.0015	.0170
#2	.0002	.0082	.0001	-.0034	-.0052	-.0066	.0171
#3	.0001	.0016	-.0004	-.0052	.0135	-.0021	.0167
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5635.8
Stddev	25.1
%RSD	.44491
#1	5661.9
#2	5611.8
#3	5633.8

Sample Name: LCSSRM 160-122752/2- Acquired: 5/22/2014 15:28:11 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3656**	**37.65**	**.4916**	**.4989**	**1.067**	**.3026**	**<.0000**	**44.99**	**.8302**
Stddev	.0042	.22	.0040	.0025	.004	.0011	.0012	.07	.0002
%RSD	1.140	.5924	.8195	.4951	.3594	.3727	102.0	.1569	.0262
#1	.3703	37.89	.4873	.4988	1.071	.3039	.0001	45.05	.8300
#2	.3641	37.62	.4953	.4965	1.067	.3023	-.0013	45.01	.8304
#3	.3624	37.45	.4921	.5014	1.064	.3018	-.0022	44.91	.8303
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.216**	**.5087**	**1.519**	**58.37**	**11.83**	**.0404**	**13.87**	**2.313**	**.5965**
Stddev	.004	.0021	.006	.20	.08	.0007	.07	.013	.0029
%RSD	.3076	.4112	.4021	.3423	.6532	1.613	.4898	.5460	.4932
#1	1.213	.5111	1.512	58.59	11.91	.0411	13.94	2.325	.5932
#2	1.215	.5077	1.519	58.29	11.75	.0404	13.85	2.313	.5976
#3	1.220	.5073	1.524	58.22	11.83	.0398	13.81	2.300	.5987
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.409**	**1.437**	**3.045**	**.5810**	**1.310**	**.4499**	**.7075**	**3.182**	**.8613**
Stddev	.040	.002	.012	.0017	.005	.0024	.0052	.004	.0021
%RSD	.7383	.1267	.3879	.2859	.4236	.5402	.7377	.1260	.2494
#1	5.453	1.435	3.032	.5796	1.304	.4489	.7016	3.183	.8594
#2	5.375	1.439	3.052	.5804	1.315	.4481	.7117	3.186	.8636
#3	5.400	1.437	3.052	.5828	1.311	.4526	.7091	3.178	.8608
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCSSRM 160-122752/2- Acquired: 5/22/2014 15:28:11 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.8990	.1768	.8828	.9089	.0345	.8102	.7278
Stddev	.0042	.0043	.0045	.0019	.0079	.0012	.0014
%RSD	.4660	2.411	.5107	.2052	22.81	.1443	.1977
#1	.9035	.1791	.8856	.9071	.0373	.8094	.7264
#2	.8985	.1719	.8851	.9088	.0405	.8116	.7277
#3	.8952	.1796	.8776	.9109	.0256	.8097	.7293
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6060.8
Stddev	27.7
%RSD	.45642
#1	6032.5
#2	6062.2
#3	6087.8

Sample Name: 160-6694-C-1-A Acquired: 5/22/2014 15:31:42 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0005**	**7.683**	**.0032**	**.0028**	**.1143**	**.0003**	**.0005**	**3.918**	**.0006**
Stddev	.0005	.019	.0009	.0014	.0002	.0000	.0008	.024	.0001
%RSD	98.23	.2495	26.87	52.23	.1807	5.803	155.1	.6020	14.76
#1	.0010	7.676	.0040	.0027	.1144	.0003	.0011	3.891	.0005
#2	.0000	7.668	.0034	.0042	.1144	.0002	.0007	3.929	.0006
#3	.0006	7.704	.0023	.0014	.1141	.0003	-.0004	3.933	.0007
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0077**	**.0331**	**.0312**	**12.36**	**.8100**	**.0105**	**3.780**	**.1623**	**.0007**
Stddev	.0003	.0010	.0008	.02	.0200	.0002	.023	.0005	.0001
%RSD	4.431	3.051	2.588	.1436	2.471	2.025	.5967	.3124	13.57
#1	.0076	.0323	.0312	12.34	.8137	.0104	3.756	.1619	.0006
#2	.0080	.0342	.0320	12.37	.7883	.0107	3.800	.1621	.0006
#3	.0074	.0327	.0304	12.37	.8278	.0104	3.785	.1628	.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.1164**	**.0152**	**.5263**	**.0938**	**.3133**	**.0008**	**<.0000**	**.5442**	**.0014**
Stddev	.0017	.0003	.0032	.0010	.0019	.0004	.0025	.0063	.0003
%RSD	1.486	1.690	.6071	1.060	.6135	47.42	176.8	1.166	18.12
#1	.1178	.0155	.5228	.0927	.3125	.0009	-.0039	.5475	.0015
#2	.1145	.0152	.5271	.0942	.3119	.0004	.0012	.5483	.0011
#3	.1171	.0150	.5290	.0946	.3155	.0012	-.0017	.5369	.0016
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-1-A Acquired: 5/22/2014 15:31:42 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0082	.0304	.5180	<.0000	.0085	.0178	.1288
Stddev	.0000	.0015	.0009	.0005	.0051	.0030	.0006
%RSD	.3455	4.811	.1723	17.51	59.41	16.96	.4578
#1	.0083	.0287	.5182	-.0031	.0056	.0179	.1282
#2	.0082	.0312	.5171	-.0033	.0144	.0147	.1294
#3	.0082	.0312	.5188	-.0024	.0056	.0207	.1290
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5679.5
Stddev	26.5
%RSD	.46664
#1	5709.6
#2	5668.9
#3	5659.9

Sample Name: 160-6694-C-1-A SD Acquired: 5/22/2014 15:35:32 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=50

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	1.445	.0000	.0001	.0214	.0001	<.0000	.7417	.0002
Stddev	.0002	.006	.0009	.0044	.0001	.0000	.0021	.0025	.0000
%RSD	57.20	.4308	2163.	6575.	.3779	12.80	96.66	.3335	25.17
#1	-.0005	1.448	.0004	.0051	.0214	.0001	.0000	.7425	.0002
#2	-.0002	1.438	-.0010	-.0016	.0215	.0001	-.0041	.7437	.0002
#3	-.0002	1.448	.0007	-.0032	.0214	.0001	-.0023	.7389	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0017	.0073	.0042	2.329	.1387	.0023	.7175	.0303	.0000
Stddev	.0003	.0012	.0005	.008	.0088	.0002	.0109	.0002	.0002
%RSD	16.10	16.36	12.74	.3355	6.350	8.920	1.513	.7980	744.5
#1	.0016	.0078	.0037	2.338	.1481	.0025	.7293	.0303	-.0001
#2	.0014	.0080	.0040	2.325	.1306	.0021	.7153	.0305	-.0001
#3	.0020	.0059	.0048	2.325	.1374	.0023	.7079	.0300	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0413	.0028	.0993	.0178	.0605	<.0000	<.0000	.1030	.0001
Stddev	.0010	.0002	.0003	.0007	.0017	.0007	.0026	.0029	.0006
%RSD	2.317	6.891	.2990	4.133	2.739	416.8	275.9	2.861	549.8
#1	.0417	.0026	.0993	.0183	.0599	-.0004	.0006	.1009	.0008
#2	.0402	.0030	.0990	.0182	.0592	-.0007	-.0039	.1018	-.0001
#3	.0420	.0029	.0996	.0170	.0623	.0006	.0005	.1064	-.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-1-A SD Acquired: 5/22/2014 15:35:32 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=50

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0015	.0060	.0961	<.0000	.0079	.0037	.0285
Stddev	.0000	.0045	.0009	.0010	.0107	.0010	.0002
%RSD	3.058	74.57	.8881	37.78	136.0	28.11	.7663
#1	.0015	.0042	.0969	-.0028	.0133	.0049	.0287
#2	.0014	.0111	.0962	-.0034	-.0045	.0029	.0283
#3	.0015	.0027	.0952	-.0015	.0148	.0034	.0283
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5713.8
Stddev	21.9
%RSD	.38327
#1	5689.9
#2	5718.4
#3	5733.0

Sample Name: 160-6694-C-1-B MS Acquired: 5/22/2014 15:39:24 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0216**	**11.49**	**.1061**	**.1922**	**.1970**	**.1013**	**.1080**	**5.233**	**.1090**
Stddev	.0005	.03	.0019	.0047	.0005	.0006	.0020	.013	.0001
%RSD	2.452	.2869	1.818	2.440	.2625	.5594	1.871	.2500	.1225
#1	.0210	11.50	.1080	.1923	.1965	.1008	.1066	5.220	.1090
#2	.0218	11.51	.1060	.1875	.1975	.1011	.1103	5.232	.1088
#3	.0220	11.45	.1042	.1969	.1971	.1019	.1070	5.246	.1091
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.1217**	**.1411**	**.1408**	**14.21**	**2.038**	**.1147**	**4.873**	**.2726**	**.0542**
Stddev	.0002	.0009	.0002	.08	.012	.0004	.039	.0009	.0004
%RSD	.1408	.6112	.1146	.5388	.5858	.3196	.7966	.3412	.7739
#1	.1215	.1401	.1408	14.15	2.047	.1149	4.869	.2715	.0537
#2	.1216	.1415	.1406	14.20	2.043	.1150	4.836	.2728	.0545
#3	.1219	.1416	.1410	14.30	2.024	.1143	4.913	.2733	.0545
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.153**	**.1307**	**.6300**	**.1953**	**1.321**	**.0302**	**.0505**	**.8284**	**.1062**
Stddev	.005	.0003	.0022	.0005	.002	.0009	.0018	.0045	.0002
%RSD	.4164	.2171	.3517	.2499	.1829	2.872	3.618	.5491	.2020
#1	1.152	.1303	.6294	.1955	1.319	.0292	.0527	.8327	.1063
#2	1.158	.1308	.6325	.1947	1.319	.0305	.0495	.8237	.1060
#3	1.148	.1308	.6282	.1956	1.323	.0308	.0495	.8289	.1064
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-1-B MS Acquired: 5/22/2014 15:39:24 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1120	.1366	.7463	.0231	.1171	.1286	.2224
Stddev	.0003	.0009	.0016	.0007	.0134	.0003	.0005
%RSD	.2757	.6373	.2124	3.065	11.45	.2551	.2084
#1	.1116	.1370	.7447	.0225	.1198	.1289	.2222
#2	.1121	.1371	.7463	.0239	.1289	.1283	.2220
#3	.1121	.1356	.7479	.0229	.1026	.1286	.2229
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5727.3
Stddev	21.6
%RSD	.37657
#1	5741.3
#2	5738.2
#3	5702.5

Sample Name: CCV Acquired: 5/22/2014 15:43:10 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.028**	**48.81**	**5.164**	**4.896**	**5.051**	**5.091**	**5.157**	**54.24**	**5.220**
Stddev	.004	.14	.010	.008	.061	.053	.019	.24	.018
%RSD	.4257	.2929	.1884	.1581	1.212	1.039	.3770	.4450	.3390
#1	1.023	48.98	5.153	4.901	4.988	5.031	5.135	53.96	5.200
#2	1.031	48.71	5.170	4.887	5.111	5.115	5.161	54.36	5.228
#3	1.031	48.75	5.170	4.900	5.053	5.128	5.173	54.40	5.233
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.339**	**5.300**	**5.173**	**50.37**	**49.79**	**4.900**	**49.65**	**5.028**	**1.058**
Stddev	.025	.035	.020	.17	.32	.048	.35	.015	.005
%RSD	.4666	.6675	.3816	.3404	.6369	.9773	.7030	.2889	.4703
#1	5.310	5.260	5.150	50.17	50.12	4.951	49.25	5.012	1.052
#2	5.354	5.315	5.180	50.48	49.48	4.857	49.89	5.040	1.062
#3	5.353	5.325	5.188	50.45	49.77	4.891	49.82	5.030	1.059
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**49.64**	**5.322**	F **55.05**	**5.364**	**51.55**	**1.030**	**1.029**	**4.888**	**5.339**
Stddev	.39	.021	.28	.020	.19	.002	.008	.013	.021
%RSD	.7882	.3944	.5110	.3759	.3619	.1609	.7499	.2707	.3947
#1	50.04	5.299	54.73	5.341	51.33	1.029	1.021	4.880	5.314
#2	49.25	5.329	55.26	5.374	51.65	1.032	1.029	4.903	5.351
#3	49.63	5.340	55.15	5.378	51.66	1.030	1.036	4.881	5.351
Check ?	Chk Pass	Chk Pass	Chk Fail	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value			50.00						
Range			10.00%						

Sample Name: CCV Acquired: 5/22/2014 15:43:10 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.101**	**5.238**	**5.037**	**1.087**	**5.200**	**5.055**	**5.281**
Stddev	.043	.031	.010	.006	.049	.020	.023
%RSD	.8410	.5886	.1972	.5127	.9353	.3850	.4296
#1	5.052	5.203	5.027	1.081	5.146	5.039	5.255
#2	5.125	5.262	5.047	1.091	5.238	5.051	5.292
#3	5.128	5.248	5.039	1.090	5.217	5.077	5.297
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5341.3**
Stddev	32.3
%RSD	.60487
#1	5377.5
#2	5331.2
#3	5315.3

Sample Name: CCB Acquired: 5/22/2014 15:46:59 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0004**	**<.0000**	**<.0000**	**.0066**	**.0001**	**.0001**	**<.0000**	**<.0000**	**.0000**
Stddev	.0008	.0044	.0003	.0024	.0001	.0001	.0020	.0005	.0001
%RSD	186.9	517.6	20.73	36.41	82.96	95.59	1295.	105.6	3781.
#1	-.0001	-.0052	-.0014	.0067	.0001	.0000	-.0008	.0001	.0001
#2	.0000	-.0010	-.0010	.0089	.0001	.0001	-.0018	-.0006	.0000
#3	.0013	.0037	-.0015	.0041	.0002	.0000	.0021	-.0009	-.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0007**	**<.0000**	**.0018**	**<.0000**	**.0005**	**.0040**	**.0002**	**.0001**
Stddev	.0003	.0003	.0007	.0009	.0146	.0008	.0069	.0001	.0001
%RSD	211.5	51.47	67.84	48.71	622.7	162.0	170.9	44.81	181.8
#1	-.0002	.0003	-.0006	.0027	.0129	.0011	.0120	.0003	.0001
#2	.0004	.0006	-.0017	.0018	-.0161	-.0004	.0002	.0002	-.0001
#3	.0002	.0010	-.0006	.0010	-.0039	.0007	-.0001	.0001	.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0078**	**.0001**	**.0008**	**.0008**	**.0020**	**.0006**	**.0015**	**.0000**	**.0002**
Stddev	.0006	.0002	.0010	.0007	.0016	.0004	.0014	.0030	.0007
%RSD	7.667	330.1	114.9	83.02	80.14	61.68	94.39	19660.	438.2
#1	.0075	.0003	.0012	.0016	.0038	.0007	.0019	.0035	-.0002
#2	.0085	-.0001	.0015	.0003	.0016	.0002	.0026	-.0018	-.0003
#3	.0075	-.0001	-.0003	.0006	.0006	.0010	-.0001	-.0016	.0010
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 15:46:59 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	<.0000	.0011	.0005	.0022	.0000
Stddev	.0001	.0002	.0001	.0010	.0100	.0011	.0001
%RSD	100.1	11.68	32.82	87.51	2210.	47.61	149.8
#1	.0000	-.0017	-.0004	.0023	.0016	.0035	.0001
#2	.0001	-.0015	-.0003	.0004	-.0101	.0017	.0001
#3	.0001	-.0019	-.0006	.0007	.0098	.0016	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5608.1
Stddev	21.0
%RSD	.37453
#1	5615.6
#2	5624.4
#3	5584.4

Sample Name: 160-6694-C-1-C MSD Acquired: 5/22/2014 15:50:57 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0211	11.36	.1089	.1953	.1968	.1031	.1053	3.565	.1090
Stddev	.0006	.05	.0026	.0007	.0014	.0007	.0012	.013	.0005
%RSD	2.617	.4145	2.391	.3380	.6933	.7029	1.092	.3664	.4814
#1	.0217	11.32	.1096	.1946	.1956	.1027	.1065	3.574	.1095
#2	.0210	11.36	.1060	.1959	.1965	.1027	.1054	3.550	.1084
#3	.0207	11.41	.1111	.1953	.1983	.1040	.1042	3.571	.1091
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1199	.1349	.1350	12.47	1.944	.1169	4.241	.2385	.0539
Stddev	.0007	.0012	.0014	.01	.021	.0020	.019	.0017	.0006
%RSD	.5965	.9183	1.067	.1036	1.087	1.742	.4563	.7027	1.092
#1	.1207	.1360	.1361	12.48	1.926	.1148	4.251	.2381	.0544
#2	.1196	.1351	.1355	12.45	1.940	.1172	4.218	.2371	.0541
#3	.1195	.1336	.1334	12.47	1.967	.1188	4.252	.2404	.0533
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.152	.1296	.5773	.1794	1.291	.0301	.0531	.7376	.1074
Stddev	.018	.0006	.0027	.0008	.001	.0011	.0015	.0108	.0008
%RSD	1.540	.4588	.4673	.4272	.0901	3.687	2.765	1.460	.7463
#1	1.133	.1301	.5798	.1802	1.292	.0290	.0547	.7490	.1082
#2	1.154	.1289	.5744	.1786	1.290	.0313	.0519	.7276	.1074
#3	1.168	.1297	.5777	.1794	1.291	.0301	.0527	.7362	.1066
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-1-C MSD Acquired: 5/22/2014 15:50:57 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1130	.1292	.7180	.0239	.1044	.1270	.2037
Stddev	.0008	.0034	.0015	.0022	.0059	.0027	.0003
%RSD	.7498	2.659	.2020	9.080	5.629	2.097	.1518
#1	.1125	.1325	.7170	.0245	.1095	.1300	.2040
#2	.1125	.1296	.7174	.0257	.1057	.1252	.2038
#3	.1140	.1256	.7196	.0215	.0979	.1258	.2034
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5784.1
Stddev	22.6
%RSD	.39135
#1	5759.7
#2	5804.4
#3	5788.2

Sample Name: 160-6694-C-2-A Acquired: 5/22/2014 15:54:42 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0003**	**4.157**	**.0016**	**.0029**	**.0341**	**.0001**	**<.0000**	**21.78**	**.0002**
Stddev	.0002	.130	.0009	.0015	.0011	.0000	.0003	2.29	.0001
%RSD	81.12	3.131	57.45	53.05	3.366	17.51	1563.	10.52	42.10
#1	.0005	4.022	.0010	.0016	.0331	.0001	.0000	19.49	.0001
#2	.0001	4.167	.0026	.0046	.0339	.0001	-.0003	21.80	.0002
#3	.0002	4.282	.0011	.0024	.0353	.0001	.0003	24.07	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0070**	**.0215**	**.0352**	**10.49**	**.8649**	**.0082**	**8.569**	**.1256**	**.0006**
Stddev	.0006	.0017	.0042	.31	.0146	.0002	.246	.0031	.0001
%RSD	8.237	7.795	11.87	2.953	1.685	2.508	2.873	2.441	14.71
#1	.0066	.0201	.0312	10.18	.8707	.0083	8.345	.1223	.0005
#2	.0069	.0211	.0350	10.49	.8483	.0079	8.528	.1260	.0006
#3	.0077	.0234	.0395	10.79	.8756	.0083	8.832	.1284	.0007
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.1178**	**.0136**	**.4249**	**.0593**	**.5283**	**.0026**	**<.0000**	**.2869**	**.0003**
Stddev	.0052	.0014	.0449	.0071	.0602	.0009	.0024	.0065	.0005
%RSD	4.413	10.16	10.56	11.97	11.40	34.27	249.0	2.277	191.0
#1	.1128	.0123	.3802	.0524	.4671	.0020	.0016	.2851	.0006
#2	.1173	.0136	.4247	.0591	.5301	.0037	-.0031	.2815	-.0003
#3	.1232	.0150	.4699	.0666	.5875	.0022	-.0014	.2942	.0006
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-2-A Acquired: 5/22/2014 15:54:42 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0113	.0303	.2747	<.0000	<.0000	.0118	.1187
Stddev	.0003	.0037	.0079	.0002	.0046	.0031	.0126
%RSD	2.310	12.24	2.890	13.95	31.51	25.89	10.59
#1	.0110	.0325	.2674	-.0017	-.0195	.0092	.1060
#2	.0113	.0260	.2736	-.0013	-.0107	.0110	.1190
#3	.0115	.0324	.2832	-.0013	-.0131	.0152	.1311
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5697.9
Stddev	24.7
%RSD	.43370
#1	5677.0
#2	5691.6
#3	5725.2

Sample Name: 160-6694-C-3-A Acquired: 5/22/2014 15:58:32 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	6.433	.0032	.0037	.0589	.0002	.0003	9.734	.0007
Stddev	.0005	.332	.0007	.0020	.0028	.0000	.0016	1.079	.0002
%RSD	178.1	5.156	20.88	52.81	4.744	18.30	562.2	11.08	25.76
#1	-.0008	6.115	.0030	.0019	.0561	.0001	-.0002	8.637	.0005
#2	.0002	6.408	.0026	.0035	.0587	.0002	-.0010	9.772	.0008
#3	-.0002	6.777	.0039	.0058	.0617	.0002	.0021	10.79	.0009
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0093	.3435	.0802	13.21	.9951	.0089	4.480	.1673	.0015
Stddev	.0012	.0144	.0088	.68	.0451	.0004	.218	.0087	.0001
%RSD	12.61	4.178	11.02	5.114	4.535	4.246	4.864	5.212	8.223
#1	.0082	.3313	.0704	12.54	.9483	.0085	4.273	.1589	.0014
#2	.0091	.3399	.0827	13.18	.9985	.0089	4.460	.1668	.0014
#3	.0105	.3593	.0876	13.89	1.038	.0092	4.708	.1763	.0016
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1020	.0224	.7726	.1624	2.972	.0032	<.0000	.4597	.0023
Stddev	.0066	.0024	.0841	.0184	.338	.0002	.0006	.0248	.0005
%RSD	6.496	10.64	10.88	11.33	11.39	5.730	39.67	5.392	23.57
#1	.1013	.0200	.6853	.1443	2.625	.0032	-.0010	.4328	.0019
#2	.0958	.0224	.7795	.1619	2.991	.0035	-.0023	.4646	.0029
#3	.1090	.0248	.8530	.1811	3.301	.0031	-.0014	.4817	.0020
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-3-A Acquired: 5/22/2014 15:58:32 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0097	.0405	.4133	<.0000	.0007	.0184	.2412
Stddev	.0004	.0011	.0208	.0007	.0118	.0015	.0268
%RSD	4.016	2.659	5.026	36.10	1589.	8.145	11.11
#1	.0093	.0406	.3930	-.0019	-.0026	.0172	.2138
#2	.0097	.0415	.4124	-.0013	-.0090	.0201	.2425
#3	.0101	.0394	.4346	-.0026	.0139	.0180	.2673
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5847.6
Stddev	8.3
%RSD	.14220
#1	5838.8
#2	5855.4
#3	5848.6

Sample Name: 160-6694-C-4-A Acquired: 5/22/2014 16:02:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0000**	**2.624**	**.0075**	**.0019**	**.0292**	**.0001**	**.0027**	**5.049**	**.0010**
Stddev	.0004	.120	.0010	.0023	.0015	.0000	.0016	.600	.0001
%RSD	1776.	4.570	13.29	124.9	4.983	18.21	60.37	11.89	7.460
#1	-.0004	2.503	.0065	.0008	.0277	.0001	.0043	4.436	.0009
#2	.0001	2.626	.0076	.0045	.0291	.0001	.0011	5.076	.0010
#3	.0004	2.743	.0085	.0002	.0306	.0001	.0026	5.636	.0010
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0056**	**.0204**	**.0622**	**8.196**	**.3647**	**.0036**	**2.027**	**.0928**	**.0020**
Stddev	.0007	.0011	.0082	.427	.0174	.0004	.119	.0049	.0002
%RSD	12.56	5.607	13.25	5.211	4.761	10.99	5.863	5.306	11.78
#1	.0049	.0199	.0534	7.770	.3610	.0034	1.909	.0879	.0018
#2	.0055	.0196	.0636	8.194	.3495	.0040	2.026	.0927	.0021
#3	.0063	.0217	.0697	8.624	.3836	.0032	2.147	.0978	.0022
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.2595**	**.0169**	**.3356**	**.1496**	**2.336**	**.0012**	**<.0000**	**.2896**	**.0031**
Stddev	.0077	.0020	.0416	.0172	.284	.0012	.0017	.0197	.0002
%RSD	2.949	11.68	12.38	11.53	12.15	98.43	157.6	6.814	7.786
#1	.2507	.0150	.2932	.1313	2.052	-.0002	.0007	.2683	.0028
#2	.2645	.0169	.3375	.1518	2.335	.0017	-.0013	.2932	.0033
#3	.2634	.0189	.3762	.1656	2.620	.0021	-.0027	.3072	.0032
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-4-A Acquired: 5/22/2014 16:02:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0075	.0258	.1775	.0006	.0150	.0067	.2208
Stddev	.0003	.0016	.0097	.0014	.0020	.0010	.0260
%RSD	4.498	6.153	5.457	210.6	13.62	15.43	11.76
#1	.0072	.0244	.1676	.0004	.0134	.0078	.1942
#2	.0075	.0255	.1778	.0021	.0144	.0067	.2220
#3	.0079	.0275	.1870	-.0006	.0173	.0057	.2461
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5689.9
Stddev	36.7
%RSD	.64427
#1	5729.9
#2	5681.8
#3	5657.9

Sample Name: 160-6694-C-5-A Acquired: 5/22/2014 16:06:09 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	3.209	.0020	.0026	.0123	.0001	.0002	12.52	.0002
Stddev	.0005	.155	.0017	.0009	.0006	.0000	.0012	1.59	.0000
%RSD	110.0	4.816	82.68	32.48	4.855	60.09	783.5	12.71	20.00
#1	.0000	3.061	.0002	.0036	.0118	.0000	-.0001	10.90	.0001
#2	-.0004	3.197	.0035	.0023	.0122	.0001	.0014	12.60	.0002
#3	-.0011	3.369	.0023	.0020	.0129	.0001	-.0009	14.08	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0069	.0140	.0290	11.45	.3258	.0077	4.982	.1015	.0004
Stddev	.0011	.0011	.0030	.60	.0342	.0007	.283	.0052	.0002
%RSD	16.02	8.106	10.34	5.229	10.50	9.438	5.683	5.141	36.95
#1	.0058	.0130	.0255	10.87	.2896	.0074	4.720	.0960	.0003
#2	.0070	.0139	.0305	11.40	.3301	.0071	4.944	.1021	.0005
#3	.0080	.0152	.0309	12.07	.3576	.0085	5.282	.1064	.0006
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0816	.0132	.3355	.0323	.2982	.0021	<.0000	.1555	.0011
Stddev	.0034	.0016	.0434	.0049	.0361	.0016	.0014	.0084	.0005
%RSD	4.226	12.18	12.92	15.20	12.10	74.66	126.8	5.383	44.62
#1	.0824	.0118	.2915	.0268	.2620	.0004	-.0026	.1482	.0006
#2	.0778	.0128	.3369	.0337	.2985	.0026	.0001	.1537	.0015
#3	.0846	.0149	.3782	.0363	.3341	.0034	-.0008	.1646	.0011
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-5-A Acquired: 5/22/2014 16:06:09 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0072	.0344	.0912	.0001	.0165	.0097	.1010
Stddev	.0002	.0012	.0050	.0013	.0075	.0014	.0128
%RSD	3.258	3.624	5.485	1755.	45.27	14.05	12.70
#1	.0069	.0333	.0873	.0005	.0091	.0113	.0879
#2	.0071	.0342	.0894	.0011	.0163	.0088	.1017
#3	.0074	.0357	.0968	-.0014	.0240	.0091	.1135
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5652.7
Stddev	33.3
%RSD	.58865
#1	5690.2
#2	5640.8
#3	5626.9

Sample Name: 160-6694-C-6-A Acquired: 5/22/2014 16:10:00 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0000**	**6.580**	**.0036**	**.0053**	**.0641**	**.0002**	**.0007**	**18.44**	**.0013**
Stddev	.0006	.407	.0006	.0035	.0041	.0000	.0015	2.29	.0001
%RSD	1604.	6.192	17.88	65.73	6.330	6.102	213.2	12.41	4.054
#1	-.0002	6.157	.0029	.0066	.0599	.0002	.0003	16.12	.0012
#2	.0007	6.613	.0039	.0079	.0644	.0002	-.0006	18.52	.0013
#3	-.0004	6.969	.0041	.0013	.0680	.0002	.0024	20.69	.0013
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0114**	**.3310**	**.1157**	**14.54**	**1.042**	**.0086**	**5.523**	**.1710**	**.0024**
Stddev	.0014	.0216	.0157	1.10	.063	.0005	.419	.0127	.0004
%RSD	12.28	6.517	13.56	7.535	6.009	5.340	7.587	7.424	16.08
#1	.0099	.3095	.1002	13.48	.9810	.0082	5.119	.1581	.0022
#2	.0118	.3309	.1155	14.49	1.038	.0087	5.494	.1713	.0023
#3	.0126	.3527	.1315	15.67	1.106	.0091	5.956	.1835	.0029
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.1117**	**.0248**	**.9425**	**.2520**	**4.596**	**.0034**	**<.0000**	**.4710**	**.0028**
Stddev	.0089	.0033	.1208	.0299	.587	.0012	.0021	.0357	.0003
%RSD	7.928	13.47	12.81	11.87	12.78	34.94	60.04	7.577	10.74
#1	.1087	.0214	.8183	.2216	4.006	.0022	-.0026	.4348	.0025
#2	.1047	.0247	.9497	.2530	4.601	.0045	-.0059	.4721	.0030
#3	.1216	.0281	1.060	.2814	5.180	.0034	-.0020	.5061	.0030
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6694-C-6-A Acquired: 5/22/2014 16:10:00 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0126	.0467	.4192	<.0000	.0261	.0201	.3551
Stddev	.0008	.0055	.0291	.0019	.0171	.0034	.0442
%RSD	6.217	11.80	6.952	1072.	65.47	16.88	12.43
#1	.0118	.0421	.3905	-.0008	.0110	.0163	.3101
#2	.0126	.0451	.4184	-.0017	.0227	.0214	.3568
#3	.0134	.0528	.4488	.0020	.0447	.0228	.3984
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5665.3
Stddev	11.5
%RSD	.20358
#1	5676.0
#2	5666.8
#3	5653.1

Sample Name: 160-6681-D-1-B Acquired: 5/22/2014 16:13:45 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0028	18.45	<.0000	<.0000	.0064	<.0000	<.0000	.5663	<.0000
Stddev	.0002	1.15	.0015	.0016	.0004	.0000	.0005	.0776	.0001
%RSD	8.246	6.231	239.5	1534.	6.145	308.8	30.69	13.71	303.0
#1	.0025	17.37	-.0016	.0017	.0061	.0000	-.0011	.4876	-.0002
#2	.0028	18.32	-.0014	-.0007	.0063	.0000	-.0019	.5685	.0001
#3	.0030	19.66	.0011	-.0013	.0069	.0000	-.0021	.6429	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0159	.1273	.0355	4.761	.0536	.0086	.6860	.0594	.0423
Stddev	.0023	.0081	.0045	.277	.0127	.0006	.0417	.0033	.0060
%RSD	14.21	6.392	12.71	5.823	23.72	6.761	6.072	5.599	14.06
#1	.0135	.1192	.0310	4.492	.0580	.0081	.6495	.0563	.0365
#2	.0162	.1271	.0356	4.745	.0393	.0083	.6771	.0590	.0421
#3	.0179	.1355	.0400	5.046	.0636	.0092	.7314	.0629	.0484
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.7397	.6322	.3123	.0074	.3582	<.0000	.0028	.1487	.0429
Stddev	.0439	.0905	.0467	.0014	.0512	.0010	.0024	.0025	.0060
%RSD	5.933	14.32	14.95	19.48	14.29	36.73	86.67	1.661	13.93
#1	.6968	.5419	.2658	.0060	.3083	-.0031	.0026	.1462	.0371
#2	.7377	.6317	.3121	.0074	.3559	-.0015	.0005	.1511	.0427
#3	.7845	.7229	.3592	.0089	.4106	-.0033	.0053	.1489	.0490
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6681-D-1-B Acquired: 5/22/2014 16:13:45 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0032	.0065	1.809	<.0000	.0476	.7183	.0292
Stddev	.0002	.0020	.107	.0023	.0086	.0460	.0041
%RSD	7.414	30.19	5.923	33.20	18.01	6.404	14.06
#1	.0030	.0055	1.708	-.0066	.0435	.6760	.0252
#2	.0031	.0053	1.798	-.0049	.0574	.7117	.0289
#3	.0035	.0088	1.922	-.0095	.0418	.7673	.0334
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5677.8
Stddev	14.8
%RSD	.25985
#1	5663.5
#2	5693.0
#3	5676.8

Sample Name: LB 160-122248/1-B Acquired: 5/22/2014 16:17:37 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0008	<.0000	.0016	.0002	<.0000	<.0000	.0241	.0001
Stddev	.0006	.0048	.0009	.0021	.0000	.0001	.0008	.0002	.0000
%RSD	871.2	581.9	113.3	133.8	8.539	68950.	51.02	1.005	59.07
#1	-.0001	.0040	.0000	.0040	.0002	.0000	-.0022	.0240	.0001
#2	-.0006	.0031	-.0006	.0007	.0003	.0001	-.0016	.0239	.0001
#3	.0006	-.0047	-.0018	.0000	.0002	.0000	-.0007	.0244	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0024	<.0000	.0055	.0101	.0006	<.0000	.0002	<.0000
Stddev	.0003	.0003	.0011	.0015	.0040	.0005	.0075	.0002	.0001
%RSD	178.9	14.51	46.60	26.75	39.66	83.45	318.0	112.9	34.03
#1	.0000	.0026	-.0036	.0044	.0117	.0008	.0060	.0003	-.0003
#2	.0000	.0025	-.0019	.0072	.0056	.0010	-.0047	.0000	-.0002
#3	.0004	.0020	-.0016	.0049	.0131	.0000	-.0083	.0003	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	534.2	.0003	.0027	<.0000	.0092	.0010	.0006	.0050	.0004
Stddev	8.1	.0002	.0014	.0006	.0025	.0010	.0021	.0083	.0006
%RSD	1.512	67.64	51.65	133.9	27.66	95.71	373.6	164.3	142.2
#1	526.1	.0006	.0037	-.0007	.0066	.0022	-.0007	-.0037	-.0001
#2	542.2	.0002	.0011	.0002	.0094	.0005	-.0005	.0128	.0011
#3	534.4	.0003	.0034	-.0009	.0117	.0005	.0030	.0060	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LB 160-122248/1-B Acquired: 5/22/2014 16:17:37 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.0008	.0001	<.0000	<.0000	.0003	.0086
Stddev	.0000	.0026	.0006	.0017	.0072	.0048	.0001
%RSD	15.35	337.1	465.6	34.19	23.07	1443.	1.013
#1	.0002	.0000	.0003	-.0033	-.0287	-.0029	.0086
#2	.0002	-.0014	.0006	-.0067	-.0254	-.0019	.0086
#3	.0002	.0036	-.0006	-.0048	-.0391	.0058	.0087
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5547.5
Stddev	39.2
%RSD	.70650
#1	5562.3
#2	5577.2
#3	5503.1

Sample Name: LCS 160-122858/2-A Acquired: 5/22/2014 16:21:41 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2062	10.15	1.112	2.029	1.020	1.069	1.004	10.70	1.097
Stddev	.0010	.08	.004	.004	.004	.003	.004	.04	.003
%RSD	.4619	.8207	.3935	.1856	.3727	.2412	.3732	.4010	.2365
#1	.2073	10.14	1.108	2.027	1.021	1.070	.9992	10.72	1.096
#2	.2059	10.07	1.112	2.033	1.015	1.071	1.005	10.73	1.100
#3	.2055	10.23	1.117	2.027	1.023	1.066	1.006	10.65	1.095
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.079	1.074	1.090	10.57	10.26	1.010	9.816	1.045	.5169
Stddev	.005	.007	.003	.03	.10	.018	.074	.003	.0014
%RSD	.4463	.6263	.2501	.3240	.9808	1.771	.7519	.3027	.2702
#1	1.077	1.079	1.087	10.59	10.23	1.010	9.879	1.048	.5155
#2	1.085	1.077	1.092	10.58	10.18	.9918	9.834	1.046	.5183
#3	1.076	1.067	1.091	10.53	10.37	1.028	9.735	1.042	.5168
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	530.3	1.089	1.216	1.050	10.64	.5190	.5753	.0377	1.025
Stddev	10.3	.002	.010	.001	.03	.0045	.0020	.0084	.004
%RSD	1.944	.1531	.8302	.0942	.3018	.8761	.3428	22.19	.3391
#1	536.9	1.087	1.215	1.050	10.62	.5138	.5760	.0326	1.025
#2	535.5	1.091	1.227	1.051	10.68	.5213	.5731	.0330	1.029
#3	518.4	1.089	1.207	1.049	10.63	.5219	.5768	.0473	1.022
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCS 160-122858/2-A Acquired: 5/22/2014 16:21:41 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.066	1.047	1.017	.2089	.9799	1.069	1.125
Stddev	.003	.010	.001	.0042	.0100	.006	.004
%RSD	.2476	.9259	.1377	2.019	1.020	.5753	.3386
#1	1.066	1.036	1.018	.2097	.9850	1.076	1.124
#2	1.063	1.054	1.017	.2126	.9863	1.064	1.129
#3	1.068	1.051	1.015	.2043	.9684	1.066	1.122
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5497.9
Stddev	20.7
%RSD	.37609
#1	5483.4
#2	5488.7
#3	5521.6

Sample Name: 160-6629-A-1-C Acquired: 5/22/2014 16:25:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	2.133	<.0000	.1645	.0773	.0000	.0015	219.4	.0005
Stddev	.0006	.014	.0011	.0019	.0003	.0000	.0026	.9	.0001
%RSD	121.0	.6589	53.48	1.147	.4450	11160.	176.4	.4185	24.90
#1	.0000	2.143	-.0010	.1627	.0774	.0000	.0045	220.4	.0004
#2	-.0003	2.139	-.0021	.1642	.0775	.0000	.0000	219.1	.0004
#3	-.0012	2.117	-.0033	.1665	.0769	.0000	.0000	218.6	.0006
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0017	.0051	<.0000	.0711	1.815	.0462	.6566	.0854	.0120
Stddev	.0002	.0009	.0010	.0009	.005	.0000	.0083	.0002	.0001
%RSD	9.988	17.11	94.33	1.272	.2853	.0843	1.271	.2335	.8678
#1	.0015	.0045	.0001	.0718	1.820	.0462	.6659	.0853	.0120
#2	.0018	.0048	-.0016	.0713	1.810	.0461	.6544	.0852	.0119
#3	.0018	.0061	-.0015	.0701	1.817	.0461	.6497	.0856	.0121
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	577.3	.0102	.0010	.0015	12.44	.0330	.0017	6.294	<.0000
Stddev	8.8	.0001	.0011	.0009	.05	.0002	.0000	.047	.0011
%RSD	1.528	1.305	113.4	61.67	.3958	.4592	2.283	.7454	152.3
#1	581.7	.0102	.0017	.0012	12.47	.0332	.0018	6.338	-.0012
#2	582.9	.0100	.0016	.0025	12.46	.0330	.0017	6.298	.0005
#3	567.1	.0103	-.0003	.0008	12.38	.0329	.0017	6.245	-.0015
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6629-A-1-C Acquired: 5/22/2014 16:25:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.4207	<.0000	.0053	<.0000	.0417	.0063	.3075
Stddev	.0015	.0035	.0005	.0005	.0131	.0022	.0012
%RSD	.3491	1038.	9.035	10.24	31.52	35.44	.3849
#1	.4215	-.0043	.0055	-.0048	.0568	.0088	.3084
#2	.4216	.0011	.0055	-.0055	.0330	.0047	.3079
#3	.4190	.0023	.0047	-.0045	.0352	.0054	.3061
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5498.9
Stddev	12.5
%RSD	.22695
#1	5484.5
#2	5507.3
#3	5504.8

Sample Name: CCV Acquired: 5/22/2014 16:29:16 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.017**	**49.27**	**5.072**	**4.859**	**5.068**	**4.956**	**5.124**	**52.78**	**5.148**
Stddev	.004	.37	.028	.023	.027	.031	.023	.14	.020
%RSD	.3557	.7523	.5542	.4694	.5272	.6186	.4542	.2624	.3821
#1	1.020	49.68	5.102	4.885	5.098	4.992	5.148	52.87	5.168
#2	1.013	49.16	5.046	4.850	5.059	4.939	5.101	52.62	5.128
#3	1.018	48.96	5.067	4.842	5.047	4.938	5.124	52.86	5.148
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.226**	**5.196**	**5.142**	**49.02**	**50.77**	**5.123**	**47.84**	**4.899**	**1.041**
Stddev	.016	.014	.031	.12	.47	.059	.19	.017	.006
%RSD	.2964	.2604	.6058	.2467	.9232	1.155	.3879	.3441	.5423
#1	5.235	5.209	5.172	49.16	51.29	5.190	48.05	4.918	1.046
#2	5.208	5.182	5.110	48.96	50.37	5.078	47.71	4.894	1.035
#3	5.235	5.197	5.144	48.94	50.66	5.100	47.76	4.885	1.042
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**50.90**	**5.196**	**54.05**	**5.239**	**50.84**	**1.021**	**1.014**	**4.827**	**5.215**
Stddev	.47	.019	.20	.025	.23	.006	.003	.044	.019
%RSD	.9319	.3738	.3731	.4731	.4466	.6154	.2937	.9180	.3661
#1	51.43	5.217	54.16	5.266	51.07	1.027	1.017	4.874	5.235
#2	50.52	5.179	53.82	5.217	50.61	1.015	1.011	4.821	5.198
#3	50.75	5.191	54.17	5.233	50.85	1.021	1.014	4.786	5.211
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 16:29:16 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.140**	**5.159**	**4.975**	**1.073**	**5.212**	**4.934**	**5.183**
Stddev	.022	.025	.024	.004	.032	.021	.017
%RSD	.4306	.4763	.4756	.4170	.6203	.4307	.3296
#1	5.147	5.182	4.998	1.076	5.238	4.957	5.200
#2	5.158	5.133	4.978	1.067	5.176	4.930	5.166
#3	5.116	5.161	4.950	1.075	5.221	4.915	5.183
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5475.0**
Stddev	16.4
%RSD	.30017
#1	5459.5
#2	5492.2
#3	5473.3

Sample Name: CCB Acquired: 5/22/2014 16:33:04 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0005**	**.0001**	**<.0000**	**.0082**	**<.0000**	**.0000**	**.0017**	**.0037**	**.0001**
Stddev	.0002	.0032	.0020	.0036	.0001	.0000	.0002	.0011	.0000
%RSD	48.01	2145.	214.0	44.52	279.2	150.8	11.95	29.86	36.73
#1	.0005	.0010	-.0008	.0072	.0000	.0001	.0020	.0050	.0001
#2	.0007	.0028	.0010	.0122	-.0001	.0000	.0015	.0028	.0001
#3	.0002	-.0034	-.0030	.0051	.0000	.0000	.0017	.0033	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0007**	**<.0000**	**<.0000**	**.0250**	**.0006**	**.0076**	**.0002**	**.0001**
Stddev	.0002	.0011	.0017	.0015	.0070	.0002	.0159	.0001	.0002
%RSD	134.3	170.2	58.77	503.9	27.94	30.16	209.8	48.52	171.9
#1	.0003	.0005	-.0034	.0003	.0290	.0008	.0061	.0003	.0002
#2	.0004	-.0004	-.0010	-.0020	.0169	.0004	-.0075	.0001	-.0001
#3	-.0001	.0019	-.0043	.0008	.0290	.0006	.0241	.0003	.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0353**	**.0001**	**.0010**	**.0006**	**.0027**	**<.0000**	**<.0000**	**<.0000**	**.0006**
Stddev	.0029	.0001	.0006	.0005	.0015	.0013	.0011	.0035	.0006
%RSD	8.153	191.0	60.18	90.12	56.13	312.6	190.3	121.2	94.20
#1	.0366	.0000	.0014	.0012	.0044	.0011	-.0016	-.0009	.0012
#2	.0320	.0002	.0003	.0002	.0018	-.0015	.0005	-.0008	.0001
#3	.0373	.0000	.0013	.0004	.0018	-.0009	-.0007	-.0069	.0006
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 16:33:04 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	<.0000	<.0000	<.0000	.0128	<.0000	.0003
Stddev	.0000	.0021	.0001	.0004	.0130	.0013	.0001
%RSD	71.92	659.8	136.3	14.26	102.0	105.3	20.25
#1	.0000	-.0020	.0000	-.0024	-.0022	.0001	.0004
#2	.0000	.0020	-.0001	-.0030	.0211	-.0013	.0002
#3	.0000	-.0009	-.0001	-.0023	.0194	-.0026	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5692.9
Stddev	36.7
%RSD	.64534
#1	5693.0
#2	5656.1
#3	5729.6

Sample Name: 160-6629-A-1-C SD Acquired: 5/22/2014 16:37:00 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.4130	.0003	.0325	.0154	<.0000	<.0000	50.39	.0001
Stddev	.0005	.0085	.0002	.0007	.0002	.0000	.0007	.19	.0001
%RSD	259.4	2.060	79.27	2.249	1.042	78.95	82.89	.3750	79.90
#1	.0000	.4227	.0002	.0325	.0156	.0000	-.0017	50.25	.0002
#2	.0007	.4072	.0006	.0332	.0155	.0000	-.0002	50.31	.0000
#3	-.0002	.4090	.0001	.0317	.0153	-.0001	-.0008	50.60	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0006	.0034	<.0000	.0155	.3742	.0098	.1269	.0172	.0026
Stddev	.0001	.0003	.0008	.0009	.0265	.0005	.0026	.0002	.0002
%RSD	11.65	7.859	85.10	5.927	7.095	5.523	2.028	1.349	5.924
#1	.0005	.0032	-.0011	.0146	.3512	.0092	.1240	.0173	.0025
#2	.0006	.0038	-.0015	.0164	.4033	.0100	.1275	.0174	.0027
#3	.0007	.0033	.0000	.0153	.3680	.0102	.1291	.0170	.0028
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	119.6	.0022	<.0000	.0006	2.429	.0080	.0004	1.195	<.0000
Stddev	2.0	.0001	.0006	.0004	.009	.0008	.0005	.007	.0001
%RSD	1.636	5.153	90.33	61.29	.3524	9.976	125.0	.5681	7.084
#1	119.1	.0021	-.0009	.0005	2.425	.0086	.0003	1.188	-.0009
#2	121.7	.0023	.0000	.0010	2.423	.0084	.0010	1.198	-.0008
#3	117.9	.0022	-.0012	.0003	2.439	.0071	-.0001	1.200	-.0009
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6629-A-1-C SD Acquired: 5/22/2014 16:37:00 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=5

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0820	<.0000	.0007	<.0000	.0048	.0029	.0661
Stddev	.0001	.0012	.0005	.0014	.0037	.0027	.0002
%RSD	.0722	151.8	66.56	118.5	75.60	90.97	.3488
#1	.0819	.0001	.0013	.0004	.0085	.0035	.0663
#2	.0820	-.0022	.0004	-.0022	.0047	.0000	.0660
#3	.0820	-.0003	.0005	-.0019	.0012	.0052	.0659
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5728.7
Stddev	19.5
%RSD	.34059
#1	5745.8
#2	5733.0
#3	5707.5

Sample Name: 160-6629-A-1-D MS Acquired: 5/22/2014 16:41:00 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.2103**	**11.82**	**1.006**	**2.073**	**1.030**	**.9918**	**.9726**	**227.9**	**1.003**
Stddev	.0013	.02	.002	.005	.004	.0033	.0030	.8	.002
%RSD	.6169	.2001	.1925	.2413	.3762	.3357	.3117	.3640	.1970
#1	.2090	11.84	1.005	2.067	1.033	.9916	.9731	227.0	1.001
#2	.2116	11.79	1.008	2.075	1.031	.9952	.9693	228.2	1.003
#3	.2103	11.82	1.005	2.076	1.025	.9885	.9753	228.5	1.005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.9727**	**.9874**	**.9903**	**9.731**	**11.49**	**1.007**	**9.591**	**1.042**	**.5103**
Stddev	.0044	.0041	.0035	.029	.06	.008	.093	.006	.0024
%RSD	.4476	.4129	.3533	.2941	.5125	.7560	.9708	.5668	.4760
#1	.9679	.9838	.9863	9.703	11.55	1.016	9.493	1.035	.5075
#2	.9740	.9918	.9917	9.760	11.47	1.003	9.601	1.044	.5113
#3	.9763	.9866	.9928	9.730	11.44	1.003	9.678	1.046	.5121
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**572.7**	**.9715**	**1.139**	**.9386**	**22.63**	**.5386**	**.5179**	**6.246**	**.9680**
Stddev	4.9	.0022	.006	.0034	.06	.0018	.0026	.019	.0024
%RSD	.8585	.2265	.5741	.3638	.2518	.3332	.5019	.2975	.2464
#1	567.1	.9691	1.132	.9352	22.56	.5368	.5192	6.228	.9653
#2	576.1	.9721	1.140	.9386	22.65	.5384	.5150	6.265	.9698
#3	575.0	.9734	1.145	.9421	22.67	.5404	.5197	6.245	.9688
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6629-A-1-D MS Acquired: 5/22/2014 16:41:00 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.394	.9961	1.007	.1862	1.024	1.007	1.324
Stddev	.006	.0072	.002	.0011	.008	.006	.004
%RSD	.4660	.7227	.1967	.5795	.7837	.5762	.3358
#1	1.398	1.001	1.006	.1856	1.015	1.001	1.319
#2	1.398	.9998	1.009	.1856	1.028	1.006	1.327
#3	1.387	.9878	1.005	.1875	1.029	1.013	1.327
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5474.2
Stddev	25.9
%RSD	.47246
#1	5503.6
#2	5464.3
#3	5454.9

Sample Name: 160-6629-A-1-E MSD Acquired: 5/22/2014 16:44:37 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2196	12.60	1.064	2.192	1.093	1.037	1.021	228.5	1.053
Stddev	.0018	.04	.003	.002	.000	.001	.001	.6	.002
%RSD	.8256	.2791	.2843	.1069	.0073	.1202	.0464	.2829	.2098
#1	.2183	12.60	1.065	2.194	1.093	1.036	1.022	228.4	1.054
#2	.2216	12.64	1.066	2.190	1.094	1.039	1.021	229.2	1.054
#3	.2188	12.57	1.060	2.193	1.093	1.037	1.022	227.9	1.050
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.018	1.036	1.043	10.14	12.46	1.111	9.909	1.079	.5337
Stddev	.003	.008	.004	.01	.04	.001	.044	.006	.0012
%RSD	.3161	.7778	.3436	.1286	.3368	.0776	.4441	.5250	.2326
#1	1.022	1.035	1.047	10.13	12.42	1.110	9.909	1.083	.5347
#2	1.017	1.045	1.040	10.14	12.47	1.112	9.953	1.082	.5341
#3	1.015	1.029	1.041	10.15	12.50	1.111	9.865	1.073	.5323
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	590.3	1.018	1.198	.9817	23.28	.5644	.5498	6.336	1.008
Stddev	11.0	.003	.004	.0039	.04	.0009	.0005	.025	.004
%RSD	1.866	.2512	.3262	.4016	.1672	.1575	.0880	.3996	.4355
#1	590.3	1.018	1.202	.9829	23.33	.5651	.5495	6.352	1.011
#2	601.3	1.021	1.194	.9849	23.27	.5646	.5503	6.348	1.009
#3	579.3	1.016	1.197	.9773	23.26	.5634	.5495	6.306	1.003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6629-A-1-E MSD Acquired: 5/22/2014 16:44:37 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.464**	**1.046**	**1.050**	**.1949**	**1.078**	**1.051**	**1.372**
Stddev	.002	.011	.002	.0002	.009	.001	.003
%RSD	.1089	1.023	.1911	.0831	.8110	.1061	.2280
#1	1.462	1.040	1.050	.1951	1.082	1.052	1.375
#2	1.464	1.058	1.052	.1949	1.084	1.052	1.372
#3	1.465	1.039	1.048	.1948	1.068	1.050	1.369
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5509.8**
Stddev	18.9
%RSD	.34386
#1	5518.8
#2	5488.0
#3	5522.6

Sample Name: MB 160-123123/1-A Acquired: 5/22/2014 16:48:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0135**	**<.0000**	**.0118**	**.0003**	**<.0000**	**<.0000**	**.0395**	**.0002**
Stddev	.0004	.0046	.0009	.0009	.0002	.0000	.0017	.0018	.0001
%RSD	211.4	33.81	53.04	7.510	65.44	538.0	1003.	4.605	55.13
#1	.0001	.0134	-.0007	.0119	.0004	.0000	.0018	.0390	.0001
#2	.0007	.0091	-.0023	.0127	.0002	.0000	-.0011	.0379	.0002
#3	-.0002	.0182	-.0020	.0109	.0001	.0000	-.0012	.0415	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0016**	**<.0000**	**.0138**	**.0325**	**.0003**	**.0248**	**.0004**	**.0002**
Stddev	.0002	.0005	.0005	.0015	.0143	.0007	.0029	.0003	.0002
%RSD	80.69	28.32	39.76	11.04	44.01	241.7	11.84	75.11	109.2
#1	.0002	.0017	-.0016	.0121	.0488	-.0005	.0231	.0008	.0001
#2	.0001	.0021	-.0007	.0150	.0222	.0007	.0230	.0003	.0000
#3	.0004	.0012	-.0013	.0142	.0264	.0007	.0282	.0002	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.1246**	**.0004**	**.0023**	**.0006**	**.0086**	**<.0000**	**.0008**	**.0595**	**.0002**
Stddev	.0053	.0002	.0003	.0004	.0022	.0005	.0009	.0044	.0001
%RSD	4.216	59.50	12.49	61.20	25.48	260.3	121.7	7.432	49.62
#1	.1307	.0006	.0025	.0002	.0069	-.0008	.0019	.0643	.0002
#2	.1211	.0002	.0020	.0010	.0111	.0000	.0004	.0587	.0002
#3	.1220	.0002	.0025	.0006	.0078	.0002	.0001	.0556	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-123123/1-A Acquired: 5/22/2014 16:48:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0004	.0006	<.0000	.0237	.0008	.0129
Stddev	.0000	.0019	.0005	.0023	.0173	.0006	.0002
%RSD	43.01	440.9	73.72	174.0	72.92	78.18	1.519
#1	.0000	-.0015	.0010	-.0039	.0360	.0009	.0130
#2	.0001	.0004	.0001	-.0008	.0312	.0001	.0129
#3	.0001	.0024	.0007	.0007	.0039	.0014	.0126
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5681.3
Stddev	44.1
%RSD	.77572
#1	5641.8
#2	5673.4
#3	5728.9

Sample Name: LCSSRM 160-123123/2- Acquired: 5/22/2014 16:52:08 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3579**	**33.19**	**.4667**	**.4790**	**1.075**	**.2942**	**.0008**	**43.50**	**.7753**
Stddev	.0020	.19	.0025	.0013	.003	.0011	.0007	.14	.0033
%RSD	.5524	.5639	.5362	.2800	.2402	.3746	88.86	.3282	.4202
#1	.3595	33.14	.4662	.4801	1.075	.2953	.0017	43.61	.7769
#2	.3557	33.40	.4645	.4775	1.077	.2931	.0006	43.34	.7716
#3	.3585	33.03	.4694	.4792	1.072	.2943	.0003	43.55	.7775
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.169**	**.4829**	**1.452**	**50.29**	**11.09**	**.0373**	**12.54**	**2.156**	**.5440**
Stddev	.005	.0024	.010	.22	.07	.0008	.04	.005	.0022
%RSD	.4143	.4887	.6781	.4443	.6276	2.030	.3541	.2292	.4078
#1	1.173	.4848	1.455	50.50	11.08	.0375	12.58	2.158	.5454
#2	1.163	.4803	1.441	50.05	11.17	.0380	12.49	2.150	.5414
#3	1.171	.4837	1.460	50.33	11.03	.0365	12.55	2.159	.5451
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.455**	**1.365**	**3.254**	**.5501**	**1.307**	**.2448**	**.6757**	**3.543**	**.8160**
Stddev	.044	.005	.018	.0026	.005	.0024	.0036	.004	.0031
%RSD	.8150	.3699	.5664	.4682	.3731	.9698	.5288	.1237	.3791
#1	5.454	1.369	3.265	.5516	1.311	.2452	.6781	3.539	.8179
#2	5.500	1.359	3.232	.5471	1.302	.2422	.6716	3.548	.8124
#3	5.411	1.367	3.264	.5516	1.310	.2469	.6773	3.543	.8177
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCSSRM 160-123123/2- Acquired: 5/22/2014 16:52:08 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.8920	.1439	.7422	.8689	.0356	.7735	.6909
Stddev	.0023	.0037	.0011	.0055	.0111	.0037	.0029
%RSD	.2545	2.558	.1502	.6369	31.14	.4772	.4143
#1	.8932	.1438	.7411	.8728	.0234	.7696	.6924
#2	.8934	.1477	.7433	.8626	.0382	.7739	.6876
#3	.8894	.1403	.7422	.8714	.0451	.7769	.6926
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6357.0
Stddev	22.1
%RSD	.34732
#1	6347.1
#2	6382.3
#3	6341.7

Sample Name: 160-6669-A-1-E Acquired: 5/22/2014 16:55:39 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0003**	**10.23**	**.0031**	**.0125**	**.1782**	**.0002**	**.0024**	**7.416**	**<.0000**
Stddev	.0005	.04	.0007	.0045	.0006	.0000	.0016	.026	.0002
%RSD	151.1	.3511	23.60	35.77	.3330	9.873	68.81	.3499	294.5
#1	.0008	10.25	.0027	.0158	.1780	.0002	.0006	7.392	.0001
#2	.0002	10.18	.0027	.0074	.1778	.0002	.0037	7.443	-.0002
#3	-.0001	10.25	.0039	.0143	.1789	.0003	.0029	7.414	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0442**	**.2248**	**.0652**	**30.21**	**.9089**	**.0111**	**61.55**	**.7086**	**.0014**
Stddev	.0002	.0009	.0013	.09	.0191	.0008	.19	.0023	.0002
%RSD	.4684	.3928	2.051	.2884	2.107	7.274	.3090	.3257	16.38
#1	.0443	.2238	.0662	30.11	.9191	.0120	61.38	.7080	.0016
#2	.0440	.2253	.0658	30.22	.9207	.0105	61.76	.7066	.0014
#3	.0444	.2253	.0637	30.29	.8868	.0108	61.51	.7111	.0012
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.7269**	**.6503**	**.3070**	**.0813**	**.2691**	**<.0000**	**<.0000**	**.6742**	**1.369**
Stddev	.0004	.0052	.0028	.0008	.0059	.0010	.0011	.0101	.009
%RSD	.0553	.7942	.9242	1.021	2.191	149.3	358.7	1.504	.6882
#1	.7273	.6444	.3038	.0822	.2623	-.0009	-.0013	.6679	1.358
#2	.7266	.6541	.3094	.0806	.2723	-.0016	.0009	.6688	1.376
#3	.7267	.6524	.3077	.0810	.2728	.0004	-.0006	.6859	1.372
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-1-E Acquired: 5/22/2014 16:55:39 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0269	.0821	.6389	<.0000	.0039	.0462	.2015
Stddev	.0001	.0038	.0014	.0016	.0084	.0010	.0016
%RSD	.4547	4.616	.2120	114.5	214.7	2.256	.7982
#1	.0268	.0783	.6375	-.0026	-.0054	.0472	.1997
#2	.0269	.0820	.6388	.0004	.0062	.0451	.2028
#3	.0271	.0859	.6402	-.0019	.0109	.0464	.2020
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5700.4
Stddev	16.5
%RSD	.28975
#1	5718.0
#2	5685.3
#3	5697.9

Sample Name: 160-6669-A-1-E SD Acquired: 5/22/2014 16:59:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=50

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	1.983	.0004	.0020	.0349	.0001	.0003	1.437	.0000
Stddev	.0007	.011	.0011	.0014	.0005	.0002	.0008	.011	.0001
%RSD	1110.	.5735	265.8	68.99	1.368	181.1	296.5	.7683	9269.
#1	-.0008	1.986	.0008	.0021	.0348	.0000	.0012	1.444	-.0001
#2	.0006	1.971	.0012	.0032	.0344	.0000	.0000	1.424	.0001
#3	.0000	1.993	-.0008	.0005	.0354	.0003	-.0004	1.442	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0085	.0517	.0118	5.868	.1785	.0026	11.25	.1358	<.0000
Stddev	.0001	.0004	.0011	.055	.0166	.0006	.08	.0017	.0001
%RSD	.9530	.7092	9.336	.9330	9.303	22.92	.6831	1.277	1098.
#1	.0084	.0521	.0127	5.860	.1776	.0021	11.21	.1345	-.0002
#2	.0085	.0514	.0121	5.818	.1623	.0024	11.20	.1351	.0001
#3	.0086	.0517	.0106	5.927	.1955	.0032	11.34	.1378	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1802	.1294	.0572	.0162	.0491	<.0000	<.0000	.1287	.2606
Stddev	.0005	.0009	.0013	.0004	.0011	.0024	.0007	.0084	.0014
%RSD	.2821	.6871	2.254	2.363	2.295	92.63	135.2	6.492	.5214
#1	.1803	.1293	.0579	.0166	.0488	-.0034	-.0006	.1234	.2610
#2	.1806	.1285	.0558	.0159	.0482	-.0045	.0002	.1244	.2590
#3	.1796	.1303	.0580	.0161	.0504	.0001	-.0011	.1384	.2616
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-1-E SD Acquired: 5/22/2014 16:59:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=50

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0054	.0156	.1217	<.0000	<.0000	.0100	.0425
Stddev	.0005	.0028	.0008	.0018	.0045	.0023	.0005
%RSD	9.300	18.06	.6187	117.0	32.95	23.01	1.085
#1	.0052	.0177	.1224	-.0036	-.0120	.0123	.0428
#2	.0050	.0167	.1209	-.0001	-.0103	.0102	.0420
#3	.0060	.0124	.1218	-.0010	-.0188	.0077	.0428
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5800.0
Stddev	31.2
%RSD	.53843
#1	5798.9
#2	5831.7
#3	5769.3

Sample Name: 160-6669-A-2-D Acquired: 5/22/2014 17:03:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	10.65	.0044	.0097	.1303	.0003	.0045	11.20	<.0000
Stddev	.0004	.74	.0016	.0013	.0086	.0000	.0009	.84	.0000
%RSD	193.2	6.993	36.70	13.39	6.608	16.99	20.29	7.522	34.58
#1	-.0004	9.902	.0026	.0082	.1218	.0002	.0039	10.31	-.0001
#2	.0002	10.65	.0047	.0101	.1300	.0003	.0040	11.29	-.0001
#3	-.0004	11.39	.0058	.0108	.1390	.0003	.0055	11.99	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0678	.3105	.1397	30.91	.7845	.0115	67.29	.7480	.0019
Stddev	.0050	.0137	.0107	2.01	.0553	.0004	4.57	.0496	.0001
%RSD	7.383	4.418	7.679	6.516	7.055	3.295	6.788	6.626	7.232
#1	.0626	.2955	.1292	28.90	.7288	.0111	62.67	.6975	.0018
#2	.0684	.3135	.1391	30.90	.7852	.0115	67.41	.7498	.0019
#3	.0726	.3224	.1507	32.93	.8395	.0119	71.81	.7966	.0021
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.5612	1.038	.4445	.0774	.3857	.0021	<.0000	.6305	1.377
Stddev	.0372	.077	.0379	.0067	.0302	.0004	.0027	.0514	.104
%RSD	6.629	7.423	8.524	8.654	7.842	18.22	90.18	8.154	7.546
#1	.5269	.9572	.4046	.0702	.3556	.0019	-.0019	.5796	1.267
#2	.5559	1.047	.4490	.0785	.3854	.0025	-.0010	.6294	1.389
#3	.6007	1.111	.4800	.0835	.4161	.0018	-.0061	.6824	1.474
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-2-D Acquired: 5/22/2014 17:03:13 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0268	.1063	.6463	<.0000	.0438	.0463	.2303
Stddev	.0017	.0092	.0436	.0008	.0073	.0052	.0184
%RSD	6.452	8.670	6.753	77.09	16.60	11.24	7.983
#1	.0252	.0957	.6029	-.0019	.0510	.0411	.2107
#2	.0267	.1127	.6459	-.0003	.0365	.0462	.2330
#3	.0287	.1105	.6901	-.0009	.0438	.0515	.2471
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5607.7
Stddev	26.3
%RSD	.46842
#1	5612.9
#2	5579.2
#3	5630.9

Sample Name: 160-6669-A-3-D Acquired: 5/22/2014 17:06:57 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0003**	**10.71**	**.0019**	**.0067**	**.1913**	**.0002**	**.0012**	**37.34**	**<.0000**
Stddev	.0004	.58	.0009	.0014	.0099	.0000	.0019	2.70	.0001
%RSD	172.9	5.431	46.91	20.64	5.172	9.253	159.8	7.234	26.47
#1	.0004	10.15	.0009	.0083	.1815	.0002	.0017	34.48	-.0003
#2	-.0002	10.67	.0025	.0062	.1910	.0002	-.0009	37.71	-.0002
#3	.0006	11.31	.0024	.0057	.2013	.0002	.0027	39.84	-.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0510**	**.3042**	**.1266**	**26.39**	**.9262**	**.0100**	**58.45**	**.6565**	**.0002**
Stddev	.0040	.0128	.0092	1.15	.0708	.0006	2.54	.0272	.0001
%RSD	7.831	4.223	7.254	4.338	7.650	6.306	4.354	4.144	34.45
#1	.0468	.2902	.1167	25.24	.8765	.0097	55.89	.6288	.0003
#2	.0514	.3068	.1283	26.41	.8948	.0096	58.48	.6574	.0002
#3	.0547	.3155	.1348	27.53	1.007	.0107	60.98	.6832	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.7895**	**.8889**	**.4138**	**.0344**	**.3705**	**.0012**	**<.0000**	**.7202**	**.6199**
Stddev	.0461	.0665	.0329	.0025	.0276	.0008	.0021	.0382	.0457
%RSD	5.837	7.480	7.958	7.364	7.443	64.26	692.8	5.300	7.372
#1	.7459	.8183	.3787	.0319	.3409	.0014	.0020	.6924	.5717
#2	.7849	.8981	.4187	.0343	.3753	.0003	-.0021	.7046	.6255
#3	.8377	.9503	.4441	.0369	.3954	.0018	-.0008	.7638	.6625
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-3-D Acquired: 5/22/2014 17:06:57 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1064	.0895	.3604	<.0000	.0194	.0393	.1092
Stddev	.0053	.0062	.0172	.0002	.0038	.0008	.0081
%RSD	5.003	6.886	4.771	12.54	19.31	2.017	7.388
#1	.1011	.0826	.3431	-.0016	.0221	.0385	.1007
#2	.1062	.0914	.3606	-.0013	.0211	.0393	.1101
#3	.1117	.0945	.3775	-.0014	.0151	.0400	.1168
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5644.2
Stddev	29.8
%RSD	.52831
#1	5618.7
#2	5636.9
#3	5677.0

Sample Name: 160-6669-A-4-D Acquired: 5/22/2014 17:10:41 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	8.586	.0046	.0095	.1408	.0002	.0024	32.25	<.0000
Stddev	.0005	.323	.0006	.0011	.0050	.0000	.0021	2.82	.0001
%RSD	1309.	3.758	12.62	11.87	3.559	4.604	87.44	8.749	71.64
#1	-.0002	8.276	.0040	.0082	.1358	.0002	.0006	29.37	-.0003
#2	-.0005	8.563	.0052	.0100	.1407	.0002	.0018	32.37	-.0002
#3	.0005	8.920	.0046	.0104	.1458	.0002	.0047	35.01	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0517	.2718	.1039	25.67	.8059	.0084	71.58	.5817	.0003
Stddev	.0046	.0116	.0111	.93	.0145	.0003	2.65	.0219	.0004
%RSD	8.970	4.281	10.71	3.632	1.801	3.077	3.697	3.771	131.4
#1	.0468	.2607	.0930	24.78	.7899	.0085	69.04	.5609	-.0001
#2	.0522	.2709	.1034	25.61	.8183	.0087	71.36	.5796	.0005
#3	.0560	.2839	.1152	26.64	.8095	.0082	74.32	.6046	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.6124	.9897	.3315	.0247	.5805	.0016	<.0000	.3586	.6607
Stddev	.0225	.0851	.0306	.0020	.0518	.0012	.0012	.0108	.0578
%RSD	3.678	8.601	9.234	7.962	8.918	70.31	59.42	3.007	8.754
#1	.5908	.9030	.2997	.0230	.5274	.0007	-.0024	.3462	.6025
#2	.6108	.9930	.3341	.0242	.5833	.0013	-.0031	.3658	.6616
#3	.6357	1.073	.3607	.0268	.6309	.0029	-.0007	.3638	.7181
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-4-D Acquired: 5/22/2014 17:10:41 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0840	.0894	.3326	<.0000	.0047	.0357	.1372
Stddev	.0030	.0063	.0122	.0005	.0087	.0013	.0124
%RSD	3.596	7.026	3.671	29.69	184.2	3.739	9.061
#1	.0809	.0828	.3204	-.0021	-.0009	.0372	.1245
#2	.0841	.0899	.3325	-.0014	.0147	.0353	.1377
#3	.0870	.0953	.3448	-.0012	.0004	.0346	.1494
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5683.5
Stddev	4.5
%RSD	.07882
#1	5688.6
#2	5681.8
#3	5680.2

Sample Name: CCV Acquired: 5/22/2014 17:14:26 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.014**	**49.40**	**5.162**	**4.868**	**4.983**	**5.019**	**5.175**	**53.31**	**5.212**
Stddev	.010	.07	.054	.002	.072	.062	.056	.23	.044
%RSD	.9443	.1495	1.042	.0468	1.453	1.230	1.087	.4361	.8524
#1	1.003	49.38	5.100	4.867	4.911	4.950	5.112	53.06	5.161
#2	1.017	49.48	5.191	4.870	5.056	5.069	5.192	53.52	5.233
#3	1.022	49.34	5.194	4.866	4.982	5.039	5.221	53.34	5.241
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.251**	**5.214**	**5.196**	**49.62**	**50.51**	**5.057**	**48.96**	**4.985**	**1.050**
Stddev	.042	.033	.059	.19	.03	.018	.15	.014	.009
%RSD	.8062	.6394	1.144	.3900	.0576	.3566	.3143	.2833	.8211
#1	5.202	5.176	5.129	49.42	50.54	5.074	48.79	4.970	1.040
#2	5.272	5.236	5.220	49.64	50.49	5.060	49.07	4.998	1.054
#3	5.278	5.231	5.240	49.81	50.49	5.038	49.03	4.987	1.055
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**50.39**	**5.285**	**54.57**	**5.314**	**51.56**	**1.032**	**1.027**	**4.896**	**5.303**
Stddev	.04	.030	.49	.032	.50	.009	.009	.015	.030
%RSD	.0825	.5640	.9059	.6068	.9645	.8635	.8881	.3137	.5742
#1	50.44	5.251	54.01	5.277	50.99	1.022	1.016	4.882	5.268
#2	50.36	5.306	54.80	5.335	51.77	1.037	1.030	4.913	5.324
#3	50.38	5.299	54.91	5.329	51.92	1.037	1.034	4.893	5.317
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 17:14:26 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.093**	**5.116**	**5.021**	**1.075**	**5.164**	**4.973**	**5.237**
Stddev	.069	.042	.014	.009	.042	.009	.040
%RSD	1.357	.8238	.2718	.8649	.8188	.1774	.7684
#1	5.013	5.069	5.007	1.064	5.115	4.964	5.191
#2	5.129	5.129	5.022	1.080	5.190	4.982	5.258
#3	5.135	5.151	5.035	1.081	5.186	4.973	5.263
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5453.3**
Stddev	30.7
%RSD	.56326
#1	5488.2
#2	5430.2
#3	5441.5

Sample Name: CCB Acquired: 5/22/2014 17:18:14 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	<.0000	.0064	.0000	.0001	.0025	.0020	.0001
Stddev	.0004	.0054	.0012	.0021	.0001	.0000	.0006	.0025	.0001
%RSD	95.65	181.0	140.0	33.17	235.5	7.379	25.73	124.5	150.8
#1	-.0002	-.0019	.0003	.0062	.0001	.0001	.0031	.0045	.0002
#2	-.0009	-.0087	-.0009	.0086	.0000	.0001	.0026	.0022	.0001
#3	-.0002	.0018	-.0020	.0044	.0000	.0001	.0018	-.0006	-.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0005	.0007	<.0000	.0016	.0130	.0006	.0024	.0002	.0001
Stddev	.0001	.0005	.0005	.0008	.0051	.0001	.0035	.0002	.0001
%RSD	24.63	68.65	18.91	46.19	39.05	20.09	143.6	132.7	109.9
#1	.0006	.0011	-.0031	.0022	.0087	.0005	.0018	.0000	.0002
#2	.0004	.0002	-.0032	.0008	.0186	.0006	-.0007	.0000	.0001
#3	.0004	.0008	-.0022	.0019	.0118	.0007	.0062	.0004	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0217	<.0000	.0015	.0007	.0036	.0009	.0015	<.0000	.0001
Stddev	.0044	.0001	.0015	.0004	.0006	.0006	.0012	.0031	.0004
%RSD	20.10	11250.	101.1	50.93	16.75	75.23	77.64	59.71	592.5
#1	.0168	.0000	.0033	.0005	.0041	.0001	.0026	-.0069	.0006
#2	.0252	-.0001	.0003	.0011	.0038	.0013	.0018	-.0069	-.0002
#3	.0230	.0001	.0010	.0005	.0029	.0011	.0002	-.0016	-.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 17:18:14 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	<.0000	<.0000	<.0000	<.0000	<.0000	.0005
Stddev	.0000	.0021	.0002	.0004	.0094	.0037	.0002
%RSD	166.7	458.8	70.92	46.58	65.40	721.8	48.20
#1	.0000	-.0026	.0000	-.0009	-.0087	.0020	.0007
#2	.0000	-.0003	-.0004	-.0004	-.0252	.0012	.0003
#3	.0000	.0016	-.0003	-.0010	-.0091	-.0047	.0004
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5717.2
Stddev	4.6
%RSD	.07987
#1	5721.4
#2	5712.3
#3	5717.8

Sample Name: 160-6669-A-5-D Acquired: 5/22/2014 17:22:10 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	19.97	.0048	.0126	.1401	.0004	.0025	20.88	<.0000
Stddev	.0002	.94	.0018	.0016	.0065	.0000	.0005	1.70	.0000
%RSD	945.4	4.696	38.32	12.40	4.606	2.418	21.57	8.133	13.55
#1	.0001	19.12	.0031	.0116	.1338	.0004	.0031	19.13	-.0002
#2	-.0003	19.82	.0067	.0118	.1397	.0004	.0022	20.99	-.0001
#3	.0001	20.98	.0046	.0144	.1467	.0004	.0022	22.52	-.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0409	.2466	.0578	31.05	.8480	.0220	35.56	.7433	.0005
Stddev	.0034	.0106	.0046	1.40	.0439	.0010	1.57	.0318	.0003
%RSD	8.329	4.300	7.920	4.499	5.172	4.644	4.406	4.280	52.16
#1	.0373	.2349	.0533	29.66	.8042	.0213	34.01	.7117	.0004
#2	.0415	.2492	.0577	31.03	.8478	.0214	35.53	.7429	.0003
#3	.0441	.2556	.0625	32.46	.8919	.0231	37.15	.7753	.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.3153	.4400	.6827	.0139	.8479	.0008	<.0000	.4111	.5464
Stddev	.0207	.0372	.0570	.0017	.0783	.0006	.0009	.0178	.0440
%RSD	6.563	8.456	8.353	12.16	9.236	76.93	22.63	4.319	8.060
#1	.3008	.4016	.6246	.0120	.7675	.0011	-.0035	.3934	.5015
#2	.3061	.4426	.6848	.0151	.8522	.0001	-.0036	.4110	.5483
#3	.3390	.4759	.7386	.0146	.9239	.0011	-.0052	.4289	.5895
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-5-D Acquired: 5/22/2014 17:22:10 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0653	.1017	1.096	<.0000	.0294	.0604	.0935
Stddev	.0031	.0086	.050	.0017	.0075	.0033	.0079
%RSD	4.739	8.461	4.555	112.5	25.44	5.542	8.491
#1	.0622	.0919	1.047	-.0004	.0275	.0574	.0854
#2	.0652	.1050	1.094	-.0034	.0376	.0598	.0940
#3	.0684	.1082	1.147	-.0007	.0231	.0640	.1013
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5695.5
Stddev	27.1
%RSD	.47614
#1	5668.0
#2	5696.2
#3	5722.2

Sample Name: 160-6669-A-6-D Acquired: 5/22/2014 17:25:54 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0004**	**18.22**	**.0051**	**.0112**	**.1047**	**.0003**	**.0034**	**27.86**	**<.0000**
Stddev	.0004	1.16	.0017	.0034	.0063	.0000	.0016	3.85	.0001
%RSD	97.60	6.359	33.23	29.91	5.980	2.282	47.33	13.82	60.13
#1	.0006	17.07	.0034	.0109	.0985	.0003	.0023	23.97	-.0001
#2	.0005	18.19	.0051	.0081	.1046	.0003	.0027	27.94	-.0003
#3	.0000	19.39	.0068	.0147	.1110	.0003	.0053	31.67	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0463**	**.2136**	**.0695**	**26.91**	**.6634**	**.0187**	**30.16**	**.8007**	**.0004**
Stddev	.0061	.0137	.0094	1.67	.0503	.0014	1.95	.0512	.0003
%RSD	13.17	6.432	13.57	6.207	7.589	7.275	6.461	6.398	71.78
#1	.0400	.2005	.0602	25.29	.6055	.0174	28.29	.7516	.0001
#2	.0467	.2124	.0693	26.80	.6967	.0187	30.02	.7968	.0007
#3	.0522	.2279	.0791	28.63	.6881	.0201	32.18	.8538	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3853**	**.4615**	**.7123**	**.0125**	**1.221**	**.0011**	**<.0000**	**.3059**	**.6572**
Stddev	.0210	.0647	.1003	.0013	.174	.0010	.0016	.0244	.0918
%RSD	5.445	14.02	14.09	10.66	14.29	95.08	43.17	7.960	13.96
#1	.3644	.3961	.6107	.0116	1.044	-.0001	-.0020	.2781	.5644
#2	.3851	.4631	.7149	.0118	1.226	.0020	-.0039	.3160	.6592
#3	.4064	.5255	.8114	.0140	1.393	.0014	-.0053	.3236	.7479
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-6-D Acquired: 5/22/2014 17:25:54 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0624	.0866	1.100	<.0000	.0219	.0488	.1175
Stddev	.0037	.0090	.070	.0008	.0179	.0035	.0171
%RSD	5.931	10.35	6.357	41.33	81.48	7.088	14.55
#1	.0587	.0803	1.032	-.0019	.0013	.0448	.1000
#2	.0623	.0828	1.096	-.0013	.0323	.0507	.1183
#3	.0661	.0969	1.172	-.0030	.0321	.0509	.1342
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5872.7
Stddev	24.2
%RSD	.41229
#1	5850.4
#2	5898.5
#3	5869.3

Sample Name: 160-6669-A-7-D Acquired: 5/22/2014 17:29:39 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0003**	**19.13**	**.0062**	**.0143**	**.1237**	**.0004**	**.0046**	**18.83**	**<.0000**
Stddev	.0003	1.08	.0026	.0025	.0064	.0000	.0005	1.95	.0001
%RSD	104.6	5.627	41.45	17.68	5.215	.4326	10.01	10.35	29.32
#1	.0000	18.05	.0033	.0124	.1171	.0004	.0044	16.82	-.0003
#2	.0005	19.15	.0073	.0134	.1239	.0004	.0051	18.96	-.0002
#3	.0002	20.20	.0080	.0172	.1300	.0004	.0043	20.71	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0574**	**.4323**	**.1053**	**32.68**	**.8760**	**.0223**	**52.05**	**.8679**	**.0007**
Stddev	.0062	.0246	.0109	1.85	.0404	.0011	3.22	.0506	.0001
%RSD	10.84	5.695	10.38	5.647	4.608	4.720	6.184	5.826	20.05
#1	.0509	.4073	.0939	30.87	.8389	.0211	48.97	.8197	.0007
#2	.0579	.4332	.1064	32.61	.8700	.0226	51.79	.8635	.0005
#3	.0633	.4565	.1157	34.56	.9190	.0232	55.40	.9205	.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.8102**	**.7719**	**.5987**	**.0210**	**1.180**	**.0027**	**<.0000**	**.3071**	**.6468**
Stddev	.0409	.0789	.0631	.0006	.121	.0009	.0008	.0197	.0653
%RSD	5.042	10.22	10.55	2.718	10.28	32.64	29.14	6.412	10.09
#1	.7682	.6898	.5341	.0206	1.056	.0037	-.0035	.2892	.5790
#2	.8128	.7787	.6017	.0217	1.184	.0026	-.0019	.3040	.6523
#3	.8498	.8471	.6603	.0207	1.299	.0019	-.0028	.3282	.7092
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-7-D Acquired: 5/22/2014 17:29:39 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0702	.1124	1.066	<.0000	.0179	.0533	.1056
Stddev	.0034	.0078	.059	.0016	.0051	.0047	.0110
%RSD	4.879	6.903	5.523	61.77	28.60	8.906	10.42
#1	.0668	.1053	1.008	-.0022	.0123	.0496	.0942
#2	.0702	.1112	1.065	-.0013	.0194	.0516	.1064
#3	.0737	.1207	1.126	-.0044	.0222	.0587	.1162
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5663.0
Stddev	17.9
%RSD	.31566
#1	5681.7
#2	5661.4
#3	5646.0

Sample Name: 160-6669-A-8-D Acquired: 5/22/2014 17:33:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	16.37	.0088	.0085	.1227	.0004	.0035	18.25	<.0000
Stddev	.0001	.72	.0004	.0029	.0050	.0001	.0006	1.68	.0000
%RSD	285.7	4.410	4.776	34.80	4.034	14.86	17.76	9.184	28.84
#1	-.0002	15.66	.0088	.0061	.1176	.0004	.0038	16.54	-.0002
#2	.0001	16.33	.0084	.0118	.1229	.0003	.0028	18.33	-.0001
#3	.0000	17.10	.0093	.0075	.1275	.0004	.0039	19.89	-.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0568	.2570	.1044	33.02	.9557	.0206	50.05	.9787	.0003
Stddev	.0054	.0133	.0094	1.65	.0341	.0010	2.74	.0519	.0001
%RSD	9.490	5.177	9.046	5.008	3.569	4.649	5.482	5.304	33.98
#1	.0513	.2433	.0946	31.34	.9263	.0197	47.31	.9280	.0003
#2	.0570	.2578	.1052	33.06	.9477	.0205	50.04	.9762	.0003
#3	.0620	.2699	.1134	34.65	.9931	.0216	52.79	1.032	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.9764	.6269	.7045	.0261	.6126	<.0000	<.0000	.3975	.7139
Stddev	.0347	.0570	.0645	.0024	.0587	.0011	.0013	.0262	.0647
%RSD	3.551	9.095	9.153	9.369	9.582	123.0	50.36	6.580	9.057
#1	.9412	.5683	.6384	.0237	.5534	-.0021	-.0028	.3699	.6471
#2	.9774	.6303	.7077	.0261	.6136	.0001	-.0037	.4006	.7185
#3	1.010	.6822	.7672	.0286	.6708	-.0008	-.0011	.4220	.7762
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-8-D Acquired: 5/22/2014 17:33:23 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0574	.1047	1.074	<.0000	.0033	.0585	.1195
Stddev	.0024	.0060	.053	.0015	.0084	.0044	.0108
%RSD	4.108	5.732	4.939	67.92	250.8	7.518	9.068
#1	.0550	.0982	1.020	-.0007	.0114	.0556	.1084
#2	.0575	.1061	1.075	-.0025	.0039	.0562	.1200
#3	.0597	.1100	1.126	-.0037	-.0053	.0635	.1301
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5786.9
Stddev	54.2
%RSD	.93603
#1	5840.5
#2	5788.0
#3	5732.2

Sample Name: 160-6669-A-9-D Acquired: 5/22/2014 17:37:06 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0009**	**16.52**	**.0067**	**.0061**	**.2602**	**.0003**	**.0037**	**12.74**	**.0007**
Stddev	.0009	.37	.0012	.0033	.0054	.0000	.0012	1.13	.0001
%RSD	101.0	2.221	17.60	54.14	2.069	7.548	33.70	8.875	16.81
#1	.0002	16.26	.0054	.0025	.2565	.0003	.0051	11.62	.0007
#2	.0005	16.35	.0071	.0070	.2578	.0004	.0029	12.72	.0007
#3	.0018	16.94	.0077	.0089	.2664	.0003	.0031	13.88	.0009
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0513**	**.3268**	**1.400**	**35.71**	**.8436**	**.0179**	**46.60**	**.8777**	**.0009**
Stddev	.0051	.0107	.128	.91	.0193	.0005	1.45	.0270	.0002
%RSD	9.976	3.288	9.154	2.554	2.283	2.674	3.113	3.074	18.78
#1	.0460	.3162	1.274	34.85	.8643	.0178	45.17	.8526	.0007
#2	.0515	.3267	1.398	35.60	.8263	.0176	46.55	.8742	.0011
#3	.0563	.3377	1.530	36.67	.8401	.0185	48.07	.9063	.0010
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.1896**	**.7326**	**.5657**	**.2532**	**.4145**	**.0007**	**<.0000**	**.4774**	**.3930**
Stddev	.0056	.0658	.0524	.0228	.0339	.0011	.0017	.0130	.0354
%RSD	2.934	8.983	9.264	8.988	8.178	170.9	64.45	2.719	9.018
#1	.1855	.6672	.5124	.2304	.3816	.0004	-.0008	.4639	.3575
#2	.1959	.7318	.5675	.2532	.4127	-.0003	-.0031	.4786	.3931
#3	.1874	.7988	.6171	.2759	.4493	.0019	-.0042	.4898	.4284
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-9-D Acquired: 5/22/2014 17:37:06 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0399	.1126	.8920	<.0000	.0139	.0649	.5807
Stddev	.0008	.0069	.0224	.0010	.0042	.0013	.0540
%RSD	1.926	6.098	2.509	36.10	30.02	2.068	9.306
#1	.0395	.1053	.8728	-.0019	.0114	.0637	.5270
#2	.0396	.1138	.8867	-.0037	.0115	.0648	.5800
#3	.0408	.1188	.9166	-.0024	.0187	.0663	.6351
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5691.4
Stddev	4.3
%RSD	.07559
#1	5686.5
#2	5694.5
#3	5693.3

Sample Name: 160-6669-A-10-D Acquired: 5/22/2014 17:40:49 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**14.22**	**.0118**	**.0032**	**.1789**	**.0003**	**.0035**	**27.52**	**.0003**
Stddev	.0005	.46	.0012	.0021	.0062	.0001	.0014	2.21	.0001
%RSD	274.6	3.212	9.803	65.72	3.489	20.13	41.22	8.042	46.05
#1	.0000	13.76	.0109	.0046	.1724	.0002	.0044	25.27	.0002
#2	-.0002	14.25	.0131	.0041	.1795	.0003	.0043	27.61	.0002
#3	.0007	14.67	.0113	.0008	.1849	.0003	.0018	29.69	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0397**	**.2214**	**.6483**	**27.90**	**.8830**	**.0130**	**34.90**	**.7316**	**.0004**
Stddev	.0028	.0071	.0526	.88	.0418	.0008	.95	.0203	.0002
%RSD	6.973	3.198	8.120	3.158	4.730	6.385	2.729	2.780	42.90
#1	.0369	.2142	.5939	27.01	.8559	.0121	33.96	.7112	.0002
#2	.0396	.2216	.6522	27.92	.8620	.0136	34.88	.7316	.0006
#3	.0425	.2283	.6989	28.77	.9311	.0133	35.86	.7519	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3428**	**.4687**	**.4862**	**.1010**	**.3403**	**.0008**	**<.0000**	**.2648**	**.5261**
Stddev	.0093	.0383	.0388	.0081	.0279	.0008	.0010	.0085	.0426
%RSD	2.702	8.179	7.981	8.039	8.184	91.01	42.19	3.208	8.093
#1	.3324	.4293	.4480	.0933	.3136	.0005	-.0037	.2564	.4821
#2	.3462	.4709	.4849	.1002	.3381	.0017	-.0020	.2646	.5290
#3	.3500	.5058	.5256	.1095	.3692	.0003	-.0018	.2734	.5671
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-10-D Acquired: 5/22/2014 17:40:49 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0706	.0833	.9558	<.0000	.0095	.0521	.2704
Stddev	.0024	.0051	.0295	.0010	.0009	.0021	.0223
%RSD	3.437	6.160	3.089	48.04	9.888	4.001	8.251
#1	.0681	.0773	.9261	-.0028	.0106	.0507	.2476
#2	.0709	.0863	.9562	-.0009	.0088	.0510	.2715
#3	.0730	.0861	.9851	-.0022	.0092	.0545	.2922
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5894.5
Stddev	1.7
%RSD	.02812
#1	5893.5
#2	5896.4
#3	5893.6

Sample Name: 160-6669-A-11-D Acquired: 5/22/2014 17:44:33 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	13.43	.0030	.0066	.1191	.0003	.0049	23.20	<.0000
Stddev	.0003	.80	.0012	.0016	.0072	.0000	.0016	2.23	.0000
%RSD	116.1	5.943	39.62	24.41	6.056	10.85	32.74	9.636	13.99
#1	-.0004	12.71	.0016	.0072	.1122	.0003	.0068	20.88	-.0003
#2	-.0005	13.31	.0037	.0047	.1184	.0003	.0039	23.38	-.0002
#3	.0001	14.29	.0038	.0078	.1266	.0003	.0041	25.34	-.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0691	.3080	.0485	29.74	.7888	.0134	68.69	.7554	.0001
Stddev	.0066	.0200	.0057	1.92	.0359	.0004	4.76	.0498	.0002
%RSD	9.606	6.490	11.67	6.458	4.557	2.866	6.929	6.587	159.1
#1	.0622	.2875	.0432	27.80	.7850	.0131	63.99	.7065	-.0001
#2	.0697	.3089	.0479	29.78	.7549	.0132	68.56	.7537	.0002
#3	.0755	.3274	.0545	31.64	.8265	.0138	73.51	.8060	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.4368	1.070	.5158	.0153	.7555	<.0000	<.0000	.2114	.4683
Stddev	.0214	.101	.0542	.0013	.0728	.0001	.0021	.0124	.0461
%RSD	4.889	9.452	10.50	8.426	9.639	4.847	102.4	5.849	9.841
#1	.4165	.9645	.4602	.0141	.6797	-.0019	-.0026	.1992	.4208
#2	.4347	1.079	.5188	.0153	.7621	-.0018	.0003	.2112	.4712
#3	.4591	1.166	.5685	.0167	.8249	-.0019	-.0038	.2239	.5128
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-11-D Acquired: 5/22/2014 17:44:33 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0539	.1065	.7690	<.0000	.0237	.0436	.0839
Stddev	.0033	.0055	.0487	.0017	.0058	.0037	.0083
%RSD	6.146	5.136	6.338	54.89	24.49	8.404	9.843
#1	.0507	.1002	.7213	-.0030	.0185	.0415	.0754
#2	.0536	.1092	.7669	-.0048	.0300	.0414	.0844
#3	.0573	.1101	.8187	-.0014	.0227	.0478	.0919
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5653.2
Stddev	20.9
%RSD	.36930
#1	5676.9
#2	5637.5
#3	5645.2

Sample Name: 160-6669-A-12-D Acquired: 5/22/2014 17:48:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	13.91	.0023	.0073	.1454	.0002	.0007	15.83	<.0000
Stddev	.0004	.48	.0014	.0011	.0045	.0000	.0013	1.28	.0001
%RSD	2687.	3.469	61.00	15.36	3.078	12.80	175.5	8.109	63.77
#1	-.0002	13.43	.0008	.0085	.1413	.0002	.0019	14.55	-.0001
#2	-.0002	13.90	.0036	.0062	.1449	.0003	.0010	15.83	-.0002
#3	.0005	14.39	.0026	.0072	.1502	.0002	-.0006	17.12	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0616	.3281	.0507	31.71	.8108	.0152	70.26	.8651	<.0000
Stddev	.0050	.0107	.0033	1.02	.0217	.0009	2.52	.0294	.0002
%RSD	8.167	3.267	6.560	3.214	2.672	5.652	3.591	3.394	215.6
#1	.0565	.3174	.0472	30.79	.7887	.0152	67.89	.8370	-.0003
#2	.0615	.3281	.0511	31.54	.8116	.0143	69.96	.8627	.0000
#3	.0666	.3388	.0538	32.80	.8320	.0161	72.91	.8955	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.4387	.9524	.4978	.0115	.3883	.0006	<.0000	.2038	.3039
Stddev	.0108	.0765	.0451	.0009	.0363	.0018	.0036	.0068	.0241
%RSD	2.472	8.032	9.059	8.116	9.353	301.6	398.8	3.341	7.941
#1	.4266	.8752	.4521	.0105	.3522	.0026	.0002	.1960	.2798
#2	.4423	.9538	.4990	.0120	.3878	-.0001	.0020	.2067	.3040
#3	.4474	1.028	.5423	.0121	.4248	-.0008	-.0049	.2087	.3281
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-12-D Acquired: 5/22/2014 17:48:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0518	.1066	.8486	<.0000	.0053	.0476	.0745
Stddev	.0016	.0067	.0278	.0013	.0097	.0037	.0062
%RSD	3.148	6.251	3.274	61.94	183.1	7.787	8.309
#1	.0502	.0989	.8223	-.0007	-.0059	.0443	.0684
#2	.0516	.1111	.8457	-.0023	.0103	.0468	.0744
#3	.0535	.1097	.8777	-.0032	.0115	.0516	.0808
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5704.7
Stddev	13.6
%RSD	.23842
#1	5696.7
#2	5720.4
#3	5697.0

Sample Name: 160-6669-A-13-D Acquired: 5/22/2014 17:52:01 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	20.34	.0002	.0131	.2578	.0004	.0046	24.57	<.0000
Stddev	.0003	1.02	.0010	.0027	.0122	.0000	.0019	2.11	.0002
%RSD	83.94	4.990	588.4	20.27	4.717	5.908	39.93	8.604	265.1
#1	.0000	19.36	.0012	.0148	.2463	.0004	.0027	22.42	.0001
#2	-.0007	20.27	.0001	.0100	.2568	.0003	.0064	24.65	-.0003
#3	-.0005	21.38	-.0008	.0145	.2705	.0004	.0048	26.65	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0532	.2582	.0976	38.72	.9557	.0138	43.38	.7976	.0004
Stddev	.0044	.0118	.0084	1.80	.0536	.0020	2.04	.0390	.0002
%RSD	8.207	4.561	8.601	4.650	5.608	14.59	4.700	4.892	41.35
#1	.0487	.2471	.0889	37.02	.8971	.0123	41.44	.7604	.0004
#2	.0535	.2571	.0982	38.53	.9680	.0131	43.20	.7943	.0005
#3	.0574	.2705	.1057	40.60	1.002	.0161	45.50	.8382	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	1.474	.5690	.5294	.0163	1.135	<.0000	<.0000	.3587	1.069
Stddev	.068	.0482	.0460	.0014	.093	.0012	.0020	.0122	.091
%RSD	4.591	8.478	8.697	8.507	8.232	899.2	144.1	3.407	8.526
#1	1.407	.5196	.4833	.0147	1.039	.0010	.0008	.3449	.9758
#2	1.472	.5715	.5296	.0171	1.139	.0000	-.0019	.3628	1.075
#3	1.543	.6160	.5754	.0171	1.226	-.0013	-.0030	.3683	1.158
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-13-D Acquired: 5/22/2014 17:52:01 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0698	.1212	1.619	<.0000	.0299	.0792	.1203
Stddev	.0032	.0010	.076	.0003	.0083	.0049	.0100
%RSD	4.580	.8191	4.670	13.29	27.63	6.207	8.302
#1	.0667	.1201	1.546	-.0022	.0219	.0757	.1102
#2	.0696	.1216	1.614	-.0021	.0295	.0770	.1206
#3	.0731	.1219	1.697	-.0026	.0384	.0848	.1302
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5845.5
Stddev	9.1
%RSD	.15508
#1	5845.8
#2	5854.4
#3	5836.3

Sample Name: 160-6669-A-14-D Acquired: 5/22/2014 17:55:44 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0000**	**17.95**	**.0075**	**.0090**	**.1301**	**.0004**	**.0043**	**20.20**	**<.0000**
Stddev	.0003	.80	.0015	.0024	.0061	.0000	.0029	2.06	.0001
%RSD	2903.	4.467	20.55	26.60	4.714	8.818	67.06	10.20	53.24
#1	-.0003	17.18	.0057	.0115	.1242	.0003	.0011	18.05	-.0002
#2	.0000	17.90	.0084	.0087	.1296	.0004	.0051	20.38	-.0001
#3	.0003	18.78	.0085	.0067	.1365	.0004	.0066	22.16	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0478**	**.2343**	**.1332**	**35.26**	**1.001**	**.0218**	**36.28**	**.9610**	**.0005**
Stddev	.0048	.0120	.0133	1.69	.039	.0010	1.69	.0422	.0003
%RSD	10.00	5.125	9.988	4.778	3.886	4.523	4.662	4.389	48.24
#1	.0428	.2215	.1193	33.65	.9639	.0213	34.63	.9198	.0007
#2	.0482	.2360	.1346	35.13	.9984	.0210	36.21	.9593	.0002
#3	.0523	.2453	.1458	37.01	1.042	.0229	38.01	1.004	.0007
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.342**	**.5167**	**.7012**	**.0332**	**.8142**	**.0020**	**<.0000**	**.4410**	**.8401**
Stddev	.059	.0529	.0743	.0029	.0856	.0019	.0039	.0202	.0854
%RSD	4.401	10.24	10.59	8.681	10.52	96.11	89.85	4.590	10.17
#1	1.286	.4618	.6242	.0302	.7234	.0002	-.0032	.4215	.7517
#2	1.335	.5210	.7069	.0335	.8257	.0017	-.0088	.4394	.8465
#3	1.403	.5674	.7724	.0359	.8935	.0040	-.0012	.4619	.9222
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-14-D Acquired: 5/22/2014 17:55:44 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0626	.1118	1.069	<.0000	.0338	.0632	.1376
Stddev	.0029	.0043	.050	.0017	.0097	.0013	.0146
%RSD	4.669	3.885	4.689	54.46	28.60	2.046	10.59
#1	.0600	.1079	1.021	-.0017	.0361	.0617	.1224
#2	.0622	.1111	1.065	-.0027	.0422	.0640	.1388
#3	.0658	.1165	1.121	-.0051	.0233	.0638	.1515
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5718.6
Stddev	24.7
%RSD	.43162
#1	5705.4
#2	5703.3
#3	5747.1

Sample Name: CCV Acquired: 5/22/2014 17:59:28 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.025**	**50.05**	**5.103**	**4.941**	**5.048**	**5.006**	**5.140**	**52.98**	**5.149**
Stddev	.004	.09	.018	.019	.006	.030	.018	.11	.012
%RSD	.3899	.1879	.3467	.3892	.1206	.5966	.3605	.2108	.2262
#1	1.020	50.14	5.123	4.919	5.054	5.014	5.161	52.86	5.160
#2	1.027	49.95	5.098	4.957	5.042	4.973	5.133	53.02	5.150
#3	1.028	50.06	5.089	4.946	5.046	5.031	5.126	53.07	5.137
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.262**	**5.214**	**5.146**	**49.50**	**51.82**	**5.252**	**48.29**	**4.944**	**1.045**
Stddev	.004	.013	.021	.16	.26	.032	.15	.005	.002
%RSD	.0679	.2411	.4101	.3178	.5079	.5990	.3196	.0946	.2284
#1	5.264	5.201	5.169	49.32	51.97	5.275	48.20	4.940	1.048
#2	5.258	5.213	5.138	49.58	51.52	5.216	48.21	4.942	1.045
#3	5.264	5.227	5.129	49.60	51.99	5.264	48.47	4.949	1.043
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**52.12**	**5.204**	**54.64**	**5.255**	**51.15**	**1.023**	**1.023**	**4.880**	**5.230**
Stddev	.24	.004	.04	.005	.14	.004	.001	.002	.003
%RSD	.4594	.0867	.0732	.1053	.2808	.4305	.0651	.0460	.0475
#1	52.20	5.207	54.63	5.258	51.32	1.028	1.023	4.882	5.232
#2	51.86	5.206	54.60	5.258	51.07	1.023	1.023	4.879	5.231
#3	52.32	5.198	54.68	5.249	51.07	1.019	1.024	4.878	5.227
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 17:59:28 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.110**	**5.214**	**5.021**	**1.078**	**5.198**	**4.996**	**5.198**
Stddev	.047	.012	.007	.004	.021	.021	.008
%RSD	.9184	.2197	.1373	.3427	.4114	.4304	.1537
#1	5.074	5.201	5.013	1.078	5.189	4.982	5.207
#2	5.093	5.220	5.025	1.082	5.182	4.985	5.193
#3	5.163	5.222	5.026	1.074	5.222	5.020	5.194
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5498.6**
Stddev	11.7
%RSD	.21207
#1	5511.1
#2	5496.7
#3	5488.0

Sample Name: CCB Acquired: 5/22/2014 18:03:16 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0003**	**<.0000**	**.0079**	**<.0000**	**.0000**	**.0022**	**.0006**	**.0001**
Stddev	.0002	.0042	.0011	.0009	.0000	.0000	.0003	.0010	.0001
%RSD	227.0	1202.	130.7	11.65	38.23	745.7	12.65	180.9	72.31
#1	.0001	.0042	.0004	.0071	-.0001	.0000	.0023	-.0002	.0000
#2	-.0001	-.0040	-.0017	.0077	-.0001	.0000	.0019	.0002	.0001
#3	.0002	.0008	-.0013	.0089	-.0001	.0000	.0023	.0017	.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0001**	**.0018**	**<.0000**	**.0016**	**.0271**	**.0006**	**<.0000**	**.0003**	**.0002**
Stddev	.0001	.0006	.0013	.0002	.0056	.0003	.0043	.0000	.0001
%RSD	48.50	31.17	78.92	15.37	20.73	47.99	51.82	11.83	47.26
#1	.0001	.0015	-.0002	.0015	.0318	.0004	-.0069	.0004	.0004
#2	.0002	.0025	-.0020	.0015	.0209	.0004	-.0132	.0003	.0002
#3	.0001	.0015	-.0028	.0019	.0285	.0009	-.0049	.0003	.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0158**	**.0003**	**.0010**	**<.0000**	**.0042**	**.0005**	**<.0000**	**<.0000**	**<.0000**
Stddev	.0028	.0001	.0008	.0008	.0024	.0005	.0024	.0029	.0002
%RSD	17.62	31.28	81.53	443.0	57.23	96.76	4867.	220.0	86.38
#1	.0190	.0002	.0019	.0000	.0053	.0005	-.0027	-.0020	-.0006
#2	.0147	.0004	.0008	-.0010	.0014	.0000	.0017	.0018	-.0001
#3	.0138	.0003	.0003	.0005	.0057	.0010	.0008	-.0038	-.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 18:03:16 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	.0027	<.0000	.0001	.0004	.0012	.0002
Stddev	.0000	.0026	.0007	.0001	.0061	.0006	.0001
%RSD	148.5	98.17	264.4	175.2	1584.	49.67	49.98
#1	.0000	.0002	-.0001	.0001	.0074	.0008	.0002
#2	.0001	.0025	-.0010	-.0001	-.0023	.0018	.0003
#3	.0000	.0054	.0003	.0001	-.0039	.0009	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5703.6
Stddev	37.5
%RSD	.65831
#1	5732.7
#2	5716.8
#3	5661.2

Sample Name: 160-6669-A-15-D Acquired: 5/22/2014 18:07:12 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	20.62	.0063	.0097	.0885	.0005	.0048	18.22	<.0000
Stddev	.0004	.68	.0005	.0020	.0025	.0000	.0013	2.26	.0001
%RSD	436.7	3.275	7.796	20.66	2.838	8.219	26.79	12.40	52.78
#1	.0003	19.93	.0058	.0075	.0858	.0004	.0041	15.97	-.0001
#2	-.0003	20.66	.0063	.0104	.0889	.0005	.0063	18.20	-.0001
#3	-.0003	21.28	.0068	.0114	.0907	.0005	.0041	20.49	-.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0381	.1961	.0543	33.95	.9219	.0305	34.33	.9188	.0001
Stddev	.0051	.0090	.0084	1.20	.0169	.0008	1.41	.0363	.0001
%RSD	13.36	4.614	15.46	3.543	1.832	2.537	4.099	3.950	72.56
#1	.0329	.1879	.0466	32.71	.9025	.0297	32.94	.8841	.0001
#2	.0383	.1946	.0532	34.03	.9332	.0306	34.30	.9157	.0001
#3	.0431	.2058	.0633	35.11	.9300	.0312	35.75	.9565	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.5295	.3743	.7147	.0218	.5158	.0021	<.0000	.3179	1.256
Stddev	.0070	.0466	.0907	.0025	.0693	.0007	.0009	.0102	.155
%RSD	1.327	12.45	12.69	11.60	13.43	35.10	72.27	3.195	12.30
#1	.5215	.3275	.6244	.0189	.4467	.0021	-.0022	.3066	1.100
#2	.5323	.3746	.7138	.0231	.5153	.0013	-.0009	.3209	1.258
#3	.5348	.4207	.8058	.0235	.5853	.0028	-.0005	.3263	1.409
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-15-D Acquired: 5/22/2014 18:07:12 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0447	.1041	.7627	<.0000	.0308	.0581	.0995
Stddev	.0012	.0048	.0254	.0009	.0070	.0033	.0129
%RSD	2.614	4.565	3.325	43.28	22.67	5.705	13.00
#1	.0434	.1018	.7361	-.0027	.0331	.0552	.0865
#2	.0449	.1010	.7654	-.0011	.0229	.0575	.0996
#3	.0457	.1096	.7866	-.0027	.0363	.0617	.1124
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5869.1
Stddev	23.9
%RSD	.40691
#1	5891.9
#2	5871.1
#3	5844.3

Sample Name: 160-6669-A-16-D Acquired: 5/22/2014 18:10:55 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0004	19.33	.0059	.0138	.1459	.0004	.0037	16.90	<.0000
Stddev	.0006	.20	.0013	.0019	.0012	.0000	.0005	.94	.0000
%RSD	180.6	1.052	21.86	13.62	.8120	5.856	13.99	5.545	41.00
#1	-.0003	19.14	.0051	.0135	.1448	.0003	.0042	15.99	-.0001
#2	.0004	19.31	.0053	.0158	.1457	.0004	.0036	16.84	-.0001
#3	.0010	19.54	.0074	.0121	.1472	.0003	.0032	17.86	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0346	.2022	.0394	32.32	.9400	.0241	39.67	.9620	.0003
Stddev	.0020	.0019	.0013	.23	.0204	.0008	.26	.0066	.0001
%RSD	5.728	.9625	3.324	.7138	2.166	3.525	.6605	.6867	41.91
#1	.0330	.2002	.0387	32.12	.9268	.0237	39.42	.9569	.0002
#2	.0340	.2023	.0386	32.25	.9634	.0235	39.64	.9596	.0003
#3	.0368	.2040	.0409	32.57	.9298	.0250	39.94	.9695	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.6430	.3951	.5580	.0081	.3796	.0002	.0008	.6155	.3578
Stddev	.0096	.0231	.0314	.0003	.0213	.0012	.0026	.0091	.0207
%RSD	1.486	5.850	5.629	4.025	5.603	825.5	332.3	1.479	5.774
#1	.6344	.3736	.5287	.0084	.3611	-.0005	.0039	.6152	.3390
#2	.6413	.3921	.5540	.0078	.3750	-.0006	-.0007	.6065	.3545
#3	.6533	.4196	.5911	.0080	.4028	.0016	-.0008	.6247	.3799
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-16-D Acquired: 5/22/2014 18:10:55 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0645	.0862	.9734	<.0000	.0134	.0556	.0712
Stddev	.0005	.0029	.0080	.0013	.0094	.0044	.0041
%RSD	.7873	3.342	.8230	48.54	69.98	7.953	5.767
#1	.0641	.0853	.9668	-.0014	.0192	.0587	.0675
#2	.0643	.0839	.9712	-.0028	.0185	.0505	.0704
#3	.0651	.0894	.9823	-.0040	.0026	.0576	.0756
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5780.0
Stddev	9.7
%RSD	.16786
#1	5770.6
#2	5790.0
#3	5779.4

Sample Name: 160-6669-A-17-D Acquired: 5/22/2014 18:14:40 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0003**	**14.53**	**.0070**	**.0102**	**.0829**	**.0003**	**.0006**	**17.17**	**<.0000**
Stddev	.0007	.40	.0004	.0023	.0020	.0000	.0011	1.71	.0001
%RSD	279.1	2.756	6.119	22.85	2.450	10.04	183.3	9.964	124.4
#1	.0005	14.15	.0073	.0129	.0811	.0003	.0001	15.42	.0000
#2	-.0006	14.50	.0065	.0087	.0826	.0003	.0019	17.25	-.0002
#3	.0008	14.95	.0072	.0090	.0851	.0003	-.0002	18.84	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0310**	**.1279**	**.0407**	**26.62**	**.7895**	**.0210**	**25.39**	**.7898**	**.0004**
Stddev	.0030	.0053	.0037	.60	.0194	.0007	.55	.0188	.0001
%RSD	9.765	4.119	9.045	2.238	2.459	3.217	2.169	2.378	22.86
#1	.0279	.1229	.0364	26.08	.7763	.0210	24.87	.7714	.0003
#2	.0311	.1275	.0427	26.51	.7805	.0204	25.33	.7890	.0003
#3	.0339	.1334	.0430	27.26	.8118	.0217	25.97	.8089	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.5303**	**.3028**	**.5484**	**.0113**	**.3203**	**.0007**	**<.0000**	**.5129**	**.5297**
Stddev	.0140	.0299	.0536	.0004	.0331	.0007	.0005	.0078	.0512
%RSD	2.635	9.876	9.781	3.910	10.34	103.1	19.33	1.516	9.662
#1	.5165	.2719	.4933	.0111	.2872	.0000	-.0025	.5047	.4771
#2	.5301	.3049	.5516	.0118	.3203	.0006	-.0022	.5136	.5327
#3	.5445	.3316	.6004	.0111	.3534	.0014	-.0033	.5202	.5794
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-17-D Acquired: 5/22/2014 18:14:40 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0617	.0735	.5694	<.0000	.0095	.0454	.0665
Stddev	.0014	.0026	.0123	.0008	.0085	.0007	.0064
%RSD	2.199	3.526	2.152	37.59	89.44	1.642	9.589
#1	.0606	.0763	.5584	-.0029	.0066	.0457	.0599
#2	.0614	.0729	.5674	-.0015	.0191	.0446	.0668
#3	.0632	.0712	.5826	-.0017	.0029	.0460	.0727
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5810.9
Stddev	2.0
%RSD	.03386
#1	5813.2
#2	5809.6
#3	5810.0

Sample Name: 160-6669-A-18-D Acquired: 5/22/2014 18:18:25 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	28.91	.0108	.0110	.1875	.0005	.0046	23.90	<.0000
Stddev	.0003	.69	.0006	.0019	.0040	.0000	.0010	1.95	.0000
%RSD	238.0	2.374	5.770	17.64	2.111	5.841	21.89	8.145	8.271
#1	.0002	28.29	.0103	.0091	.1839	.0005	.0053	21.96	-.0003
#2	-.0003	28.81	.0105	.0130	.1868	.0005	.0034	23.88	-.0003
#3	-.0003	29.65	.0115	.0109	.1918	.0005	.0050	25.85	-.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0571	.4488	.0554	42.10	.9566	.0363	78.01	1.027	.0005
Stddev	.0049	.0125	.0027	.65	.0267	.0012	1.31	.018	.0000
%RSD	8.647	2.796	4.832	1.554	2.788	3.413	1.674	1.748	7.020
#1	.0520	.4380	.0535	41.49	.9295	.0353	76.84	1.010	.0005
#2	.0574	.4459	.0541	42.03	.9574	.0358	77.78	1.025	.0006
#3	.0619	.4626	.0584	42.79	.9828	.0377	79.42	1.045	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.2811	.8416	.6244	.0124	1.171	.0021	<.0000	.5023	.4854
Stddev	.0051	.0674	.0534	.0010	.097	.0004	.0033	.0085	.0409
%RSD	1.827	8.005	8.551	8.064	8.292	16.74	611.2	1.683	8.434
#1	.2782	.7737	.5709	.0115	1.073	.0019	-.0017	.4936	.4451
#2	.2780	.8428	.6247	.0122	1.173	.0025	.0032	.5028	.4840
#3	.2870	.9085	.6777	.0134	1.267	.0020	-.0031	.5105	.5270
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-18-D Acquired: 5/22/2014 18:18:25 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1074	.1273	1.418	<.0000	.0341	.0723	.1026
Stddev	.0021	.0071	.028	.0006	.0066	.0020	.0088
%RSD	1.963	5.614	1.952	27.37	19.45	2.836	8.576
#1	.1054	.1246	1.392	-.0028	.0277	.0716	.0936
#2	.1072	.1219	1.415	-.0017	.0409	.0707	.1029
#3	.1096	.1354	1.447	-.0018	.0337	.0746	.1112
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5732.9
Stddev	20.5
%RSD	.35787
#1	5711.0
#2	5751.7
#3	5736.0

Sample Name: 160-6669-A-19-D Acquired: 5/22/2014 18:22:09 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0004	10.14	.0087	.0071	.1893	.0003	.0009	9.200	.0032
Stddev	.0006	.21	.0025	.0005	.0036	.0000	.0011	.861	.0002
%RSD	144.2	2.077	29.00	6.815	1.879	9.378	120.9	9.362	7.255
#1	.0009	9.921	.0063	.0073	.1859	.0003	.0013	8.343	.0030
#2	.0007	10.15	.0084	.0065	.1890	.0002	.0017	9.191	.0031
#3	-.0003	10.34	.0113	.0074	.1930	.0003	-.0003	10.07	.0034
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0185	.2300	3.051	26.84	.7006	.0122	10.08	.6313	.0017
Stddev	.0019	.0060	.302	.48	.0183	.0003	.20	.0126	.0002
%RSD	10.16	2.616	9.914	1.786	2.618	2.798	2.017	1.988	15.02
#1	.0169	.2240	2.745	26.38	.6796	.0125	9.860	.6192	.0015
#2	.0180	.2302	3.059	26.81	.7087	.0118	10.11	.6304	.0015
#3	.0206	.2360	3.350	27.33	.7136	.0123	10.26	.6443	.0019
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.1819	.1240	.4832	.3901	.2695	.0062	.0022	.4910	1.751
Stddev	.0071	.0122	.0495	.0374	.0286	.0010	.0014	.0108	.168
%RSD	3.911	9.810	10.25	9.591	10.63	15.84	64.16	2.204	9.568
#1	.1751	.1118	.4336	.3523	.2384	.0052	.0010	.4822	1.582
#2	.1814	.1242	.4835	.3909	.2753	.0072	.0019	.4876	1.755
#3	.1893	.1361	.5326	.4271	.2948	.0062	.0037	.5031	1.917
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-19-D Acquired: 5/22/2014 18:22:09 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0258	.0759	.5369	<.0000	.0088	.0463	2.021
Stddev	.0004	.0022	.0112	.0005	.0063	.0024	.201
%RSD	1.644	2.936	2.090	44.08	71.47	5.106	9.926
#1	.0254	.0760	.5252	-.0007	.0036	.0446	1.820
#2	.0257	.0736	.5378	-.0017	.0157	.0453	2.024
#3	.0262	.0780	.5476	-.0013	.0069	.0490	2.221
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5808.7
Stddev	6.3
%RSD	.10847
#1	5814.1
#2	5801.8
#3	5810.2

Sample Name: 160-6669-A-20-D Acquired: 5/22/2014 18:25:51 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0003**	**26.39**	**.0023**	**.0170**	**.2363**	**.0003**	**.0007**	**30.43**	**<.0000**
Stddev	.0002	.52	.0012	.0013	.0047	.0001	.0017	3.59	.0001
%RSD	66.51	1.980	50.96	7.612	1.979	20.88	234.3	11.81	45.77
#1	.0001	25.89	.0032	.0185	.2323	.0002	.0016	26.82	-.0001
#2	.0004	26.35	.0010	.0165	.2353	.0003	-.0012	30.46	-.0003
#3	.0005	26.93	.0026	.0160	.2414	.0003	.0018	34.01	-.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0501**	**.1728**	**.0652**	**35.66**	**.6798**	**.0252**	**35.95**	**.8354**	**.0002**
Stddev	.0059	.0049	.0081	.74	.0165	.0002	.79	.0177	.0001
%RSD	11.86	2.850	12.50	2.067	2.424	.8773	2.192	2.113	80.84
#1	.0441	.1676	.0571	34.96	.6657	.0254	35.13	.8164	.0001
#2	.0502	.1734	.0650	35.60	.6757	.0250	36.02	.8384	.0003
#3	.0560	.1774	.0734	36.43	.6979	.0253	36.70	.8513	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.2482**	**.3344**	**.5911**	**.0061**	**.7000**	**<.0000**	**<.0000**	**.3211**	**.6106**
Stddev	.0094	.0397	.0694	.0019	.0860	.0024	.0024	.0053	.0726
%RSD	3.786	11.88	11.74	31.88	12.28	97.55	210.7	1.637	11.89
#1	.2387	.2944	.5236	.0046	.6135	-.0012	.0006	.3159	.5378
#2	.2484	.3351	.5874	.0054	.7010	-.0010	-.0001	.3210	.6109
#3	.2575	.3738	.6622	.0083	.7855	-.0053	-.0038	.3264	.6830
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6669-A-20-D Acquired: 5/22/2014 18:25:51 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0885	.1007	1.690	<.0000	.0215	.0618	.0977
Stddev	.0016	.0054	.035	.0005	.0052	.0027	.0124
%RSD	1.835	5.391	2.057	27.60	24.30	4.383	12.70
#1	.0872	.0948	1.657	-.0016	.0185	.0606	.0853
#2	.0881	.1020	1.686	-.0013	.0184	.0599	.0976
#3	.0903	.1054	1.726	-.0022	.0275	.0649	.1101
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5820.7
Stddev	18.1
%RSD	.31171
#1	5812.8
#2	5808.0
#3	5841.5

Sample Name: MB 160-122573/1-A Acquired: 5/22/2014 18:29:35 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0125	<.0000	.0104	.0004	<.0000	.0005	.0548	.0001
Stddev	.0002	.0102	.0011	.0016	.0001	.0000	.0019	.0031	.0001
%RSD	67.94	81.28	93.67	15.15	25.10	21.59	352.3	5.570	66.50
#1	-.0003	.0102	-.0006	.0120	.0004	-.0001	.0023	.0532	.0001
#2	-.0004	.0037	-.0024	.0102	.0003	-.0001	.0006	.0583	.0001
#3	-.0001	.0237	-.0004	.0088	.0005	.0000	-.0014	.0529	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	.0006	<.0000	.0146	<.0000	.0001	.0236	.0004	.0000
Stddev	.0001	.0010	.0014	.0013	.0100	.0001	.0088	.0002	.0001
%RSD	1467.	152.3	244.9	8.650	204.5	144.9	37.27	58.92	1504.
#1	.0000	.0003	-.0006	.0132	-.0030	.0002	.0153	.0005	.0000
#2	-.0001	.0017	-.0020	.0150	-.0157	.0000	.0328	.0005	-.0001
#3	.0001	-.0001	.0008	.0155	.0041	.0001	.0227	.0001	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0378	.0005	.0019	.0008	.0048	.0005	<.0000	.0538	<.0000
Stddev	.0043	.0002	.0015	.0011	.0008	.0008	.0013	.0021	.0003
%RSD	11.36	36.87	79.16	145.1	17.51	169.7	621.3	3.988	849.1
#1	.0406	.0005	.0035	.0001	.0046	.0014	-.0013	.0535	.0003
#2	.0400	.0006	.0019	.0002	.0057	.0003	.0012	.0519	-.0003
#3	.0329	.0003	.0004	.0020	.0041	-.0002	-.0006	.0561	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-122573/1-A Acquired: 5/22/2014 18:29:35 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	<.0000	.0002	<.0000	<.0000	.0014	.0056
Stddev	.0000	.0026	.0005	.0006	.0119	.0006	.0001
%RSD	88.23	146.6	286.8	88.36	127.7	39.60	1.683
#1	.0000	-.0032	.0008	-.0006	.0042	.0018	.0056
#2	.0000	-.0033	-.0002	-.0014	-.0181	.0008	.0055
#3	.0000	.0012	-.0001	-.0002	-.0141	.0017	.0056
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5862.0
Stddev	6.5
%RSD	.11029
#1	5869.3
#2	5859.5
#3	5857.2

Sample Name: LCSSRM 160-122573/2- Acquired: 5/22/2014 18:33:29 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3608**	**36.47**	**.4823**	**.5139**	**1.088**	**.3037**	**.0008**	**43.32**	**.8109**
Stddev	.0013	.30	.0038	.0015	.003	.0010	.0005	.09	.0023
%RSD	.3579	.8171	.7877	.2917	.2728	.3353	55.85	.2119	.2873
#1	.3610	36.70	.4847	.5156	1.090	.3032	.0012	43.42	.8130
#2	.3620	36.13	.4842	.5132	1.084	.3049	.0003	43.31	.8115
#3	.3595	36.57	.4779	.5128	1.089	.3030	.0010	43.24	.8084
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.185**	**.4963**	**1.516**	**59.26**	**11.95**	**.0409**	**13.18**	**2.268**	**.5969**
Stddev	.004	.0019	.006	.24	.16	.0007	.04	.008	.0019
%RSD	.3327	.3735	.4204	.4042	1.345	1.756	.3191	.3552	.3225
#1	1.189	.4983	1.520	59.25	12.05	.0414	13.17	2.276	.5988
#2	1.185	.4960	1.520	59.51	11.77	.0400	13.22	2.269	.5968
#3	1.181	.4947	1.509	59.03	12.05	.0412	13.14	2.260	.5950
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.665**	**1.419**	**3.149**	**.5631**	**1.368**	**.4927**	**.7096**	**7.926**	**.8275**
Stddev	.076	.003	.015	.0017	.003	.0046	.0020	.025	.0023
%RSD	1.340	.2221	.4611	.3071	.2180	.9364	.2875	.3172	.2829
#1	5.716	1.422	3.164	.5651	1.372	.4977	.7080	7.953	.8301
#2	5.578	1.419	3.145	.5617	1.367	.4919	.7119	7.921	.8255
#3	5.701	1.416	3.136	.5626	1.366	.4885	.7090	7.903	.8269
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCSSRM 160-122573/2- Acquired: 5/22/2014 18:33:29 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.9261	.1751	.9242	.8648	.0265	.8093	.7170
Stddev	.0009	.0023	.0007	.0029	.0101	.0060	.0018
%RSD	.0973	1.340	.0768	.3333	38.02	.7358	.2520
#1	.9271	.1726	.9235	.8651	.0375	.8110	.7186
#2	.9259	.1772	.9243	.8674	.0241	.8027	.7174
#3	.9253	.1756	.9249	.8617	.0178	.8142	.7150
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6499.8
Stddev	7.9
%RSD	.12117
#1	6491.3
#2	6501.2
#3	6506.8

Sample Name: 160-6651-H-1-A Acquired: 5/22/2014 18:36:59 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0000**	**39.83**	**.0192**	**.0050**	**.0835**	**.0007**	**.0037**	**.3590**	**<.0000**
Stddev	.0004	.31	.0010	.0031	.0004	.0000	.0016	.0008	.0000
%RSD	2453.	.7790	5.265	62.12	.4739	2.585	42.65	.2226	5.742
#1	-.0002	40.02	.0191	.0085	.0837	.0007	.0047	.3592	-.0002
#2	-.0002	39.47	.0182	.0040	.0830	.0007	.0019	.3581	-.0002
#3	.0005	40.00	.0203	.0025	.0837	.0008	.0046	.3596	-.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0071**	**.0801**	**.0369**	**54.36**	**.9563**	**.0257**	**1.128**	**.1019**	**.0019**
Stddev	.0004	.0008	.0006	.16	.0056	.0003	.023	.0002	.0001
%RSD	6.213	.9449	1.711	.2873	.5854	1.359	2.014	.2324	5.371
#1	.0076	.0804	.0364	54.40	.9624	.0258	1.154	.1018	.0020
#2	.0069	.0807	.0376	54.19	.9549	.0254	1.111	.1017	.0018
#3	.0068	.0792	.0368	54.49	.9515	.0261	1.121	.1021	.0019
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0468**	**.0242**	**.3634**	**.0302**	**.2516**	**.0014**	**.0007**	**6.337**	**.0025**
Stddev	.0052	.0005	.0010	.0012	.0016	.0004	.0008	.033	.0006
%RSD	11.08	2.218	.2726	3.957	.6432	28.45	119.1	.5163	25.17
#1	.0441	.0242	.3629	.0314	.2497	.0016	-.0001	6.354	.0026
#2	.0528	.0236	.3627	.0301	.2526	.0016	.0015	6.299	.0018
#3	.0435	.0247	.3645	.0290	.2524	.0009	.0006	6.357	.0030
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6651-H-1-A Acquired: 5/22/2014 18:36:59 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0054	.1680	.3173	<.0000	.0305	.1146	.0388
Stddev	.0001	.0009	.0001	.0014	.0005	.0016	.0000
%RSD	1.552	.5521	.0401	312.2	1.523	1.370	.0705
#1	.0055	.1674	.3173	-.0014	.0308	.1128	.0388
#2	.0054	.1675	.3175	-.0012	.0300	.1157	.0388
#3	.0054	.1691	.3172	.0012	.0306	.1152	.0387
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6034.0
Stddev	26.8
%RSD	.44399
#1	6032.2
#2	6061.7
#3	6008.2

Sample Name: 160-6651-H-1-A SD Acquired: 5/22/2014 18:40:51 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	8.322	.0024	<.0000	.0174	.0002	.0002	.0771	<.0000
Stddev	.0004	.039	.0005	.0013	.0000	.0000	.0004	.0004	.0001
%RSD	269.7	.4700	21.52	620.4	.2298	9.809	257.3	.4700	1620.
#1	-.0005	8.361	.0021	-.0012	.0174	.0002	-.0001	.0774	-.0001
#2	-.0003	8.322	.0021	-.0007	.0175	.0001	.0007	.0767	.0001
#3	.0003	8.282	.0030	.0013	.0174	.0002	-.0001	.0772	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0017	.0171	.0078	11.30	.2062	.0060	.2384	.0209	.0005
Stddev	.0003	.0003	.0009	.06	.0142	.0001	.0106	.0001	.0002
%RSD	15.73	1.555	12.01	.5039	6.888	1.632	4.438	.6931	32.02
#1	.0017	.0171	.0087	11.35	.2208	.0061	.2496	.0210	.0007
#2	.0015	.0173	.0068	11.32	.1924	.0060	.2286	.0211	.0005
#3	.0020	.0168	.0078	11.24	.2055	.0060	.2369	.0208	.0003
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0245	.0048	.0742	.0066	.0566	.0008	<.0000	1.295	.0005
Stddev	.0058	.0001	.0017	.0001	.0004	.0009	.0013	.010	.0003
%RSD	23.73	3.025	2.299	1.631	.7571	105.5	92.71	.8055	67.11
#1	.0298	.0050	.0760	.0067	.0563	.0002	-.0003	1.304	.0007
#2	.0183	.0049	.0737	.0066	.0565	.0018	-.0028	1.284	.0001
#3	.0254	.0047	.0727	.0065	.0571	.0004	-.0011	1.298	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6651-H-1-A SD Acquired: 5/22/2014 18:40:51 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0012	.0333	.0649	<.0000	<.0000	.0225	.0129
Stddev	.0000	.0054	.0010	.0009	.0054	.0017	.0002
%RSD	3.224	16.29	1.591	25.63	111.3	7.607	1.173
#1	.0012	.0395	.0661	-.0025	-.0066	.0224	.0131
#2	.0012	.0300	.0645	-.0039	.0012	.0208	.0129
#3	.0011	.0303	.0642	-.0042	-.0090	.0242	.0128
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5958.1
Stddev	25.8
%RSD	.43359
#1	5933.9
#2	5954.9
#3	5985.3

Sample Name: CCV Acquired: 5/22/2014 18:44:46 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.020**	**50.34**	**5.116**	**4.923**	**5.183**	**5.037**	**5.100**	**52.81**	**5.165**
Stddev	.002	.17	.032	.016	.052	.037	.051	.24	.020
%RSD	.1516	.3296	.6204	.3190	1.010	.7306	1.008	.4569	.3935
#1	1.020	50.33	5.142	4.906	5.209	4.997	5.152	52.57	5.181
#2	1.019	50.52	5.126	4.936	5.219	5.046	5.097	53.05	5.171
#3	1.022	50.19	5.081	4.927	5.123	5.069	5.050	52.80	5.142
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.182**	**5.206**	**5.132**	**49.69**	**51.23**	**5.199**	**48.99**	**5.014**	**1.040**
Stddev	.019	.022	.041	.16	.23	.041	.27	.027	.003
%RSD	.3636	.4214	.8047	.3243	.4496	.7856	.5542	.5389	.3176
#1	5.187	5.181	5.172	49.50	51.44	5.233	48.67	4.985	1.042
#2	5.198	5.216	5.133	49.78	51.27	5.211	49.12	5.038	1.042
#3	5.161	5.222	5.090	49.79	50.98	5.154	49.16	5.020	1.036
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**51.21**	**5.254**	**53.78**	**5.271**	**50.87**	**1.022**	**1.016**	**4.952**	**5.265**
Stddev	.25	.018	.24	.017	.33	.010	.009	.015	.018
%RSD	.4812	.3346	.4473	.3207	.6539	.9442	.8796	.3067	.3455
#1	51.45	5.248	54.01	5.264	51.19	1.030	1.022	4.946	5.254
#2	51.22	5.274	53.81	5.290	50.89	1.025	1.020	4.970	5.286
#3	50.96	5.240	53.53	5.258	50.53	1.011	1.006	4.941	5.255
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 18:44:46 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.174**	**5.116**	**5.064**	**1.058**	**5.237**	**4.996**	**5.184**
Stddev	.029	.022	.014	.006	.026	.037	.019
%RSD	.5646	.4368	.2815	.5597	.5021	.7461	.3604
#1	5.141	5.097	5.048	1.056	5.210	4.971	5.196
#2	5.193	5.112	5.075	1.065	5.237	5.038	5.194
#3	5.190	5.141	5.069	1.053	5.263	4.977	5.163
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5522.9**
Stddev	25.3
%RSD	.45735
#1	5549.0
#2	5498.6
#3	5521.1

Sample Name: CCB Acquired: 5/22/2014 18:48:34 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**<.0000**	**<.0000**	**.0050**	**.0001**	**.0001**	**<.0000**	**.0012**	**.0001**
Stddev	.0004	.0050	.0006	.0002	.0002	.0000	.0015	.0002	.0001
%RSD	193.5	213.5	115.7	3.645	165.0	53.19	85.82	14.90	117.9
#1	-.0003	-.0081	-.0011	.0048	-.0001	.0000	-.0029	.0012	.0001
#2	.0004	-.0004	.0001	.0051	.0003	.0001	.0000	.0010	.0001
#3	.0005	.0014	-.0005	.0051	.0002	.0001	-.0023	.0014	.0000
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0003**	**.0001**	**<.0000**	**.0020**	**<.0000**	**.0002**	**<.0000**	**.0004**	**.0002**
Stddev	.0004	.0001	.0013	.0019	.0135	.0008	.0057	.0002	.0001
%RSD	114.2	150.2	1102.	96.82	8076.	342.1	2447.	41.82	47.18
#1	.0006	.0001	.0013	.0012	-.0041	.0012	.0048	.0002	.0002
#2	.0006	.0002	-.0012	.0041	-.0113	-.0004	-.0063	.0004	.0001
#3	-.0001	-.0001	-.0005	.0006	.0149	.0000	.0008	.0006	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0177**	**.0003**	**.0006**	**.0005**	**.0026**	**.0003**	**.0017**	**.0014**	**.0002**
Stddev	.0029	.0002	.0005	.0004	.0022	.0006	.0011	.0061	.0000
%RSD	16.11	58.90	80.82	74.28	85.09	199.4	63.44	438.8	16.27
#1	.0147	.0002	.0011	.0005	.0001	-.0003	.0030	.0010	.0002
#2	.0204	.0002	.0001	.0002	.0033	.0008	.0011	.0076	.0002
#3	.0180	.0005	.0007	.0009	.0043	.0004	.0011	-.0045	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 18:48:34 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	.0001	<.0000	<.0000	.0002	.0002
Stddev	.0000	.0047	.0002	.0007	.0117	.0026	.0001
%RSD	65.80	381.8	174.3	32.61	2131.	1170.	62.92
#1	.0000	-.0052	.0000	-.0023	.0113	-.0003	.0003
#2	.0001	.0039	.0004	-.0014	-.0008	.0031	.0001
#3	.0001	-.0025	.0000	-.0029	-.0120	-.0021	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5805.0
Stddev	16.0
%RSD	.27503
#1	5788.5
#2	5806.4
#3	5820.3

Sample Name: 160-6651-H-3-A Acquired: 5/22/2014 18:52:31 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	35.23	.0127	.0066	.0979	.0009	.0019	.5294	<.0000
Stddev	.0002	.14	.0011	.0021	.0002	.0000	.0015	.0018	.0000
%RSD	421.0	.3919	8.931	32.20	.2525	1.540	77.54	.3315	34.92
#1	.0001	35.35	.0122	.0053	.0978	.0009	.0002	.5279	-.0001
#2	.0000	35.27	.0119	.0055	.0982	.0009	.0025	.5290	-.0001
#3	-.0003	35.08	.0140	.0091	.0978	.0009	.0030	.5313	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0113	.0628	.0230	47.17	1.127	.0264	1.709	.2364	.0016
Stddev	.0001	.0007	.0013	.15	.010	.0005	.018	.0014	.0003
%RSD	1.146	1.042	5.612	.3154	.8986	1.739	1.049	.5989	16.71
#1	.0112	.0635	.0239	47.02	1.116	.0269	1.692	.2348	.0019
#2	.0114	.0622	.0215	47.19	1.128	.0261	1.708	.2372	.0015
#3	.0113	.0629	.0236	47.32	1.136	.0261	1.728	.2372	.0014
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0512	.0221	.3993	.0318	.3505	.0012	.0009	6.125	.0023
Stddev	.0048	.0002	.0016	.0004	.0023	.0013	.0007	.019	.0009
%RSD	9.355	.8783	.4040	1.290	.6555	107.4	73.44	.3074	37.83
#1	.0549	.0219	.3975	.0314	.3491	.0014	.0015	6.118	.0025
#2	.0528	.0220	.3997	.0317	.3492	.0023	.0002	6.146	.0014
#3	.0458	.0223	.4006	.0322	.3531	-.0002	.0011	6.110	.0032
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6651-H-3-A Acquired: 5/22/2014 18:52:31 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0061	.1442	.4223	.0001	.0124	.0898	.0523
Stddev	.0000	.0027	.0012	.0003	.0106	.0029	.0001
%RSD	.6673	1.873	.2750	318.5	85.15	3.283	.1062
#1	.0061	.1425	.4209	.0001	.0246	.0888	.0522
#2	.0061	.1429	.4228	.0004	.0072	.0875	.0523
#3	.0060	.1474	.4231	-.0002	.0055	.0931	.0522
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5988.3
Stddev	12.7
%RSD	.21167
#1	5998.0
#2	5992.9
#3	5973.9

Sample Name: 160-6672-A-8-A Acquired: 5/22/2014 18:56:20 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	.0121	<.0000	.0017	.0006	.0182	.0188	<.0000
Stddev	.0001	.0040	.0017	.0011	.0001	.0001	.0026	.0018	.0007
%RSD	3.260	71.77	14.27	35.81	7.506	12.87	14.51	9.770	13.95
#1	-.0032	-.0021	.0103	-.0045	.0018	.0005	.0157	.0170	-.0042
#2	-.0031	-.0047	.0138	-.0023	.0016	.0007	.0178	.0186	-.0048
#3	-.0033	-.0100	.0123	-.0028	.0018	.0006	.0210	.0207	-.0056
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0125	.1600	.2115	8.146	.0365	.0033	<.0000	.0568	.0231
Stddev	.0015	.0029	.0230	.159	.0044	.0007	.0102	.0007	.0024
%RSD	11.91	1.808	10.86	1.947	12.10	19.78	4.976	1.255	10.28
#1	.0109	.1577	.1894	7.980	.0330	.0041	-.2169	.0561	.0206
#2	.0126	.1592	.2098	8.163	.0415	.0031	-.1966	.0569	.0233
#3	.0139	.1633	.2353	8.296	.0349	.0028	-.2041	.0575	.0254
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	47.63	.6271	.0430	.0168	.7327	<.0000	<.0000	.0485	.0097
Stddev	1.28	.0710	.0053	.0073	.0843	.0009	.0030	.0043	.0007
%RSD	2.687	11.31	12.31	43.17	11.51	24.28	24.79	8.785	6.851
#1	46.43	.5582	.0372	.0089	.6531	-.0027	-.0121	.0531	.0093
#2	47.49	.6231	.0443	.0183	.7240	-.0044	-.0090	.0477	.0093
#3	48.98	.6999	.0476	.0232	.8210	-.0043	-.0149	.0447	.0104
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-8-A Acquired: 5/22/2014 18:56:20 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0015	.3741	.0196	<.0000	57.02	.0200	.0085
Stddev	.0001	.0109	.0002	.0038	1.50	.0007	.0008
%RSD	3.610	2.914	1.203	18.84	2.626	3.528	8.983
#1	.0015	.3615	.0197	-.0168	55.70	.0199	.0078
#2	.0015	.3796	.0193	-.0189	56.71	.0194	.0084
#3	.0016	.3811	.0197	-.0241	58.65	.0208	.0094
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5830.1
Stddev	17.8
%RSD	.30546
#1	5847.1
#2	5831.8
#3	5811.6

Sample Name: 160-6672-A-9-A Acquired: 5/22/2014 19:00:08 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	.0327	<.0000	.0058	.0021	.0593	.0752	<.0000
Stddev	.0018	.0050	.0044	.0021	.0001	.0000	.0077	.0069	.0017
%RSD	217.4	2.606	13.58	66.59	1.542	1.961	12.92	9.140	9.203
#1	.0011	-.1946	.0290	-.0036	.0057	.0021	.0522	.0696	-.0164
#2	-.0012	-.1873	.0314	-.0051	.0059	.0021	.0582	.0730	-.0179
#3	-.0024	-.1969	.0376	-.0009	.0059	.0022	.0674	.0828	-.0197
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0381	.6140	.8128	7.487	.0414	.0117	<.0000	.0746	.0657
Stddev	.0035	.0133	.0755	.106	.0303	.0011	.0182	.0009	.0057
%RSD	9.308	2.161	9.290	1.412	73.15	9.571	2.159	1.260	8.676
#1	.0348	.6058	.7436	7.404	.0511	.0104	-.8628	.0743	.0601
#2	.0378	.6069	.8015	7.451	.0075	.0123	-.8291	.0740	.0654
#3	.0418	.6293	.8933	7.606	.0658	.0124	-.8342	.0757	.0715
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	48.36	1.383	.1577	.0660	.2847	<.0000	<.0000	.0918	.0377
Stddev	.50	.122	.0160	.0269	.0264	.0012	.0033	.0006	.0037
%RSD	1.031	8.832	10.13	40.81	9.283	7.635	12.19	.6927	9.908
#1	47.80	1.267	.1429	.0397	.2586	-.0147	-.0231	.0919	.0339
#2	48.75	1.372	.1556	.0649	.2838	-.0167	-.0282	.0923	.0377
#3	48.54	1.511	.1746	.0935	.3115	-.0147	-.0292	.0911	.0414
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-9-A Acquired: 5/22/2014 19:00:08 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0060	1.384	.0952	<.0000	227.1	.0822	.0279
Stddev	.0001	.032	.0014	.0067	4.1	.0032	.0025
%RSD	2.311	2.324	1.420	8.899	1.786	3.910	8.831
#1	.0059	1.364	.0952	-.0673	223.5	.0799	.0256
#2	.0059	1.367	.0938	-.0773	226.4	.0859	.0276
#3	.0061	1.421	.0965	-.0799	231.5	.0808	.0305
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5632.8
Stddev	28.5
%RSD	.50573
#1	5627.1
#2	5663.7
#3	5607.6

Sample Name: 160-6672-A-10-A Acquired: 5/22/2014 19:03:52 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0012**	**.1516**	**.0443**	**<.0000**	**.0051**	**.0003**	**.0064**	**.9951**	**<.0000**
Stddev	.0002	.0106	.0063	.0049	.0001	.0000	.0023	.1161	.0003
%RSD	17.16	6.984	14.32	333.9	2.791	5.985	35.78	11.66	12.07
#1	.0009	.1477	.0371	.0013	.0050	.0004	.0040	.8838	-.0020
#2	.0013	.1435	.0465	-.0071	.0050	.0003	.0085	.9861	-.0024
#3	.0013	.1636	.0492	.0014	.0052	.0003	.0069	1.115	-.0025
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0134**	**.5078**	**2.558**	**1.397**	**.0832**	**.0030**	**<.0000**	**.0306**	**.0020**
Stddev	.0014	.0174	.294	.032	.0124	.0007	.0081	.0003	.0002
%RSD	10.19	3.433	11.49	2.304	14.93	22.99	13.29	1.137	12.21
#1	.0120	.4918	2.272	1.369	.0691	.0024	-.0584	.0304	.0017
#2	.0135	.5052	2.543	1.390	.0926	.0038	-.0543	.0303	.0021
#3	.0147	.5263	2.859	1.433	.0879	.0029	-.0699	.0310	.0021
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**54.56**	**.8845**	**.0495**	**.0281**	**.1343**	**<.0000**	**<.0000**	**.5688**	**.0106**
Stddev	.71	.1010	.0072	.0066	.0137	.0015	.0020	.0039	.0008
%RSD	1.303	11.42	14.58	23.55	10.23	70.28	16.98	.6942	7.538
#1	53.89	.7862	.0416	.0212	.1213	-.0039	-.0098	.5644	.0097
#2	54.47	.8794	.0511	.0287	.1329	-.0011	-.0112	.5704	.0112
#3	55.31	.9880	.0558	.0344	.1487	-.0015	-.0137	.5718	.0110
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-10-A Acquired: 5/22/2014 19:03:52 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0028	.3611	.0472	<.0000	50.45	.0132	.0783
Stddev	.0001	.0115	.0013	.0015	1.58	.0029	.0089
%RSD	2.640	3.178	2.777	7.802	3.122	22.27	11.43
#1	.0028	.3503	.0470	-.0173	49.00	.0166	.0696
#2	.0029	.3597	.0460	-.0202	50.22	.0117	.0777
#3	.0029	.3732	.0486	-.0193	52.12	.0113	.0874
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5746.0
Stddev	20.2
%RSD	.35154
#1	5746.9
#2	5765.8
#3	5725.4

Sample Name: 160-6672-A-11-A Acquired: 5/22/2014 19:07:35 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.3838	.0559	<.0000	.0077	.0008	.0436	.6148	<.0000
Stddev	.0011	.0157	.0090	.0014	.0003	.0000	.0068	.0885	.0013
%RSD	567.0	4.103	16.07	31.68	4.195	3.906	15.64	14.39	13.64
#1	-.0012	.3739	.0468	-.0053	.0074	.0008	.0374	.5277	-.0080
#2	-.0004	.3755	.0560	-.0028	.0076	.0009	.0425	.6123	-.0095
#3	.0010	.4019	.0648	-.0050	.0081	.0008	.0510	.7045	-.0106
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0488	2.341	1.729	20.00	.0605	.0080	<.0000	.1874	.0160
Stddev	.0069	.087	.241	.56	.0093	.0005	.0032	.0058	.0023
%RSD	14.11	3.725	13.93	2.797	15.40	5.676	1.482	3.111	14.32
#1	.0417	2.258	1.486	19.46	.0500	.0083	-.2154	.1818	.0137
#2	.0493	2.334	1.733	19.97	.0635	.0075	-.2153	.1870	.0159
#3	.0555	2.432	1.968	20.58	.0678	.0081	-.2209	.1934	.0183
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	40.25	3.972	.0501	.1127	.1941	<.0000	<.0000	.3020	.0295
Stddev	1.32	.548	.0070	.0317	.0280	.0031	.0014	.0131	.0041
%RSD	3.279	13.79	13.97	28.10	14.43	74.03	7.554	4.335	13.92
#1	39.28	3.425	.0434	.0812	.1666	-.0046	-.0174	.2873	.0259
#2	39.71	3.972	.0496	.1124	.1931	-.0071	-.0201	.3065	.0286
#3	41.75	4.520	.0574	.1445	.2226	-.0009	-.0198	.3123	.0340
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-11-A Acquired: 5/22/2014 19:07:35 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0047	.7823	.1800	<.0000	124.0	.0277	.0616
Stddev	.0001	.0259	.0047	.0070	3.8	.0068	.0088
%RSD	1.927	3.307	2.586	15.97	3.040	24.60	14.34
#1	.0047	.7552	.1751	-.0391	120.4	.0226	.0530
#2	.0047	.7850	.1807	-.0400	123.7	.0250	.0612
#3	.0048	.8068	.1843	-.0516	127.9	.0354	.0706
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5752.5
Stddev	24.4
%RSD	.42492
#1	5728.5
#2	5751.6
#3	5777.4

Sample Name: MB 160-122574/1-A Acquired: 5/22/2014 19:11:16 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0407	<.0000	.0197	.0005	<.0000	.0007	.0697	.0001
Stddev	.0003	.0020	.0005	.0019	.0000	.0000	.0016	.0012	.0001
%RSD	197.4	4.915	29.09	9.887	7.200	922.4	235.1	1.679	64.59
#1	-.0002	.0430	-.0018	.0203	.0005	.0000	.0012	.0694	.0000
#2	.0002	.0395	-.0014	.0175	.0005	.0000	.0020	.0710	.0002
#3	.0004	.0396	-.0025	.0213	.0005	.0000	-.0011	.0687	.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.0011	<.0000	.0129	.0170	.0003	.0347	.0005	<.0000
Stddev	.0001	.0006	.0008	.0006	.0024	.0005	.0047	.0001	.0001
%RSD	72.00	58.14	57.70	4.858	14.06	169.7	13.46	24.19	379.1
#1	.0001	.0015	-.0015	.0132	.0178	.0004	.0338	.0005	.0001
#2	.0001	.0004	-.0020	.0134	.0143	-.0003	.0306	.0005	-.0001
#3	.0003	.0013	-.0005	.0122	.0189	.0007	.0398	.0003	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0603	.0007	.0023	.0005	.0023	.0016	.0022	.0778	.0008
Stddev	.0092	.0002	.0007	.0004	.0013	.0007	.0024	.0043	.0001
%RSD	15.17	23.94	29.96	86.92	55.24	44.70	109.2	5.479	8.546
#1	.0692	.0005	.0026	.0003	.0018	.0017	.0029	.0753	.0007
#2	.0509	.0009	.0028	.0002	.0014	.0023	.0041	.0754	.0007
#3	.0609	.0006	.0015	.0010	.0038	.0008	-.0005	.0827	.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-122574/1-A Acquired: 5/22/2014 19:11:16 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	.0009	.0001	.0028	<.0000	.0058
Stddev	.0001	.0027	.0004	.0004	.0047	.0011	.0000
%RSD	149.7	2973.	42.06	326.7	169.8	1058.	.5220
#1	.0002	-.0030	.0006	.0003	-.0027	-.0007	.0058
#2	.0000	.0005	.0014	.0004	.0052	-.0008	.0058
#3	.0000	.0022	.0008	-.0003	.0059	.0012	.0058
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5809.9
Stddev	14.3
%RSD	.24588
#1	5826.3
#2	5802.9
#3	5800.3

Sample Name: LCSSRM 160-122574/2- Acquired: 5/22/2014 19:15:11 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3616**	**38.55**	**.4924**	**.5155**	**1.114**	**.3078**	**.0012**	**44.23**	**.8350**
Stddev	.0001	.15	.0095	.0019	.006	.0011	.0008	.20	.0113
%RSD	.0328	.3902	1.927	.3644	.5023	.3653	69.84	.4455	1.354
#1	.3617	38.41	.4844	.5134	1.109	.3067	.0006	44.00	.8245
#2	.3617	38.71	.4899	.5167	1.120	.3089	.0009	44.36	.8336
#3	.3615	38.54	.5029	.5166	1.114	.3077	.0021	44.32	.8470
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.204**	**.5055**	**1.540**	**62.87**	**12.40**	**.0423**	**13.70**	**2.328**	**.6073**
Stddev	.017	.0017	.029	.19	.03	.0004	.06	.010	.0092
%RSD	1.441	.3392	1.888	.3096	.2581	.9901	.4656	.4290	1.522
#1	1.187	.5049	1.516	62.68	12.37	.0426	13.63	2.317	.5997
#2	1.202	.5043	1.532	63.07	12.43	.0423	13.72	2.336	.6047
#3	1.222	.5075	1.573	62.86	12.39	.0418	13.75	2.331	.6176
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.763**	**1.440**	**3.219**	**.5702**	**1.345**	**.5601**	**.7259**	**4.932**	**.8679**
Stddev	.003	.016	.050	.0067	.024	.0086	.0120	.018	.0106
%RSD	.0474	1.111	1.550	1.183	1.810	1.540	1.656	.3640	1.220
#1	5.763	1.425	3.177	.5638	1.325	.5513	.7171	4.912	.8564
#2	5.760	1.440	3.207	.5695	1.339	.5605	.7210	4.940	.8703
#3	5.765	1.457	3.274	.5773	1.372	.5685	.7396	4.945	.8772
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCSSRM 160-122574/2- Acquired: 5/22/2014 19:15:11 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.9432	.1910	.9301	.8936	.0199	.8075	.7313
Stddev	.0046	.0048	.0048	.0098	.0037	.0084	.0100
%RSD	.4842	2.517	.5190	1.101	18.55	1.045	1.366
#1	.9397	.1880	.9258	.8850	.0239	.7994	.7221
#2	.9484	.1966	.9354	.8915	.0166	.8068	.7298
#3	.9416	.1885	.9292	.9043	.0191	.8163	.7420
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6362.8
Stddev	21.0
%RSD	.32977
#1	6386.7
#2	6347.1
#3	6354.7

Sample Name: 160-6672-A-1-A Acquired: 5/22/2014 19:18:43 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0016	<.0000	.0854	.0015	.0031	.0008	.0172	.0453	<.0000
Stddev	.0011	.0026	.0021	.0008	.0000	.0000	.0008	.0005	.0000
%RSD	70.89	3.418	2.501	52.28	.4909	5.458	4.459	1.051	.3674
#1	.0027	-.0804	.0877	.0014	.0031	.0009	.0163	.0455	-.0064
#2	.0017	-.0757	.0853	.0007	.0031	.0008	.0175	.0456	-.0065
#3	.0004	-.0760	.0834	.0023	.0031	.0008	.0178	.0447	-.0064
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0197	1.042	.8314	2.014	.1463	.0062	<.0000	.0447	.0058
Stddev	.0002	.004	.0041	.004	.0064	.0010	.0086	.0004	.0001
%RSD	1.256	.3436	.4914	.1790	4.341	15.82	2.104	.9149	2.169
#1	.0199	1.046	.8351	2.018	.1529	.0065	-.4036	.0447	.0059
#2	.0196	1.040	.8270	2.011	.1460	.0070	-.4197	.0442	.0058
#3	.0195	1.040	.8322	2.015	.1402	.0051	-.4064	.0450	.0056
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	58.73	1.415	.0137	.0041	.1615	<.0000	<.0000	.0592	.0160
Stddev	.38	.005	.0004	.0005	.0005	.0018	.0008	.0037	.0005
%RSD	.6533	.3227	2.900	12.09	.3286	21.16	8.379	6.184	3.328
#1	59.05	1.420	.0135	.0041	.1611	-.0101	-.0098	.0603	.0166
#2	58.83	1.413	.0134	.0045	.1621	-.0084	-.0111	.0551	.0156
#3	58.31	1.411	.0141	.0035	.1612	-.0066	-.0095	.0621	.0157
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-1-A Acquired: 5/22/2014 19:18:43 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0030	.6937	.0938	<.0000	104.7	.0404	.0187
Stddev	.0001	.0132	.0005	.0003	.5	.0008	.0002
%RSD	2.041	1.900	.5185	.9696	.4530	2.050	.9709
#1	.0029	.7089	.0937	-.0284	105.3	.0395	.0188
#2	.0030	.6853	.0943	-.0289	104.3	.0405	.0185
#3	.0031	.6869	.0934	-.0287	104.6	.0411	.0189
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5818.6
Stddev	15.0
%RSD	.25800
#1	5801.4
#2	5829.2
#3	5825.3

Sample Name: 160-6672-A-1-A SD Acquired: 5/22/2014 19:22:30 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=100

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	.0154	<.0000	.0006	.0001	.0044	.0110	<.0000
Stddev	.0002	.0019	.0019	.0031	.0001	.0000	.0017	.0007	.0001
%RSD	11.43	10.99	12.50	167.5	15.17	5.065	37.84	6.731	5.945
#1	-.0014	-.0156	.0168	-.0007	.0005	.0001	.0049	.0117	-.0015
#2	-.0017	-.0191	.0162	-.0054	.0007	.0001	.0057	.0102	-.0014
#3	-.0017	-.0162	.0132	.0005	.0005	.0001	.0025	.0109	-.0013
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0037	.1986	.1609	.3779	.0082	.0020	<.0000	.0083	.0008
Stddev	.0003	.0008	.0014	.0011	.0061	.0001	.0151	.0002	.0001
%RSD	7.308	.3940	.8444	.2848	74.84	5.987	19.96	1.994	12.38
#1	.0040	.1983	.1594	.3786	.0019	.0019	-.0783	.0082	.0007
#2	.0036	.1995	.1620	.3766	.0141	.0021	-.0891	.0085	.0009
#3	.0034	.1980	.1614	.3783	.0085	.0021	-.0593	.0084	.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	11.05	.2738	.0024	.0006	.0334	<.0000	<.0000	.0077	.0028
Stddev	.14	.0018	.0008	.0005	.0036	.0012	.0020	.0014	.0008
%RSD	1.224	.6705	33.10	82.06	10.78	109.0	183.7	17.73	27.56
#1	11.08	.2724	.0031	.0012	.0331	-.0016	-.0003	.0079	.0037
#2	10.91	.2759	.0026	.0003	.0371	-.0019	.0004	.0062	.0021
#3	11.17	.2733	.0015	.0004	.0299	.0003	-.0034	.0089	.0027
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-1-A SD Acquired: 5/22/2014 19:22:30 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=100

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0006	.1341	.0170	<.0000	20.08	.0059	.0085
Stddev	.0000	.0004	.0007	.0014	.11	.0004	.0001
%RSD	7.437	.3228	3.865	17.19	.5461	6.249	1.447
#1	.0005	.1336	.0171	-.0071	20.07	.0058	.0084
#2	.0006	.1344	.0176	-.0081	20.20	.0056	.0086
#3	.0005	.1342	.0163	-.0099	19.98	.0063	.0085
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5831.8
Stddev	30.5
%RSD	.52223
#1	5841.8
#2	5797.6
#3	5855.9

Sample Name: 160-6672-A-1-B MS Acquired: 5/22/2014 19:26:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0123	.4431	.1324	.0957	.0569	.0530	.0690	.5826	.0476
Stddev	.0003	.0059	.0017	.0011	.0001	.0001	.0002	.0042	.0003
%RSD	2.566	1.339	1.285	1.164	.1484	.2828	.3415	.7257	.5737
#1	.0126	.4402	.1339	.0970	.0570	.0530	.0692	.5859	.0479
#2	.0120	.4392	.1328	.0949	.0570	.0529	.0687	.5779	.0474
#3	.0123	.4499	.1306	.0952	.0568	.0532	.0689	.5841	.0476
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0759	1.255	.8038	2.569	.6819	.0638	.0404	.1012	.0311
Stddev	.0005	.008	.0046	.015	.0030	.0006	.0046	.0006	.0004
%RSD	.6987	.6664	.5677	.5830	.4459	.9108	11.36	.5502	1.151
#1	.0765	1.261	.8085	2.582	.6846	.0632	.0381	.1018	.0307
#2	.0756	1.245	.8037	2.553	.6825	.0644	.0374	.1010	.0311
#3	.0756	1.258	.7994	2.571	.6786	.0637	.0457	.1007	.0313
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	66.26	1.284	.0708	.0637	.6758	.0170	.0146	.0492	.0725
Stddev	.40	.005	.0005	.0017	.0008	.0015	.0010	.0087	.0009
%RSD	.6047	.4279	.6848	2.714	.1210	8.571	7.145	17.75	1.207
#1	65.81	1.290	.0703	.0636	.6750	.0153	.0153	.0429	.0732
#2	66.59	1.279	.0713	.0654	.6757	.0181	.0150	.0455	.0715
#3	66.38	1.284	.0707	.0619	.6767	.0176	.0134	.0591	.0726
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-1-B MS Acquired: 5/22/2014 19:26:19 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0586	.8195	.1575	<.0000	117.4	.0975	.0728
Stddev	.0001	.0076	.0011	.0022	.9	.0039	.0003
%RSD	.1578	.9299	.7260	9.371	.7256	3.974	.3694
#1	.0586	.8154	.1585	-.0214	117.3	.0973	.0731
#2	.0587	.8148	.1562	-.0256	116.7	.1015	.0727
#3	.0585	.8283	.1577	-.0226	118.4	.0938	.0727
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5777.8
Stddev	24.4
%RSD	.42284
#1	5760.1
#2	5805.7
#3	5767.7

Sample Name: CCV Acquired: 5/22/2014 19:30:03 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.024**	**50.99**	**5.178**	**4.980**	**5.140**	**5.097**	**5.219**	**52.71**	**5.244**
Stddev	.003	.08	.011	.020	.085	.017	.019	.14	.019
%RSD	.2620	.1475	.2115	.4023	1.656	.3233	.3694	.2561	.3600
#1	1.021	51.07	5.169	4.962	5.043	5.082	5.207	52.57	5.225
#2	1.026	50.92	5.190	4.976	5.199	5.115	5.242	52.72	5.263
#3	1.025	50.96	5.176	5.002	5.179	5.095	5.209	52.84	5.244
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.201**	**5.218**	**5.262**	**50.12**	**52.04**	**5.317**	**49.44**	**5.055**	**1.049**
Stddev	.006	.009	.021	.07	.33	.039	.16	.019	.004
%RSD	.1193	.1800	.4070	.1483	.6370	.7359	.3285	.3759	.3823
#1	5.194	5.208	5.246	50.05	52.17	5.338	49.39	5.049	1.046
#2	5.206	5.226	5.287	50.10	51.66	5.272	49.63	5.076	1.054
#3	5.202	5.219	5.255	50.20	52.28	5.342	49.32	5.039	1.048
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**51.94**	**5.282**	**54.35**	**5.299**	**51.69**	**1.044**	**1.034**	**5.026**	**5.297**
Stddev	.46	.014	.14	.017	.22	.007	.001	.018	.014
%RSD	.8892	.2660	.2551	.3121	.4287	.6965	.0863	.3481	.2639
#1	52.02	5.266	54.22	5.280	51.49	1.036	1.034	5.044	5.281
#2	51.45	5.293	54.49	5.307	51.93	1.051	1.035	5.024	5.308
#3	52.36	5.288	54.33	5.311	51.64	1.045	1.033	5.010	5.302
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Sample Name: CCV Acquired: 5/22/2014 19:30:03 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.192**	**5.101**	**5.116**	**1.066**	**5.284**	**4.988**	**5.237**
Stddev	.087	.010	.007	.003	.039	.028	.016
%RSD	1.668	.1955	.1452	.3085	.7326	.5662	.3047
#1	5.101	5.113	5.123	1.063	5.274	4.957	5.222
#2	5.273	5.093	5.108	1.070	5.326	5.013	5.254
#3	5.204	5.099	5.115	1.065	5.251	4.994	5.235
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5510.5**
Stddev	11.3
%RSD	.20422
#1	5523.4
#2	5505.5
#3	5502.7

Sample Name: CCB Acquired: 5/22/2014 19:33:52 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	<.0000	.0067	.0001	.0001	.0008	.0015	.0002
Stddev	.0005	.0088	.0016	.0012	.0001	.0000	.0005	.0014	.0002
%RSD	418.4	375.3	130.1	17.86	61.76	36.34	61.28	91.27	72.67
#1	.0002	-.0072	.0006	.0069	.0002	.0001	.0014	.0030	.0003
#2	-.0007	.0078	-.0023	.0055	.0001	.0001	.0005	.0009	.0000
#3	.0002	-.0076	-.0019	.0078	.0001	.0001	.0006	.0005	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0002	.0002	.0002	.0019	<.0000	.0007	.0102	.0005	.0001
Stddev	.0002	.0009	.0008	.0011	.0203	.0003	.0082	.0003	.0001
%RSD	90.72	423.5	336.6	59.93	126.6	43.32	79.71	70.72	77.68
#1	.0005	-.0007	-.0006	.0030	-.0230	.0009	.0075	.0004	.0002
#2	.0001	.0003	.0003	.0018	-.0319	.0008	.0194	.0002	.0000
#3	.0002	.0010	.0010	.0008	.0068	.0003	.0038	.0009	.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0179	.0002	.0010	<.0000	.0032	.0011	.0001	<.0000	.0000
Stddev	.0056	.0003	.0022	.0005	.0031	.0007	.0017	.0010	.0004
%RSD	31.30	162.5	214.3	93.45	97.39	62.74	1841.	94.32	1456.
#1	.0212	.0004	.0032	-.0006	.0059	.0005	.0008	-.0010	.0000
#2	.0211	.0003	.0013	-.0009	-.0002	.0018	-.0018	-.0022	.0005
#3	.0114	-.0002	-.0013	.0000	.0038	.0008	.0013	-.0001	-.0004
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 19:33:52 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	.0008	.0003	.0000	<.0000	<.0000	.0003
Stddev	.0001	.0053	.0004	.0006	.0047	.0021	.0002
%RSD	57.28	662.3	117.0	15490.	79.70	627.1	43.17
#1	.0002	.0053	.0006	-.0003	-.0027	-.0022	.0005
#2	.0001	-.0050	-.0001	-.0003	-.0037	.0019	.0002
#3	.0001	.0020	.0005	.0007	-.0114	-.0006	.0004
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5745.3
Stddev	14.3
%RSD	.24839
#1	5748.7
#2	5757.5
#3	5729.6

Sample Name: 160-6672-A-1-C MSD Acquired: 5/22/2014 19:37:47 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0123**	**.4386**	**.1480**	**.0981**	**.0562**	**.0529**	**.0676**	**.5873**	**.0479**
Stddev	.0013	.0036	.0015	.0021	.0002	.0004	.0010	.0025	.0004
%RSD	10.73	.8141	1.007	2.176	.3083	.7247	1.447	.4283	.8365
#1	.0107	.4350	.1496	.1003	.0560	.0533	.0686	.5899	.0484
#2	.0132	.4422	.1468	.0961	.0563	.0527	.0667	.5871	.0478
#3	.0128	.4386	.1474	.0979	.0562	.0526	.0675	.5849	.0476
Check ?	None	None	None	None	None	None	None	None	None
Value Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0744**	**1.083**	**.9030**	**2.645**	**.7298**	**.0627**	**.0658**	**.0964**	**.0329**
Stddev	.0008	.008	.0110	.018	.0218	.0013	.0220	.0007	.0004
%RSD	1.050	.7704	1.218	.6669	2.982	2.117	33.51	.7246	1.354
#1	.0753	1.093	.9152	2.664	.7062	.0616	.0652	.0972	.0329
#2	.0739	1.079	.9002	2.641	.7491	.0642	.0440	.0961	.0333
#3	.0739	1.077	.8937	2.629	.7342	.0625	.0881	.0959	.0324
Check ?	None	None	None	None	None	None	None	None	None
Value Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**63.62**	**1.211**	**.0724**	**.0630**	**.7088**	**.0185**	**.0175**	**.0570**	**.0723**
Stddev	.84	.008	.0011	.0028	.0077	.0023	.0036	.0059	.0011
%RSD	1.315	.6279	1.482	4.436	1.081	12.60	20.70	10.36	1.493
#1	63.22	1.219	.0734	.0639	.7174	.0204	.0213	.0566	.0734
#2	64.58	1.209	.0725	.0653	.7062	.0159	.0141	.0632	.0722
#3	63.05	1.204	.0713	.0599	.7028	.0193	.0171	.0514	.0712
Check ?	None	None	None	None	None	None	None	None	None
Value Range									

Sample Name: 160-6672-A-1-C MSD Acquired: 5/22/2014 19:37:47 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0580	.7771	.1452	<.0000	111.5	.0953	.0745
Stddev	.0002	.0067	.0010	.0019	.6	.0016	.0008
%RSD	.3081	.8565	.7088	8.711	.5144	1.628	1.056
#1	.0582	.7740	.1462	-.0236	112.1	.0937	.0753
#2	.0580	.7726	.1452	-.0199	111.2	.0953	.0745
#3	.0578	.7848	.1441	-.0226	111.0	.0968	.0737
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5703.7
Stddev	36.9
%RSD	.64740
#1	5662.3
#2	5715.4
#3	5733.3

Sample Name: 160-6672-A-2-A Acquired: 5/22/2014 19:41:30 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0032	<.0000	.0680	<.0000	.0033	.0008	.0286	.0369	<.0000
Stddev	.0006	.0079	.0057	.0038	.0002	.0000	.0034	.0029	.0009
%RSD	17.73	9.063	8.435	448.6	5.373	1.856	11.89	7.853	10.61
#1	.0036	-.0842	.0632	-.0049	.0031	.0008	.0253	.0341	-.0080
#2	.0026	-.0812	.0665	-.0004	.0034	.0008	.0284	.0368	-.0088
#3	.0035	-.0962	.0744	.0027	.0034	.0008	.0321	.0399	-.0099
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0281	1.256	1.050	2.323	.0844	.0064	<.0000	.0569	.0024
Stddev	.0032	.038	.120	.052	.0072	.0003	.0114	.0013	.0003
%RSD	11.49	3.010	11.46	2.247	8.565	4.975	2.655	2.320	12.10
#1	.0249	1.219	.9334	2.267	.0852	.0063	-.4215	.0558	.0022
#2	.0282	1.255	1.042	2.330	.0768	.0067	-.4429	.0565	.0024
#3	.0313	1.295	1.174	2.371	.0912	.0061	-.4254	.0583	.0028
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	57.81	2.314	.0130	.0362	.1373	<.0000	<.0000	.0506	.0210
Stddev	1.43	.257	.0015	.0155	.0153	.0014	.0010	.0047	.0018
%RSD	2.468	11.12	11.34	42.92	11.14	18.72	4.694	9.344	8.745
#1	56.25	2.066	.0114	.0216	.1215	-.0074	-.0209	.0548	.0197
#2	58.12	2.297	.0134	.0344	.1383	-.0065	-.0208	.0455	.0203
#3	59.05	2.580	.0143	.0525	.1521	-.0093	-.0226	.0515	.0231
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-2-A Acquired: 5/22/2014 19:41:30 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0031	.7405	.1020	<.0000	115.6	.0384	.0202
Stddev	.0000	.0159	.0016	.0050	2.9	.0074	.0020
%RSD	1.510	2.149	1.562	12.24	2.472	19.20	9.662
#1	.0031	.7236	.1002	-.0361	112.7	.0375	.0184
#2	.0031	.7427	.1026	-.0399	115.7	.0315	.0200
#3	.0032	.7552	.1032	-.0459	118.4	.0461	.0223
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5681.0
Stddev	34.3
%RSD	.60405
#1	5711.4
#2	5687.9
#3	5643.8

Sample Name: 160-6672-A-3-A Acquired: 5/22/2014 19:45:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0015	.0086	<.0000	.0016	.0005	.0163	.0331	<.0000
Stddev	.0017	.0062	.0008	.0012	.0001	.0000	.0012	.0033	.0005
%RSD	61.46	419.8	9.519	20.89	5.893	5.892	7.516	9.910	10.28
#1	-.0028	-.0040	.0084	-.0051	.0016	.0005	.0171	.0303	-.0043
#2	-.0045	.0002	.0095	-.0049	.0016	.0005	.0149	.0322	-.0048
#3	-.0011	.0082	.0079	-.0071	.0017	.0006	.0170	.0367	-.0053
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0094	.2038	.0531	2.207	.0086	.0030	<.0000	.0215	.0180
Stddev	.0013	.0057	.0057	.047	.0027	.0003	.0064	.0003	.0020
%RSD	13.47	2.792	10.77	2.117	31.33	11.08	3.235	1.527	10.98
#1	.0082	.1991	.0479	2.169	.0065	.0032	-.2048	.0211	.0160
#2	.0093	.2022	.0523	2.192	.0116	.0026	-.1920	.0215	.0181
#3	.0108	.2101	.0592	2.259	.0077	.0032	-.1971	.0218	.0200
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	50.34	.2099	.0360	.0187	.7977	<.0000	<.0000	.0931	.0094
Stddev	1.01	.0225	.0054	.0082	.0820	.0005	.0042	.0039	.0011
%RSD	2.014	10.74	15.12	43.67	10.28	18.43	37.43	4.192	11.70
#1	49.71	.1881	.0304	.0103	.7200	-.0030	-.0072	.0976	.0082
#2	49.79	.2085	.0363	.0193	.7897	-.0034	-.0107	.0909	.0096
#3	51.51	.2331	.0413	.0266	.8834	-.0023	-.0155	.0908	.0104
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-3-A Acquired: 5/22/2014 19:45:17 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0016	.3578	.0216	<.0000	57.05	.0177	.0104
Stddev	.0001	.0069	.0007	.0026	1.32	.0022	.0009
%RSD	3.285	1.935	3.092	11.92	2.321	12.59	8.431
#1	.0016	.3504	.0209	-.0206	55.94	.0176	.0095
#2	.0015	.3590	.0220	-.0198	56.69	.0156	.0103
#3	.0016	.3641	.0220	-.0246	58.51	.0200	.0113
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5704.6
Stddev	31.7
%RSD	.55615
#1	5677.0
#2	5739.3
#3	5697.6

Sample Name: 160-6672-A-4-A Acquired: 5/22/2014 19:49:05 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0023**	**.1299**	**.0008**	**.0002**	**.0045**	**<.0000**	**<.0000**	**.3929**	**.0077**
Stddev	.0005	.0046	.0011	.0017	.0001	.0000	.0006	.0402	.0008
%RSD	20.52	3.579	134.5	828.6	2.510	180.6	8.220	10.22	10.58
#1	.0022	.1249	.0019	-.0006	.0044	.0000	-.0061	.3526	.0069
#2	.0019	.1305	.0007	.0022	.0045	-.0001	-.0069	.3932	.0076
#3	.0028	.1342	-.0002	-.0010	.0046	.0000	-.0071	.4329	.0085
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0118**	**.0829**	**13.09**	**1.679**	**.0852**	**.0010**	**.0619**	**.0269**	**.0007**
Stddev	.0013	.0024	1.37	.037	.0214	.0003	.0120	.0009	.0001
%RSD	11.24	2.861	10.45	2.184	25.14	26.96	19.46	3.199	14.35
#1	.0105	.0810	11.75	1.650	.0606	.0014	.0630	.0259	.0008
#2	.0118	.0821	13.05	1.667	.0954	.0008	.0733	.0272	.0006
#3	.0132	.0855	14.48	1.720	.0997	.0009	.0493	.0275	.0008
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**69.71**	**1.496**	**.1435**	**.0287**	**.1030**	**.0014**	**.0004**	**.1543**	**.0033**
Stddev	1.79	.150	.0148	.0010	.0124	.0010	.0007	.0038	.0005
%RSD	2.562	10.05	10.29	3.476	12.01	69.21	197.3	2.445	15.18
#1	67.80	1.348	.1288	.0277	.0909	.0005	.0006	.1499	.0029
#2	70.00	1.493	.1434	.0296	.1024	.0013	.0009	.1568	.0031
#3	71.34	1.649	.1584	.0289	.1156	.0024	-.0004	.1560	.0038
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-4-A Acquired: 5/22/2014 19:49:05 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0009	.0070	.0042	<.0000	.2344	.0013	.2465
Stddev	.0000	.0021	.0004	.0011	.0164	.0032	.0247
%RSD	1.722	30.30	8.565	33.02	7.000	242.7	10.02
#1	.0009	.0051	.0047	-.0021	.2203	.0045	.2221
#2	.0008	.0067	.0040	-.0041	.2305	.0012	.2459
#3	.0009	.0093	.0041	-.0039	.2524	-.0018	.2715
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5768.9
Stddev	21.2
%RSD	.36774
#1	5747.3
#2	5789.7
#3	5769.8

Sample Name: 160-6672-A-5-A Acquired: 5/22/2014 19:53:00 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	.0019	<.0000	.0019	.0006	.0136	.0444	<.0000
Stddev	.0006	.0061	.0018	.0026	.0000	.0001	.0019	.0010	.0001
%RSD	23.24	12.26	91.45	38.50	.5226	10.41	13.76	2.257	1.961
#1	-.0031	-.0432	.0025	-.0051	.0019	.0006	.0114	.0456	-.0038
#2	-.0020	-.0504	.0000	-.0099	.0019	.0006	.0148	.0437	-.0037
#3	-.0022	-.0552	.0034	-.0055	.0019	.0007	.0146	.0440	-.0039
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0082	.0141	.0079	.6734	.0002	.0037	<.0000	.0090	.0217
Stddev	.0001	.0015	.0006	.0022	.0033	.0003	.0190	.0001	.0002
%RSD	1.039	10.59	7.205	.3265	1820.	7.865	8.969	.8162	.8348
#1	.0081	.0126	.0081	.6722	.0035	.0034	-.2268	.0091	.0218
#2	.0083	.0143	.0083	.6720	-.0031	.0040	-.1906	.0091	.0218
#3	.0081	.0156	.0073	.6759	.0002	.0037	-.2187	.0089	.0215
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	5.316	.0276	.0424	.0010	.0892	<.0000	<.0000	.0197	.0091
Stddev	.030	.0002	.0006	.0016	.0034	.0016	.0014	.0068	.0005
%RSD	.5599	.7478	1.475	169.8	3.825	72.23	35.21	34.61	5.372
#1	5.351	.0278	.0429	.0005	.0927	-.0028	-.0047	.0276	.0087
#2	5.300	.0276	.0426	.0028	.0889	-.0034	-.0047	.0157	.0097
#3	5.299	.0274	.0417	-.0004	.0859	-.0004	-.0023	.0159	.0089
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-5-A Acquired: 5/22/2014 19:53:00 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0017	.3379	.0181	<.0000	56.73	.0275	.0087
Stddev	.0000	.0054	.0003	.0024	.46	.0022	.0001
%RSD	2.404	1.588	1.576	13.62	.8029	8.009	1.685
#1	.0018	.3438	.0184	-.0170	57.25	.0278	.0088
#2	.0018	.3368	.0178	-.0207	56.42	.0295	.0087
#3	.0017	.3332	.0180	-.0161	56.53	.0251	.0086
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5788.5
Stddev	7.7
%RSD	.13359
#1	5797.0
#2	5781.8
#3	5786.8

Sample Name: 160-6672-A-6-A Acquired: 5/22/2014 19:56:51 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.1969	.0589	<.0000	.0071	.0013	.0419	.3004	<.0000
Stddev	.0016	.0026	.0024	.0031	.0002	.0000	.0023	.0158	.0006
%RSD	56.86	1.329	4.146	87.39	2.507	.6015	5.413	5.249	5.618
#1	-.0020	.1978	.0566	-.0010	.0073	.0013	.0396	.2849	-.0104
#2	-.0018	.1939	.0587	-.0027	.0069	.0013	.0441	.2998	-.0108
#3	-.0046	.1989	.0615	-.0069	.0072	.0013	.0421	.3164	-.0116
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0337	1.304	.1749	7.067	.0943	.0105	<.0000	.1053	.0195
Stddev	.0018	.007	.0102	.033	.0123	.0008	.0235	.0009	.0013
%RSD	5.378	.5214	5.848	.4654	13.10	7.230	3.942	.8903	6.607
#1	.0320	1.304	.1661	7.037	.0802	.0103	-.5849	.1052	.0182
#2	.0333	1.297	.1725	7.063	.1034	.0113	-.5820	.1044	.0196
#3	.0356	1.311	.1862	7.102	.0991	.0099	-.6241	.1063	.0207
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	40.26	.8758	.0611	.0603	.2599	<.0000	<.0000	.2268	.0297
Stddev	.15	.0466	.0038	.0133	.0101	.0015	.0017	.0093	.0024
%RSD	.3818	5.322	6.137	21.97	3.889	13.40	8.535	4.093	8.161
#1	40.23	.8332	.0569	.0474	.2488	-.0098	-.0181	.2162	.0276
#2	40.12	.8686	.0622	.0597	.2624	-.0128	-.0215	.2303	.0290
#3	40.42	.9256	.0642	.0739	.2686	-.0110	-.0204	.2337	.0323
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-6-A Acquired: 5/22/2014 19:56:51 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0060	1.132	.1857	<.0000	176.7	.0561	.0509
Stddev	.0000	.007	.0009	.0037	.8	.0041	.0028
%RSD	.6520	.6601	.4841	7.371	.4378	7.335	5.484
#1	.0060	1.124	.1863	-.0460	176.3	.0556	.0482
#2	.0059	1.139	.1847	-.0512	176.2	.0605	.0507
#3	.0060	1.133	.1862	-.0532	177.6	.0523	.0538
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5666.4
Stddev	15.6
%RSD	.27616
#1	5650.0
#2	5681.1
#3	5668.2

Sample Name: 160-6672-A-7-A Acquired: 5/22/2014 20:00:36 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	.0372	.0035	<.0000	.0012	.0001	.0012	.1104	<.0000
Stddev	.0003	.0055	.0009	.0020	.0001	.0000	.0019	.0176	.0001
%RSD	193.8	14.91	25.24	147.8	4.183	13.39	164.8	15.94	15.18
#1	.0000	.0318	.0034	.0009	.0013	.0001	.0026	.0932	-.0004
#2	-.0005	.0429	.0026	-.0021	.0013	.0001	-.0010	.1095	-.0005
#3	.0000	.0370	.0044	-.0029	.0012	.0001	.0019	.1284	-.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0062	.1567	.3688	1.254	.0088	.0011	<.0000	.0157	<.0000
Stddev	.0013	.0066	.0575	.041	.0103	.0002	.0044	.0006	.0003
%RSD	21.73	4.210	15.58	3.304	117.2	16.00	12.30	3.660	1566.
#1	.0047	.1502	.3118	1.212	-.0019	.0011	-.0308	.0151	-.0003
#2	.0064	.1566	.3679	1.254	.0185	.0010	-.0386	.0159	.0003
#3	.0074	.1634	.4267	1.295	.0097	.0013	-.0382	.0162	-.0001
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	65.06	.5309	.0090	.0154	.1112	<.0000	<.0000	.0911	.0043
Stddev	2.92	.0809	.0007	.0058	.0195	.0010	.0025	.0096	.0009
%RSD	4.483	15.23	7.764	37.56	17.56	340.8	111.8	10.49	20.23
#1	62.01	.4491	.0084	.0104	.0912	-.0015	.0003	.0801	.0034
#2	65.33	.5329	.0087	.0142	.1121	.0005	-.0022	.0960	.0043
#3	67.83	.6108	.0097	.0218	.1302	.0001	-.0047	.0973	.0052
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6672-A-7-A Acquired: 5/22/2014 20:00:36 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=20

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0005	.1256	.0134	<.0000	15.86	.0043	.0205
Stddev	.0000	.0062	.0007	.0012	.64	.0021	.0029
%RSD	8.140	4.897	4.962	12.93	4.060	48.56	14.18
#1	.0005	.1192	.0128	-.0090	15.14	.0044	.0177
#2	.0006	.1262	.0141	-.0077	16.03	.0021	.0204
#3	.0006	.1315	.0134	-.0100	16.40	.0063	.0235
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5789.4
Stddev	27.9
%RSD	.48131
#1	5796.7
#2	5758.6
#3	5812.9

Sample Name: MB 160-123259/1-A Acquired: 5/22/2014 20:04:28 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0081**	**<.0000**	**.0103**	**.0001**	**<.0000**	**<.0000**	**.0338**	**.0001**
Stddev	.0005	.0005	.0007	.0008	.0001	.0000	.0021	.0005	.0001
%RSD	343.0	6.566	60.04	7.311	55.48	113.2	87.46	1.602	112.7
#1	.0001	.0087	-.0019	.0103	.0001	.0000	.0000	.0334	.0001
#2	.0007	.0080	-.0011	.0096	.0002	.0000	-.0036	.0337	.0002
#3	-.0004	.0076	-.0005	.0111	.0002	.0000	-.0035	.0344	.0000
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0009**	**<.0000**	**.0071**	**<.0000**	**.0006**	**.0296**	**.0003**	**.0001**
Stddev	.0002	.0006	.0003	.0004	.0025	.0008	.0062	.0002	.0001
%RSD	118.7	65.22	246.2	5.553	160.8	125.6	20.85	54.58	45.01
#1	.0004	.0012	.0001	.0073	-.0014	-.0001	.0368	.0005	.0002
#2	.0000	.0012	-.0005	.0067	.0009	.0005	.0256	.0002	.0001
#3	.0001	.0002	.0000	.0074	-.0040	.0015	.0266	.0002	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0505**	**.0004**	**.0011**	**.0007**	**.0054**	**.0013**	**<.0000**	**.0476**	**.0003**
Stddev	.0104	.0001	.0015	.0009	.0014	.0007	.0015	.0100	.0002
%RSD	20.66	22.58	142.8	132.2	24.97	53.89	1127.	21.04	53.44
#1	.0385	.0005	.0009	.0006	.0039	.0020	.0015	.0392	.0002
#2	.0576	.0003	-.0004	.0016	.0059	.0012	-.0004	.0450	.0002
#3	.0553	.0003	.0026	-.0002	.0065	.0006	-.0014	.0587	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: MB 160-123259/1-A Acquired: 5/22/2014 20:04:28 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0000	.0005	<.0000	<.0000	<.0000	<.0000	.0082
Stddev	.0000	.0022	.0006	.0005	.0089	.0034	.0001
%RSD	237.9	463.5	242.5	16.44	37.80	14910.	1.369
#1	.0000	.0009	-.0001	-.0025	-.0244	-.0026	.0081
#2	.0000	.0025	-.0008	-.0034	-.0322	-.0013	.0083
#3	.0000	-.0019	.0003	-.0028	-.0144	.0038	.0083
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5864.9
Stddev	48.2
%RSD	.82119
#1	5920.5
#2	5837.5
#3	5836.7

Sample Name: LCSSRM 160-123259/2- Acquired: 5/22/2014 20:08:22 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3256**	**34.84**	**.4305**	**.4373**	**.9840**	**.2688**	**.0011**	**39.09**	**.7321**
Stddev	.0026	.08	.0026	.0031	.0033	.0012	.0013	.17	.0013
%RSD	.8050	.2251	.6047	.7159	.3397	.4319	117.9	.4319	.1786
#1	.3286	34.93	.4302	.4342	.9875	.2700	.0010	39.28	.7336
#2	.3236	34.81	.4280	.4404	.9836	.2688	-.0002	38.99	.7312
#3	.3246	34.79	.4332	.4373	.9809	.2676	.0025	38.99	.7315
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.058**	**.4474**	**1.372**	**55.00**	**11.26**	**.0391**	**11.95**	**2.074**	**.5411**
Stddev	.005	.0019	.003	.16	.04	.0006	.03	.007	.0028
%RSD	.4612	.4333	.1911	.2974	.3321	1.606	.2441	.3258	.5173
#1	1.063	.4497	1.374	55.19	11.29	.0398	11.97	2.081	.5439
#2	1.057	.4461	1.374	54.93	11.27	.0389	11.96	2.067	.5410
#3	1.054	.4466	1.369	54.89	11.22	.0386	11.91	2.075	.5383
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.188**	**1.274**	**2.609**	**.5069**	**1.228**	**.5075**	**.6215**	**2.417**	**.7652**
Stddev	.015	.004	.013	.0035	.004	.0018	.0019	.022	.0027
%RSD	.2879	.3237	.4784	.6924	.2981	.3477	.3095	.9198	.3484
#1	5.200	1.279	2.623	.5106	1.227	.5094	.6228	2.432	.7682
#2	5.194	1.272	2.604	.5063	1.233	.5072	.6193	2.391	.7635
#3	5.171	1.272	2.600	.5037	1.225	.5060	.6225	2.426	.7638
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: LCSSRM 160-123259/2- Acquired: 5/22/2014 20:08:22 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.8317	.1673	.7777	.7833	.0230	.7103	.6478
Stddev	.0035	.0022	.0014	.0021	.0043	.0034	.0019
%RSD	.4208	1.337	.1783	.2654	18.65	.4818	.2890
#1	.8350	.1667	.7775	.7853	.0279	.7106	.6495
#2	.8319	.1653	.7792	.7833	.0209	.7068	.6481
#3	.8280	.1697	.7764	.7812	.0201	.7136	.6458
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6322.9
Stddev	20.8
%RSD	.32914
#1	6299.6
#2	6329.3
#3	6339.7

Sample Name: 160-6698-D-1-B Acquired: 5/22/2014 20:11:53 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**44.85**	**.0339**	**.0062**	**.7447**	**.0026**	**.0031**	**7.405**	**.0004**
Stddev	.0002	.14	.0007	.0009	.0025	.0000	.0004	.021	.0001
%RSD	89.90	.3105	1.965	14.67	.3344	.5157	14.14	.2822	29.28
#1	.0002	45.00	.0343	.0058	.7467	.0026	.0031	7.397	.0004
#2	.0000	44.73	.0343	.0072	.7455	.0026	.0027	7.429	.0003
#3	.0005	44.82	.0331	.0054	.7419	.0026	.0035	7.389	.0005
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0471**	**.0691**	**.0414**	**63.51**	**4.587**	**.0302**	**8.680**	**4.067**	**.0021**
Stddev	.0001	.0010	.0005	.15	.018	.0002	.010	.004	.0003
%RSD	.3120	1.456	1.271	.2412	.3857	.8191	.1108	.1087	15.09
#1	.0472	.0702	.0410	63.45	4.605	.0305	8.681	4.068	.0024
#2	.0469	.0687	.0420	63.68	4.584	.0300	8.690	4.072	.0021
#3	.0471	.0683	.0411	63.39	4.570	.0301	8.670	4.063	.0017
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3320**	**.0735**	**1.146**	**.1057**	**.2077**	**.0055**	**.0010**	**1.224**	**.0018**
Stddev	.0025	.0003	.005	.0004	.0018	.0002	.0021	.013	.0007
%RSD	.7474	.3681	.4584	.3858	.8768	3.093	201.3	1.091	37.41
#1	.3310	.0735	1.143	.1057	.2064	.0053	-.0009	1.237	.0011
#2	.3301	.0738	1.152	.1054	.2098	.0056	.0032	1.211	.0019
#3	.3348	.0733	1.143	.1062	.2070	.0056	.0007	1.223	.0025
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6698-D-1-B Acquired: 5/22/2014 20:11:53 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0316	.1927	.5240	<.0000	.0199	.1011	.2589
Stddev	.0001	.0057	.0010	.0005	.0046	.0006	.0011
%RSD	.4215	2.949	.1904	8.600	23.18	.6083	.4125
#1	.0316	.1989	.5237	-.0067	.0165	.1004	.2590
#2	.0318	.1878	.5232	-.0064	.0181	.1014	.2600
#3	.0315	.1914	.5251	-.0057	.0252	.1016	.2579
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6740.5
Stddev	15.4
%RSD	.22839
#1	6743.7
#2	6723.8
#3	6754.1

Sample Name: CCV Acquired: 5/22/2014 20:15:38 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.048**	**52.23**	**5.342**	**5.136**	**5.294**	**5.257**	**5.364**	**54.36**	**5.396**
Stddev	.009	.03	.019	.011	.069	.010	.022	.07	.014
%RSD	.8147	.0526	.3542	.2146	1.302	.1867	.4081	.1230	.2652
#1	1.046	52.20	5.335	5.124	5.349	5.253	5.347	54.33	5.383
#2	1.058	52.25	5.328	5.146	5.217	5.249	5.357	54.43	5.394
#3	1.041	52.24	5.364	5.137	5.315	5.268	5.389	54.30	5.412
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.371**	**5.367**	**5.402**	**51.71**	**53.18**	**5.410**	**51.07**	**5.232**	**1.084**
Stddev	.001	.020	.021	.22	.15	.024	.10	.012	.001
%RSD	.0256	.3656	.3953	.4231	.2750	.4507	.2043	.2245	.0420
#1	5.372	5.369	5.389	51.57	53.34	5.434	51.01	5.221	1.084
#2	5.371	5.385	5.391	51.96	53.06	5.385	51.19	5.244	1.084
#3	5.369	5.346	5.427	51.59	53.14	5.410	51.01	5.229	1.084
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**53.02**	**5.445**	F **56.03**	**5.450**	**53.21**	**1.072**	**1.070**	**5.200**	**5.457**
Stddev	.23	.008	.03	.006	.21	.005	.005	.019	.004
%RSD	.4278	.1537	.0621	.1022	.3943	.4463	.4720	.3675	.0661
#1	53.27	5.437	56.07	5.444	53.06	1.072	1.064	5.186	5.453
#2	52.84	5.446	56.01	5.452	53.13	1.068	1.070	5.221	5.460
#3	52.94	5.454	56.01	5.455	53.45	1.077	1.074	5.192	5.459
Check ?	Chk Pass	Chk Pass	Chk Fail	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value			50.00						
Range			10.00%						

Sample Name: CCV Acquired: 5/22/2014 20:15:38 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	5.376	5.251	5.250	1.094	5.399	5.172	5.394
Stddev	.046	.037	.016	.001	.048	.026	.006
%RSD	.8476	.7028	.3111	.1048	.8899	.5029	.1032
#1	5.324	5.236	5.234	1.093	5.427	5.189	5.389
#2	5.401	5.293	5.267	1.094	5.427	5.186	5.392
#3	5.404	5.224	5.248	1.095	5.344	5.142	5.400
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	5526.9
Stddev	7.2
%RSD	.13099
#1	5528.1
#2	5519.1
#3	5533.4

Sample Name: CCB Acquired: 5/22/2014 20:19:26 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	<.0000	.0002	.0055	.0000	.0001	<.0000	.0136	.0010
Stddev	.0001	.0043	.0016	.0018	.0001	.0000	.0035	.0169	.0015
%RSD	23.95	75.55	671.9	33.68	1835.	4.971	638.7	124.5	155.5
#1	-.0002	-.0008	.0021	.0075	-.0001	.0001	.0035	.0330	.0028
#2	-.0003	-.0089	-.0009	.0040	.0000	.0001	-.0024	.0034	.0000
#3	-.0004	-.0071	-.0005	.0049	.0001	.0001	-.0028	.0042	.0002
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0012	.0013	.0001	.0026	.0004	.0012	.0059	.0003	.0004
Stddev	.0018	.0004	.0024	.0010	.0174	.0005	.0099	.0003	.0004
%RSD	154.8	30.59	2162.	40.03	4313.	40.10	168.0	86.06	105.7
#1	.0032	.0018	.0023	.0020	-.0194	.0007	.0172	.0001	.0008
#2	.0002	.0013	-.0025	.0020	.0133	.0017	-.0010	.0007	.0001
#3	.0001	.0009	.0006	.0038	.0073	.0011	.0014	.0003	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0190	.0011	.0109	.0010	.0132	.0014	<.0000	<.0000	.0010
Stddev	.0042	.0014	.0165	.0013	.0174	.0012	.0029	.0035	.0008
%RSD	22.19	125.7	151.2	124.8	131.5	85.89	200.0	91.38	82.15
#1	.0230	.0027	.0299	.0024	.0333	.0001	.0014	-.0066	.0019
#2	.0146	.0002	.0000	.0001	.0032	.0017	-.0013	-.0050	.0004
#3	.0195	.0004	.0029	.0005	.0031	.0024	-.0044	.0001	.0007
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 20:19:26 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	<.0000	.0005	.0063	<.0000	.0014
Stddev	.0001	.0008	.0003	.0006	.0069	.0031	.0015
%RSD	78.97	105.6	296.3	120.5	109.0	263.9	105.6
#1	.0001	-.0014	-.0001	.0012	.0044	-.0021	.0031
#2	.0002	.0001	.0002	.0000	.0006	.0023	.0005
#3	.0000	-.0011	-.0004	.0004	.0140	-.0037	.0006
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5984.1
Stddev	9.8
%RSD	.16371
#1	5974.3
#2	5984.2
#3	5993.8

Sample Name: 160-6698-D-1-B SD Acquired: 5/22/2014 20:23:22 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	<.0000	9.668	.0077	.0016	.1606	.0006	.0011	1.681	.0001
Stddev	.0004	.026	.0009	.0017	.0006	.0000	.0016	.002	.0000
%RSD	538.2	.2650	12.04	102.5	.3981	3.075	147.9	.1392	37.87
#1	.0002	9.654	.0067	.0014	.1605	.0006	.0030	1.683	.0001
#2	-.0006	9.652	.0081	.0034	.1600	.0006	.0000	1.679	.0001
#3	.0001	9.697	.0084	.0001	.1613	.0006	.0004	1.682	.0002
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0109	.0157	.0089	14.28	.9613	.0063	1.922	.9164	.0002
Stddev	.0003	.0005	.0009	.01	.0133	.0002	.002	.0016	.0001
%RSD	2.633	3.168	9.868	.1022	1.385	3.047	.0958	.1707	49.23
#1	.0108	.0156	.0089	14.28	.9475	.0061	1.924	.9150	.0001
#2	.0112	.0162	.0097	14.26	.9625	.0065	1.922	.9181	.0002
#3	.0106	.0152	.0080	14.29	.9740	.0063	1.921	.9162	.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0856	.0167	.2537	.0244	.0601	.0017	.0023	.2600	.0002
Stddev	.0025	.0002	.0022	.0010	.0014	.0007	.0022	.0050	.0005
%RSD	2.913	.9172	.8757	3.940	2.328	41.41	96.62	1.918	297.0
#1	.0827	.0166	.2543	.0253	.0594	.0013	.0001	.2650	.0004
#2	.0869	.0166	.2556	.0234	.0591	.0013	.0045	.2601	.0005
#3	.0872	.0169	.2512	.0246	.0617	.0026	.0022	.2550	-.0004
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6698-D-1-B SD Acquired: 5/22/2014 20:23:22 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=10

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0069	.0422	.1142	.0001	<.0000	.0241	.0645
Stddev	.0000	.0042	.0005	.0009	.0128	.0008	.0004
%RSD	.5454	9.913	.4159	1262.	105.2	3.458	.5674
#1	.0069	.0397	.1147	-.0008	.0026	.0237	.0650
#2	.0069	.0470	.1139	-.0001	-.0188	.0250	.0644
#3	.0070	.0399	.1139	.0011	-.0203	.0235	.0643
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6046.0
Stddev	7.2
%RSD	.11894
#1	6040.0
#2	6043.9
#3	6054.0

Sample Name: 160-6698-D-1-C MS Acquired: 5/22/2014 20:27:12 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0828**	**89.47**	**.4387**	**.7410**	**1.203**	**.4161**	**.4193**	**11.99**	**.4226**
Stddev	.0007	.20	.0042	.0054	.004	.0013	.0012	.04	.0023
%RSD	.7987	.2259	.9664	.7328	.3194	.3027	.2879	.3593	.5381
#1	.0820	89.71	.4390	.7446	1.207	.4175	.4180	11.97	.4212
#2	.0833	89.38	.4344	.7348	1.202	.4154	.4197	11.95	.4213
#3	.0830	89.33	.4428	.7436	1.199	.4153	.4204	12.04	.4252
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.4643**	**.5173**	**.4752**	**78.30**	**12.16**	**.5033**	**15.82**	**4.536**	**.2052**
Stddev	.0024	.0001	.0020	.20	.05	.0024	.05	.019	.0010
%RSD	.5107	.0180	.4179	.2590	.4281	.4705	.3193	.4107	.4633
#1	.4630	.5174	.4739	78.48	12.18	.5045	15.78	4.539	.2049
#2	.4628	.5172	.4743	78.08	12.20	.5048	15.80	4.516	.2044
#3	.4670	.5173	.4775	78.33	12.10	.5006	15.87	4.553	.2063
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**4.666**	**.5272**	**1.664**	**.5268**	**4.223**	**.1007**	**.2013**	**1.528**	**.4123**
Stddev	.021	.0022	.008	.0023	.022	.0021	.0014	.015	.0025
%RSD	.4493	.4086	.4640	.4340	.5325	2.130	.6721	1.003	.6037
#1	4.681	.5262	1.662	.5256	4.224	.1032	.2029	1.544	.4106
#2	4.675	.5257	1.657	.5254	4.199	.0995	.2007	1.528	.4111
#3	4.642	.5297	1.672	.5294	4.244	.0995	.2004	1.513	.4152
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6698-D-1-C MS Acquired: 5/22/2014 20:27:12 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.4888	.6292	1.240	.0817	.4582	.5472	.7381
Stddev	.0016	.0034	.003	.0016	.0070	.0034	.0027
%RSD	.3172	.5430	.2298	1.969	1.531	.6219	.3627
#1	.4904	.6300	1.244	.0836	.4651	.5490	.7372
#2	.4888	.6255	1.238	.0809	.4585	.5433	.7359
#3	.4873	.6322	1.239	.0808	.4511	.5494	.7411
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6835.3
Stddev	23.5
%RSD	.34394
#1	6845.0
#2	6852.3
#3	6808.4

Sample Name: 160-6698-D-1-D MSD Acquired: 5/22/2014 20:30:46 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0899**	**80.04**	**.4765**	**.7927**	**1.283**	**.4442**	**.4515**	**12.85**	**.4570**
Stddev	.0005	.22	.0006	.0037	.004	.0012	.0014	.03	.0003
%RSD	.5455	.2691	.1327	.4691	.3206	.2637	.3195	.2560	.0715
#1	.0895	80.13	.4772	.7959	1.287	.4453	.4518	12.81	.4571
#2	.0904	80.19	.4762	.7886	1.283	.4442	.4528	12.88	.4566
#3	.0898	79.79	.4760	.7935	1.279	.4430	.4499	12.85	.4573
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.5272**	**.5443**	**.5121**	**79.56**	**11.47**	**.5077**	**15.55**	**7.632**	**.2245**
Stddev	.0004	.0038	.0017	.10	.07	.0049	.04	.018	.0004
%RSD	.0808	.7048	.3394	.1222	.5819	.9578	.2307	.2426	.1746
#1	.5270	.5405	.5125	79.51	11.47	.5095	15.52	7.616	.2249
#2	.5270	.5482	.5102	79.67	11.54	.5114	15.59	7.627	.2241
#3	.5277	.5443	.5135	79.50	11.40	.5022	15.55	7.652	.2245
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**4.771**	**.5657**	**1.791**	**.5764**	**4.516**	**.1317**	**.2162**	**2.189**	**.4538**
Stddev	.041	.0008	.004	.0017	.009	.0012	.0033	.011	.0005
%RSD	.8553	.1449	.2284	.2935	.1999	.9152	1.521	.5043	.1140
#1	4.782	.5647	1.793	.5745	4.526	.1331	.2128	2.197	.4538
#2	4.805	.5663	1.786	.5770	4.509	.1311	.2162	2.192	.4544
#3	4.725	.5660	1.793	.5777	4.514	.1310	.2194	2.176	.4533
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6698-D-1-D MSD Acquired: 5/22/2014 20:30:46 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.5074	.6634	1.224	.0862	.4831	.5738	.7700
Stddev	.0019	.0028	.003	.0001	.0105	.0085	.0006
%RSD	.3689	.4235	.2593	.1205	2.170	1.476	.0811
#1	.5092	.6611	1.225	.0862	.4794	.5652	.7705
#2	.5075	.6665	1.227	.0863	.4949	.5821	.7702
#3	.5054	.6626	1.221	.0861	.4749	.5740	.7693
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6543.0
Stddev	12.3
%RSD	.18736
#1	6556.8
#2	6533.3
#3	6538.9

Sample Name: 160-6698-D-2-B Acquired: 5/22/2014 20:34:20 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0013**	**41.44**	**.0387**	**.0100**	**1.204**	**.0029**	**.0035**	**7.883**	**.0014**
Stddev	.0004	.05	.0010	.0024	.003	.0000	.0012	.045	.0000
%RSD	31.87	.1221	2.582	23.98	.2589	1.182	34.17	.5714	2.469
#1	.0017	41.47	.0378	.0072	1.207	.0029	.0032	7.857	.0014
#2	.0014	41.46	.0398	.0114	1.201	.0029	.0026	7.935	.0013
#3	.0009	41.38	.0386	.0113	1.204	.0029	.0049	7.857	.0014
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0673**	**.0704**	**.0494**	**68.60**	**4.112**	**.0272**	**8.305**	**7.676**	**.0037**
Stddev	.0005	.0002	.0022	.21	.017	.0003	.081	.051	.0001
%RSD	.6802	.2530	4.440	.2994	.4010	1.040	.9716	.6638	1.795
#1	.0669	.0702	.0475	68.52	4.122	.0274	8.283	7.658	.0038
#2	.0678	.0705	.0518	68.83	4.093	.0268	8.395	7.733	.0038
#3	.0671	.0705	.0489	68.44	4.120	.0273	8.238	7.636	.0037
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.3142**	**.0870**	**1.303**	**.1079**	**.2175**	**.0022**	**<.0000**	**1.291**	**.0016**
Stddev	.0003	.0007	.013	.0010	.0018	.0016	.0013	.009	.0005
%RSD	.0956	.8610	1.002	.9701	.8388	71.18	641.5	.6942	32.76
#1	.3139	.0868	1.304	.1075	.2189	.0040	.0013	1.292	.0020
#2	.3145	.0878	1.315	.1091	.2154	.0020	-.0010	1.282	.0017
#3	.3142	.0864	1.289	.1071	.2181	.0008	-.0009	1.300	.0010
Check ?	None	None	None	None	None	None	None	None	None
Value									
Range									

Sample Name: 160-6698-D-2-B Acquired: 5/22/2014 20:34:20 Type: Unk
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment: DF=2

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0317	.2105	.5374	<.0000	.0153	.1200	.2836
Stddev	.0000	.0033	.0009	.0004	.0058	.0025	.0021
%RSD	.0517	1.563	.1603	4.471	38.13	2.100	.7228
#1	.0317	.2103	.5379	-.0087	.0096	.1227	.2828
#2	.0317	.2138	.5379	-.0090	.0150	.1177	.2859
#3	.0317	.2072	.5364	-.0095	.0213	.1196	.2821
Check ?	None	None	None	None	None	None	None
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	6614.0
Stddev	48.6
%RSD	.73408
#1	6637.3
#2	6558.1
#3	6646.4

Sample Name: CCV Acquired: 5/22/2014 20:38:06 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**1.041**	**52.41**	**5.368**	**5.114**	**5.245**	**5.268**	**5.341**	F **55.02**	**5.431**
Stddev	.007	.13	.023	.004	.051	.053	.035	.30	.030
%RSD	.7101	.2474	.4226	.0837	.9630	.9998	.6610	.5429	.5480
#1	1.048	52.42	5.387	5.119	5.303	5.328	5.370	55.36	5.459
#2	1.033	52.27	5.343	5.111	5.219	5.237	5.302	54.82	5.400
#3	1.041	52.53	5.375	5.112	5.213	5.238	5.352	54.88	5.436
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Fail	Chk Pass
Value								50.00	
Range								10.00%	

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.377**	**5.398**	**5.398**	**52.31**	**53.36**	**5.405**	**52.17**	**5.307**	**1.087**
Stddev	.020	.026	.036	.13	.41	.051	.31	.030	.005
%RSD	.3762	.4906	.6604	.2475	.7728	.9370	.5949	.5629	.4487
#1	5.399	5.425	5.426	52.46	53.14	5.377	52.47	5.339	1.091
#2	5.360	5.372	5.358	52.23	53.11	5.375	52.19	5.300	1.082
#3	5.372	5.395	5.411	52.24	53.84	5.464	51.85	5.281	1.087
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value									
Range									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**52.80**	F **5.517**	F **55.98**	F **5.514**	**53.19**	**1.075**	**1.062**	**5.262**	F **5.527**
Stddev	.46	.030	.27	.032	.35	.006	.009	.013	.028
%RSD	.8665	.5517	.4911	.5855	.6518	.5395	.8451	.2521	.5055
#1	52.51	5.550	56.26	5.550	53.48	1.078	1.067	5.272	5.558
#2	52.57	5.490	55.71	5.487	52.81	1.068	1.051	5.247	5.505
#3	53.33	5.512	55.96	5.506	53.29	1.079	1.067	5.267	5.517
Check ?	Chk Pass	Chk Fail	Chk Fail	Chk Fail	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Fail
Value		5.000	50.00	5.000					5.000
Range		10.00%	10.00%	10.00%					10.00%

Sample Name: CCV Acquired: 5/22/2014 20:38:06 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**5.364**	**5.178**	**5.305**	**1.098**	**5.402**	**5.164**	**5.427**
Stddev	.046	.044	.013	.005	.022	.021	.030
%RSD	.8515	.8560	.2497	.4565	.4108	.3986	.5533
#1	5.372	5.228	5.317	1.101	5.427	5.188	5.458
#2	5.314	5.145	5.290	1.092	5.384	5.156	5.398
#3	5.405	5.160	5.307	1.100	5.394	5.149	5.424
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Int. Std.	Y_3710
Units	Cts/S
Avg	**5455.5**
Stddev	26.5
%RSD	.48560
#1	5425.0
#2	5472.7
#3	5468.8

Sample Name: CCB Acquired: 5/22/2014 20:41:54 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Ag3280	Al3961	As1890	B_2496	Ba4554	Be3130	Bi2230	Ca1840	Cd2288
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**<.0000**	**.0004**	**.0099**	**.0001**	**.0001**	**<.0000**	**.0040**	**.0003**
Stddev	.0004	.0064	.0015	.0016	.0001	.0000	.0015	.0003	.0000
%RSD	163.9	141.4	373.9	16.12	51.75	27.93	165.8	8.562	18.88
#1	-.0002	.0014	.0021	.0100	.0001	.0001	-.0019	.0041	.0003
#2	.0004	-.0113	-.0006	.0083	.0001	.0001	.0008	.0036	.0002
#3	.0005	-.0037	-.0003	.0115	.0002	.0002	-.0017	.0042	.0003
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Co2286	Cr2835	Cu2178	Fe2599	K_7664	Li6707	Mg2798	Mn2576	Mo2020
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0002**	**.0010**	**<.0000**	**.0037**	**.0123**	**.0004**	**.0071**	**.0006**	**.0002**
Stddev	.0003	.0004	.0012	.0007	.0146	.0007	.0065	.0003	.0002
%RSD	118.0	36.12	146.7	19.95	117.9	199.0	91.70	43.20	127.9
#1	.0003	.0006	.0003	.0034	.0172	.0010	.0025	.0009	.0004
#2	-.0001	.0011	-.0022	.0031	.0239	-.0004	.0043	.0004	.0000
#3	.0005	.0012	-.0007	.0045	-.0040	.0005	.0145	.0006	.0001
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Elem	Na5895	Ni2216	P_1774	Pb2203	S_1820	Sb2068	Se1960	Si2516	Sn1899
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	**.0099**	**.0002**	**.0026**	**<.0000**	**.0053**	**.0007**	**.0004**	**<.0000**	**.0006**
Stddev	.0011	.0002	.0015	.0007	.0004	.0023	.0011	.0061	.0001
%RSD	10.82	97.76	59.21	663.6	8.387	337.9	264.3	243.4	13.67
#1	.0090	.0003	.0037	-.0008	.0057	.0014	.0008	-.0076	.0005
#2	.0097	.0000	.0033	.0006	.0048	-.0019	-.0008	-.0042	.0006
#3	.0111	.0003	.0008	-.0001	.0054	.0026	.0013	.0043	.0007
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit									
Low Limit									

Sample Name: CCB Acquired: 5/22/2014 20:41:54 Type: QC
Method: 2014v3(v93) Mode: CONC Corr. Factor: 1.000000
User: metals Custom ID1: Custom ID2: Custom ID3:
Comment:

Elem	Sr4077	Th2832	Ti3349	Tl1908	U_3670	V_2908	Zn2138
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Avg	.0001	<.0000	.0000	<.0000	<.0000	<.0000	.0005
Stddev	.0000	.0026	.0004	.0003	.0097	.0026	.0002
%RSD	32.67	608.8	2049.	69.98	62.79	117.9	32.56
#1	.0002	.0015	.0004	-.0007	-.0066	-.0026	.0006
#2	.0001	-.0033	-.0001	-.0001	-.0259	-.0045	.0003
#3	.0001	.0005	-.0002	-.0007	-.0139	.0006	.0005
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit							
Low Limit							

Int. Std.	Y_3710
Units	Cts/S
Avg	5781.5
Stddev	9.7
%RSD	.16707
#1	5792.0
#2	5773.0
#3	5779.4

HAA052214C1

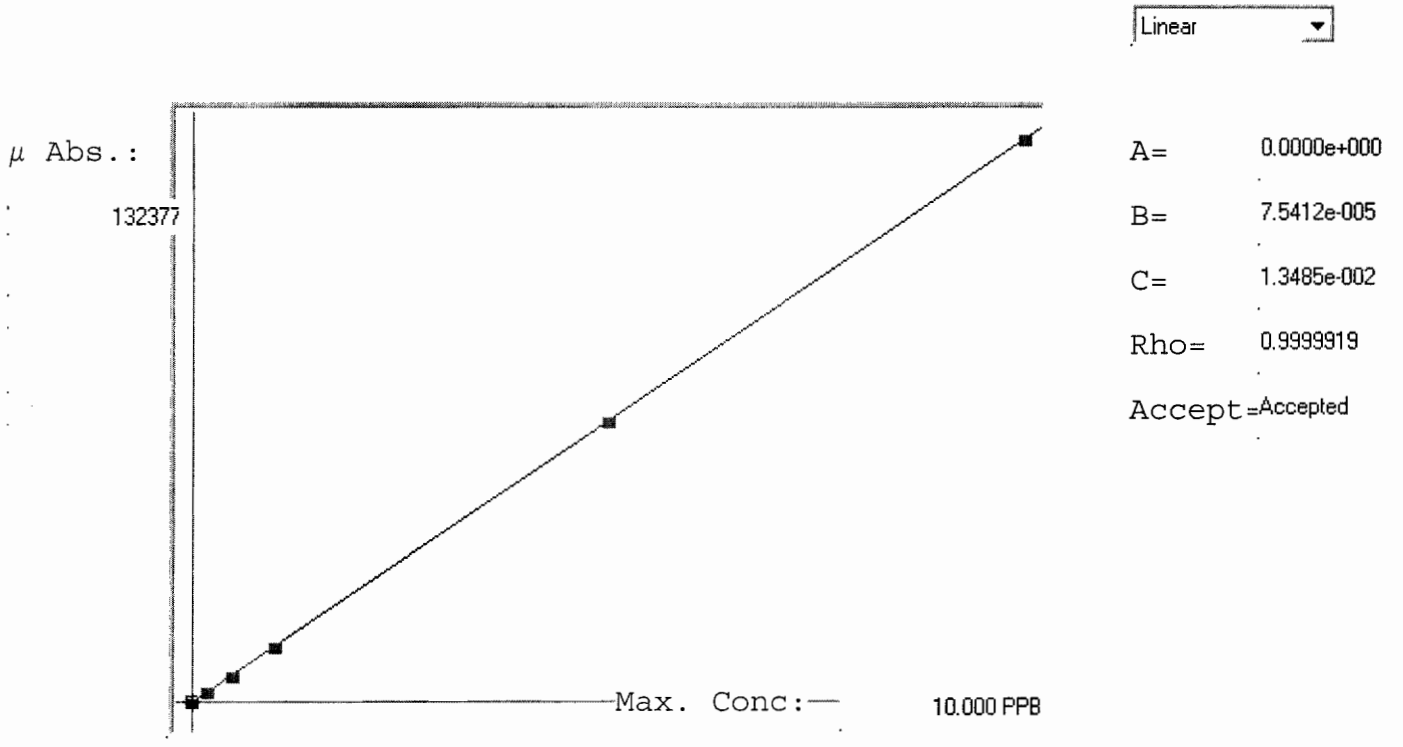
Method: Hg LLC Operator: Admin Date of Analysis: 27 May 2014 10:09:45

Seq ID	Type	Sample ID	Extended ID	Date	Stats Data	Mean	Units	Stnd Conc	Method	Chapter
5556	STND RECALC	CALIBRATION BLANK		27 May 2014 10:10:24	79, 81, 76,	79	PPB	0.0000	Hg LLC	HAA052214C1
5557	STND RECALC	CALIBRATION 1		27 May 2014 10:10:27	2584, 2591, 2598,	2591	PPB	0.2000	Hg LLC	HAA052214C1
5558	STND RECALC	CALIBRATION 2		27 May 2014 10:10:30	6172, 6198, 6218,	6196	PPB	0.5000	Hg LLC	HAA052214C1
5559	STND RECALC	CALIBRATION 3		27 May 2014 10:10:33	12805, 12854, 12890,	12850	PPB	1.0000	Hg LLC	HAA052214C1
5560	STND RECALC	CALIBRATION 4		27 May 2014 10:10:36	66043, 66308, 66501,	66284	PPB	5.0000	Hg LLC	HAA052214C1
5561	STND RECALC	CALIBRATION 5		27 May 2014 10:10:39	132132, 132412, 132588,	132377	PPB	10.0000	Hg LLC	HAA052214C1
5562	CK STD RECALC	ICV		27 May 2014 10:10:43	4.9914, 5.0175, 5.0375,	5.0155	PPB		Hg LLC	HAA052214C1
5563	CK STD RECALC	ICB		27 May 2014 10:10:46	-0.0282, -0.0286, -0.0288,	-0.0285	PPB		Hg LLC	HAA052214C1
5564	SMPL RECALC	MB 160-123407/1-A		27 May 2014 10:12:27	0.0207, 0.0222, 0.0221,	0.0217	PPB		Hg LLC	HAA052214C1
5565	SMPL RECALC	LCS 160-123407/2-A		27 May 2014 10:12:30	4.7176, 4.7381, 4.7532,	4.7363	PPB		Hg LLC	HAA052214C1
5566	SMPL RECALC	160-6694-F-7-C		27 May 2014 10:12:33	-0.0140, -0.0131, -0.0127,	-0.0133	PPB		Hg LLC	HAA052214C1
5567	SMPL RECALC	160-6694-F-7-C SD	5x	27 May 2014 10:12:36	0.0173, 0.0184, 0.0197,	0.0185	PPB		Hg LLC	HAA052214C1
5568	SMPL RECALC	160-6694-F-7-D MS		27 May 2014 10:12:39	5.0983, 5.1072, 5.1116,	5.1057	PPB		Hg LLC	HAA052214C1
5569	SMPL RECALC	160-6694-F-7-E MSD		27 May 2014 10:12:42	5.0343, 5.0525, 5.0655,	5.0507	PPB		Hg LLC	HAA052214C1
5570	SMPL RECALC	160-6725-B-1-A		27 May 2014 10:12:45	-0.0315, -0.0324, -0.0325,	-0.0321	PPB		Hg LLC	HAA052214C1
5571	SMPL RECALC	160-6725-B-2-A		27 May 2014 10:12:48	0.0226, 0.0223, 0.0223,	0.0224	PPB		Hg LLC	HAA052214C1
5572	SMPL RECALC	160-6725-B-3-A		27 May 2014 10:12:51	0.0196, 0.0184, 0.0183,	0.0188	PPB		Hg LLC	HAA052214C1
5573	SMPL RECALC	160-6725-B-4-A		27 May 2014 10:12:54	0.0143, 0.0144, 0.0141,	0.0143	PPB		Hg LLC	HAA052214C1
5574	CK STD RECALC	CCV		27 May 2014 10:12:57	4.8940, 4.9123, 4.9252,	4.9105	PPB		Hg LLC	HAA052214C1
5575	CK STD RECALC	CCB		27 May 2014 10:13:00	-0.0249, -0.0252, -0.0247,	-0.0250	PPB		Hg LLC	HAA052214C1
5576	SMPL RECALC	160-6725-B-5-A		27 May 2014 10:13:03	0.0213, 0.0214, 0.0213,	0.0213	PPB		Hg LLC	HAA052214C1
5577	SMPL RECALC	160-6725-B-6-A		27 May 2014 10:13:06	0.0211, 0.0219, 0.0225,	0.0218	PPB		Hg LLC	HAA052214C1
5578	SMPL RECALC	160-6725-B-7-A		27 May 2014 10:13:09	0.0181, 0.0181, 0.0179,	0.0180	PPB		Hg LLC	HAA052214C1
5579	SMPL RECALC	160-6725-B-8-A		27 May 2014 10:13:12	0.0191, 0.0195, 0.0206,	0.0197	PPB		Hg LLC	HAA052214C1
5580	SMPL RECALC	160-6725-C-1-A		27 May 2014 10:13:15	0.0143, 0.0139, 0.0133,	0.0138	PPB		Hg LLC	HAA052214C1
5581	SMPL RECALC	160-6725-C-2-A		27 May 2014 10:13:18	0.0156, 0.0156, 0.0154,	0.0155	PPB		Hg LLC	HAA052214C1
5582	SMPL RECALC	160-6725-C-3-A		27 May 2014 10:13:21	0.0193, 0.0196, 0.0195,	0.0195	PPB		Hg LLC	HAA052214C1
5583	SMPL RECALC	160-6725-C-4-A		27 May 2014 10:13:25	0.0110, 0.0109, 0.0112,	0.0110	PPB		Hg LLC	HAA052214C1
5584	SMPL RECALC	160-6725-C-5-A		27 May 2014 10:13:28	0.0189, 0.0189, 0.0193,	0.0190	PPB		Hg LLC	HAA052214C1
5585	SMPL RECALC	160-6725-C-6-A		27 May 2014 10:13:31	0.0124, 0.0127, 0.0126,	0.0125	PPB		Hg LLC	HAA052214C1
5586	CK STD RECALC	CCV		27 May 2014 10:13:34	4.9461, 4.9702, 4.9882,	4.9682	PPB		Hg LLC	HAA052214C1
5587	CK STD RECALC	CCB		27 May 2014 10:13:37	-0.0223, -0.0236, -0.0251,	-0.0237	PPB		Hg LLC	HAA052214C1
5588	SMPL RECALC	160-6725-C-7-A		27 May 2014 10:13:40	0.0090, 0.0092, 0.0091,	0.0091	PPB		Hg LLC	HAA052214C1
5589	SMPL RECALC	160-6725-C-8-A		27 May 2014 10:13:43	0.0175, 0.0183, 0.0179,	0.0179	PPB		Hg LLC	HAA052214C1
5590	CK STD RECALC	CCV		27 May 2014 10:13:46	4.9584, 4.9762, 4.9886,	4.9744	PPB		Hg LLC	HAA052214C1
5591	CK STD RECALC	CCB		27 May 2014 10:13:49	-0.0428, -0.0433,	-0.0428	PPB		Hg LLC	HAA052214C1

Hg

HAA052214C1
MTS 5/27/14
7470A
A. Batch: 123936

Hg LLC



Std ID	Conc.	Calc.	Dev.	Mean	SD or %RSD	Rep 1	Rep 2	Rep 3	Rep 4
CALIBRATION BLANK	0.000	0.019	0.019	78	2.055	79	81	76	
CALIBRATION 1	0.200	0.209	0.009	2591	0.2 %	2584	2591	2598	
CALIBRATION 2	0.500	0.481	-0.019	6196	0.3 %	6172	6198	6218	
CALIBRATION 3	1.000	0.983	-0.017	12849	0.3 %	12805	12854	12890	
CALIBRATION 4	5.000	5.012	0.012	66284	0.3 %	66043	66308	66501	
CALIBRATION 5	10.000	9.996	-0.004	132377	0.1 %	132132	132412	132588	

HAA052214C1
MTS 5/27/14
7470A
A. Batch 123936

HAA052814A

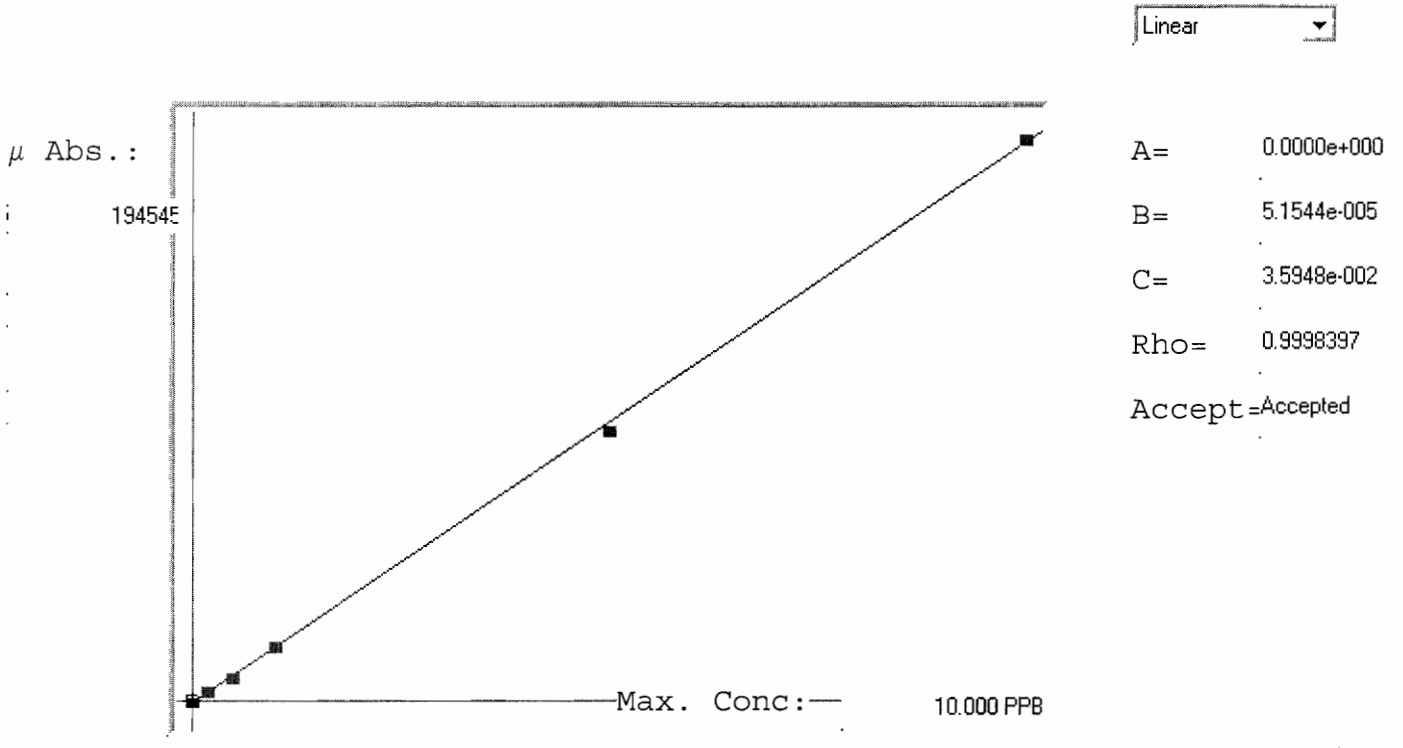
Method: Hg LLC Operator: Admin Date of Analysis: 28 May 2014 09:01:35

Seq ID	Type	Sample ID	Extended ID	Date	Stats Data	Mean	Units	Stnd Conc	Method	Chapter
5665	Std	CALIBRATION BLANK		28 May 2014 09:02:13	71, 76, 70,	72	PPB	0.0000	Hg LLC	HAA052814A
5666	Std	CALIBRATION 1		28 May 2014 09:04:05	3623, 3640, 3656,	3640	PPB	0.2000	Hg LLC	HAA052814A
5667	Std	CALIBRATION 2		28 May 2014 09:05:57	8704, 8744, 8771,	8740	PPB	0.5000	Hg LLC	HAA052814A
5668	Std	CALIBRATION 3		28 May 2014 09:07:56	19107, 19165, 19197,	19156	PPB	1.0000	Hg LLC	HAA052814A
5669	Std	CALIBRATION 4		28 May 2014 09:10:08	93390, 93683, 93894,	93656	PPB	5.0000	Hg LLC	HAA052814A
5670	Std	CALIBRATION 5		28 May 2014 09:12:21	194118, 194586, 194931,	194545	PPB	10.0000	Hg LLC	HAA052814A
5671	CK STND	ICV		28 May 2014 09:14:53	5.1367, 5.1492, 5.1553,	5.1471	PPB		Hg LLC	HAA052814A
5672	CK STND	ICB		28 May 2014 09:17:42	0.0059, 0.0060, 0.0059,	0.0060	PPB		Hg LLC	HAA052814A
5673	SMPL	MB 160-123919/1-A		28 May 2014 09:31:27	0.0351, 0.0351, 0.0352,	0.0352	PPB		Hg LLC	HAA052814A
5674	SMPL	LCSSRM 160-123919/2-A	10x	28 May 2014 09:33:17	5.0386, 5.0696, 5.0916,	5.0666	PPB		Hg LLC	HAA052814A
5675	SMPL	160-6694-C-1-D		28 May 2014 09:35:08	0.4708, 0.4720, 0.4730,	0.4719	PPB		Hg LLC	HAA052814A
5676	SMPL	160-6694-C-2-B		28 May 2014 09:37:41	0.1694, 0.1700, 0.1703,	0.1699	PPB		Hg LLC	HAA052814A
5677	SMPL	160-6694-C-3-B		28 May 2014 09:39:41	0.5931, 0.5933, 0.5927,	0.5930	PPB		Hg LLC	HAA052814A
5678	SMPL	160-6694-C-4-B		28 May 2014 09:41:33	0.0847, 0.0850, 0.0848,	0.0848	PPB		Hg LLC	HAA052814A
5679	SMPL	160-6694-C-5-B		28 May 2014 09:43:27	0.5850, 0.5880, 0.5900,	0.5877	PPB		Hg LLC	HAA052814A
5680	SMPL	160-6694-C-6-B		28 May 2014 09:45:18	0.8562, 0.8497, 0.8436,	0.8498	PPB		Hg LLC	HAA052814A
5681	SMPL	160-6694-C-6-B SD	5x	28 May 2014 09:47:18	0.1400, 0.1398, 0.1396,	0.1398	PPB		Hg LLC	HAA052814A
5682	SMPL	160-6694-C-6-C MS		28 May 2014 09:49:19	5.3986, 5.4244, 5.4448,	5.4226	PPB		Hg LLC	HAA052814A
5683	CK STND	CCV		28 May 2014 09:51:13	4.9866, 5.0097, 5.0265,	5.0076	PPB		Hg LLC	HAA052814A
5684	CK STND	CCB		28 May 2014 09:53:38	0.0072, 0.0072, 0.0070,	0.0072	PPB		Hg LLC	HAA052814A
5685	SMPL	160-6694-C-6-D MSD		28 May 2014 09:56:15	5.0985, 5.1247, 5.1434,	5.1222	PPB		Hg LLC	HAA052814A
5686	CK STND	CCV		28 May 2014 09:58:07	4.9976, 5.0255, 5.0444,	5.0225	PPB		Hg LLC	HAA052814A
5687	CK STND	CCB		28 May 2014 10:00:35	0.0078, 0.0073,	0.0074	PPB		Hg LLC	HAA052814A

All

FC
5/28/14
7471B

Hg LLC



Std ID	Conc.	Calc.	Dev.	Mean	SD or %RSD	Rep 1	Rep 2	Rep 3	Rep 4
CALIBRATION BLANK	0.000	0.040	0.040	72	2.625	71	76	70	
CALIBRATION 1	0.200	0.224	0.024	3639	0.4 %	3623	3640	3656	
CALIBRATION 2	0.500	0.486	-0.014	8739	0.3 %	8704	8744	8771	
CALIBRATION 3	1.000	1.023	0.023	19156	0.2 %	19107	19165	19197	
CALIBRATION 4	5.000	4.863	-0.137	93655	0.2 %	93390	93683	93894	
CALIBRATION 5	10.000	10.064	0.064	194545	0.2 %	194118	194586	194931	

FC
5/28/14
74713
File: HAA052814A

METALS BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122752 Batch Start Date: 05/19/14 08:37 Batch Analyst: Taddeo, Louis J

Batch Method: 3050B Batch End Date: 05/19/14 14:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	FinalAmount	PR_LCSSRM 00004	PREP 1 and 2 00002		
MB 160-122752/1		3050B, 6010C		0.5661 g	50 mL				
LCSSRM 160-122752/2		3050B, 6010C		0.5603 g	50 mL	0.5603 g			
160-6694-C-1	2222-SD01	3050B, 6010C	T	0.5210 g	50 mL				
160-6694-C-1 MS	2222-SD01	3050B, 6010C	T	0.5764 g	50 mL		0.25 mL		
160-6694-C-1 MSD	2222-SD01	3050B, 6010C	T	0.5070 g	50 mL		0.25 mL		
160-6694-C-2	2222-SD02	3050B, 6010C	T	0.5838 g	50 mL				
160-6694-C-3	2222-SD03	3050B, 6010C	T	0.5380 g	50 mL				
160-6694-C-4	2222-SD04	3050B, 6010C	T	0.5054 g	50 mL				
160-6694-C-5	2222-SD05	3050B, 6010C	T	0.5003 g	50 mL				
160-6694-C-6	2222-SD06	3050B, 6010C	T	0.5887 g	50 mL				

Batch Notes	
Balance ID	27150548
Batch Comment	(HOT BLOCK 1)
Hydrogen peroxide lot number	361073
Lot # of hydrochloric acid	358674
Lot # of Nitric Acid	362481
Hot Block ID number	1
Oven, Bath or Block Temperature 1	92.7 Degrees C
Pipette ID	M-PREP-2
ID number of the thermometer	111815886
Digestion Tube/Cup Lot #	175919

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.

METALS BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122863 Batch Start Date: 05/19/14 10:57 Batch Analyst: Taddeo, Louis J

Batch Method: 3010A Batch End Date: 05/20/14 09:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	FinalAmount	PREP 1 and 2 00002			
MB 160-122863/1		3010A, 6010C		50 mL	50 mL				
LCS 160-122863/2		3010A, 6010C		50 mL	50 mL	0.25 mL			
160-6694-F-7	2222-RIN-01	3010A, 6010C	T	50 mL	50 mL				

Batch Notes	
Balance ID	27150548
Lot # of hydrochloric acid	353918
Lot # of Nitric Acid	327704
Hot Block ID number	1
Oven, Bath or Block Temperature 1	92.2 Degrees C
Pipette ID	m-prep-2
ID number of the thermometer	111815886
Digestion Tube/Cup Lot #	175919

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.

METALS BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123407 Batch Start Date: 05/21/14 11:00 Batch Analyst: Souris, Matthew T

Batch Method: 7470A Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	FinalAmount	Hg Curve Int. 00401			
MB 160-123407/1		7470A, 7470A		30 mL	30 mL				
LCS 160-123407/2		7470A, 7470A		30 mL	30 mL	1.5 mL			
160-6694-F-7	2222-RIN-01	7470A, 7470A	T	30 mL	30 mL				
160-6694-F-7 MS	2222-RIN-01	7470A, 7470A	T	30 mL	30 mL	1.5 mL			
160-6694-F-7 MSD	2222-RIN-01	7470A, 7470A	T	30 mL	30 mL	1.5 mL			

Batch Notes	
Hydroxylamine Sulfate Lot Number	326592
Digestion End Time	1300
Digestion Start Time	1100
Sulfuric Acid Lot Number	348390
Lot # of hydrochloric acid	361062
Lot # of Nitric Acid	348392
Hood ID or number	HOOD2
Hot Block ID number	HG1
Potassium Persulfate Lot Number	326595
Potassium Permanganate Lot Number	361055
NaCl Lot #	166068
Oven, Bath or Block Temperature 1	95.7 Celsius
Oven, Bath or Block Temperature 2	95.7 Celsius
Pipette ID	HG6ANDMET12ANDMET10
Stannous Chloride Lot Number	362989
SOP Number	ST-MT-0005
ID number of the thermometer	111815895
Digestion Tube/Cup Lot #	179718

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.

METALS BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123919 Batch Start Date: 05/27/14 10:17 Batch Analyst: Souris, Matthew T

Batch Method: 7471B Batch End Date: 05/27/14 10:17

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	FinalAmount	Hg QC Int. 00388	PR_LCSSRM 00006		
MB 160-123919/1		7471B, 7471B		0.6630 g	100 mL				
LCSSRM 160-123919/2		7471B, 7471B		0.6576 g	100 mL		0.6576 g		
160-6694-C-1	2222-SD01	7471B, 7471B	T	0.6750 g	100 mL				
160-6694-C-2	2222-SD02	7471B, 7471B	T	0.5543 g	100 mL				
160-6694-C-3	2222-SD03	7471B, 7471B	T	0.6151 g	100 mL				
160-6694-C-4	2222-SD04	7471B, 7471B	T	0.6591 g	100 mL				
160-6694-C-5	2222-SD05	7471B, 7471B	T	0.6784 g	100 mL				
160-6694-C-6	2222-SD06	7471B, 7471B	T	0.6474 g	100 mL				
160-6694-C-6 MS	2222-SD06	7471B, 7471B	T	0.6210 g	100 mL	5 mL			
160-6694-C-6 MSD	2222-SD06	7471B, 7471B	T	0.6881 g	100 mL	5 mL			

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.

METALS BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123919 Batch Start Date: 05/27/14 10:17 Batch Analyst: Souris, Matthew T

Batch Method: 7471B Batch End Date: 05/27/14 10:17

Batch Notes	
Hydroxylamine Sulfate Lot Number	326592
Balance ID	27150548
Digestion End Time	1100
Digestion Start Time	1030
Sulfuric Acid Lot Number	348390
Lot # of hydrochloric acid	361062
Lot # of Nitric Acid	348392
Hood ID or number	HOOD2
Hot Block ID number	HG2
Potassium Persulfate Lot Number	326595
Potassium Permanganate Lot Number	361055
NaCl Lot #	166068
Oven, Bath or Block Temperature 1	93.7 Celsius
Oven, Bath or Block Temperature 2	93.7 Celsius
Pipette ID	HG6ANDMET12ANDMET10
Stannous Chloride Lot Number	362989
SOP Number	ST-MT-0007
ID number of the thermometer	111815895
Digestion Tube/Cup Lot #	177748

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.

GENERAL CHEMISTRY

COVER PAGE
GENERAL CHEMISTRY

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG No.:

Project: EPA Region 5 START 3 Contract

Client Sample ID	Lab Sample ID
2222-SD01	160-6694-1
2222-SD02	160-6694-2
2222-SD03	160-6694-3
2222-SD04	160-6694-4
2222-SD05	160-6694-5
2222-SD06	160-6694-6

Comments:

9-IN
DETECTION LIMITS
GENERAL CHEMISTRY

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Solid Instrument ID: NOEQUIP

Method: Moisture RL Date: 01/28/2011 14:43

Analyte	Wavelength/ Mass	RL (%)	
Percent Moisture		0.1	
Percent Solids		0.1	

9-IN
CALIBRATION BLANK DETECTION LIMITS
GENERAL CHEMISTRY

Lab Name: TestAmerica St. Louis Job Number: 160-6694-1

SDG Number:

Matrix: Solid Instrument ID: NOEQUIP

Method: Moisture XRL Date: 01/28/2011 14:42

Analyte	Wavelength/ Mass	XRL (%)	
Percent Moisture		0.1	
Percent Solids		0.1	

13-IN
ANALYSIS RUN LOG
GENERAL CHEMISTRY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Instrument ID: NOEQUIP Analysis Method: Moisture

Start Date: 05/17/2014 08:15 End Date: 05/17/2014 08:34

Lab Sample Id	D/F	Type	Time	Analytes																										
				% Sol	Moist																									
ZZZZZZ			08:15																											
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160-6694-1	1	T	08:15	X	X																									
160-6694-2	1	T	08:15	X	X																									
160-6694-3	1	T	08:15	X	X																									
160-6694-4	1	T	08:15	X	X																									
160-6694-5	1	T	08:15	X	X																									
160-6694-6	1	T	08:15	X	X																									
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FORM XIII-IN

13-IN
ANALYSIS RUN LOG
GENERAL CHEMISTRY

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Instrument ID: NOEQUIP Analysis Method: Moisture

Start Date: 05/17/2014 08:15 End Date: 05/17/2014 08:34

Lab Sample Id	D/F	Type	Time	Analytes																									
				% Sol	Moist																								
ZZZZZZ			08:34																										

Prep Types:
T = Total/NA

FORM XIII-IN

GENERAL CHEMISTRY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122677 Batch Start Date: 05/17/14 09:00 Batch Analyst: Braatz, Steve D

Batch Method: Moisture Batch End Date: 05/18/14 06:55

Lab Sample ID	Client Sample ID	Method Chain	Basis	DISH#	DishWeight	SampleMassWet	SampleMassDry		
160-6694-A-1	2222-SD01	Moisture	T	8	1.3139 g	12.7566 g	9.5871 g		
160-6694-A-2	2222-SD02	Moisture	T	9	1.3248 g	12.2013 g	9.1457 g		
160-6694-A-3	2222-SD03	Moisture	T	10	1.3355 g	11.4280 g	6.6273 g		
160-6694-A-4	2222-SD04	Moisture	T	11	1.3088 g	10.5395 g	3.9517 g		
160-6694-A-5	2222-SD05	Moisture	T	12	1.3265 g	13.6247 g	10.7836 g		
160-6694-A-6	2222-SD06	Moisture	T	13	1.3119 g	15.1661 g	8.9212 g		

Batch Notes	
Balance ID	27050421 No Unit
Batch Comment	TRAY A
Date samples were placed in the oven	5-17-14
Oven Temp when samples are put in oven	103 Degrees C
Time samples were place in the oven	09:00
Date samples were removed from oven	5-18-14
Oven Temp when samples removed from oven	103 Degrees C
Time Samples were removed from oven	06:55
Oven ID	OA

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.

ALPHA SPECTROSCOPY

Method A-01-R Th

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

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

Prep Batch: 123197

, Extraction Chromatography Resin Actinide

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123197

Lab ID: MB 160-123197/1-A
Client ID:
Sigma: 2
Analyzed: 05/21/14 19:04
Detector: AV43
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	0.02379	0.0476	0.0476	U	pCi/L	1.00	0.0714	123332
Thorium-230	0.2388	0.151	0.152		pCi/L	1.00	0.0714	123332
Thorium-232	0.04293	0.0676	0.0677	U	pCi/L	1.00	0.108	123332

Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	10.03	0.885	1.22		pCi/L	0.101	12.2	81.9	30 - 110

Lab ID: LCS 160-123197/2-A
Client ID:
Sigma: 2
Analyzed: 05/21/14 19:04
Detector: AV44
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-230	9.421	0.925	1.22		pCi/L	1.00	0.103	123333

Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	10.28	0.886	1.24		pCi/L	0.108	12.2	84.0	30 - 110

Lab ID: 160-6694-7
Client ID: 2222-RIN-01
Sigma: 2
Analyzed: 05/21/14 19:04
Detector: AV48
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	0.0369	0.0789	0.0789	U	pCi/L	1.00	0.156	123337
Thorium-230	0.132	0.108	0.108		pCi/L	1.00	0.0717	123337
Thorium-232	-0.00817	0.0116	0.0116	U	pCi/L	1.00	0.113	123337

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	10.9	0.922	1.30		pCi/L	0.0892	12.3	89.0	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 160-123197/1-A	Thorium-228			0.02379	U	pCi/L							
MB 160-123197/1-A	Thorium-230			0.2388		pCi/L							
MB 160-123197/1-A	Thorium-232			0.04293	U	pCi/L							

Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-123197/2-A	Thorium-230		8.64	9.421		pCi/L	109	81 - 125					

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123197

Glossary:

Ts = Count Duration, Sample

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:05:56PM 5/21/2014

Sample

Sample Name: MB 160-123197/1-A
SampleType: Blank
: MB 160-123197/1-A
Sample Collection Date: 5/20/2014 2:14:00PM

Spectrum #1 Analysis #1
Sample Volume : 0.5000L
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123197
AnalysisID: 608362

Analyst: 60040

Tracer

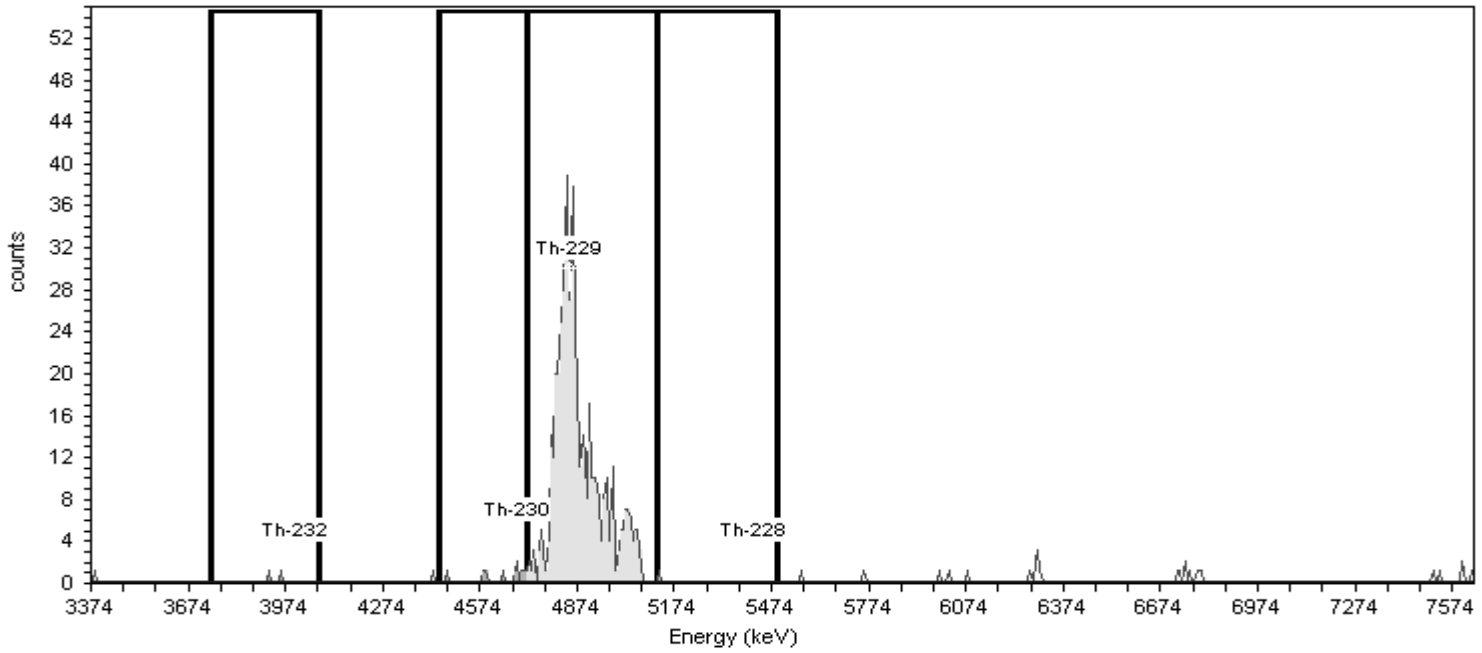
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 81.94%

Acquisition

Detector: AV43
Serial Number: 49-190X4
Acquisition Start Date: 5/21/2014 7:04:03PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:19AM
Background Info: Sample: ICB;AV43; Det: AV43; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9794;AV43-20140505
Calibration Date: 5/5/2014 10:09:47PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 25.74% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/21/2014 7:01:45PM
MDA Constants: Kα = 1.65 , Kβ = 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	53.8	100.2	2	0.1875	1.81	0.043	pCi/L
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	13.7	99.7	10	0.0000	10.03	0.239	pCi/L
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	73.3	99.6	514	0.3750	513.66	10.029	pCi/L
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	23.6	99.8	1	0.0000	1.00	0.024	pCi/L

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:06:09PM 5/21/2014

Sample

Sample Name: LCS 160-123197/2-A
SampleType: Control
: LCS 160-123197/2-A
Sample Collection Date: 5/20/2014 2:14:00PM

Spectrum #1 Analysis #1
Sample Volume : 0.5000L
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123197
AnalysisID: 608363

Analyst: 60040

Tracer

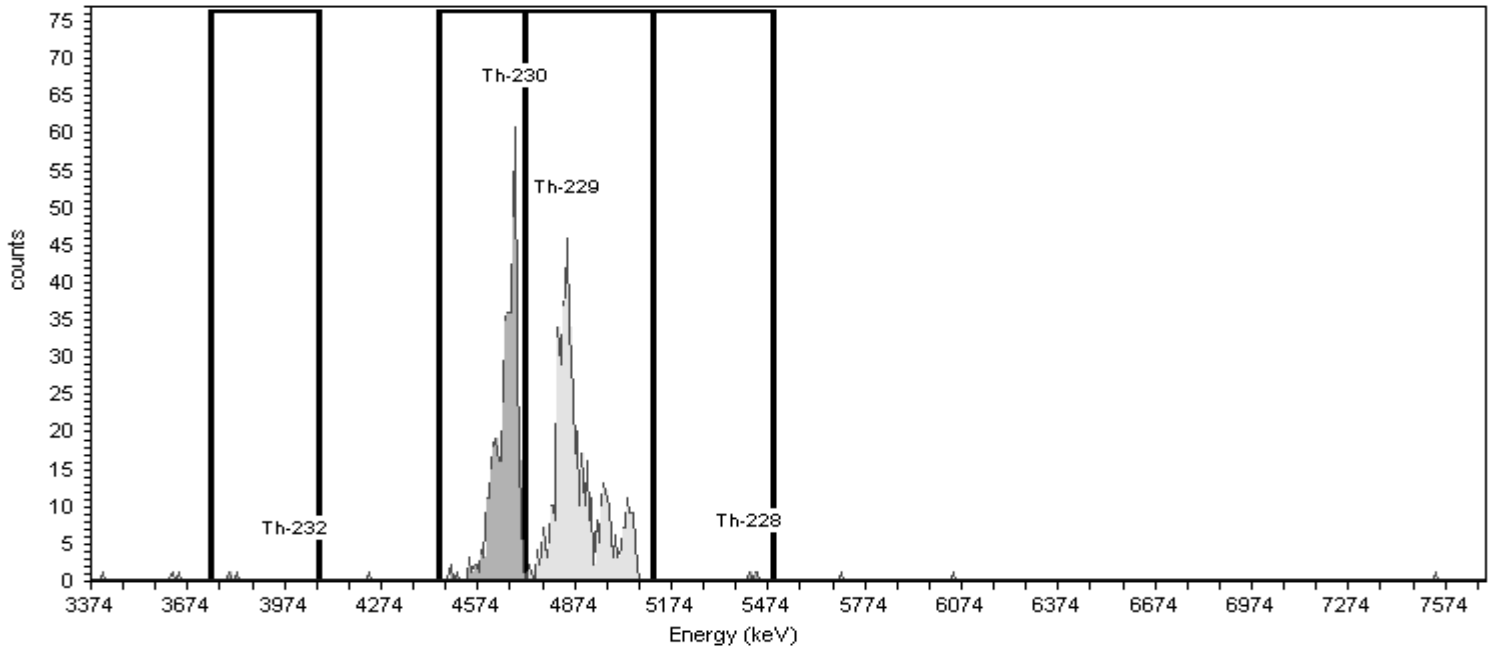
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 83.98%

Acquisition

Detector: AV44
Serial Number: 50-051JJ1
Acquisition Start Date: 5/21/2014 7:04:05PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:20AM
Background Info: Sample: ICB;AV44; Det: AV44; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9795;AV44-20140505
Calibration Date: 5/5/2014 10:09:57PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.32% +/- 0.35% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/21/2014 7:01:44PM
MDA Constants: Kα = 1.65 , Kβ = 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	40.5	100.2	2	0.1875	1.81	0.041	pCi/L
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	30.2	99.7	415	0.1817	414.82	9.421	pCi/L
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	62.6	99.6	539	0.5567	538.44	10.279	pCi/L
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	41.8	99.8	3	2.2500	0.75	0.017	pCi/L

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:06:20PM 5/21/2014

Sample

Sample Name: 160-6694-C-7-A
SampleType: Sample
: 160-6694-C-7-A
Sample Collection Date: 5/15/2014 8:10:00AM

Spectrum #1 Analysis #1
Sample Volume : 0.4995L
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123197
AnalysisID: 608365

Analyst: 60040

Tracer

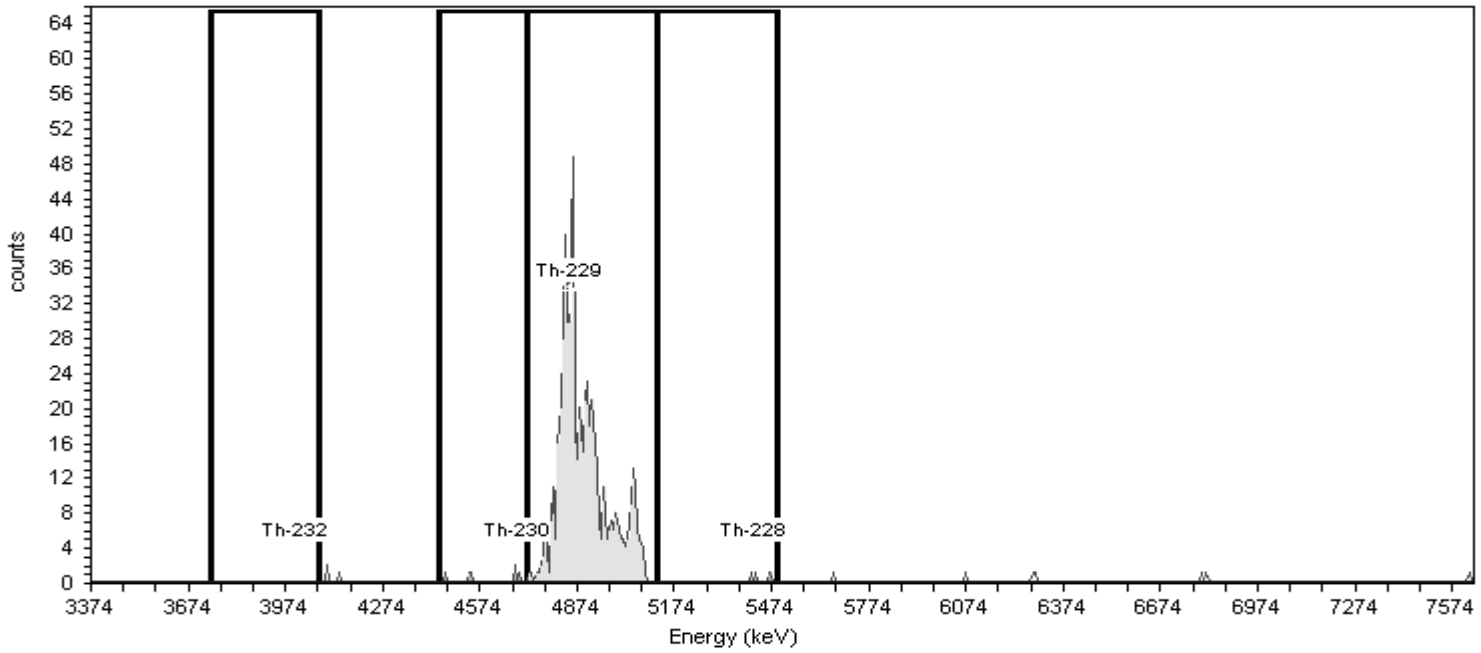
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 88.97%

Acquisition

Detector: AV48
Serial Number: 50-051JJ4
Acquisition Start Date: 5/21/2014 7:04:09PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:23AM
Background Info: Sample: ICB;AV48; Det: AV48; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9886;AV48-20140505
Calibration Date: 5/5/2014 10:10:22PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 25.78% +/- 0.35% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/21/2014 7:01:44PM
MDA Constants: Kα = 1.65 , Kβ = 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	.0	100.2	0	0.3750	-0.38	-0.008	pCi/L
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	10.1	99.7	6	0.0058	6.03	0.132	pCi/L
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	76.9	99.6	559	0.1933	558.84	10.901	pCi/L
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	10.7	99.8	3	1.3125	1.69	0.037	pCi/L

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

Prep Batch: 123276

, Extraction Chromatography Resin Actinide

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123276

Lab ID: MB 160-123276/1-A
Client ID:
Sigma: 2
Analyzed: 05/23/14 19:02
Detector: AV45
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	0.01892	0.0362	0.0362	U	pCi/g	1.00	0.0686	123806
Thorium-230	0.04828	0.0452	0.0454		pCi/g	1.00	0.0460	123806
Thorium-232	0.008162	0.0204	0.0205	U	pCi/g	1.00	0.0457	123806

Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	5.835	0.474	0.682		pCi/g	0.0501	6.12	95.4	30 - 110

Lab ID: LCS 160-123276/2-A
Client ID:
Sigma: 2
Analyzed: 05/23/14 19:02
Detector: AV46
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-230	23.35	1.37	2.39		pCi/g	1.00	0.115	123807

Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	11.40	0.926	1.33		pCi/g	0.0975	12.3	93.1	30 - 110

Lab ID: 160-6694-1
Client ID: 2222-SD01
Sigma: 2
Analyzed: 05/23/14 19:02
Detector: AV57
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	0.320	0.133	0.136		pCi/g	1.00	0.115	123811
Thorium-230	0.578	0.169	0.176		pCi/g	1.00	0.0779	123811
Thorium-232	0.333	0.127	0.130		pCi/g	1.00	0.0545	123811

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	4.79	0.425	0.586		pCi/g	0.0575	6.13	78.2	30 - 110

Lab ID: 160-6694-2
Client ID: 2222-SD02
Sigma: 2
Analyzed: 05/23/14 19:02
Detector: AV58
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	0.314	0.123	0.126		pCi/g	1.00	0.0840	123812
Thorium-230	0.417	0.139	0.143		pCi/g	1.00	0.0593	123812
Thorium-232	0.321	0.123	0.125		pCi/g	1.00	0.0693	123812

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123276

Lab ID: 160-6694-2 | Analyzed: 05/23/14 19:02 | Decay Corrected: No
Client ID: 2222-SD02 | Detector: AV58 | Yield Truncated: No
Sigma: 2 | Dil Fac: 1 | Ts: 180

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	5.09	0.440	0.613		pCi/g	0.0576	6.13	83.0	30 - 110

Lab ID: 160-6694-3 | Analyzed: 05/23/14 19:02 | Decay Corrected: No
Client ID: 2222-SD03 | Detector: AV59 | Yield Truncated: No
Sigma: 2 | Dil Fac: 1 | Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	1.07	0.235	0.251		pCi/g	1.00	0.0898	123813
Thorium-230	0.745	0.194	0.204		pCi/g	1.00	0.0379	123813
Thorium-232	0.604	0.174	0.181		pCi/g	1.00	0.0377	123813

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	4.40	0.401	0.546		pCi/g	0.0474	6.10	72.2	30 - 110

Lab ID: 160-6694-4 | Analyzed: 05/23/14 19:02 | Decay Corrected: No
Client ID: 2222-SD04 | Detector: AV60 | Yield Truncated: No
Sigma: 2 | Dil Fac: 1 | Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	0.561	0.165	0.172		pCi/g	1.00	0.103	123815
Thorium-230	0.695	0.178	0.188		pCi/g	1.00	0.0520	123815
Thorium-232	0.445	0.143	0.148		pCi/g	1.00	0.0562	123815

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	5.13	0.443	0.618		pCi/g	0.0544	6.13	83.6	30 - 110

Lab ID: 160-6694-5 | Analyzed: 05/23/14 19:02 | Decay Corrected: No
Client ID: 2222-SD05 | Detector: AV61 | Yield Truncated: No
Sigma: 2 | Dil Fac: 1 | Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	0.296	0.117	0.120		pCi/g	1.00	0.0829	123816
Thorium-230	0.296	0.115	0.118		pCi/g	1.00	0.0662	123816
Thorium-232	0.282	0.111	0.113		pCi/g	1.00	0.0523	123816

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	5.40	0.454	0.642		pCi/g	0.0495	6.15	87.9	30 - 110

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123276

Lab ID:	160-6694-6	Analyzed:	05/23/14 19:02	Decay Corrected:	No
Client ID:	2222-SD06	Detector:	AV62	Yield Truncated:	No
Sigma:	2	Dil Fac:	1	Ts:	180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Thorium-228	0.520	0.157	0.163		pCi/g	1.00	0.0666	123817
Thorium-230	0.548	0.161	0.167		pCi/g	1.00	0.0533	123817
Thorium-232	0.586	0.166	0.173		pCi/g	1.00	0.0530	123817

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Thorium-229	4.95	0.434	0.601		pCi/g	0.0494	6.10	81.1	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 160-123276/1-A	Thorium-228			0.01892	U	pCi/g							
MB 160-123276/1-A	Thorium-230			0.04828		pCi/g							
MB 160-123276/1-A	Thorium-232			0.008162	U	pCi/g							

Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-123276/2-A	Thorium-230		24.5	23.35		pCi/g	95	81 - 118					

Glossary:

Ts = Count Duration, Sample

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:02:33PM 5/23/2014

Sample

Sample Name: MB 160-123276/1-A
SampleType: Blank
: MB 160-123276/1-A
Sample Collection Date: 5/21/2014 10:07:00AM

Spectrum #1 Analysis #1
Sample Weight : 1.0000g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608735

Analyst: 60040

Tracer

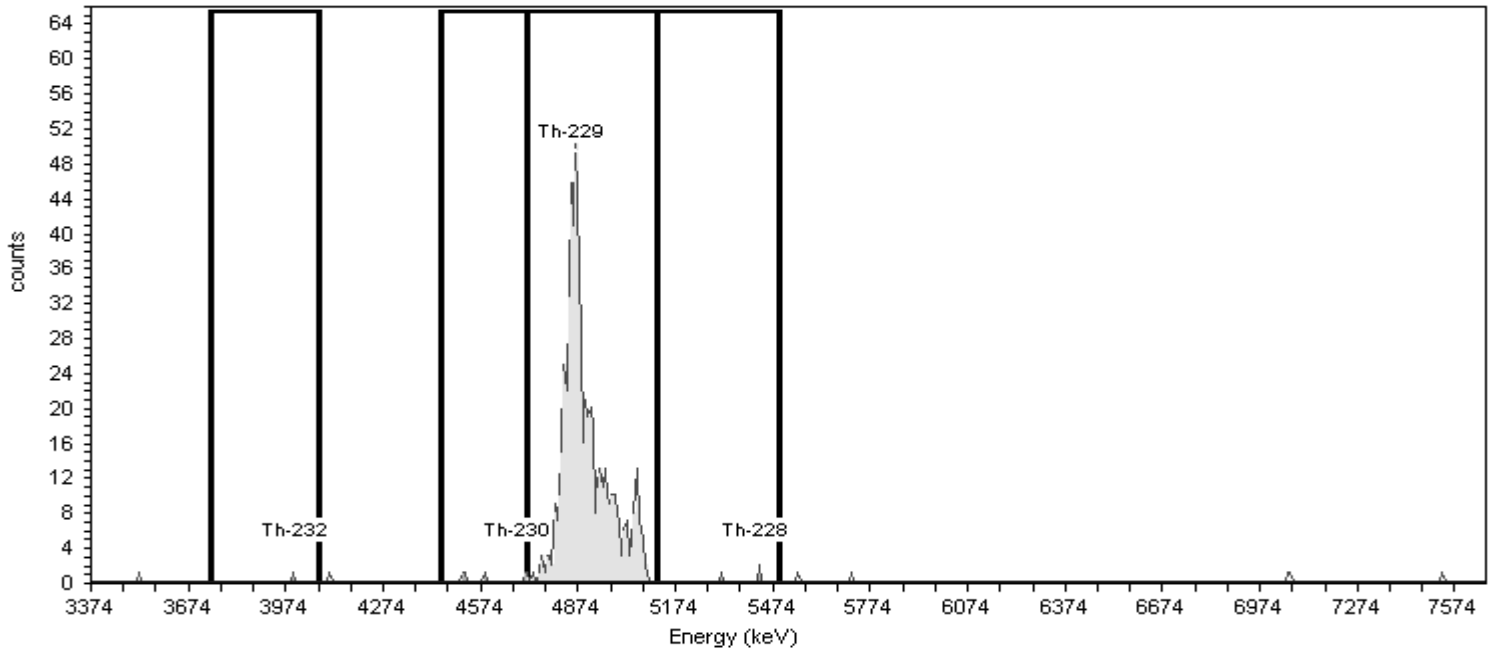
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 95.39%

Acquisition

Detector: AV45
Serial Number: 48-158FF2
Acquisition Start Date: 5/23/2014 7:02:44PM
Live Time: 180.00 min.
Real Time: 180.01 min.
Background Date: 5/15/2014 1:18:21AM
Background Info: Sample: ICB;AV45; Det: AV45; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9817;AV45-20140505
Calibration Date: 5/5/2014 10:10:03PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.06% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:59PM
MDA Constants: Kα = 1.65 , Kβ = 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	44.5	100.2	1	0.1875	0.81	0.008	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	.3	99.7	5	0.1875	4.78	0.048	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	68.5	99.6	606	0.3750	605.59	5.837	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	139.5	99.8	3	1.1250	1.88	0.019	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:02:48PM 5/23/2014

Sample

Sample Name: LCS 160-123276/2-A
SampleType: Control
: LCS 160-123276/2-A
Sample Collection Date: 5/21/2014 10:07:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.4993g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608736

Analyst: 60040

Tracer

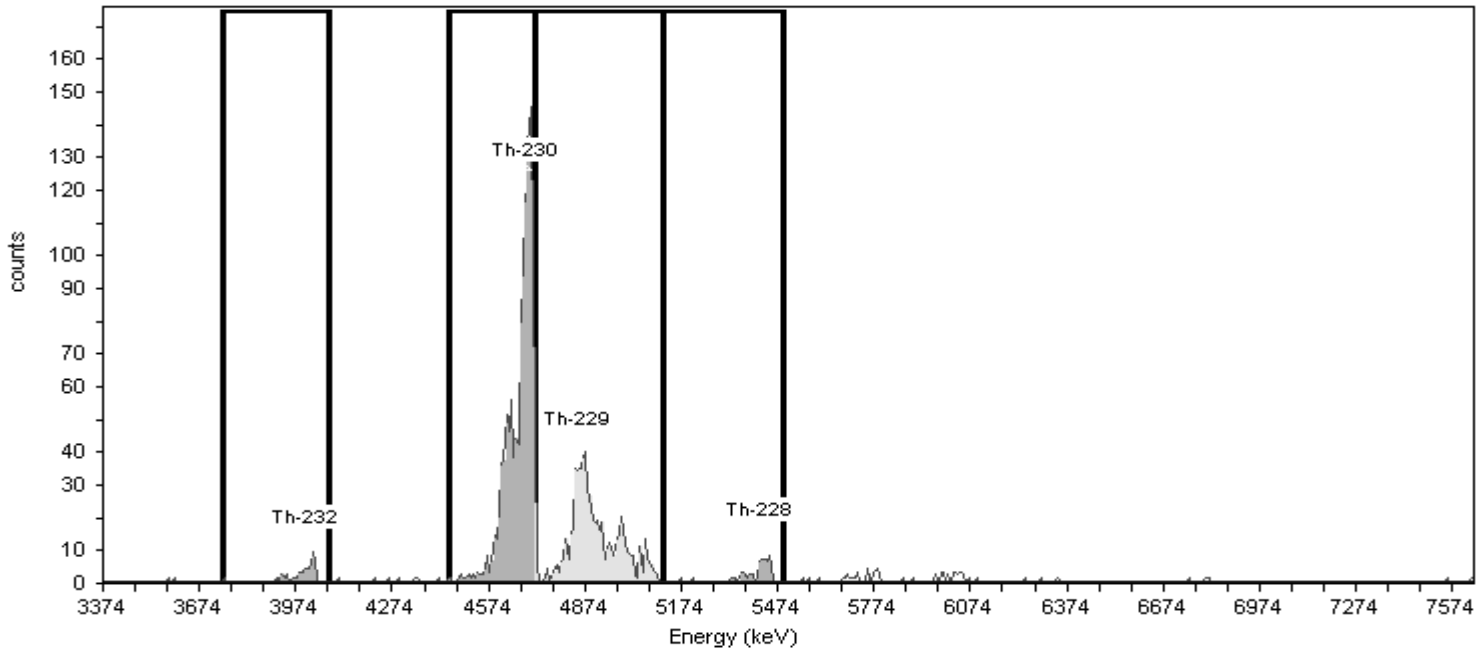
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 99.62%

Acquisition

Detector: AV46
Serial Number: 49-202GG2
Acquisition Start Date: 5/23/2014 7:02:45PM
Live Time: 180.00 min.
Real Time: 180.01 min.
Background Date: 5/15/2014 1:18:22AM
Background Info: Sample: ICB;AV46; Det: AV46; Spectrum #1;
May-15-2014 01:18

Calibration Name: IC-9884;AV46-20140505
Calibration Date: 5/5/2014 10:10:09PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.80% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 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	26.6	100.2	47	0.1875	47.24	0.885	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	45.5	99.7	1152	0.3808	1152.10	21.691	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	.0	99.6	651	0.3808	650.41	12.211	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	16.6	99.8	58	2.0625	55.94	1.053	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:57:46PM 5/26/2014

Sample

Sample Name: LCS 160-123276/2-A
SampleType: Control
: LCS 160-123276/2-A
Sample Collection Date: 5/21/2014 10:07:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.4993g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608749

Analyst: 60040

Tracer

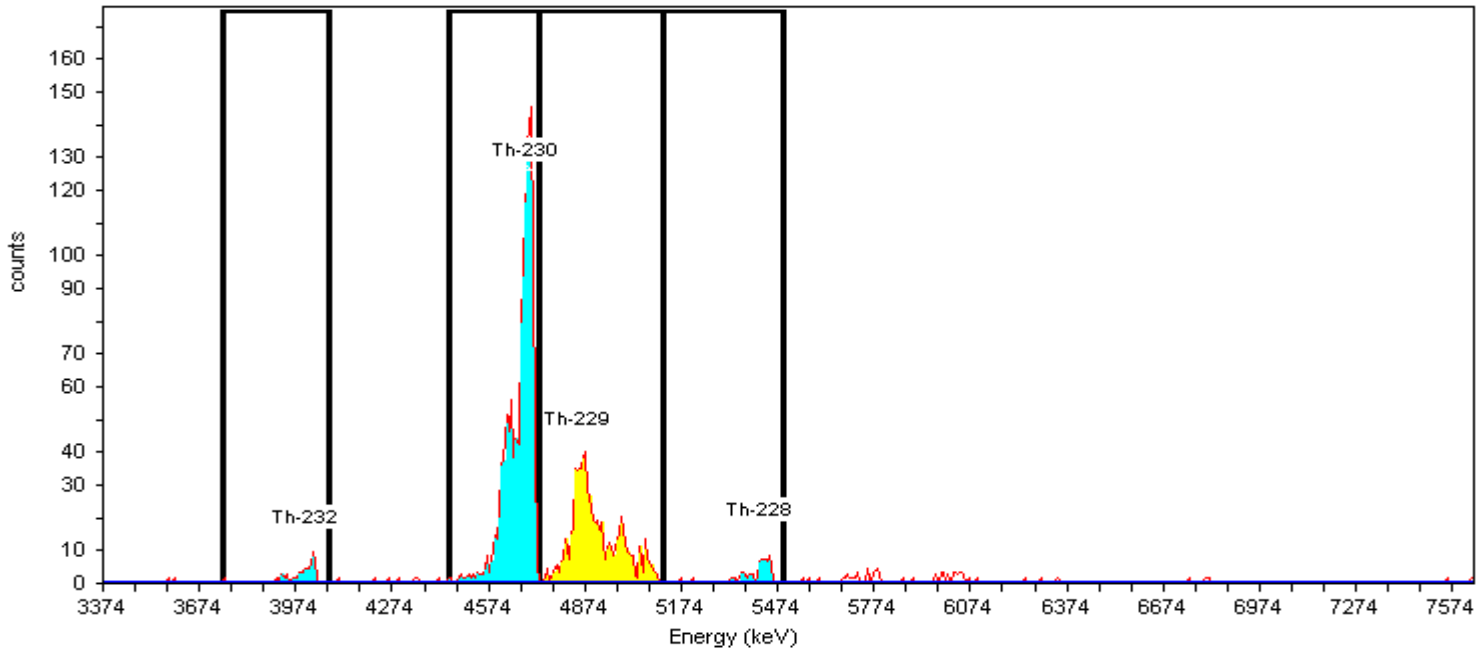
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 93.07%

Acquisition

Detector: AV46
Serial Number: 49-202GG2
Acquisition Start Date: 5/23/2014 7:02:45PM
Live Time: 180.00 min.
Real Time: 180.01 min.
Background Date: 5/15/2014 1:18:22AM
Background Info: Sample: ICB;AV46; Det: AV46; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9884;AV46-20140505
Calibration Date: 5/5/2014 10:10:09PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.80% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Thorium
MDA Source: Background

Manual Integration for tailing
RTM 5/26/2014

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	26.6	100.2	47	0.1875	47.24	0.947	pCi/g
Th-230	4688.0	4,687.5	0.5	4448.3	4731.7	25.5	99.7	1159	0.5625	1158.44	23.346	pCi/g
Th-229	4848.0	4,845.3	2.7	4731.7	5119.5	73.9	99.6	608	0.3750	607.63	11.407	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	16.6	99.8	58	2.0625	55.94	1.127	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:03:12PM 5/23/2014

Sample

Sample Name: 160-6694-A-1-B
SampleType: Sample
: 160-6694-A-1-B
Sample Collection Date: 5/15/2014 8:25:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9977g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608740

Analyst: 60040

Tracer

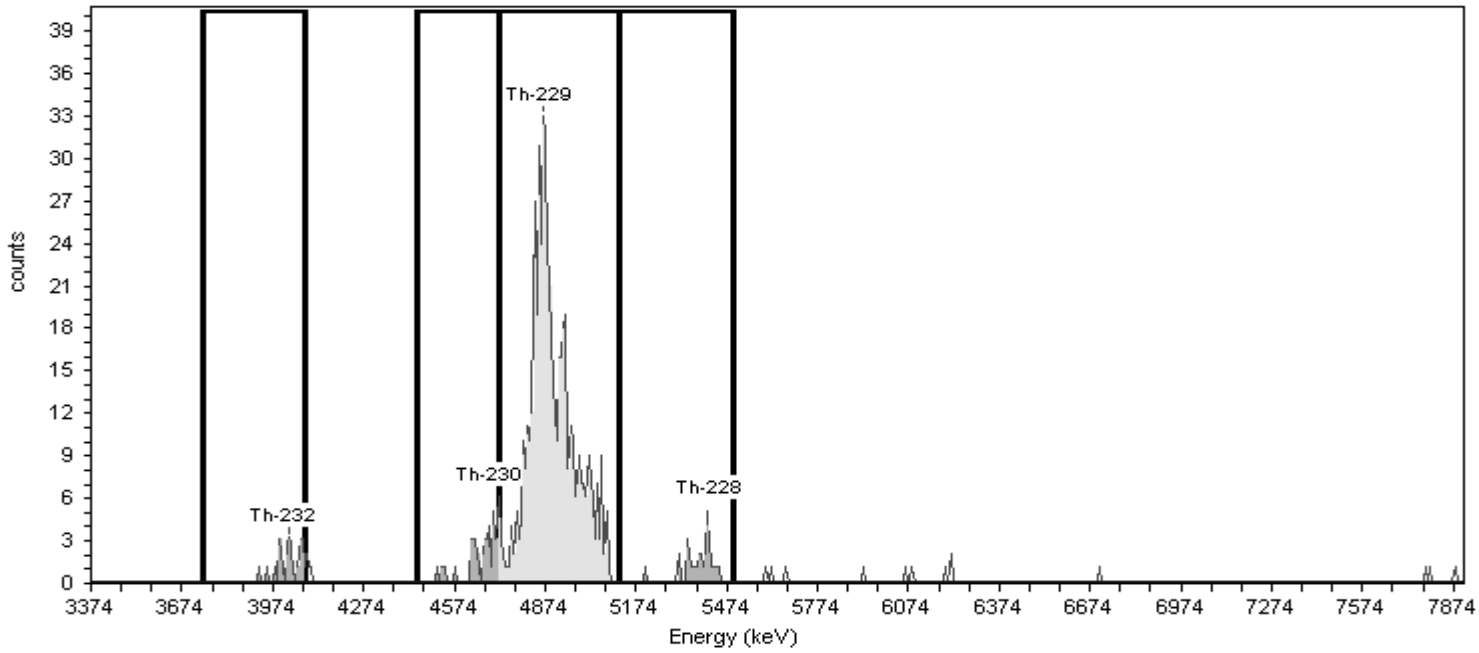
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 79.56%

Acquisition

Detector: AV57
Serial Number: 48-158EE3
Acquisition Start Date: 5/23/2014 7:02:51PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:35AM
Background Info: Sample: ICB;AV57; Det: AV57; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9793;AV57-20140504
Calibration Date: 5/5/2014 6:53:40PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.74% +/- 0.33% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 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	.0	100.2	22	0.1875	21.73	0.256	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	45.8	99.7	42	0.9375	40.97	0.485	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	74.6	99.6	519	0.7500	518.16	4.880	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	83.2	99.8	30	3.3750	26.63	0.315	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:50:46PM 5/26/2014

Sample

Sample Name: 160-6694-A-1-B
SampleType: Sample
: 160-6694-A-1-B
Sample Collection Date: 5/15/2014 8:25:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9977g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608746

Analyst: 60040

Tracer

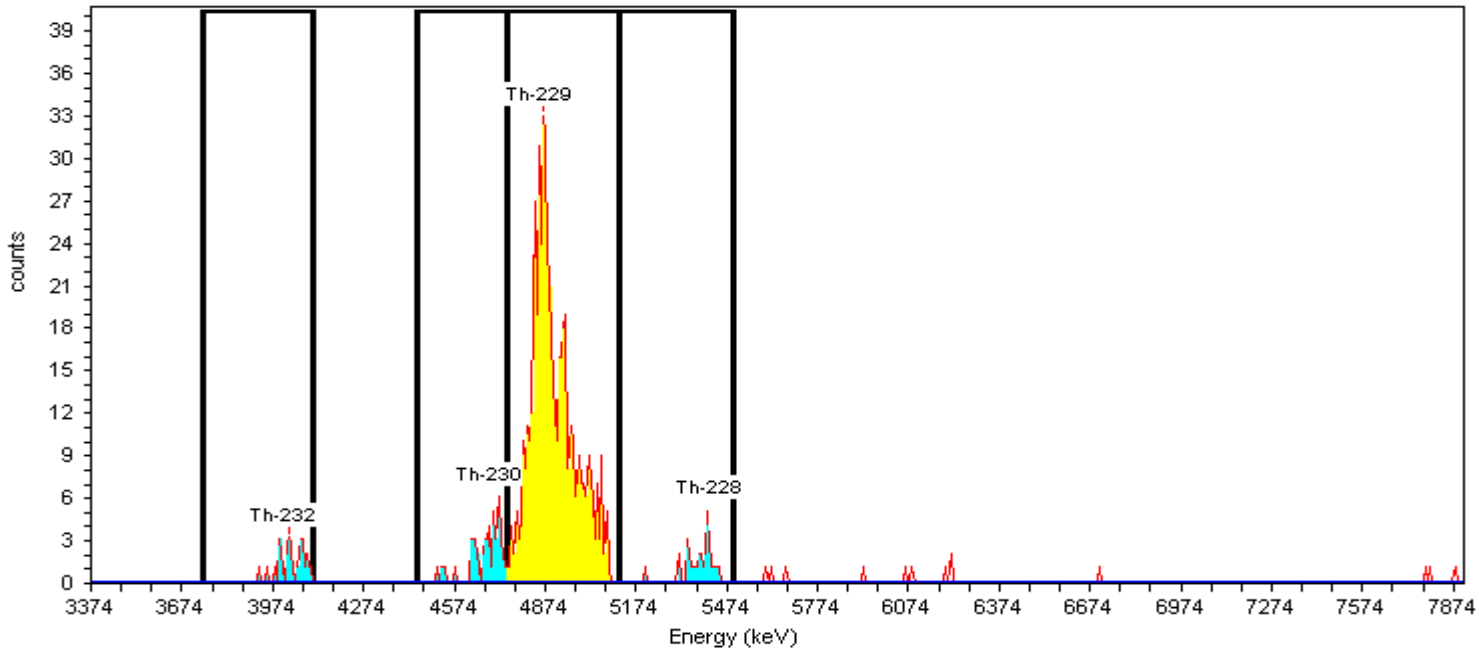
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 78.19%

Acquisition

Detector: AV57
Serial Number: 48-158EE3
Acquisition Start Date: 5/23/2014 7:02:51PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:35AM
Background Info: Sample: ICB;AV57; Det: AV57; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9793;AV57-20140504
Calibration Date: 5/5/2014 6:53:40PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.74% +/- 0.33% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Thorium
MDA Source: Background

Manual Integration for tailing
RTM 5/26/2014

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	3739.8	4105.3	26.0	100.2	28	0.1875	27.81	0.333	pCi/g
Th-230	4688.0	4,687.5	0.5	4448.3	4746.6	23.1	99.7	49	0.9375	48.06	0.578	pCi/g
Th-229	4848.0	4,845.3	2.7	4746.6	5119.5	74.6	99.6	510	0.7500	509.25	4.796	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	83.2	99.8	30	3.3750	26.63	0.320	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:03:18PM 5/23/2014

Sample

Sample Name: 160-6694-A-2-B
SampleType: Sample
: 160-6694-A-2-B
Sample Collection Date: 5/15/2014 9:45:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9979g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608741

Analyst: 60040

Tracer

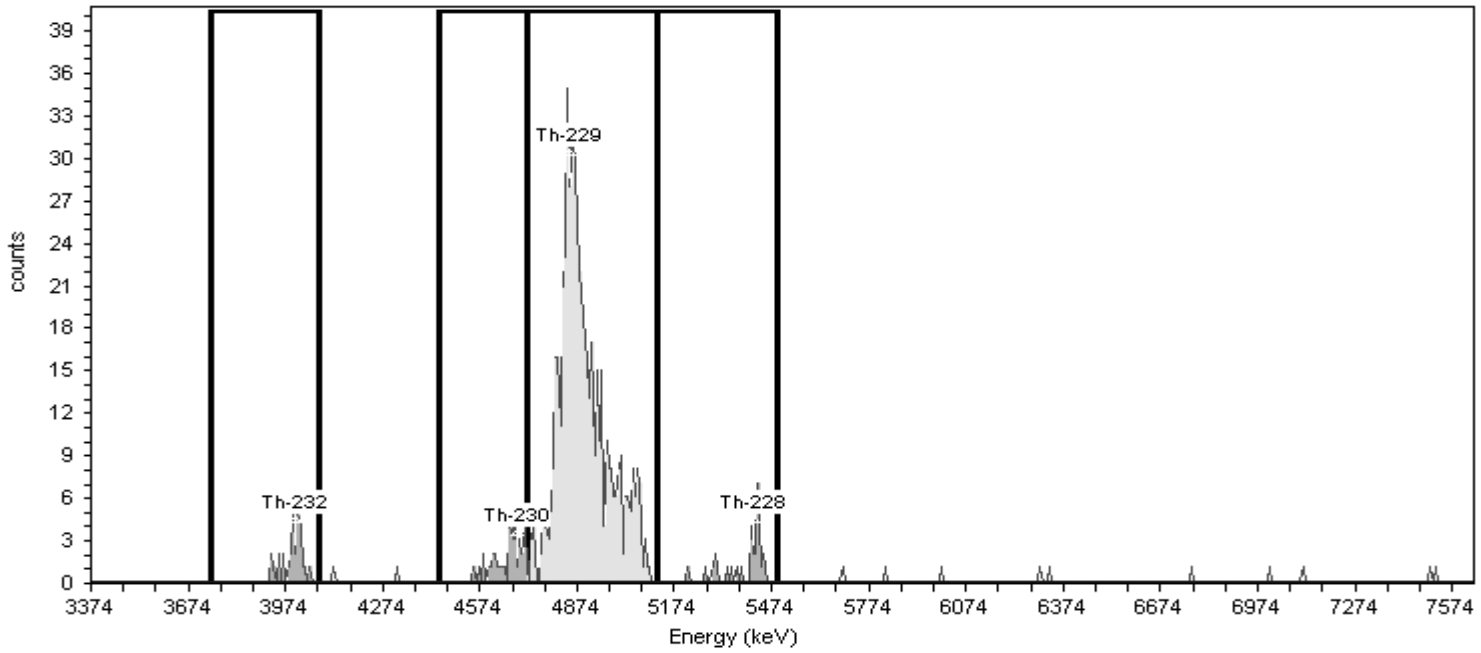
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 83.04%

Acquisition

Detector: AV58
Serial Number: 52-102 C5
Acquisition Start Date: 5/23/2014 7:02:53PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:36AM
Background Info: Sample: ICB;AV58; Det: AV58; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9794;AV58-20140504
Calibration Date: 5/5/2014 6:53:46PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.56% +/- 0.33% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 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	55.3	100.2	29	0.7500	28.25	0.321	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	17.4	99.7	37	0.3750	36.59	0.417	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	88.8	99.6	538	0.7380	537.23	5.093	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	47.9	99.8	29	1.4880	27.51	0.314	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:03:24PM 5/23/2014

Sample

Sample Name: 160-6694-A-3-B
SampleType: Sample
: 160-6694-A-3-B
Sample Collection Date: 5/15/2014 8:50:00AM

Spectrum #1 Analysis #1
Sample Weight : 1.0026g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608742

Analyst: 60040

Tracer

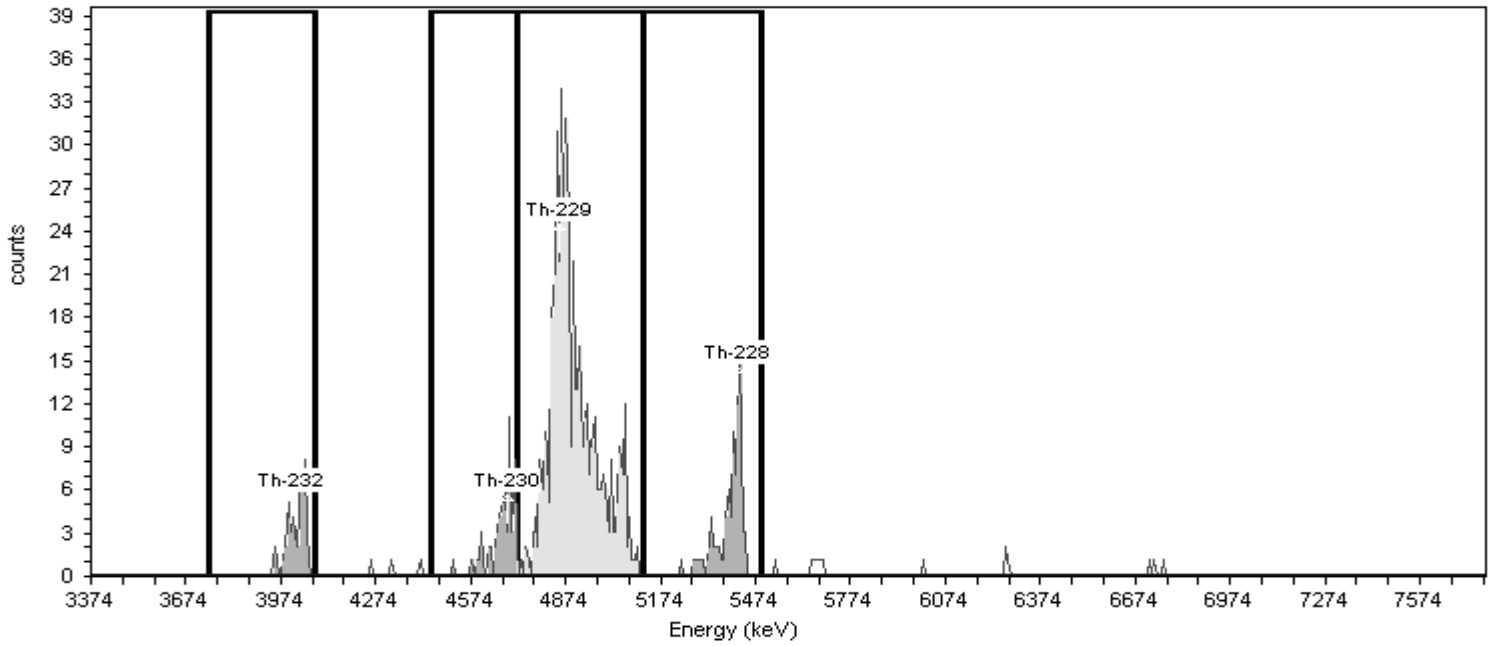
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 72.19%

Acquisition

Detector: AV59
Serial Number: 49-155M7
Acquisition Start Date: 5/23/2014 7:02:54PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:38AM
Background Info: Sample: ICB;AV59; Det: AV59; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9795;AV59-20140504
Calibration Date: 5/5/2014 6:53:53PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.44% +/- 0.36% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 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	28.3	100.2	48	0.0000	48.00	0.604	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	86.2	99.7	59	0.0000	58.94	0.745	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	77.9	99.6	483	0.3750	482.56	4.406	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	47.7	99.8	86	1.3125	84.69	1.070	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:03:29PM 5/23/2014

Sample

Sample Name: 160-6694-A-4-B
SampleType: Sample
: 160-6694-A-4-B
Sample Collection Date: 5/15/2014 9:05:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9979g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608743

Analyst: 60040

Tracer

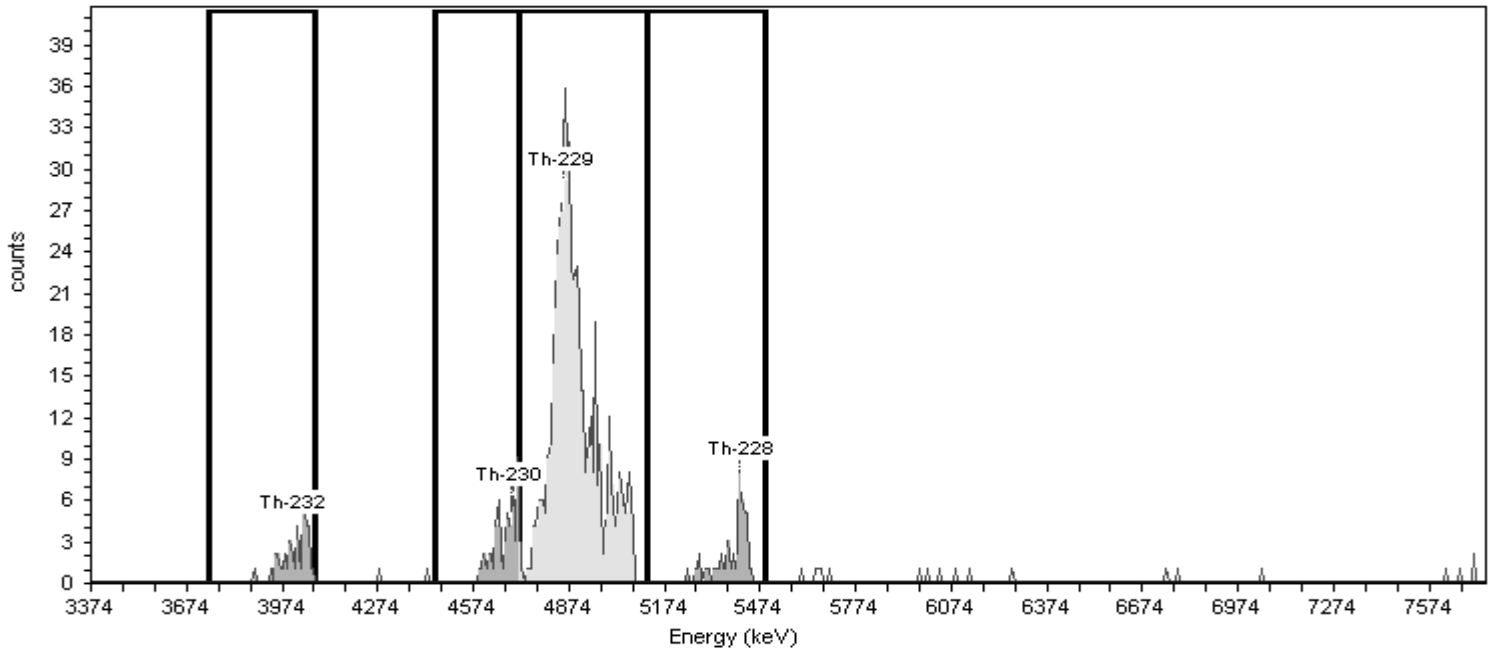
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 84.40%

Acquisition

Detector: AV60
Serial Number: 49-027117
Acquisition Start Date: 5/23/2014 7:02:55PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:40AM
Background Info: Sample: ICB;AV60; Det: AV60; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9817;AV60-20140504
Calibration Date: 5/5/2014 6:53:59PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.33% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 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	26.4	100.2	39	0.2953	39.16	0.441	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	29.8	99.7	60	0.1875	59.69	0.676	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	88.1	99.6	542	0.5625	541.31	5.176	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	49.4	99.8	52	2.8125	49.19	0.556	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:53:05PM 5/26/2014

Sample

Sample Name: 160-6694-A-4-B
SampleType: Sample
: 160-6694-A-4-B
Sample Collection Date: 5/15/2014 9:05:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9979g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608747

Analyst: 60040

Tracer

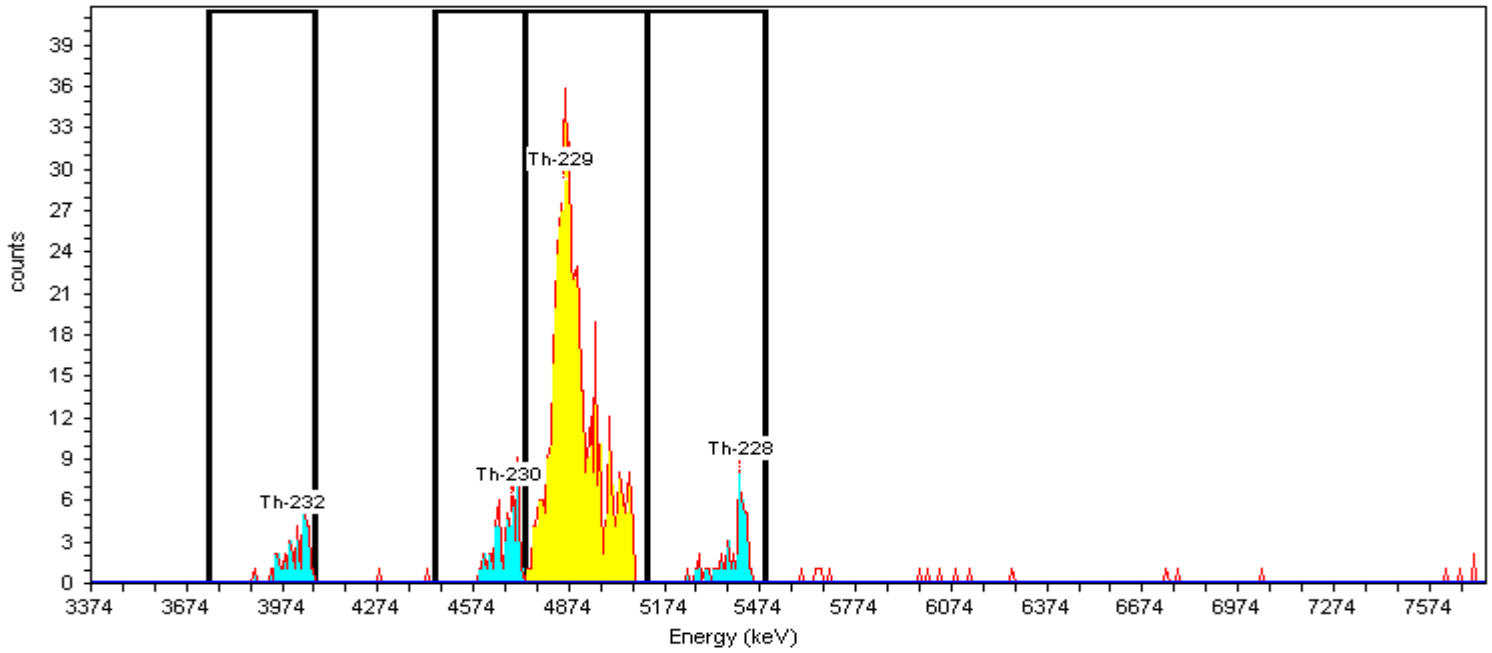
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 83.64%

Acquisition

Detector: AV60
Serial Number: 49-027117
Acquisition Start Date: 5/23/2014 7:02:55PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:40AM
Background Info: Sample: ICB;AV60; Det: AV60; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9817;AV60-20140504
Calibration Date: 5/5/2014 6:53:59PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.33% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Thorium
MDA Source: Background

Manual Integration for tailing
RTM 5/26/2014

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	26.4	100.2	39	0.2953	39.16	0.445	pCi/g
Th-230	4688.0	4,687.5	0.5	4448.3	4731.7	30.3	99.7	61	0.1875	60.81	0.695	pCi/g
Th-229	4848.0	4,845.3	2.7	4731.7	5119.5	88.1	99.6	537	0.5625	536.44	5.129	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	49.4	99.8	52	2.8125	49.19	0.561	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:03:35PM 5/23/2014

Sample

Sample Name: 160-6694-A-5-B
SampleType: Sample
: 160-6694-A-5-B
Sample Collection Date: 5/15/2014 9:15:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9957g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608744

Analyst: 60040

Tracer

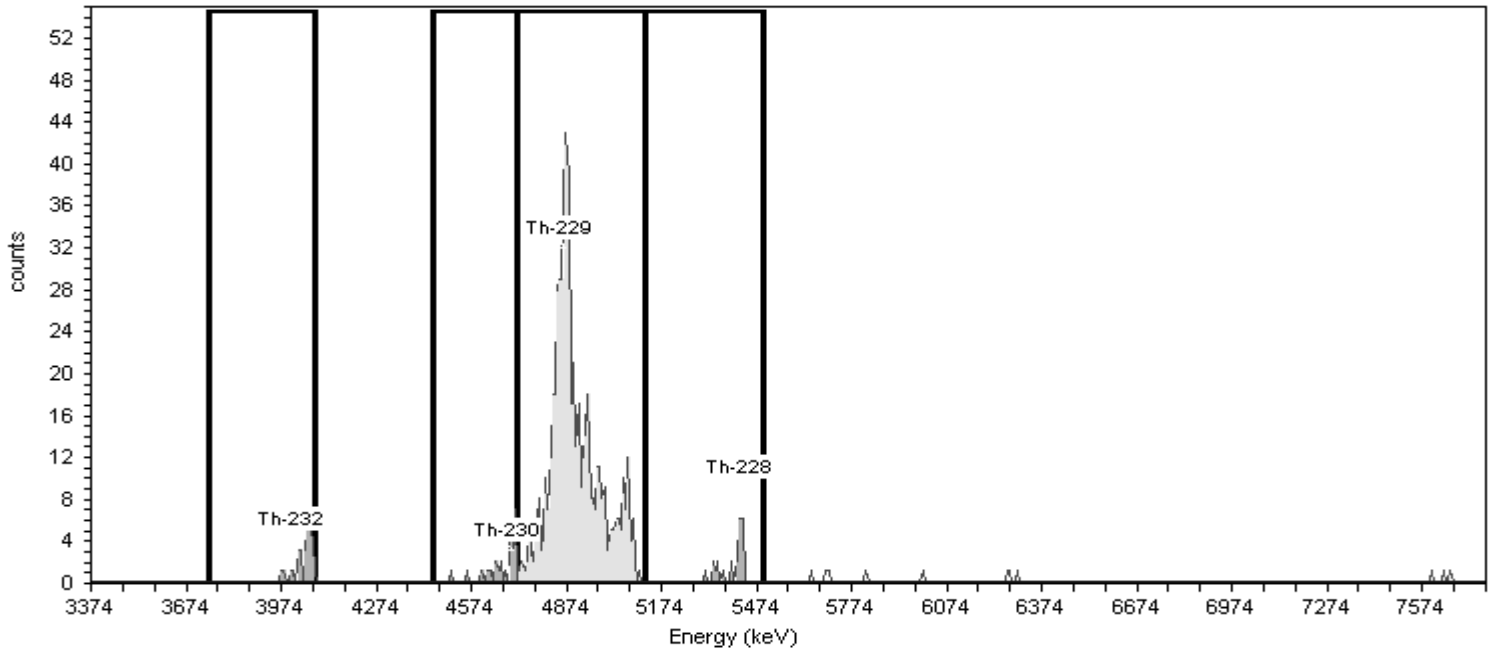
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 87.91%

Acquisition

Detector: AV61
Serial Number: 5-051JJ3
Acquisition Start Date: 5/23/2014 7:02:58PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:42AM
Background Info: Sample: ICB;AV61; Det: AV61; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9884;AV61-20140504
Calibration Date: 5/5/2014 6:54:06PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.46% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 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	27.6	100.2	26	0.2672	26.11	0.282	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	11.0	99.7	28	0.7500	27.28	0.296	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	67.4	99.6	567	0.3750	566.66	5.403	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	44.3	99.8	29	1.6875	27.31	0.296	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:03:40PM 5/23/2014

Sample

Sample Name: 160-6694-A-6-B
SampleType: Sample
: 160-6694-A-6-B
Sample Collection Date: 5/15/2014 8:45:00AM

Spectrum #1 Analysis #1
Sample Weight : 1.0029g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123276
AnalysisID: 608745

Analyst: 60040

Tracer

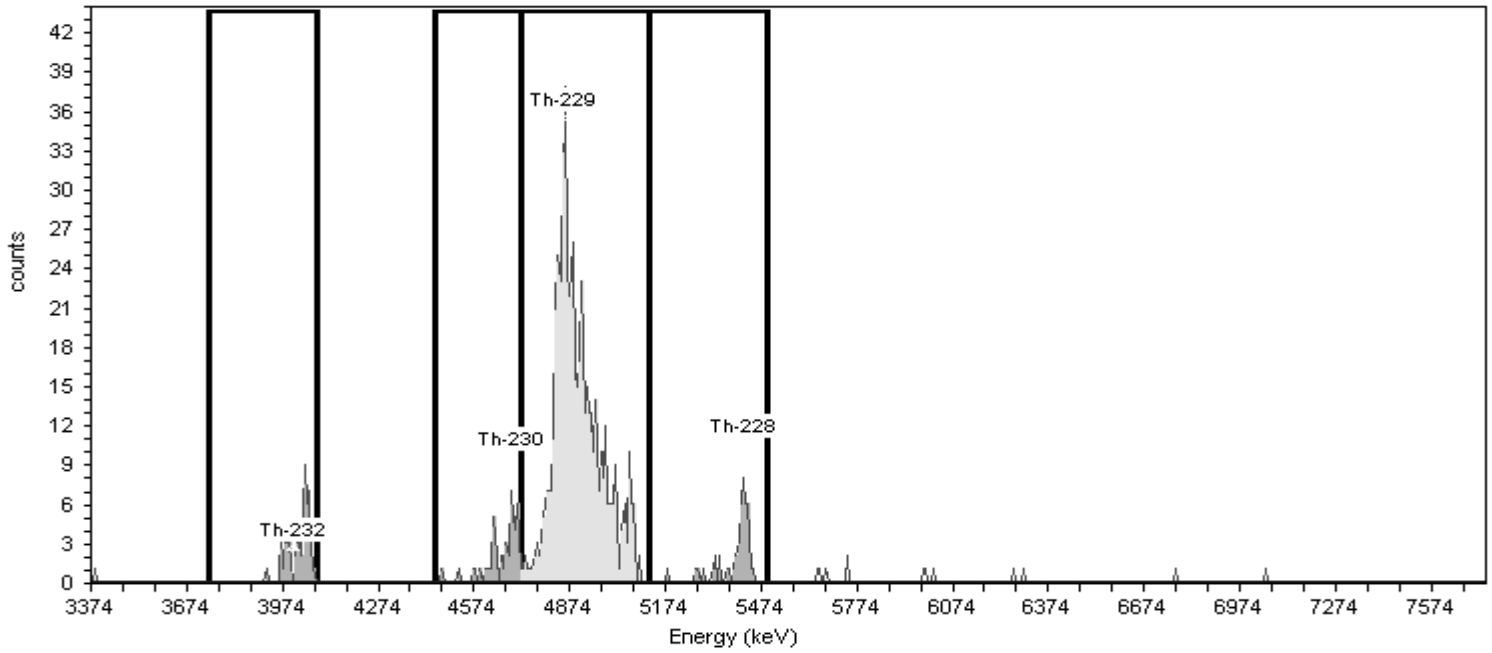
Tracer Name: Th-229_00012
Tracer Activity: 67.93 DPM/mL x (Vol.)0.20 mL = 13.59 DPM
Tracer Ref. Date: 7/14/2010 11:00:17AM

Tracer Nuclide: Th-229
Tracer Recovery: 81.15%

Acquisition

Detector: AV62
Serial Number: 52-060FF2
Acquisition Start Date: 5/23/2014 7:02:59PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:18:43AM
Background Info: Sample: ICB;AV62; Det: AV62; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9885;AV62-20140504
Calibration Date: 5/5/2014 6:54:13PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.34% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = Th2007_ROI
Decay Correction: 5/23/2014 6:58:58PM
MDA Constants: Kα = 1.65 , Kβ = 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	28.8	100.2	50	0.1875	50.27	0.586	pCi/g
Th-230	4688.0	4,687.5	0.5	4446.0	4717.0	380.2	99.7	47	0.1875	46.81	0.548	pCi/g
Th-229	4848.0	4,845.3	2.7	4717.0	5119.0	92.7	99.6	521	0.3750	520.63	4.952	pCi/g
Th-228	5420.0	5,423.3	-3.3	5119.0	5493.0	49.6	99.8	45	0.5625	44.44	0.520	pCi/g

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123197 Batch Start Date: 05/20/14 13:36 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	Th-230 00023			
MB 160-123197/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123197/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123276 Batch Start Date: 05/21/14 09:37 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:50

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Th-229 00012	TRM-2 00001			
MB 160-123276/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123276/2		ExtChrom, A-01-R		0.4993 g	0.2 mL	0.4993 g			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

Method A-01-R U

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

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

Prep Batch: 123200

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Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123200

Lab ID: MB 160-123200/1-A
Client ID:
Sigma: 2
Analyzed: 05/21/14 17:20
Detector: AV78
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	0.01901	0.0646	0.0646	U	pCi/L	1.00	0.148	123362
Uranium-235/236	0.0000	0.0101	0.0101	U	pCi/L	1.00	0.0811	123362
Uranium-238	0.1301	0.106	0.107		pCi/L	1.00	0.0650	123362

Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	12.96	1.00	1.48		pCi/L	0.119	14.8	89.8	30 - 110

Lab ID: LCS 160-123200/2-A
Client ID:
Sigma: 2
Analyzed: 05/21/14 17:20
Detector: AV79
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	13.22	1.11	1.57		pCi/L	1.00	0.150	123363
Uranium-238	13.79	1.13	1.62		pCi/L	1.00	0.0696	123363

Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	11.52	0.924	1.34		pCi/L	0.120	14.8	79.8	30 - 110

Lab ID: 160-6694-7
Client ID: 2222-RIN-01
Sigma: 2
Analyzed: 05/21/14 17:20
Detector: AV82
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180.008333333333

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	0.147	0.118	0.118		pCi/L	1.00	0.115	123366
Uranium-235/236	0.0275	0.0551	0.0551	U	pCi/L	1.00	0.0826	123366
Uranium-238	0.0842	0.0887	0.0890	U	pCi/L	1.00	0.101	123366

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	12.7	0.995	1.46		pCi/L	0.101	14.8	88.0	30 - 110

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123200

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 160-123200/1-A	Uranium-233/234			0.01901	U	pCi/L							
MB 160-123200/1-A	Uranium-235/236			0.0000	U	pCi/L							
MB 160-123200/1-A	Uranium-238			0.1301		pCi/L							

Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-123200/2-A	Uranium-233/234		12.7	13.22		pCi/L	104	84 - 120					
LCS 160-123200/2-A	Uranium-238		13.0	13.79		pCi/L	106	83 - 121					

Glossary:

Ts = Count Duration, Sample

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:07:46PM 5/21/2014

Sample

Sample Name: MB 160-123200/1-A
SampleType: Blank
: MB 160-123200/1-A
Sample Collection Date: 5/20/2014 2:14:00PM

Spectrum #1 Analysis #1
Sample Volume : 0.5000L
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123200
AnalysisID: 608354

Analyst: 60040

Tracer

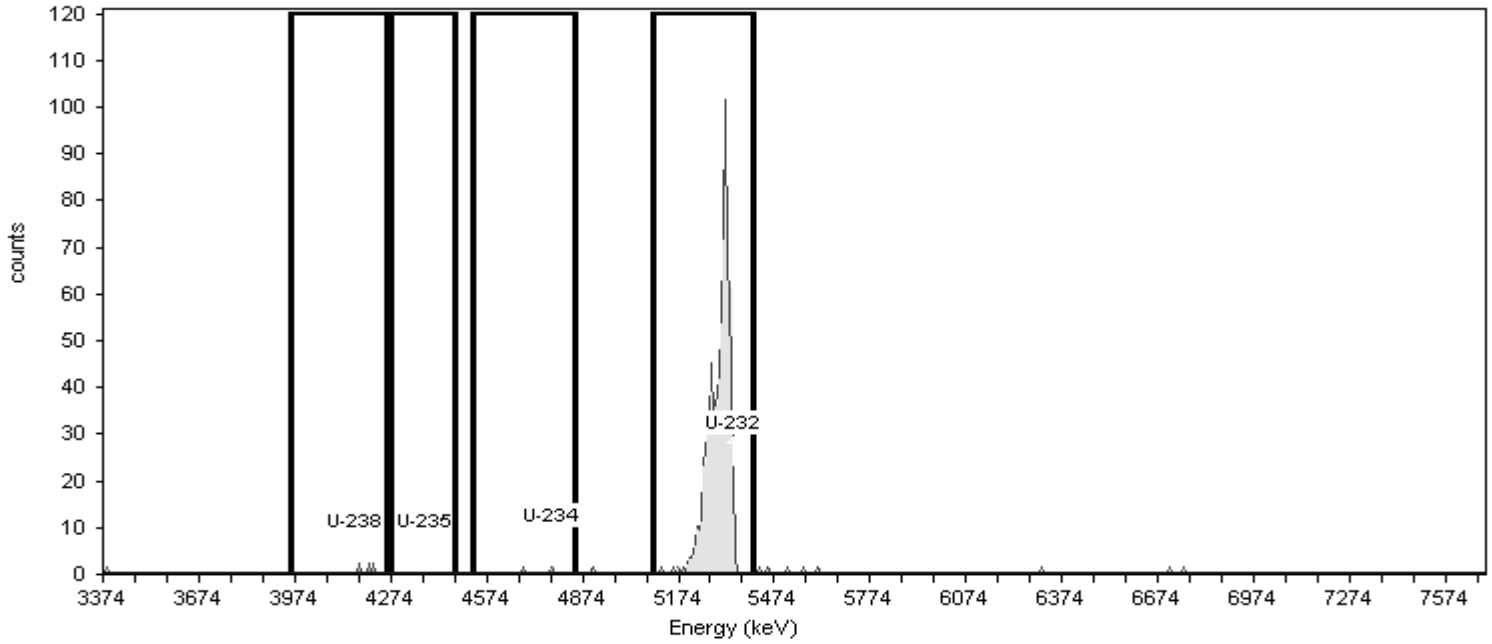
Tracer Name: U-232_00025
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:30AM

Tracer Nuclide: U-232
Tracer Recovery: 89.78%

Acquisition

Detector: AV78
Serial Number: 46-033FF4
Acquisition Start Date: 5/21/2014 5:20:08PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:19:14AM
Background Info: Sample: ICB;AV78; Det: AV78; Spectrum #1; May-15-2014 01:19

Calibration Name: IC-9886;AV78-20140504
Calibration Date: 5/4/2014 8:45:34PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 25.71% +/- 0.34% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/21/2014 5:17:36PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	58.4	100.0	6	0.0000	6.00	0.130	pCi/L
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	.0	80.2	0	0.0000	0.00	0.000	pCi/L
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	44.5	99.8	2	1.1250	0.88	0.019	pCi/L
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	59.3	100.1	667	0.7500	666.25	13.305	pCi/L

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:07:52PM 5/21/2014

Sample

Sample Name: LCS 160-123200/2-A
SampleType: Control
: LCS 160-123200/2-A
Sample Collection Date: 5/20/2014 2:14:00PM

Spectrum #1 Analysis #1
Sample Volume : 0.5000L
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123200
AnalysisID: 608355

Analyst: 60040

Tracer

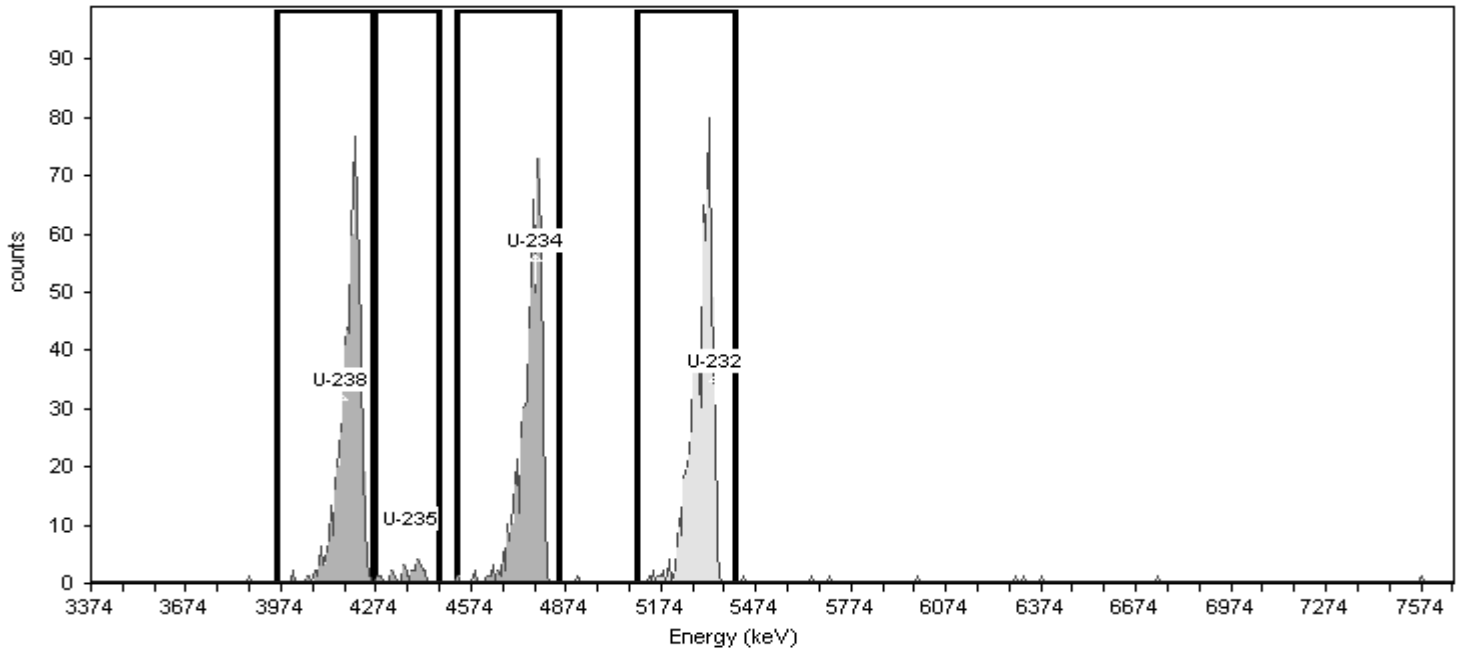
Tracer Name: U-232_00025
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:30AM

Tracer Nuclide: U-232
Tracer Recovery: 79.82%

Acquisition

Detector: AV79
Serial Number: 46-033Q5
Acquisition Start Date: 5/21/2014 5:20:09PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:19:16AM
Background Info: Sample: ICB;AV79; Det: AV79; Spectrum #1; May-15-2014 01:19

Calibration Name: IC-7107;AV79-20140501
Calibration Date: 5/4/2014 5:31:27PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.05% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/21/2014 5:17:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	58.8	100.0	595	0.0000	595.00	13.794	pCi/L
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	68.2	80.2	27	0.0000	27.00	0.781	pCi/L
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	61.2	99.8	570	0.9375	569.06	13.220	pCi/L
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	65.8	100.1	624	0.9375	623.06	11.829	pCi/L

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:08:09PM 5/21/2014

Sample

Sample Name: 160-6694-C-7-B
SampleType: Sample
: 160-6694-C-7-B
Sample Collection Date: 5/15/2014 8:10:00AM

Spectrum #1 Analysis #1
Sample Volume : 0.4995L
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123200
AnalysisID: 608358

Analyst: 60040

Tracer

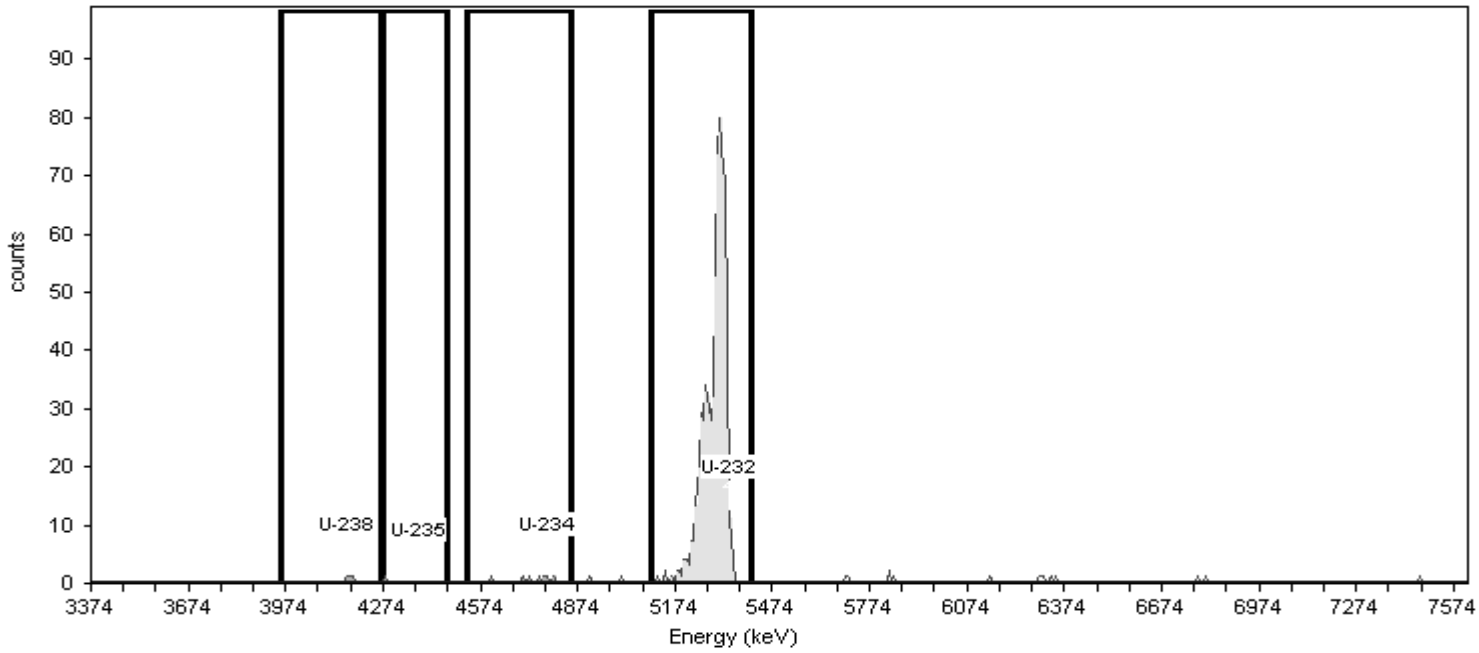
Tracer Name: U-232_00025
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:30AM

Tracer Nuclide: U-232
Tracer Recovery: 88.04%

Acquisition

Detector: AV82
Serial Number: 46-032EE5
Acquisition Start Date: 5/21/2014 5:20:14PM
Live Time: 180.01 min.
Real Time: 180.01 min.
Background Date: 5/15/2014 1:19:21AM
Background Info: Sample: ICB;AV82; Det: AV82; Spectrum #1; May-15-2014 01:19

Calibration Name: IC-8876;AV82-20140501
Calibration Date: 5/4/2014 5:31:49PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 25.76% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/21/2014 5:17:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	42.3	100.0	4	0.1875	3.81	0.084	pCi/L
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	12.7	80.2	1	0.0000	1.00	0.028	pCi/L
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	97.8	99.8	7	0.3750	6.62	0.147	pCi/L
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	57.7	100.1	655	0.3750	654.62	13.059	pCi/L

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

Prep Batch: 123278

, Extraction Chromatography Resin Actinide

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123278

Lab ID: MB 160-123278/1-A
Client ID:
Sigma: 2
Analyzed: 05/28/14 15:45
Detector: AV1
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	0.004946	0.0488	0.0488	U	pCi/g	1.00	0.110	124262
Uranium-235/236	-0.01407	0.0450	0.0451	U	pCi/g	1.00	0.130	124262
Uranium-238	0.01551	0.0478	0.0478	U	pCi/g	1.00	0.0994	124262

Tracer	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	6.086	0.482	0.702		pCi/g	0.0615	7.41	84.3	30 - 110

Lab ID: LCS 160-123278/2-A
Client ID:
Sigma: 2
Analyzed: 05/23/14 18:57
Detector: AV11
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	6.226	0.513	0.733		pCi/g	1.00	0.0683	123762
Uranium-238	6.834	0.537	0.786		pCi/g	1.00	0.0681	123762

Tracer	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	6.380	0.488	0.725		pCi/g	0.0633	7.41	88.4	30 - 110

Lab ID: 160-6694-1
Client ID: 2222-SD01
Sigma: 2
Analyzed: 05/23/14 18:57
Detector: AV15
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	0.585	0.199	0.205		pCi/g	1.00	0.111	123793
Uranium-235/236	0.0165	0.0413	0.0413	U	pCi/g	1.00	0.0924	123793
Uranium-238	0.352	0.153	0.156		pCi/g	1.00	0.0846	123793

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	4.35	0.413	0.552		pCi/g	0.0695	7.43	60.1	30 - 110

Lab ID: 160-6694-2
Client ID: 2222-SD02
Sigma: 2
Analyzed: 05/23/14 18:57
Detector: AV16
Dil Fac: 1
Decay Corrected: No
Yield Truncated: No
Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	0.369	0.131	0.134		pCi/g	1.00	0.0647	123794
Uranium-235/236	0.0230	0.0407	0.0408	U	pCi/g	1.00	0.0735	123794
Uranium-238	0.459	0.145	0.151		pCi/g	1.00	0.0645	123794

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123278

Lab ID: 160-6694-2 | Analyzed: 05/23/14 18:57 | Decay Corrected: No
Client ID: 2222-SD02 | Detector: AV16 | Yield Truncated: No
Sigma: 2 | Dil Fac: 1 | Ts: 180

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	5.90	0.467	0.681		pCi/g	0.0629	7.43	81.5	30 - 110

Lab ID: 160-6694-3 | Analyzed: 05/23/14 18:57 | Decay Corrected: No
Client ID: 2222-SD03 | Detector: AV17 | Yield Truncated: No
Sigma: 2 | Dil Fac: 1 | Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	0.666	0.172	0.181		pCi/g	1.00	0.0706	123795
Uranium-235/236	0.0110	0.0276	0.0276	U	pCi/g	1.00	0.0618	123795
Uranium-238	0.591	0.162	0.169		pCi/g	1.00	0.0665	123795

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	6.33	0.494	0.726		pCi/g	0.0917	7.39	88.0	30 - 110

Lab ID: 160-6694-4 | Analyzed: 05/23/14 18:57 | Decay Corrected: No
Client ID: 2222-SD04 | Detector: AV18 | Yield Truncated: No
Sigma: 2 | Dil Fac: 1 | Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	1.15	0.234	0.253		pCi/g	1.00	0.0672	123796
Uranium-235/236	0.0854	0.0722	0.0726		pCi/g	1.00	0.0669	123796
Uranium-238	1.08	0.226	0.244		pCi/g	1.00	0.0537	123796

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	6.04	0.488	0.704		pCi/g	0.0669	7.43	83.5	30 - 110

Lab ID: 160-6694-5 | Analyzed: 05/23/14 18:57 | Decay Corrected: No
Client ID: 2222-SD05 | Detector: AV19 | Yield Truncated: No
Sigma: 2 | Dil Fac: 1 | Ts: 180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	0.289	0.120	0.122		pCi/g	1.00	0.0831	123797
Uranium-235/236	-0.00545	0.00771	0.00773	U	pCi/g	1.00	0.0756	123797
Uranium-238	0.243	0.107	0.109		pCi/g	1.00	0.0531	123797

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	6.16	0.495	0.716		pCi/g	0.0830	7.44	85.0	30 - 110

Alpha Spectroscopy Analysis Detail Report
Prep Batch: 123278

Lab ID:	160-6694-6	Analyzed:	05/23/14 18:57	Decay Corrected:	No
Client ID:	2222-SD06	Detector:	AV20	Yield Truncated:	No
Sigma:	2	Dil Fac:	1	Ts:	180

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Uranium-233/234	0.859	0.198	0.211		pCi/g	1.00	0.0796	123798
Uranium-235/236	-0.00784	0.00906	0.00908	U	pCi/g	1.00	0.0793	123798
Uranium-238	0.588	0.163	0.170		pCi/g	1.00	0.0581	123798

Tracer	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Uranium-232	6.28	0.496	0.724		pCi/g	0.0631	7.39	87.3	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 160-123278/1-A	Uranium-233/234			0.004946	U	pCi/g							
MB 160-123278/1-A	Uranium-235/236			-0.01407	U	pCi/g							
MB 160-123278/1-A	Uranium-238			0.01551	U	pCi/g							

Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-123278/2-A	Uranium-233/234		6.37	6.226		pCi/g	98	84 - 120					
LCS 160-123278/2-A	Uranium-238		6.51	6.834		pCi/g	105	82 - 122					

Glossary:

Ts = Count Duration, Sample

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:46:49PM 5/28/2014

Sample

Sample Name: MB 160-123278/1-A
SampleType: Blank
: MB 160-123278/1-A
Sample Collection Date: 5/21/2014 10:10:00AM

Spectrum #2 Analysis #1
Sample Weight : 1.0000g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123278
AnalysisID: 609150

Analyst: 60040

Tracer

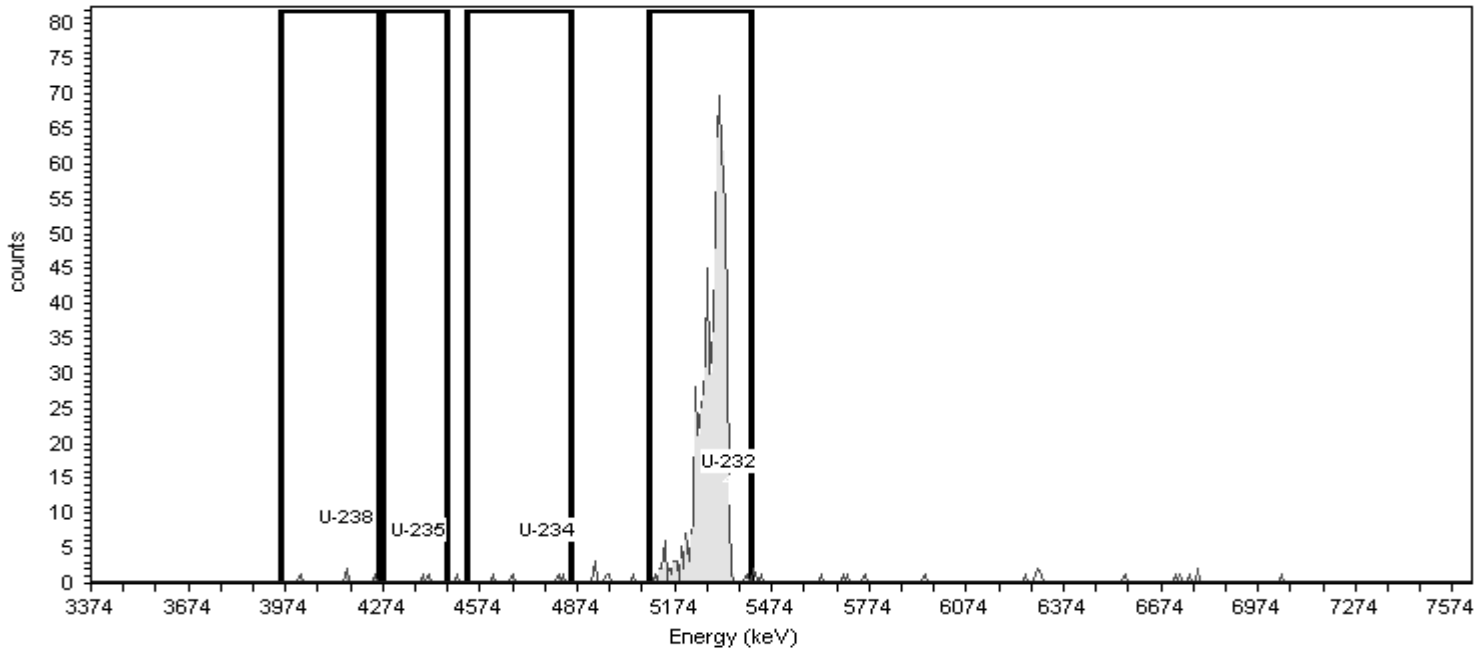
Tracer Name: U-232_00026
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:51AM

Tracer Nuclide: U-232
Tracer Recovery: 84.35%

Acquisition

Detector: AV1
Serial Number: 49-188 AA4
Acquisition Start Date: 5/28/2014 3:45:56PM
Live Time: 180.00 min.
Real Time: 180.00 min.
Background Date: 5/15/2014 1:20:59AM
Background Info: Sample: ICB;AV1; Det: AV1; Spectrum #1; May-15-2014 01:20

Calibration Name: IC-7107;AV1-20140505
Calibration Date: 5/6/2014 5:38:14PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.30% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/23/2014 6:54:36PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	10.7	100.0	4	2.6250	1.38	0.016	pCi/g
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	29.8	80.2	2	3.0000	-1.00	-0.014	pCi/g
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	25.0	99.8	4	3.5625	0.44	0.005	pCi/g
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	74.2	100.1	641	0.9375	640.06	6.250	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:58:24PM 5/23/2014

Sample

Sample Name: LCS 160-123278/2-A
SampleType: Control
: LCS 160-123278/2-A
Sample Collection Date: 5/21/2014 10:10:00AM

Spectrum #1 Analysis #1
Sample Weight : 1.0000g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123278
AnalysisID: 608727

Analyst: 60040

Tracer

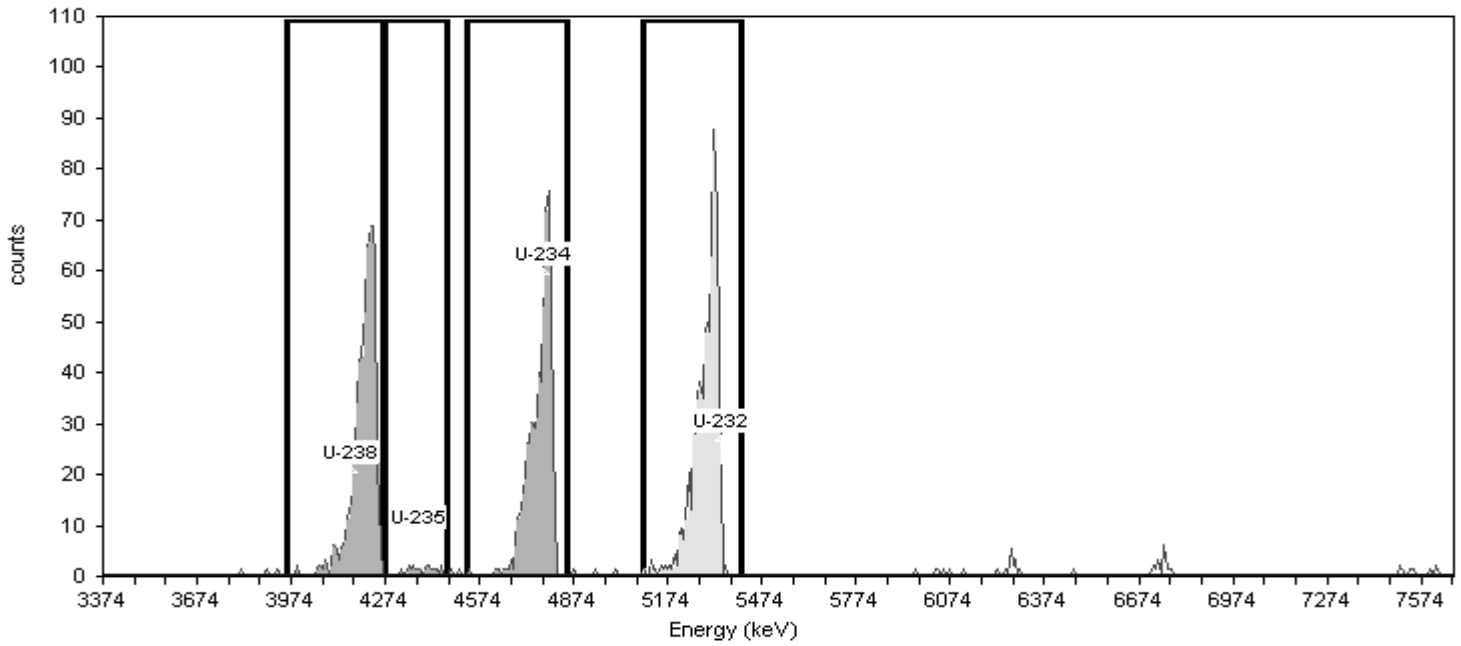
Tracer Name: U-232_00026
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:51AM

Tracer Nuclide: U-232
Tracer Recovery: 88.41%

Acquisition

Detector: AV11
Serial Number: 49-155dd2
Acquisition Start Date: 5/23/2014 6:57:10PM
Live Time: 180.00 min.
Real Time: 180.46 min.
Background Date: 5/15/2014 1:18:01AM
Background Info: Sample: ICB;AV11; Det: AV11; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-9795;AV11-20140505
Calibration Date: 5/6/2014 5:39:16PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.88% +/- 0.35% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/23/2014 6:54:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	27.4	100.0	650	0.9375	649.06	6.834	pCi/g
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	83.3	80.2	19	0.3750	18.63	0.245	pCi/g
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	66.1	99.8	591	0.9375	590.06	6.226	pCi/g
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	73.0	100.1	687	1.1250	685.88	6.551	pCi/g

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:58:06PM 5/23/2014

Sample

Sample Name: 160-6694-A-1-C
SampleType: Sample
: 160-6694-A-1-C
Sample Collection Date: 5/15/2014 8:25:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9977g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123278
AnalysisID: 608724

Analyst: 60040

Tracer

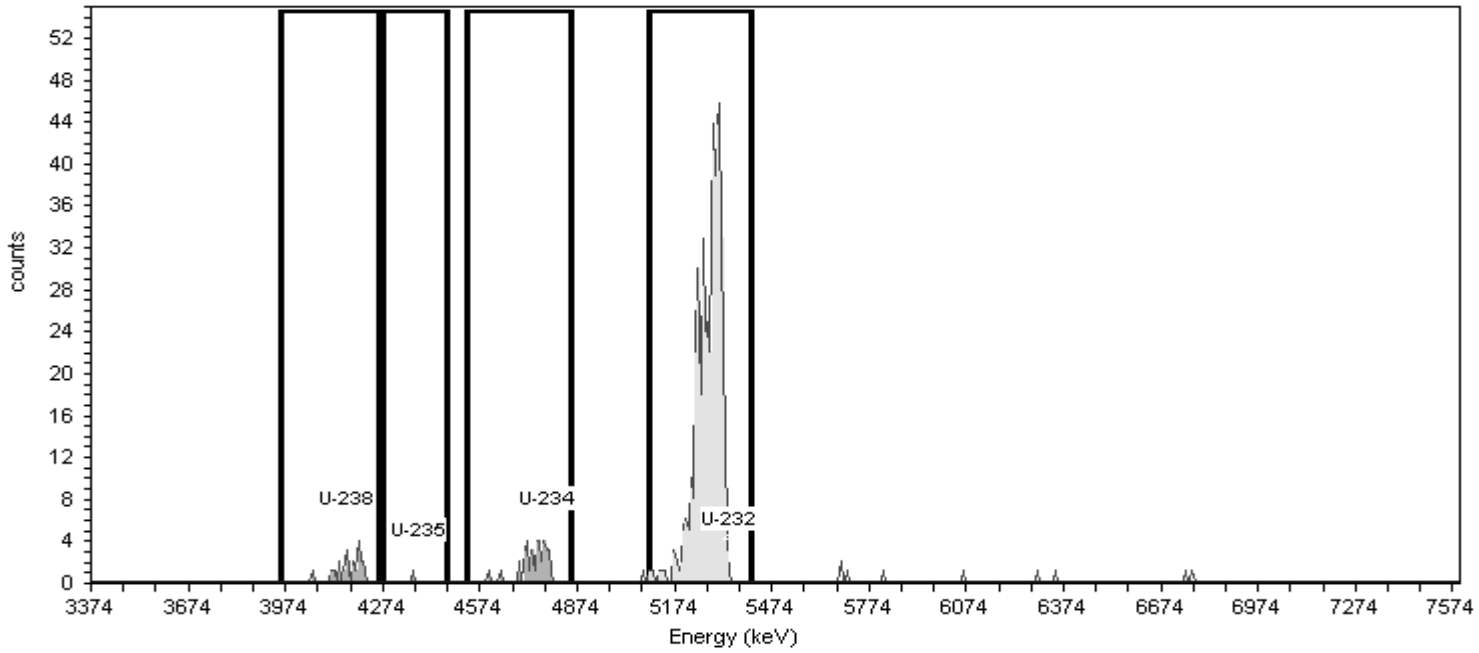
Tracer Name: U-232_00026
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:51AM

Tracer Nuclide: U-232
Tracer Recovery: 60.14%

Acquisition

Detector: AV15
Serial Number: 41-172C5
Acquisition Start Date: 5/23/2014 6:57:32PM
Live Time: 180.00 min.
Real Time: 180.46 min.
Background Date: 5/15/2014 1:17:55AM
Background Info: Sample: ICB;AV15; Det: AV15; Spectrum #1; May-15-2014 01:17

Calibration Name: IC-9886;AV15-20140505
Calibration Date: 5/6/2014 5:39:42PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 25.62% +/- 0.34% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/23/2014 6:54:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	89.0	100.0	22	0.3750	21.63	0.352	pCi/g
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	18.3	80.2	1	0.1875	0.81	0.016	pCi/g
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	83.3	99.8	37	1.1250	35.88	0.585	pCi/g
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	85.9	100.1	446	1.3125	444.69	4.466	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:58:13PM 5/23/2014

Sample

Sample Name: 160-6694-A-2-C
SampleType: Sample
: 160-6694-A-2-C
Sample Collection Date: 5/15/2014 9:45:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9979g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123278
AnalysisID: 608725

Analyst: 60040

Tracer

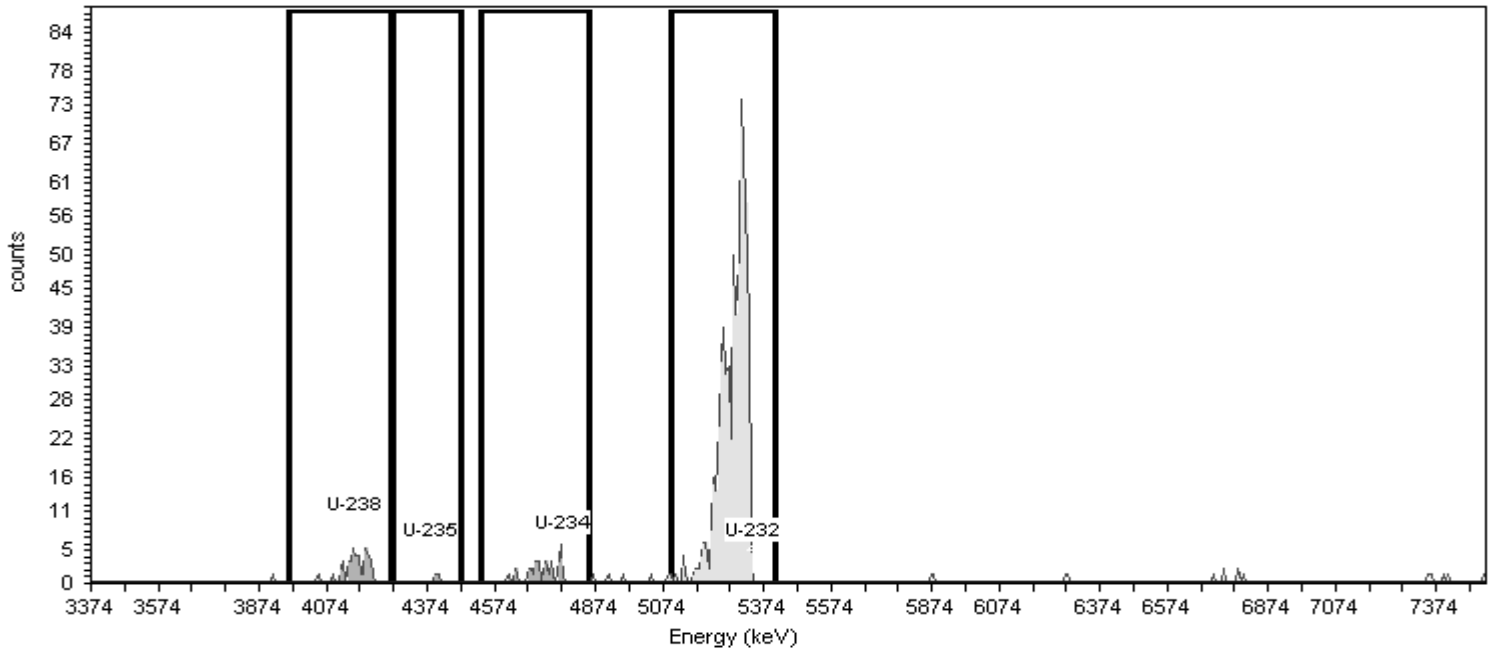
Tracer Name: U-232_00026
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:51AM

Tracer Nuclide: U-232
Tracer Recovery: 81.53%

Acquisition

Detector: AV16
Serial Number: 51-082B6
Acquisition Start Date: 5/23/2014 6:57:33PM
Live Time: 180.00 min.
Real Time: 180.46 min.
Background Date: 5/15/2014 1:17:57AM
Background Info: Sample: ICB;AV16; Det: AV16; Spectrum #1; May-15-2014 01:17

Calibration Name: IC-7107;AV16-20140505
Calibration Date: 5/5/2014 10:08:41PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.11% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/23/2014 6:54:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	88.6	100.0	41	0.5625	40.44	0.459	pCi/g
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	17.4	80.2	2	0.3750	1.63	0.023	pCi/g
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	113.7	99.8	33	0.5625	32.44	0.369	pCi/g
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	80.0	100.1	639	1.1250	637.88	6.054	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:57:02PM 5/23/2014

Sample

Sample Name: 160-6694-A-3-C
SampleType: Sample
: 160-6694-A-3-C
Sample Collection Date: 5/15/2014 8:50:00AM

Spectrum #1 Analysis #1
Sample Weight : 1.0026g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123278
AnalysisID: 608718

Analyst: 60040

Tracer

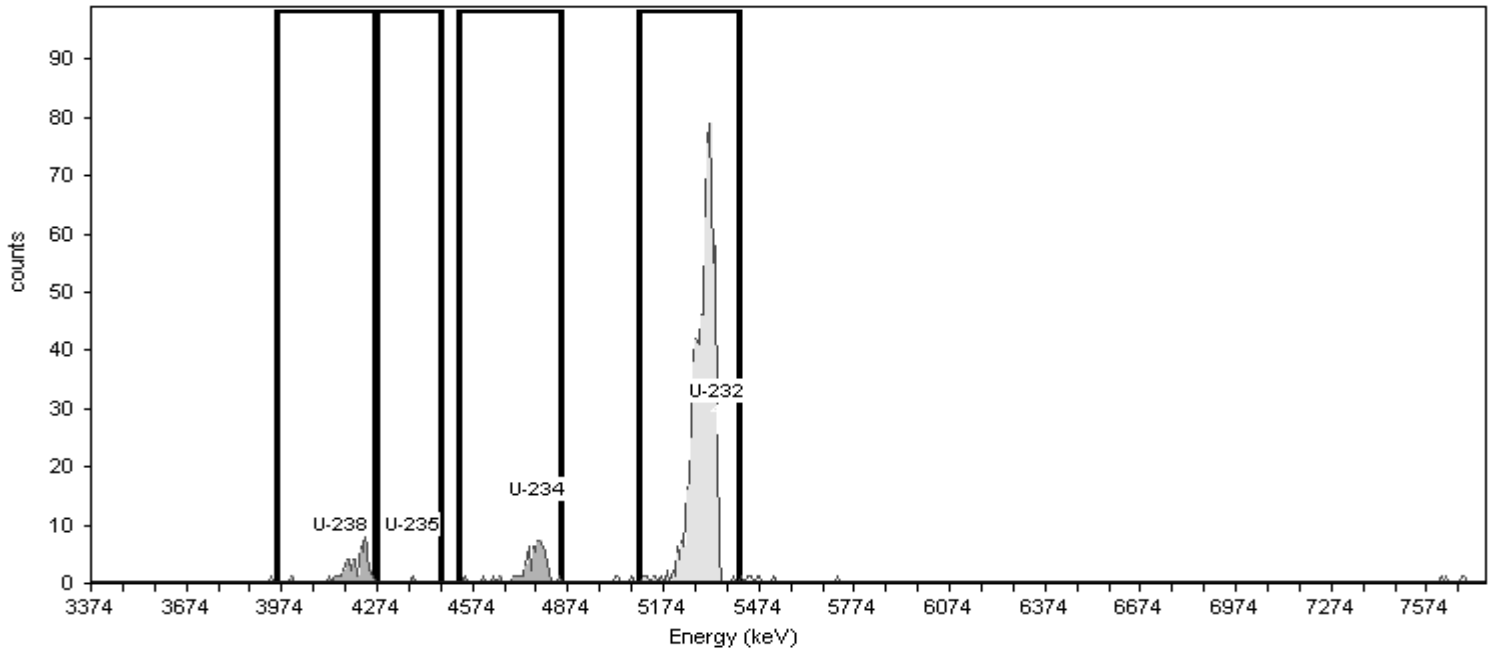
Tracer Name: U-232_00026
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:51AM

Tracer Nuclide: U-232
Tracer Recovery: 87.95%

Acquisition

Detector: AV17
Serial Number: 50-051C4
Acquisition Start Date: 5/23/2014 6:57:34PM
Live Time: 180.00 min.
Real Time: 180.01 min.
Background Date: 5/15/2014 1:17:59AM
Background Info: Sample: ICB;AV17; Det: AV17; Spectrum #1; May-15-2014 01:17

Calibration Name: IC-8874;AV17-20140505
Calibration Date: 5/5/2014 10:08:49PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.07% +/- 0.37% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/23/2014 6:54:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	22.4	100.0	55	0.7500	54.25	0.591	pCi/g
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	18.3	80.2	1	0.1875	0.81	0.011	pCi/g
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	72.5	99.8	62	0.9375	61.06	0.666	pCi/g
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	69.7	100.1	665	3.3750	661.63	6.500	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:57:15PM 5/23/2014

Sample

Sample Name: 160-6694-A-4-C
SampleType: Sample
: 160-6694-A-4-C
Sample Collection Date: 5/15/2014 9:05:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9979g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123278
AnalysisID: 608719

Analyst: 60040

Tracer

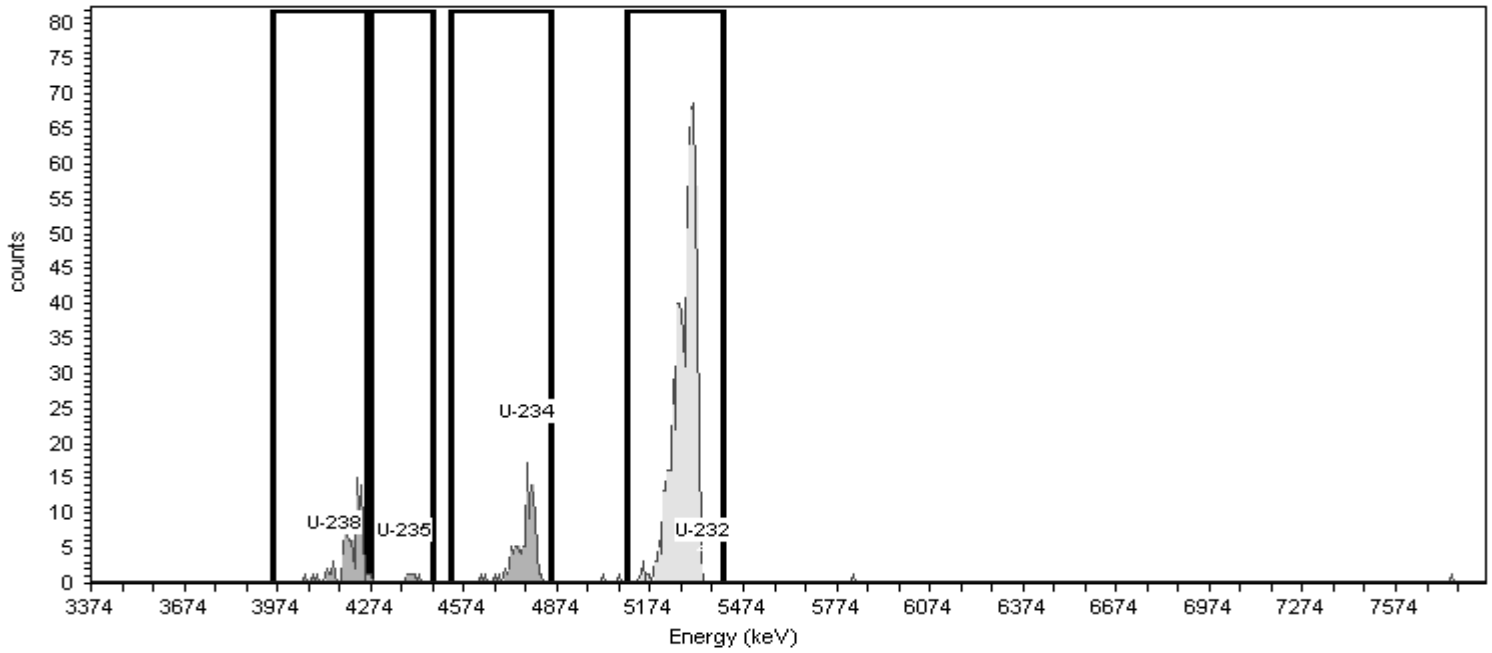
Tracer Name: U-232_00026
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:51AM

Tracer Nuclide: U-232
Tracer Recovery: 83.53%

Acquisition

Detector: AV18
Serial Number: 51-082C5
Acquisition Start Date: 5/23/2014 6:57:35PM
Live Time: 180.00 min.
Real Time: 180.01 min.
Background Date: 5/15/2014 1:18:01AM
Background Info: Sample: ICB;AV18; Det: AV18; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-8875;AV18-20140505
Calibration Date: 5/5/2014 10:09:08PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 25.46% +/- 0.36% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/23/2014 6:54:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	29.9	100.0	92	0.1875	91.81	1.082	pCi/g
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	33.5	80.2	6	0.1875	5.81	0.085	pCi/g
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	55.5	99.8	98	0.5625	97.44	1.151	pCi/g
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	69.9	100.1	615	1.1250	613.88	6.203	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:57:33PM 5/23/2014

Sample

Sample Name: 160-6694-A-5-C
SampleType: Sample
: 160-6694-A-5-C
Sample Collection Date: 5/15/2014 9:15:00AM

Spectrum #1 Analysis #1
Sample Weight : 0.9957g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123278
AnalysisID: 608720

Analyst: 60040

Tracer

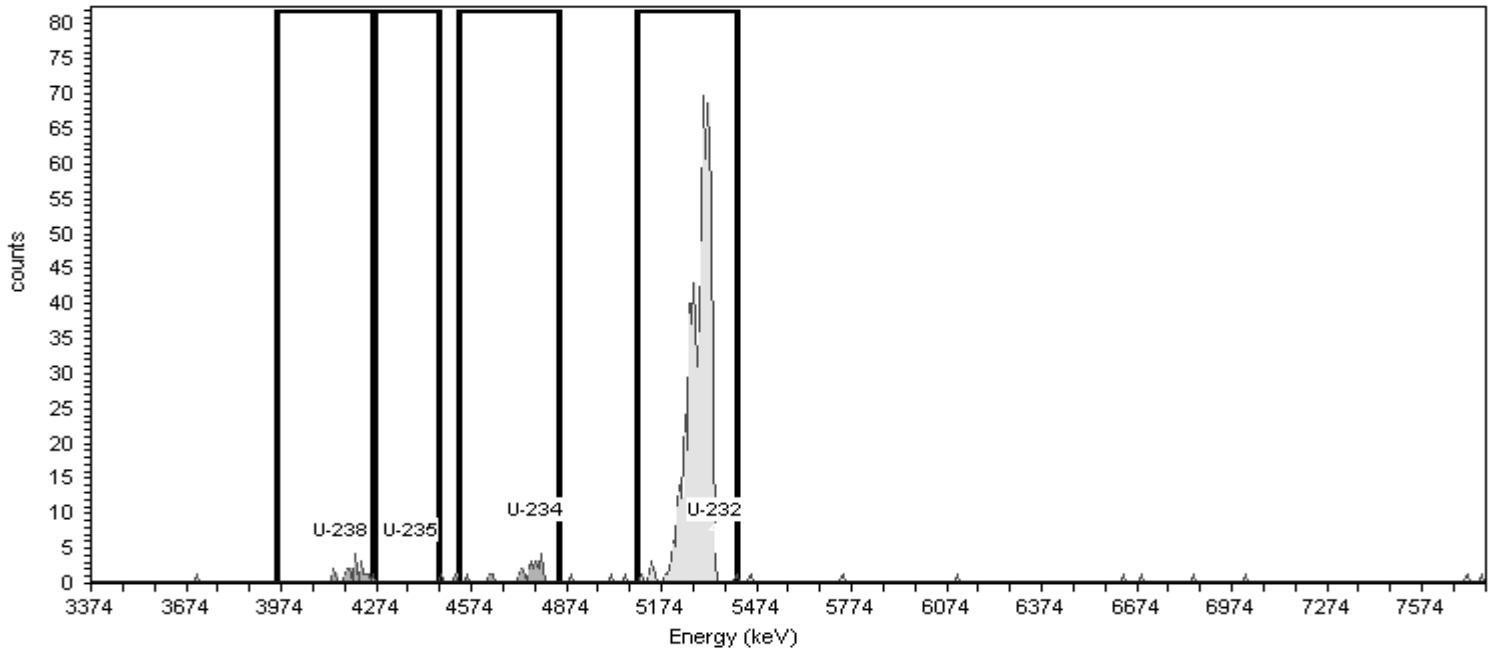
Tracer Name: U-232_00026
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:51AM

Tracer Nuclide: U-232
Tracer Recovery: 85.03%

Acquisition

Detector: AV19
Serial Number: 50-025FF5
Acquisition Start Date: 5/23/2014 6:57:36PM
Live Time: 180.00 min.
Real Time: 180.01 min.
Background Date: 5/15/2014 1:18:02AM
Background Info: Sample: ICB;AV19; Det: AV19; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-8876;AV19-20140505
Calibration Date: 5/5/2014 10:09:02PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 25.34% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/23/2014 6:54:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	13.7	100.0	21	0.1875	20.81	0.243	pCi/g
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	.0	80.2	0	0.3750	-0.38	-0.005	pCi/g
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	57.9	99.8	26	1.3125	24.69	0.289	pCi/g
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	75.5	100.1	624	2.2500	621.75	6.327	pCi/g

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Analysis Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:57:50PM 5/23/2014

Sample

Sample Name: 160-6694-A-6-C
SampleType: Sample
: 160-6694-A-6-C
Sample Collection Date: 5/15/2014 8:45:00AM

Spectrum #1 Analysis #1
Sample Weight : 1.0029g
Aliquot: N/A Aliquot Fraction: N/A

Batch

Batch Name: 123278
AnalysisID: 608721

Analyst: 60040

Tracer

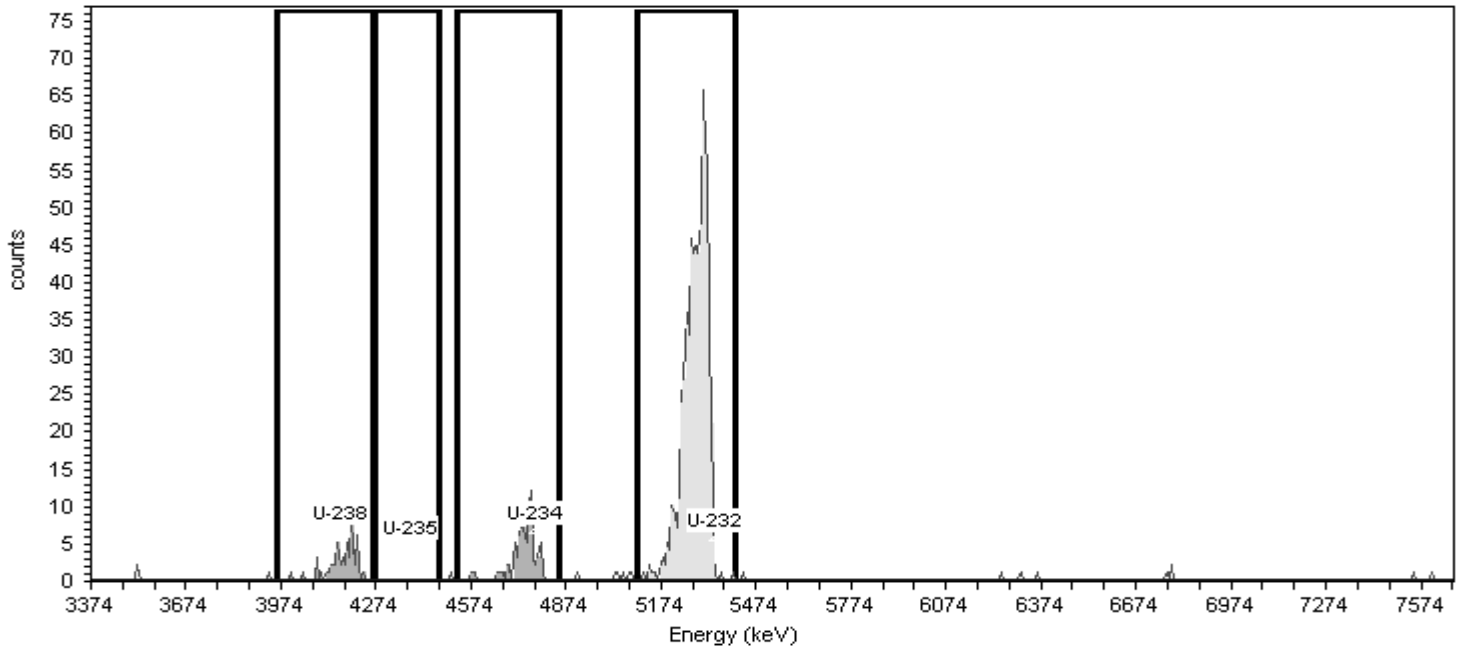
Tracer Name: U-232_00026
Tracer Activity: 82.25 DPM/mL x (Vol.)0.20 mL = 16.45 DPM
Tracer Ref. Date: 8/25/2011 11:00:51AM

Tracer Nuclide: U-232
Tracer Recovery: 87.31%

Acquisition

Detector: AV20
Serial Number: 48-121A7
Acquisition Start Date: 5/23/2014 6:57:37PM
Live Time: 180.00 min.
Real Time: 180.01 min.
Background Date: 5/15/2014 1:18:04AM
Background Info: Sample: ICB;AV20; Det: AV20; Spectrum #1; May-15-2014 01:18

Calibration Name: IC-8877;AV20-20140505
Calibration Date: 5/5/2014 10:09:21PM
Energy Cal: Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 25.56% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = UROI
Decay Correction: 5/23/2014 6:54:35PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Uranium
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
U-238	4157.5	4,196.0	-38.5	3956.1	4261.9	82.2	100.0	53	0.3750	52.63	0.588	pCi/g
U-235	4381.2	4,396.0	-14.8	4269.3	4470.7	.0	80.2	0	0.5625	-0.56	-0.008	pCi/g
U-234	4776.4	4,775.8	0.6	4530.3	4851.0	68.0	99.8	78	1.3125	76.69	0.859	pCi/g
U-232	5343.2	5,320.3	22.9	5097.1	5410.3	84.6	100.1	645	0.9375	644.06	6.451	pCi/g

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123200 Batch Start Date: 05/20/14 13:40 Batch Analyst: Bernsen, Sarah C

Batch Method: ExtChrom Batch End Date: 05/21/14 16:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00025	UNAT Spike 00001			
MB 160-123200/1		ExtChrom, A-01-R		500 mL	0.2 mL				
LCS 160-123200/2		ExtChrom, A-01-R		500 mL	0.2 mL	0.2 mL			
160-6694-C-7	2222-RIN-01	ExtChrom, A-01-R	T	499.50 mL	0.2 mL				

Batch Notes	
Balance ID	1125353055
Column Analyst	mlb
Column Date	05/21/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/21/14
Person's name who witnessed reagent drop	MLB PER SCB
Analyst who added reagent	SCB
SOP Number	ST-RC-0100, 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.

ALPHA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123278 Batch Start Date: 05/21/14 10:03 Batch Analyst: Bramblett, Megan L

Batch Method: ExtChrom Batch End Date: 05/23/14 13:49

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	U-232 00026	UNAT Spike 00001			
MB 160-123278/1		ExtChrom, A-01-R		1.0 g	0.2 mL				
LCS 160-123278/2		ExtChrom, A-01-R		1.0 g	0.2 mL	0.2 mL			
160-6694-A-1-A	2222-SD01	ExtChrom, A-01-R	T	0.9977 g	0.2 mL				
160-6694-A-2-A	2222-SD02	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-3-A	2222-SD03	ExtChrom, A-01-R	T	1.0026 g	0.2 mL				
160-6694-A-4-A	2222-SD04	ExtChrom, A-01-R	T	0.9979 g	0.2 mL				
160-6694-A-5-A	2222-SD05	ExtChrom, A-01-R	T	0.9957 g	0.2 mL				
160-6694-A-6-A	2222-SD06	ExtChrom, A-01-R	T	1.0029 g	0.2 mL				

Batch Notes	
Balance ID	1123433897
Column Analyst	mlb for nmn
Column Date	05/23/14
CoPrecipitation Analyst	mlb
CoPrecipitation Date	05/23/14
Person's name who witnessed reagent drop	mlb for scb
Analyst who added reagent	mlb
SOP Number	st-rc-0100, st-rc-0003, st-rc-0004, 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.

Daily Checks

Alpha Spectroscopy Daily Pulser Check

Analysis Date: 05/21/14

		Gross Counts			FWHM (keV)			Pulser Center			Energy (keV)		
Detector	Analysis Date	Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F
AV43	05/21/14 16:01	7450	7041.9 - 7783.1	Pass	11.7	10 - 20	Pass	221.0	216.9 - 226.9	Pass	5015	4982.0 - 5062.0	Pass
AV44	05/21/14 16:01	7512	7220.7 - 7980.8	Pass	11.6	10 - 20	Pass	221.0	216.0 - 226.0	Pass	5015	4975.1 - 5055.1	Pass
AV48	05/21/14 16:02	7618	7068.1 - 7812.1	Pass	13.5	10 - 20	Pass	223.0	218.0 - 228.0	Pass	5030	4989.8 - 5069.8	Pass
AV55	05/21/14 16:01	7164	6899.4 - 7625.7	Pass	10.9	10 - 20	Pass	225.0	220.0 - 230.0	Pass	5045	5004.9 - 5084.9	Pass
AV78	05/21/14 16:01	7551	7170.6 - 7925.4	Pass	13.5	10 - 20	Pass	224.0	219.0 - 229.0	Pass	5038	4997.5 - 5077.5	Pass
AV79	05/21/14 16:01	7433	7146.3 - 7898.6	Pass	13.1	10 - 20	Pass	222.0	217.0 - 227.0	Pass	5023	4982.6 - 5062.6	Pass
AV82	05/21/14 16:02	7539	7160.6 - 7914.3	Pass	14.3	10 - 20	Pass	223.1	218.0 - 228.0	Pass	5031	4990.4 - 5070.4	Pass
AV84	05/21/14 16:02	7488	7145.0 - 7897.1	Pass	12.6	10 - 20	Pass	226.0	221.0 - 231.0	Pass	5053	5012.6 - 5092.6	Pass

Analysis Date: 05/23/14

		Gross Counts			FWHM (keV)			Pulser Center			Energy (keV)		
Detector	Analysis Date	Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F
AV11	05/23/14 08:54	7720	7322.5 - 8093.3	Pass	13.5	10 - 20	Pass	226.0	221.1 - 231.1	Pass	5053	5012.8 - 5092.8	Pass
AV13	05/23/14 08:54	7595	7244.9 - 8007.5	Pass	17.8	10 - 20	Pass	222.8	219.1 - 229.1	Pass	5029	4998.3 - 5078.3	Pass
AV15	05/23/14 08:54	7706	7313.8 - 8083.7	Pass	14.7	10 - 20	Pass	225.1	219.2 - 229.2	Pass	5046	4998.9 - 5078.9	Pass
AV16	05/23/14 08:54	7516	7055.7 - 7798.4	Pass	12.3	10 - 20	Pass	222.0	215.9 - 225.9	Pass	5023	4974.6 - 5054.6	Pass
AV17	05/23/14 08:54	7561	7224.6 - 7985.1	Pass	11.9	10 - 20	Pass	227.0	221.0 - 231.0	Pass	5060	5012.5 - 5092.5	Pass
AV18	05/23/14 08:55	7591	7204.8 - 7963.1	Pass	12.0	10 - 20	Pass	225.0	220.0 - 230.0	Pass	5045	5004.9 - 5084.9	Pass
AV19	05/23/14 08:55	7628	7231.9 - 7993.2	Pass	11.4	10 - 20	Pass	226.0	221.0 - 231.0	Pass	5052	5012.3 - 5092.3	Pass
AV20	05/23/14 08:55	7669	7255.1 - 8018.8	Pass	15.7	10 - 20	Pass	223.1	217.9 - 227.9	Pass	5031	4989.0 - 5069.0	Pass
AV45	05/23/14 08:55	7583	7219.6 - 7979.6	Pass	16.6	10 - 20	Pass	224.0	219.7 - 229.7	Pass	5037	5003.0 - 5083.0	Pass
AV46	05/23/14 08:55	7463	7134.7 - 7885.7	Pass	12.5	10 - 20	Pass	225.0	220.0 - 230.0	Pass	5045	5004.8 - 5084.8	Pass
AV48	05/23/14 08:55	7614	7068.1 - 7812.1	Pass	13.3	10 - 20	Pass	223.0	218.0 - 228.0	Pass	5030	4989.8 - 5069.8	Pass
AV57	05/23/14 08:55	7227	6901.7 - 7628.2	Pass	17.7	10 - 20	Pass	229.0	224.0 - 234.0	Pass	5075	5034.9 - 5114.9	Pass
AV58	05/23/14 08:55	6966	6766.5 - 7478.7	Pass	12.6	10 - 20	Pass	222.9	219.0 - 229.0	Pass	5030	4997.2 - 5077.2	Pass
AV59	05/23/14 08:55	7180	6885.8 - 7610.6	Pass	17.6	10 - 20	Pass	222.9	217.9 - 227.9	Pass	5029	4989.1 - 5069.1	Pass
AV60	05/23/14 08:55	7234	6867.8 - 7590.7	Pass	15.5	10 - 20	Pass	222.1	216.2 - 226.2	Pass	5024	4976.7 - 5056.7	Pass
AV61	05/23/14 08:55	7251	6682.3 - 7385.7	Pass	14.0	10 - 20	Pass	224.1	219.0 - 229.0	Pass	5038	4997.8 - 5077.8	Pass
AV62	05/23/14 08:55	7213	6875.3 - 7599.0	Pass	17.7	10 - 20	Pass	222.1	217.1 - 227.1	Pass	5023	4983.0 - 5063.0	Pass

Analysis Date: 05/28/14

		Gross Counts			FWHM (keV)			Pulser Center			Energy (keV)		
Detector	Analysis Date	Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F	Result	Criteria	P/F
AV1	05/28/14 09:33	7282	6814.5 - 7531.8	Pass	12.8	10 - 20	Pass	223.0	216.9 - 226.9	Pass	5030	4982.0 - 5062.0	Pass

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:37:00AM 5/28/2014

Sample

Sample Name: Pulser;AV1 Spectrum #6 Analysis #1
Comment:

Batch

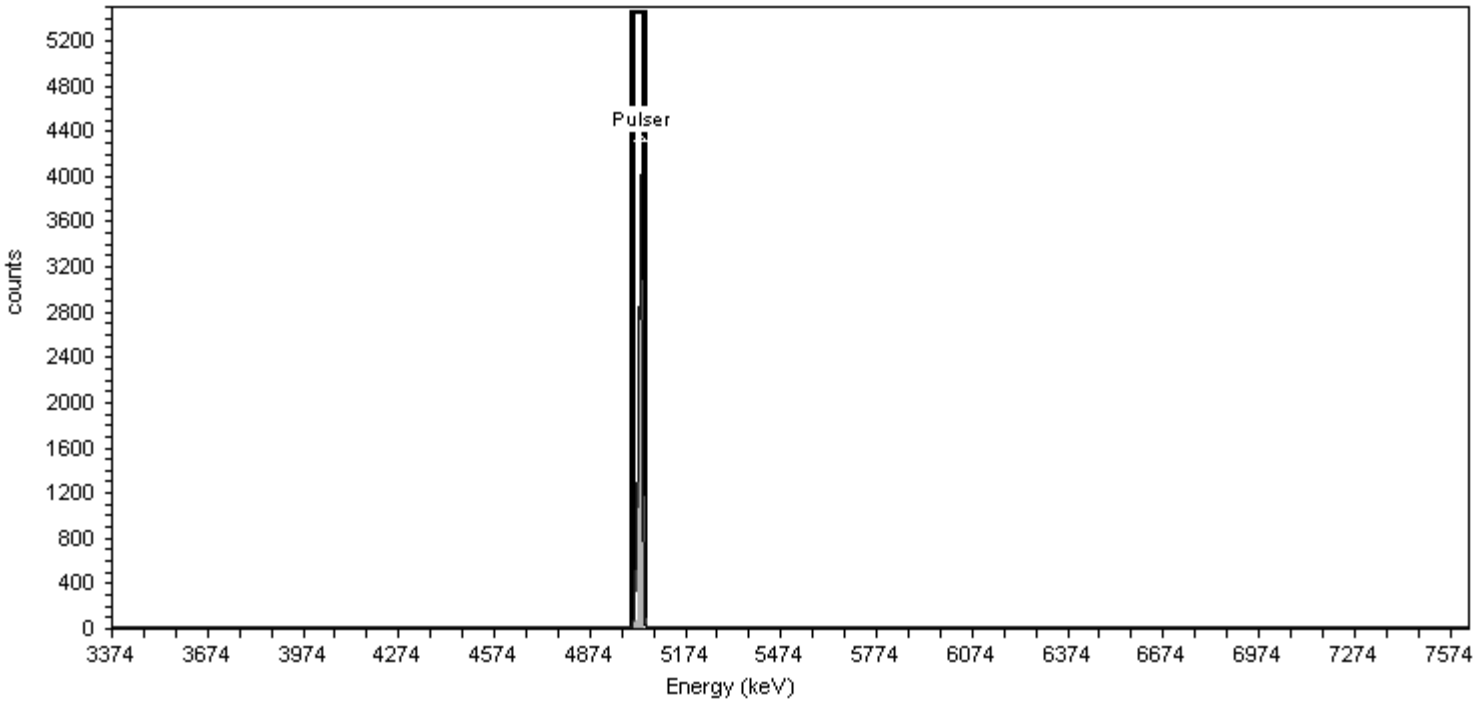
Batch Name: May2014aa Analyst: 60040
Description:

Acquisition

Detector: AV1 , SN: 49-188 AA4
Acquisition Start Date: 5/28/2014 9:33:02AM
Live Time: 1.00 min.
Real Time: 1.01 min.
Calibration Name: IC-7107;AV1-20140505
Calibration Date: 5/6/2014 5:38:14PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.30% +/- 0.30% TPU(2 sigma)



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	5029.702	5007.986	5051.418	12.76	7,338.30	7,281.61

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:00:31AM 5/23/2014

Sample

Sample Name: Pulser;AV11 Spectrum #4 Analysis #1
Comment:

Batch

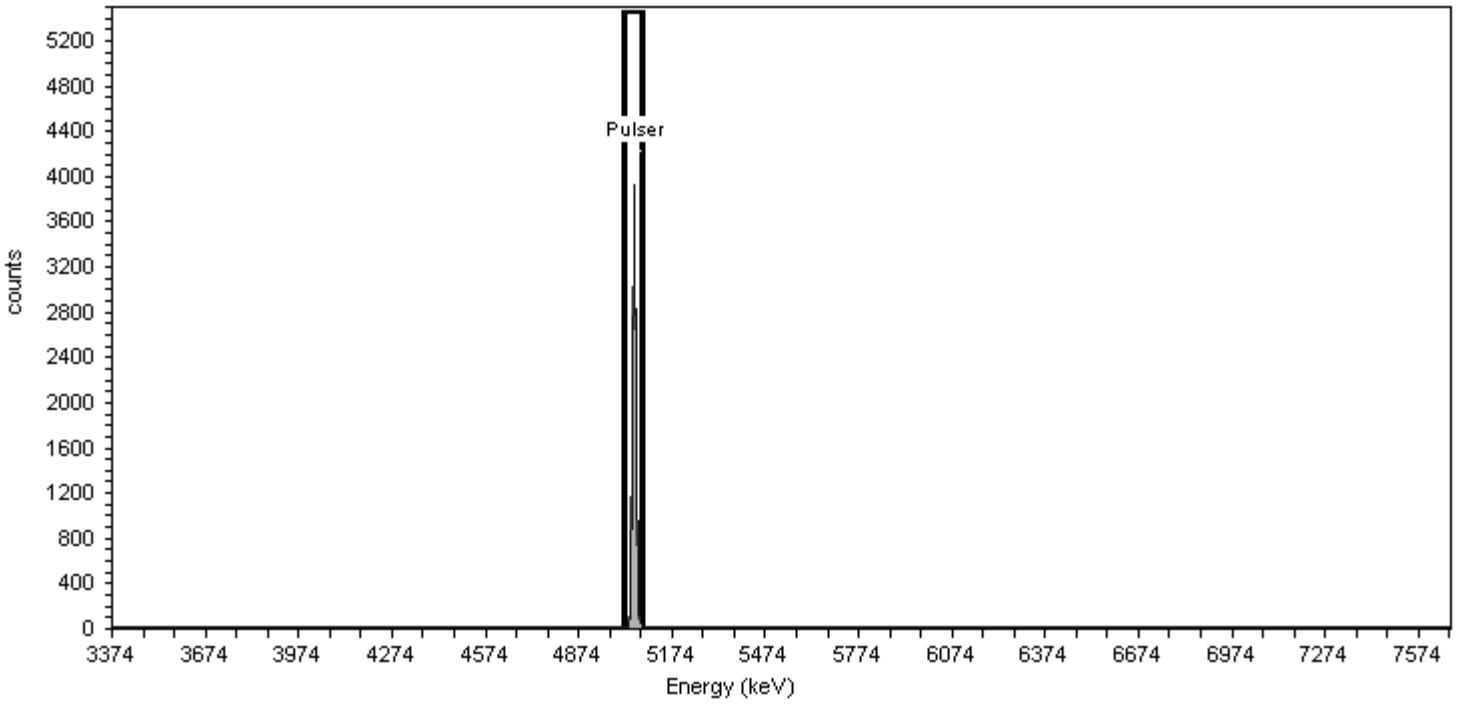
Batch Name: May2014aa Analyst: 60040
Description:

Acquisition

Detector: AV11 , SN: 49-155dd2
Acquisition Start Date: 5/23/2014 8:54:54AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9795;AV11-20140505
Calibration Date: 5/6/2014 5:39:16PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.88% +/- 0.35% TPU(2 sigma)



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	5052.549	5029.654	5075.444	13.45	7,559.68	7,719.77

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:00:48AM 5/23/2014

Sample

Sample Name: Pulser;AV13
Comment:

Spectrum #4 Analysis #1

Batch

Batch Name: May2014aa
Description:

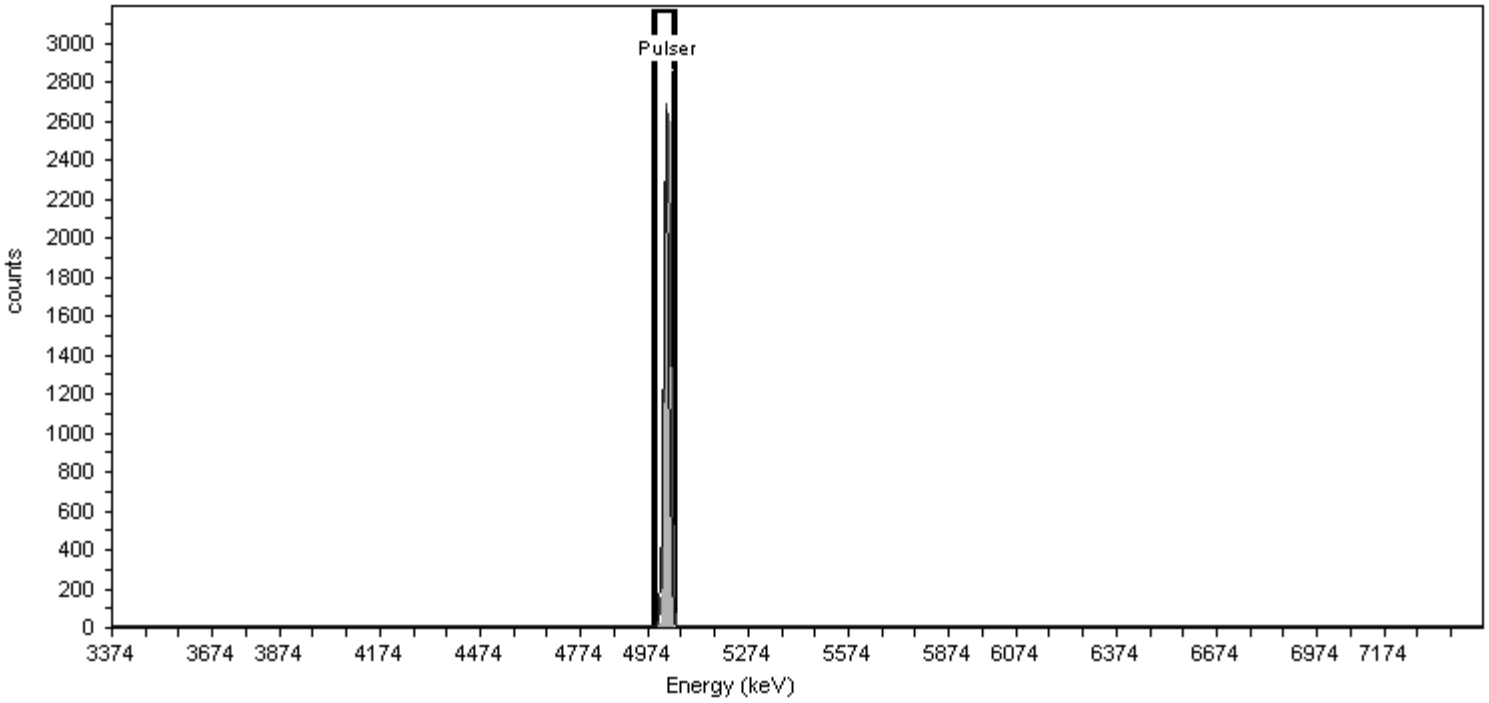
Analyst: 60040

Acquisition

Detector: AV13 , SN: 49-155M7
Acquisition Start Date: 5/23/2014 8:54:55AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9884;AV13-20140505
Calibration Date: 5/6/2014 5:39:28PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.99% +/- 0.37% TPU(2 sigma)



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	5028.785	4998.405	5059.165	17.85	6,886.36	7,595.02

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:00:59AM 5/23/2014

Sample

Sample Name: Pulser;AV15 Spectrum #4 Analysis #1
Comment:

Batch

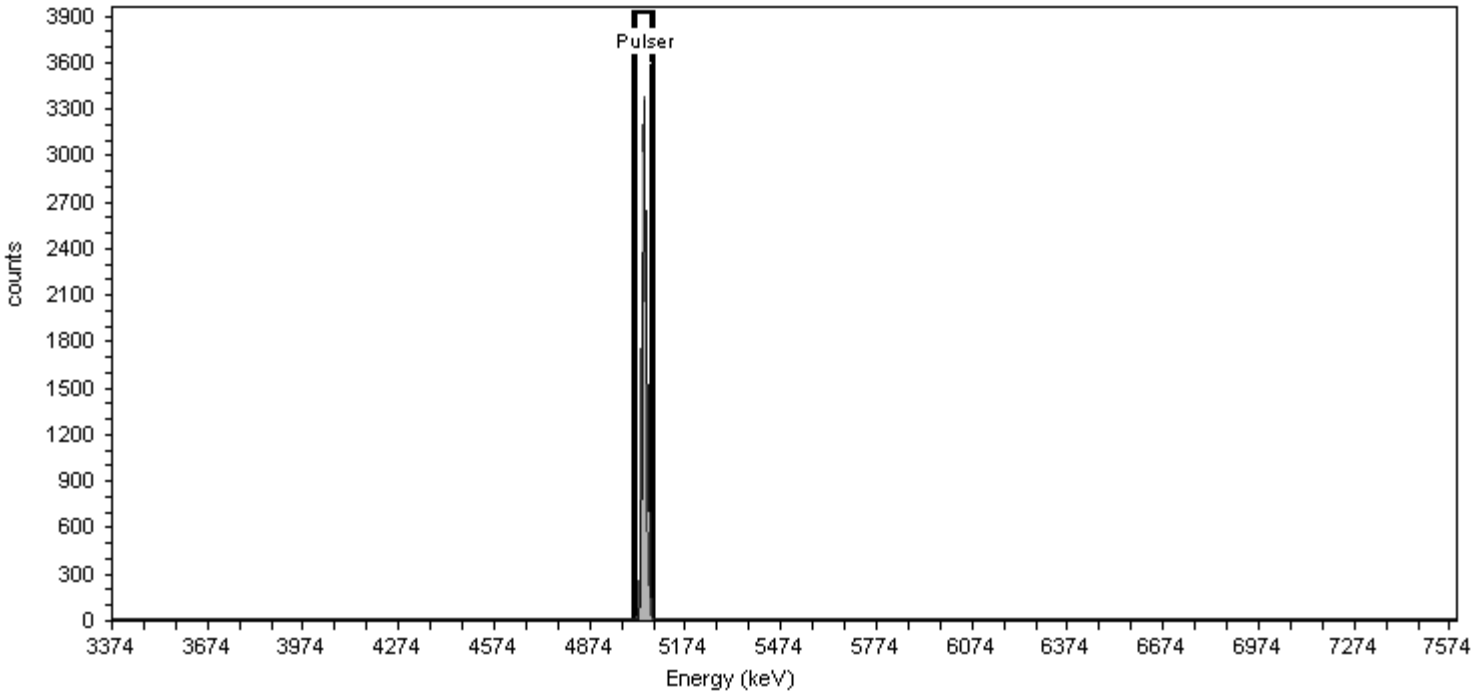
Batch Name: May2014aa Analyst: 60040
Description:

Acquisition

Detector: AV15 , SN: 41-172C5
Acquisition Start Date: 5/23/2014 8:54:57AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9886;AV15-20140505
Calibration Date: 5/6/2014 5:39:42PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.62% +/- 0.34% TPU(2 sigma)



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	5045.753	5020.708	5070.798	14.71	7,135.32	7,706.11

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:01:05AM 5/23/2014

Sample

Sample Name: Pulser;AV16
Comment:

Spectrum #4 Analysis #1

Batch

Batch Name: May2014aa
Description:

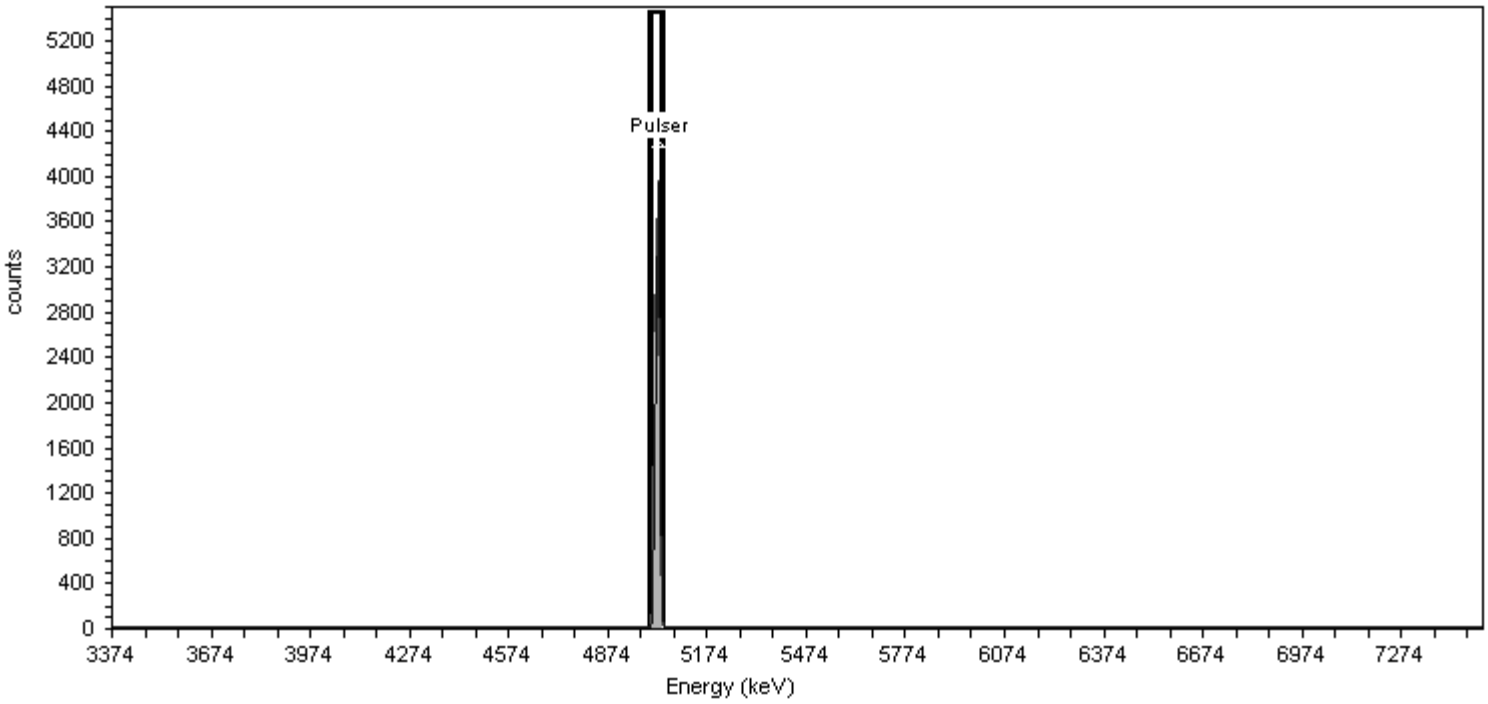
Analyst: 60040

Acquisition

Detector: AV16 , SN: 51-082B6
Acquisition Start Date: 5/23/2014 8:54:58AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-7107;AV16-20140505
Calibration Date: 5/5/2014 10:08:41PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.11% +/- 0.30% TPU(2 sigma)



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	5022.837	5001.918	5043.756	12.29	6,968.59	7,516.26

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:01:11AM 5/23/2014

Sample

Sample Name: Pulser;AV17
Comment:

Spectrum #5 Analysis #1

Batch

Batch Name: May2014aa
Description:

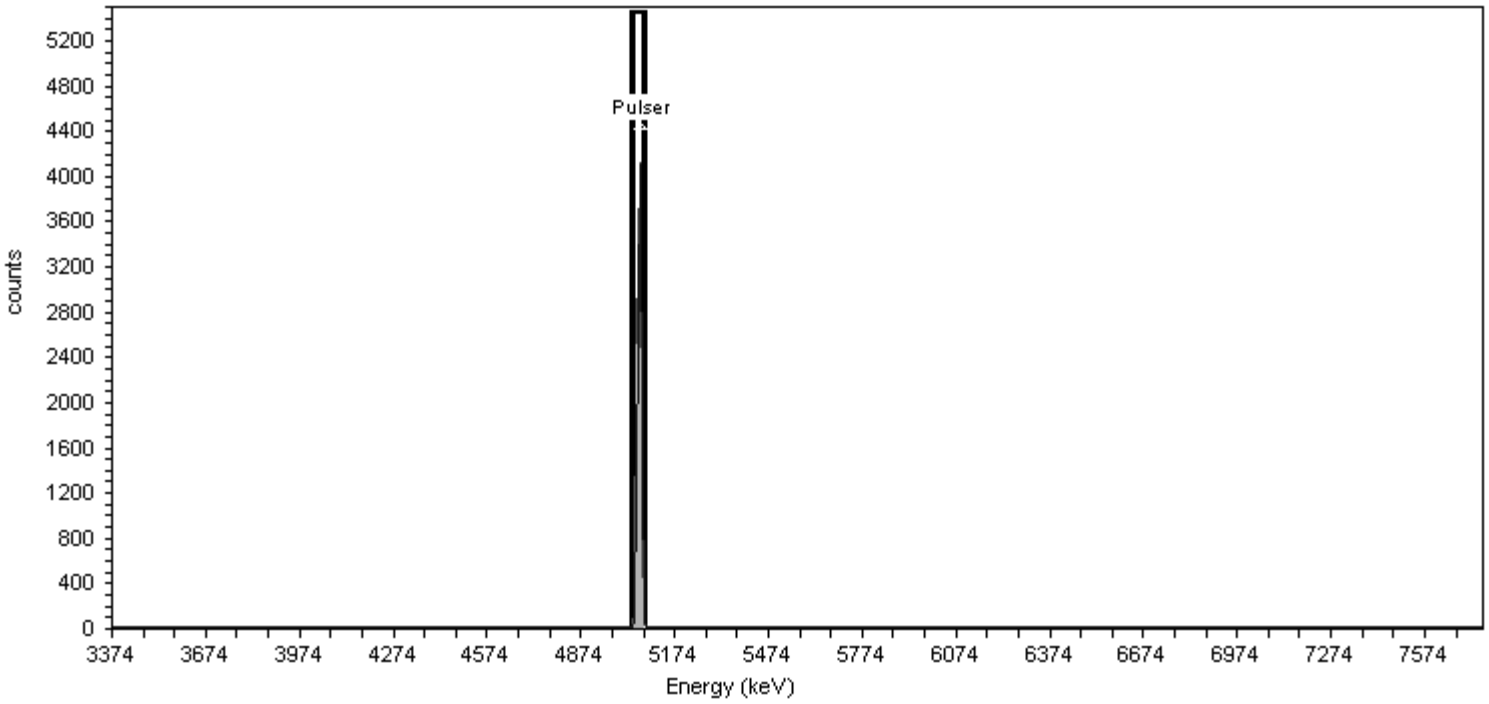
Analyst: 60040

Acquisition

Detector: AV17 , SN: 50-051C4
Acquisition Start Date: 5/23/2014 8:54:59AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-8874;AV17-20140505
Calibration Date: 5/5/2014 10:08:49PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.07% +/- 0.37% TPU(2 sigma)



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	5060.086	5039.915	5080.258	11.85	6,990.91	7,560.99

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:01:17AM 5/23/2014

Sample

Sample Name: Pulser;AV18 Spectrum #4 Analysis #1
Comment:

Batch

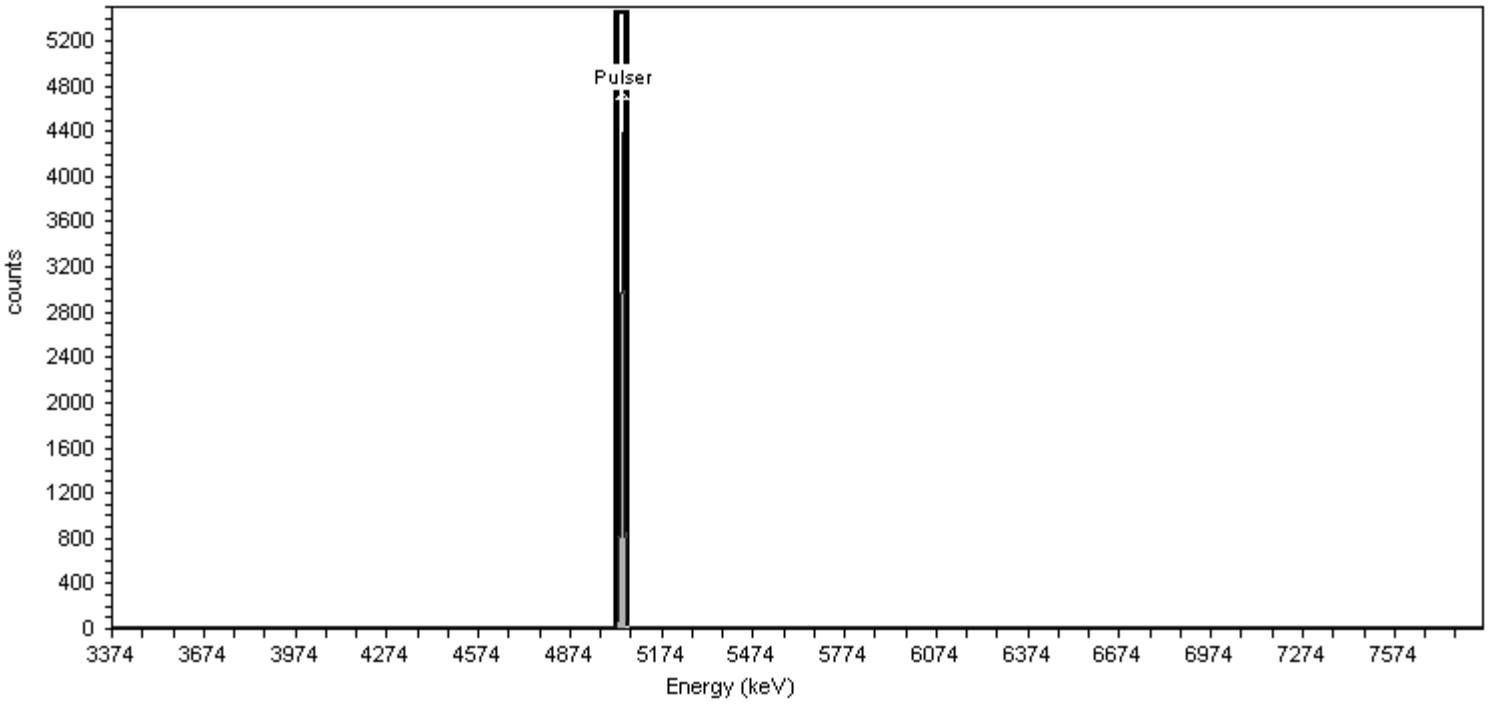
Batch Name: May2014aa Analyst: 60040
Description:

Acquisition

Detector: AV18 , SN: 51-082C5
Acquisition Start Date: 5/23/2014 8:55:01AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-8875;AV18-20140505
Calibration Date: 5/5/2014 10:09:08PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.46% +/- 0.36% TPU(2 sigma)



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	5044.920	5024.425	5065.415	12.04	7,562.55	7,591.18

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:01:23AM 5/23/2014

Sample

Sample Name: Pulser;AV19
Comment:

Spectrum #4 Analysis #1

Batch

Batch Name: May2014aa
Description:

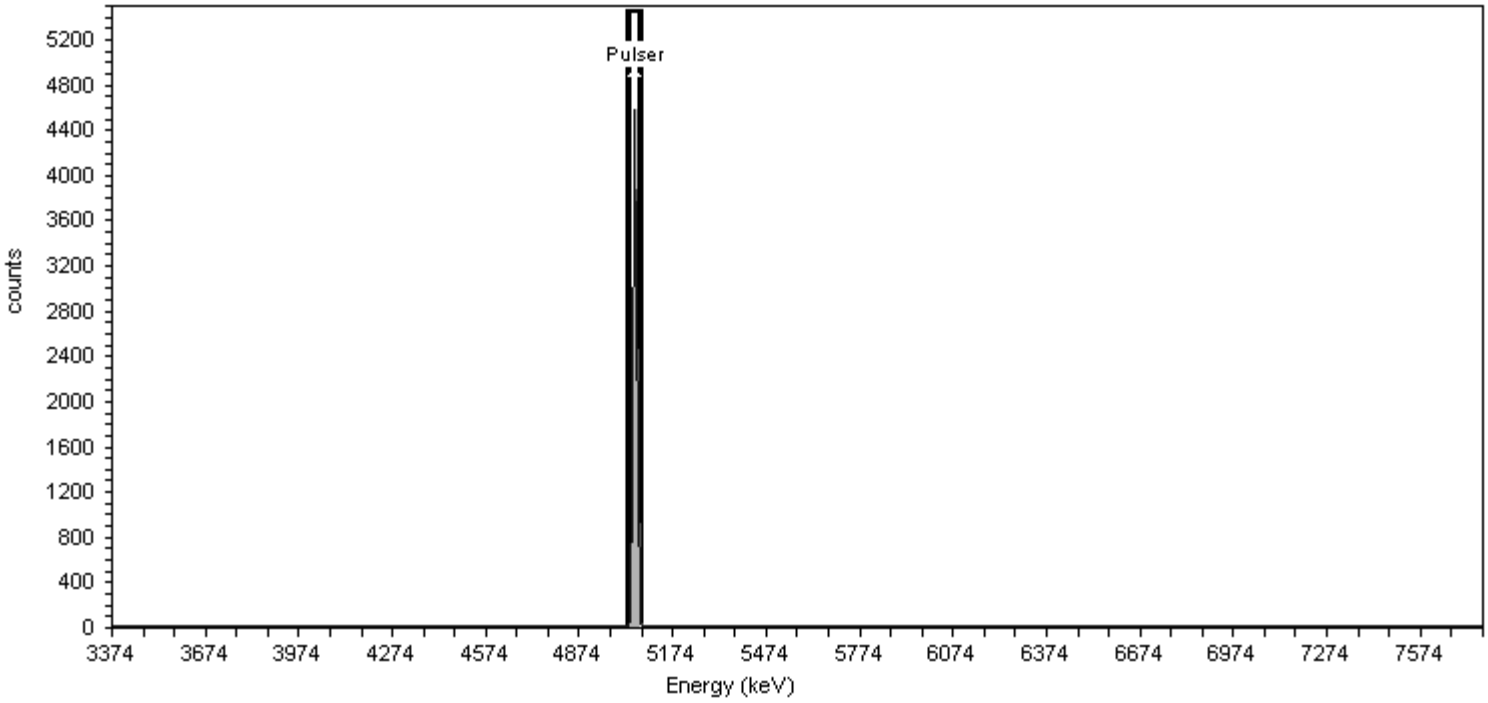
Analyst: 60040

Acquisition

Detector: AV19 , SN: 50-025FF5
Acquisition Start Date: 5/23/2014 8:55:02AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-8876;AV19-20140505
Calibration Date: 5/5/2014 10:09:02PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.34% +/- 0.30% TPU(2 sigma)



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	5052.295	5032.837	5071.753	11.43	7,498.73	7,628.25

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:01:29AM 5/23/2014

Sample

Sample Name: Pulser;AV20
Comment:

Spectrum #4 Analysis #1

Batch

Batch Name: May2014aa
Description:

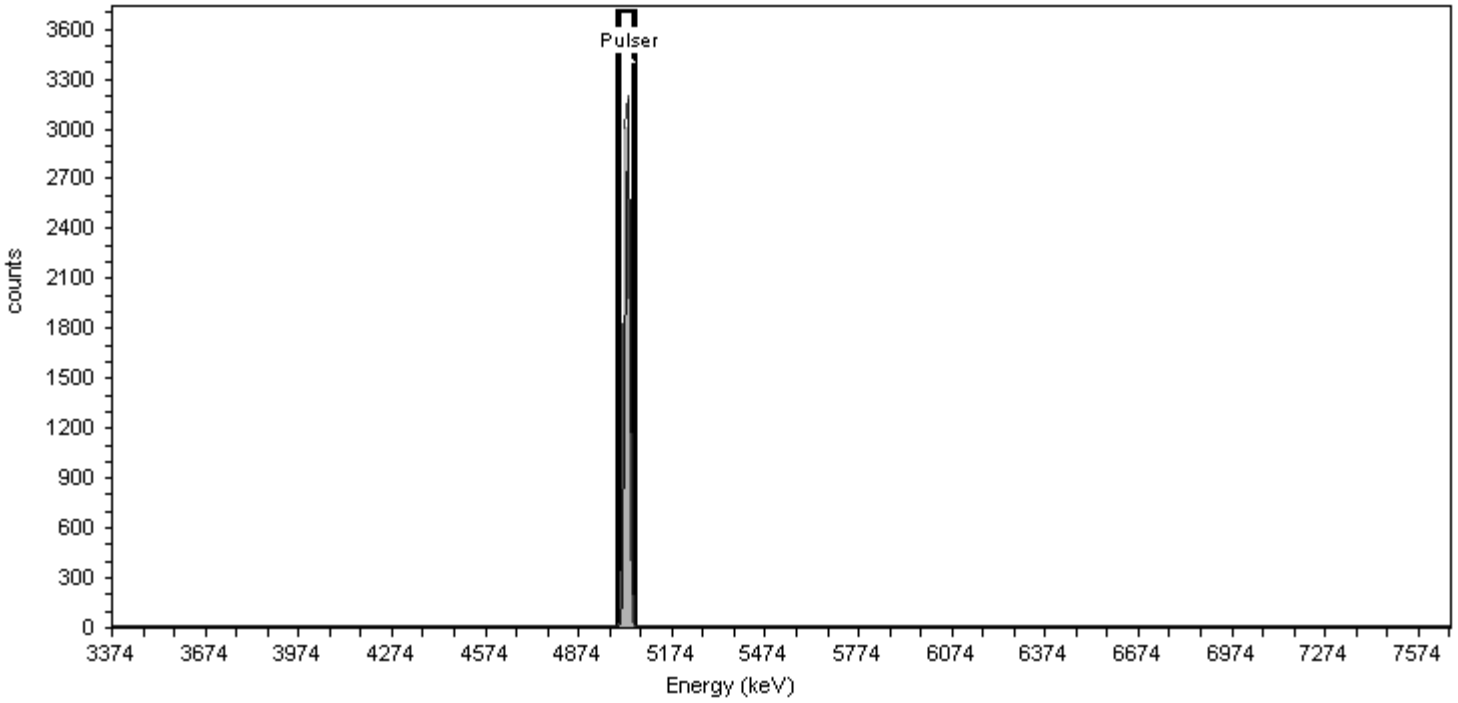
Analyst: 60040

Acquisition

Detector: AV20 , SN: 48-121A7
Acquisition Start Date: 5/23/2014 8:55:03AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-8877;AV20-20140505
Calibration Date: 5/5/2014 10:09:21PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.56% +/- 0.31% TPU(2 sigma)



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	5030.916	5004.242	5057.588	15.67	7,191.35	7,669.25

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:23:23PM 5/21/2014

Sample

Sample Name: Pulser;AV43 Spectrum #2 Analysis #1
Comment:

Batch

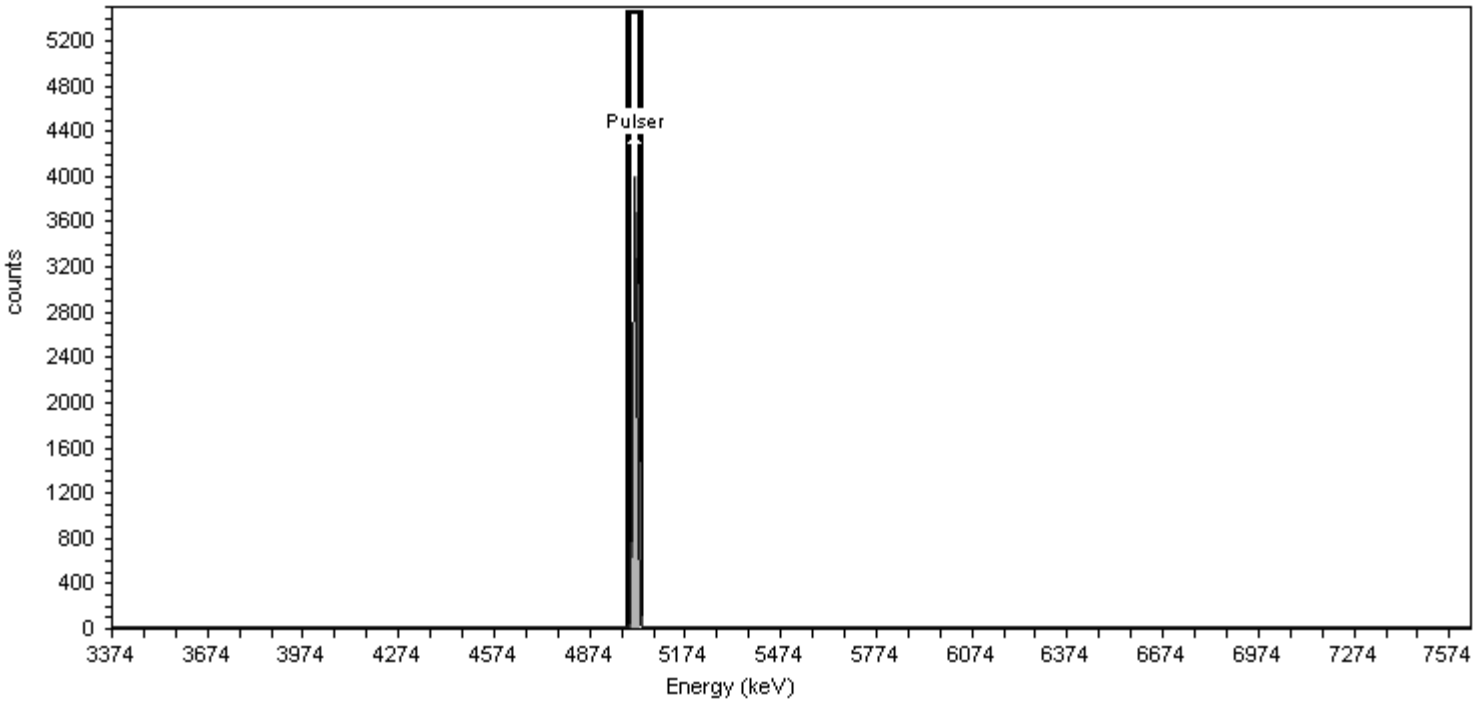
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV43 , SN: 49-190X4
Acquisition Start Date: 5/21/2014 4:01:53PM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9794;AV43-20140505
Calibration Date: 5/5/2014 10:09:47PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.74% +/- 0.32% TPU(2 sigma)



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	5014.707	4994.831	5034.582	11.68	6,686.23	7,449.97

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:23:18PM 5/21/2014

Sample

Sample Name: Pulser;AV44 Spectrum #2 Analysis #1
Comment:

Batch

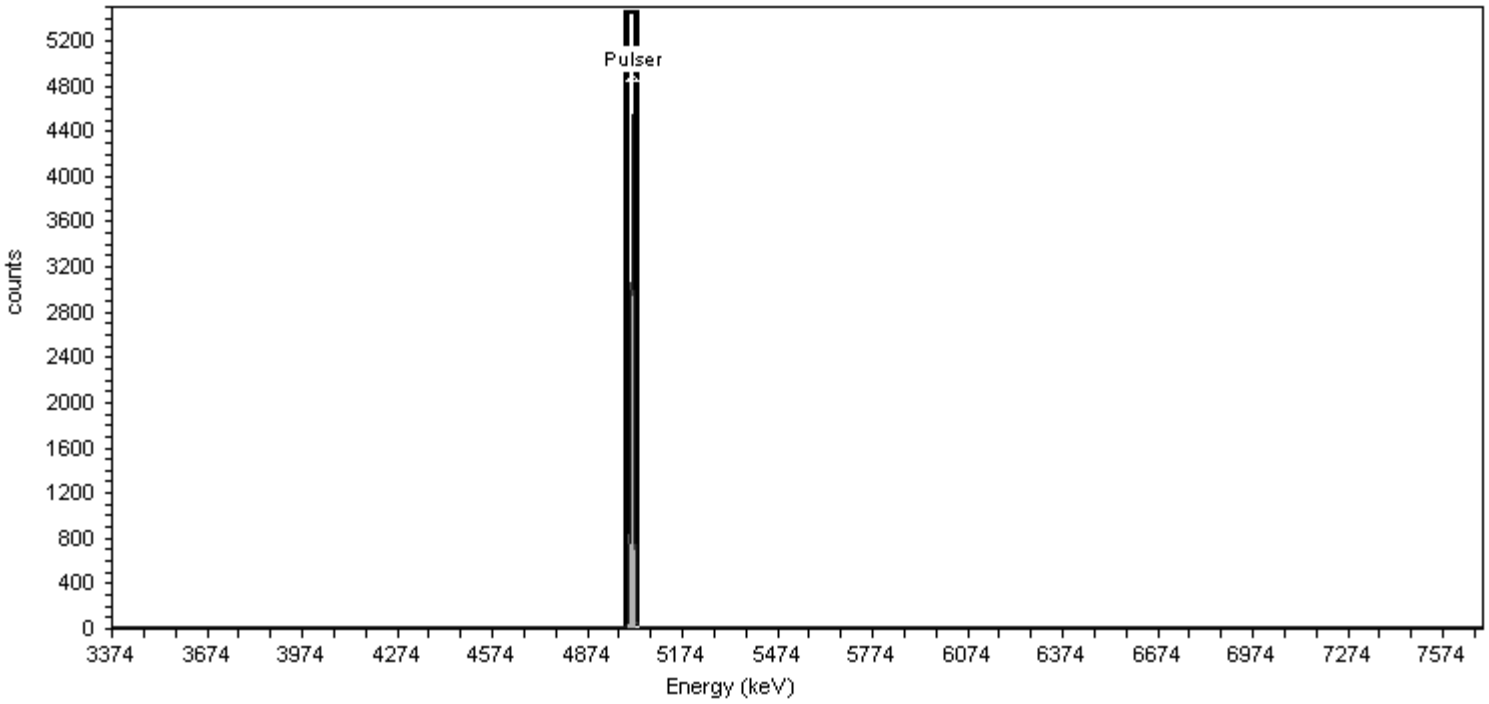
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV44 , SN: 50-051JJ1
Acquisition Start Date: 5/21/2014 4:01:57PM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9795;AV44-20140505
Calibration Date: 5/5/2014 10:09:57PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.32% +/- 0.35% TPU(2 sigma)



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	5015.092	4995.432	5034.751	11.55	7,512.21	7,511.90

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:04:11AM 5/23/2014

Sample

Sample Name: Pulser;AV45 Spectrum #4 Analysis #1
Comment:

Batch

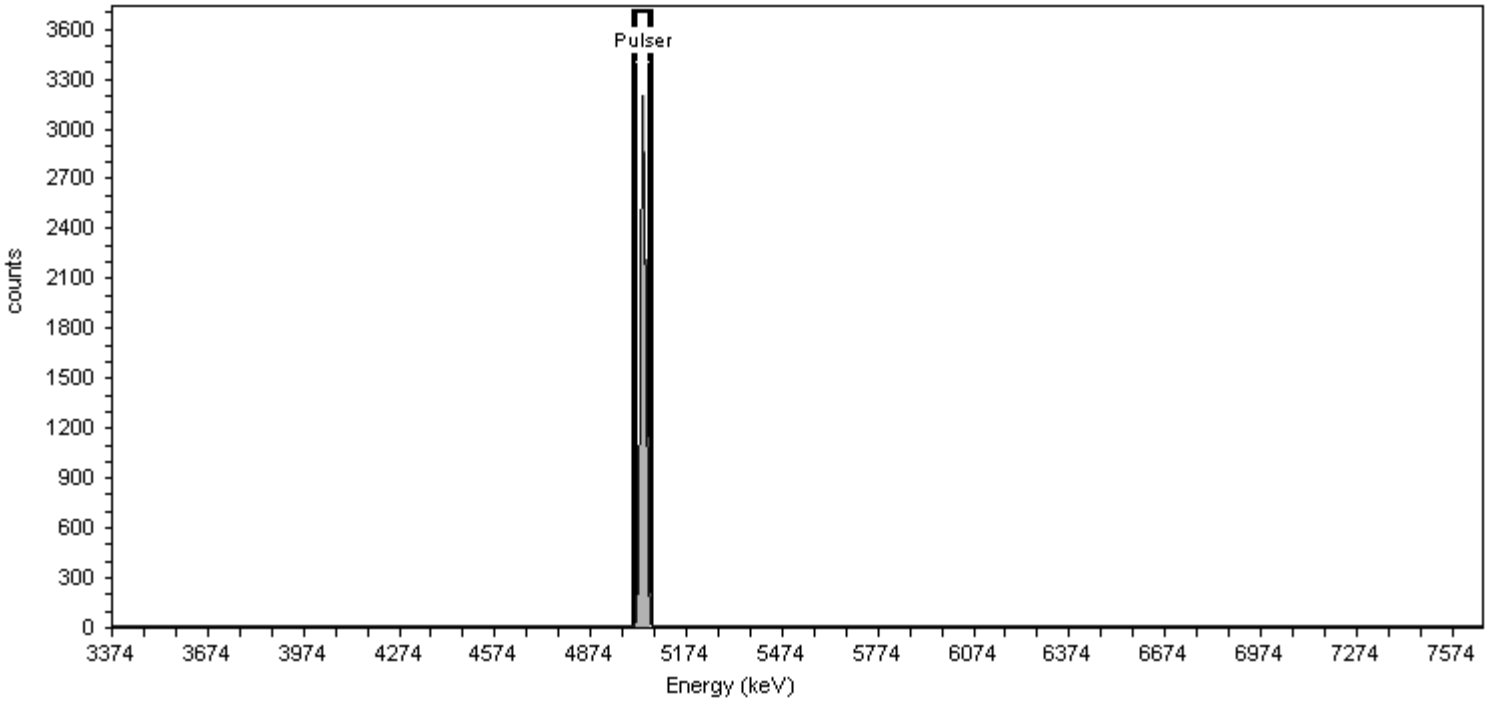
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV45 , SN: 48-158FF2
Acquisition Start Date: 5/23/2014 8:55:16AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9817;AV45-20140505
Calibration Date: 5/5/2014 10:10:03PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.06% +/- 0.31% TPU(2 sigma)



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	5037.444	5009.255	5065.633	16.56	7,607.17	7,583.34

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:04:17AM 5/23/2014

Sample

Sample Name: Pulser;AV46 Spectrum #4 Analysis #1
Comment:

Batch

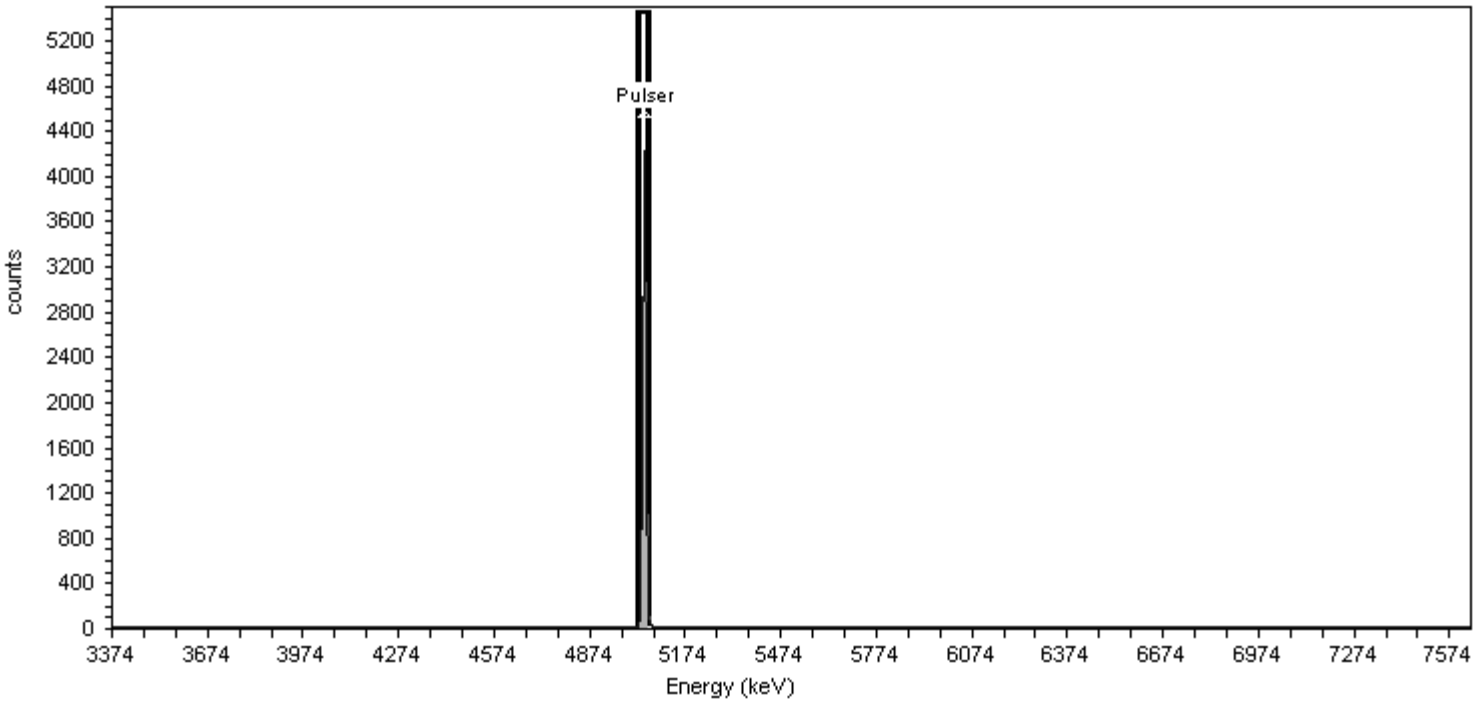
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV46 , SN: 49-202GG2
Acquisition Start Date: 5/23/2014 8:55:19AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9884;AV46-20140505
Calibration Date: 5/5/2014 10:10:09PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.80% +/- 0.38% TPU(2 sigma)



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	5044.789	5023.429	5066.149	12.55	7,605.52	7,463.19

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:23:35PM 5/21/2014

Sample

Sample Name: Pulser;AV48 Spectrum #2 Analysis #1
Comment:

Batch

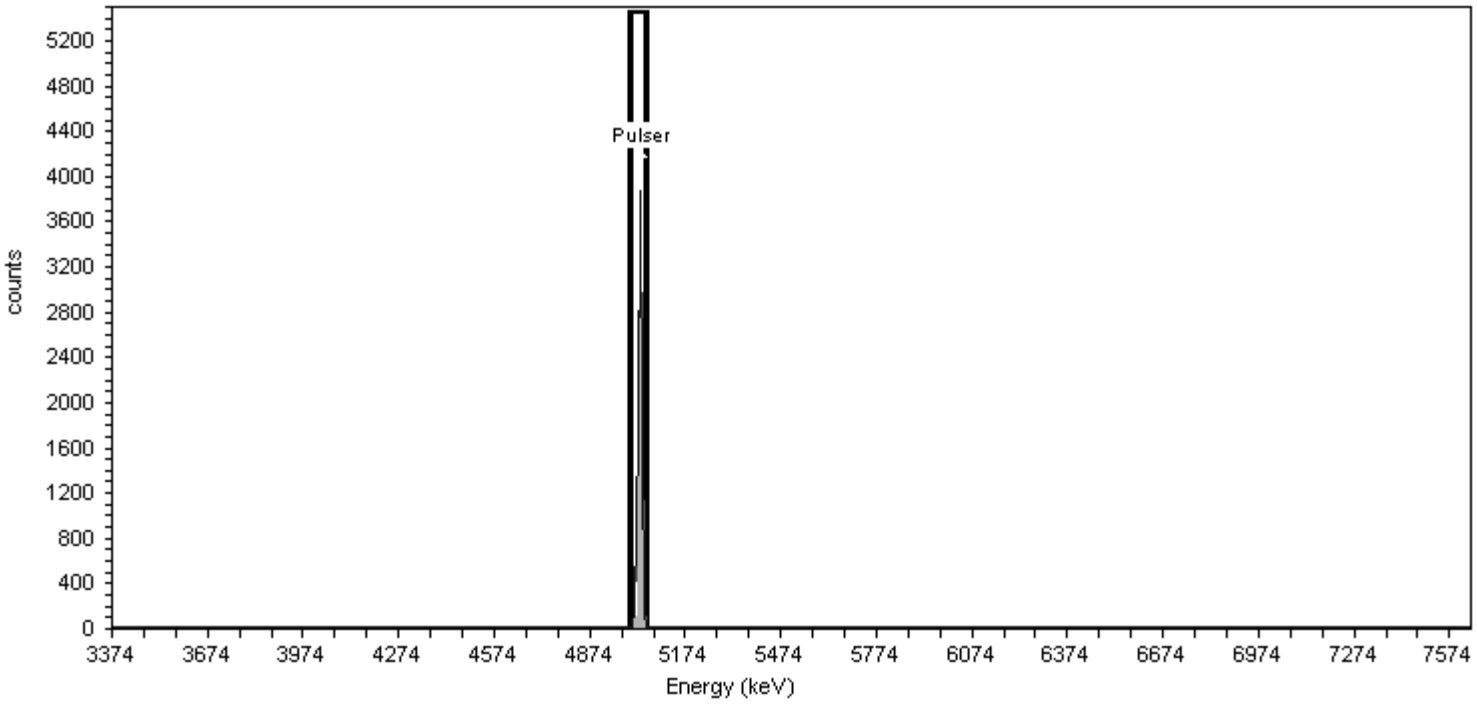
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV48 , SN: 50-051JJ4
Acquisition Start Date: 5/21/2014 4:02:04PM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9886;AV48-20140505
Calibration Date: 5/5/2014 10:10:22PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.78% +/- 0.35% TPU(2 sigma)



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	5029.806	5006.752	5052.859	13.54	7,522.86	7,617.80

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:04:27AM 5/23/2014

Sample

Sample Name: Pulser;AV48 Spectrum #4 Analysis #1
Comment:

Batch

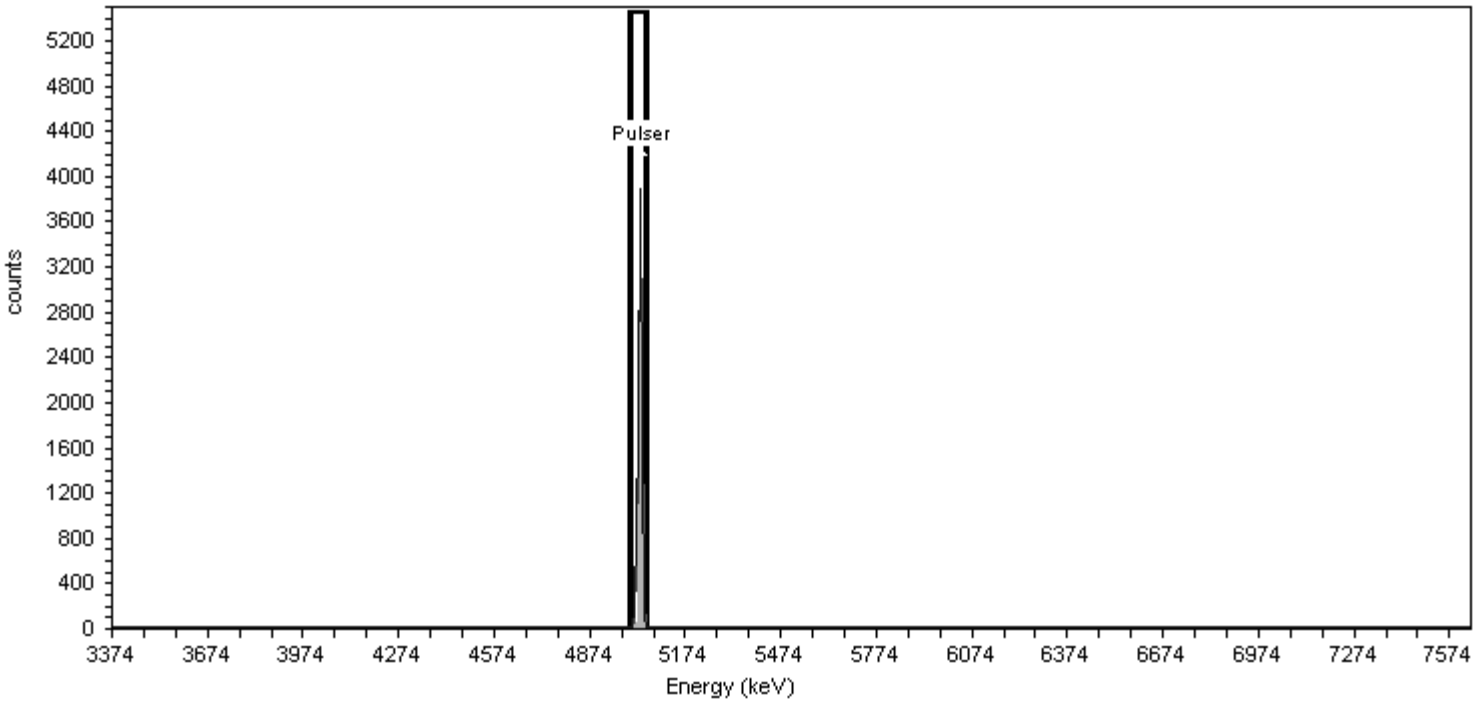
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV48 , SN: 50-051JJ4
Acquisition Start Date: 5/23/2014 8:55:29AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9886;AV48-20140505
Calibration Date: 5/5/2014 10:10:22PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.78% +/- 0.35% TPU(2 sigma)



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	5029.751	5007.117	5052.386	13.30	7,420.46	7,613.99

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:19:41PM 5/21/2014

Sample

Sample Name: Pulser;AV55 Spectrum #2 Analysis #1
Comment:

Batch

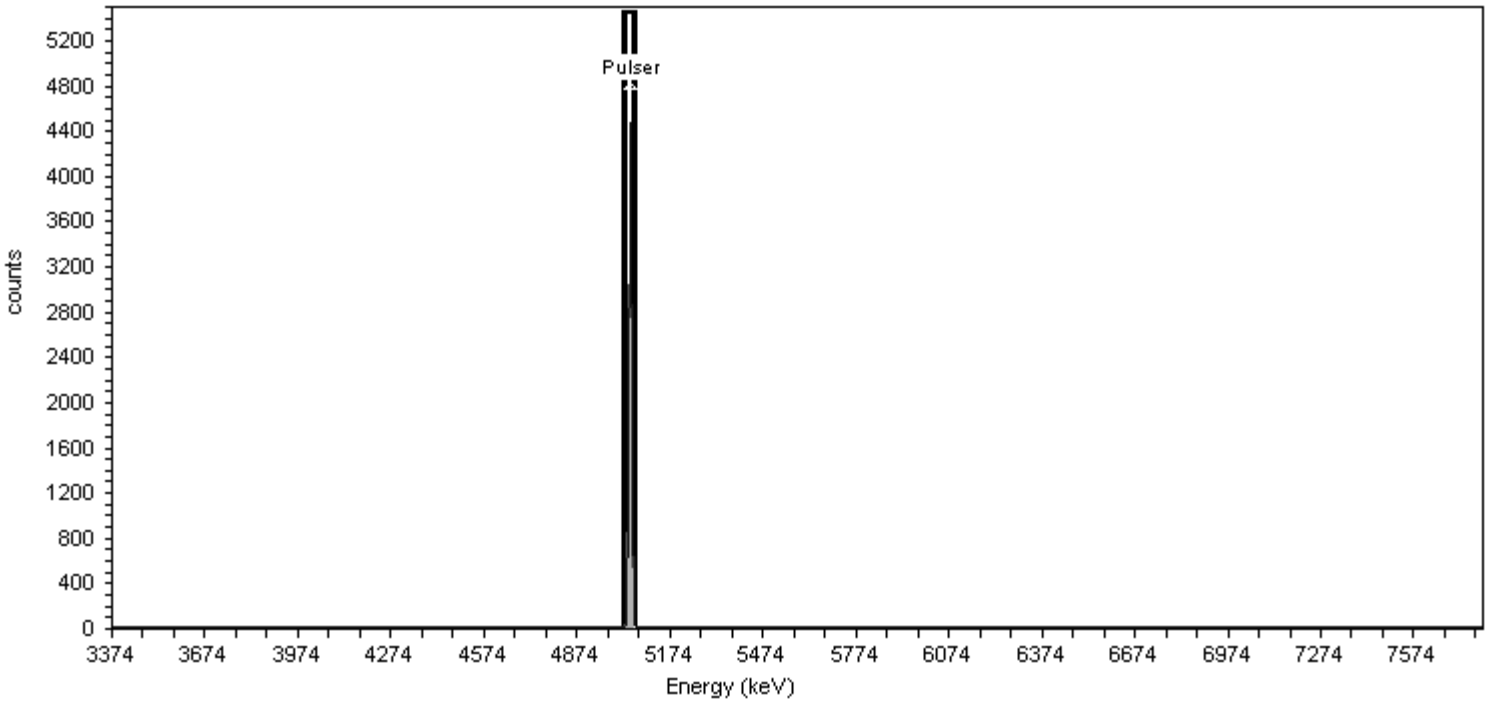
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV55 , SN: 50-051C2
Acquisition Start Date: 5/21/2014 4:01:12PM
Live Time: 1.00 min.
Real Time: 1.01 min.
Calibration Name: IC-7107;AV55-20140507
Calibration Date: 5/7/2014 10:48:56PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.79% +/- 0.30% TPU(2 sigma)



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	5044.977	5026.458	5063.495	10.88	6,974.82	7,164.28

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:03:08AM 5/23/2014

Sample

Sample Name: Pulser;AV57 Spectrum #4 Analysis #1
Comment:

Batch

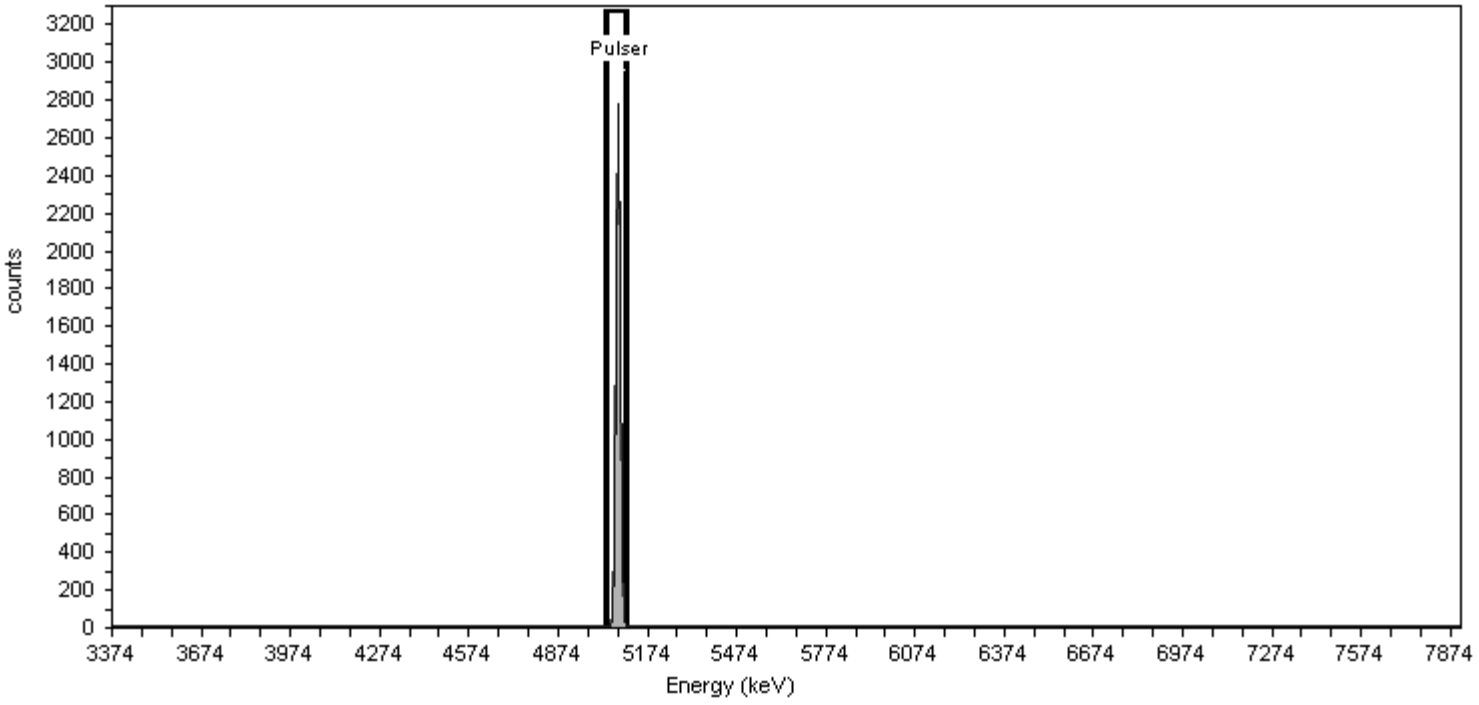
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV57 , SN: 48-158EE3
Acquisition Start Date: 5/23/2014 8:55:31AM
Live Time: 1.00 min.
Real Time: 1.01 min.
Calibration Name: IC-9793;AV57-20140504
Calibration Date: 5/5/2014 6:53:40PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.74% +/- 0.33% TPU(2 sigma)



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	5074.972	5044.802	5105.142	17.72	7,067.02	7,226.90

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:03:14AM 5/23/2014

Sample

Sample Name: Pulser;AV58 Spectrum #4 Analysis #1
Comment:

Batch

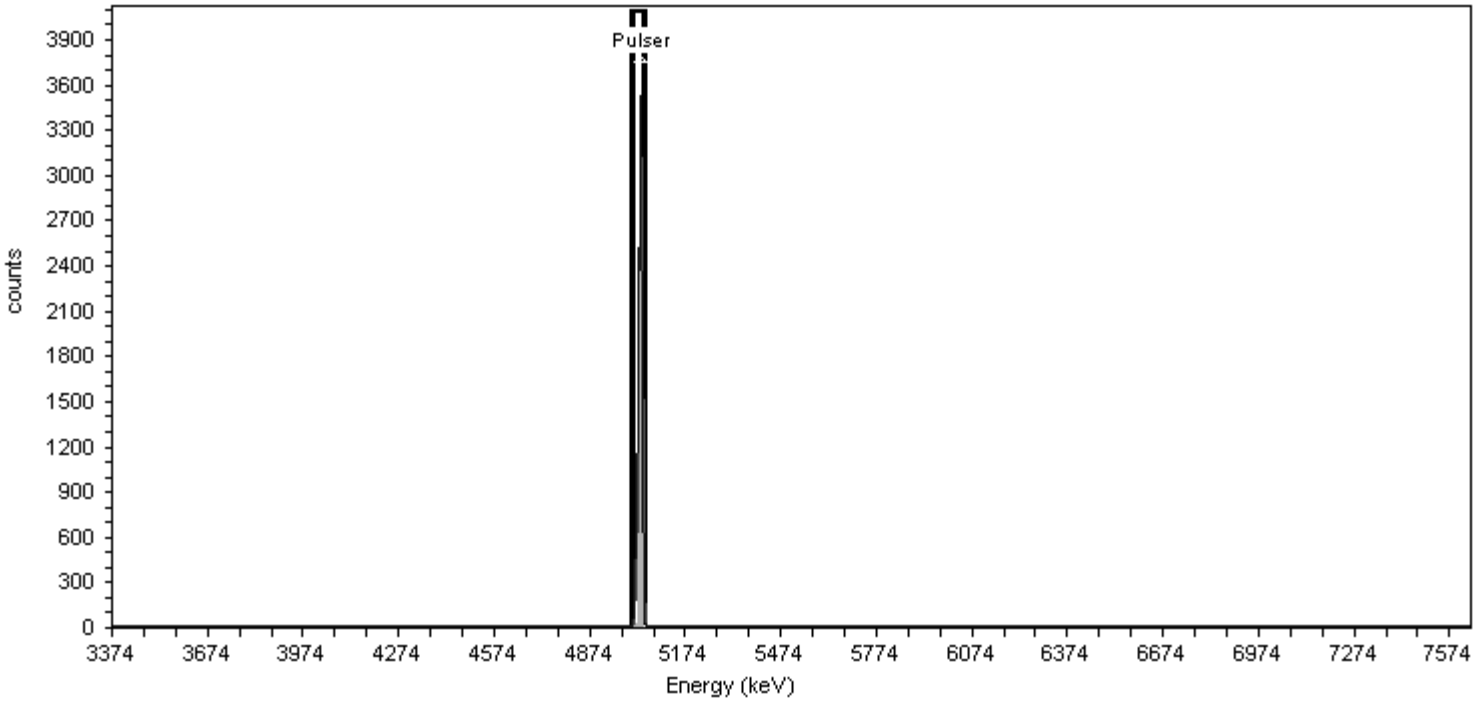
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV58 , SN: 52-102 C5
Acquisition Start Date: 5/23/2014 8:55:31AM
Live Time: 1.00 min.
Real Time: 1.01 min.
Calibration Name: IC-9794;AV58-20140504
Calibration Date: 5/5/2014 6:53:46PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.56% +/- 0.33% TPU(2 sigma)



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	5029.551	5008.093	5051.010	12.61	6,389.33	6,966.47

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:03:26AM 5/23/2014

Sample

Sample Name: Pulser;AV59 Spectrum #5 Analysis #1
Comment:

Batch

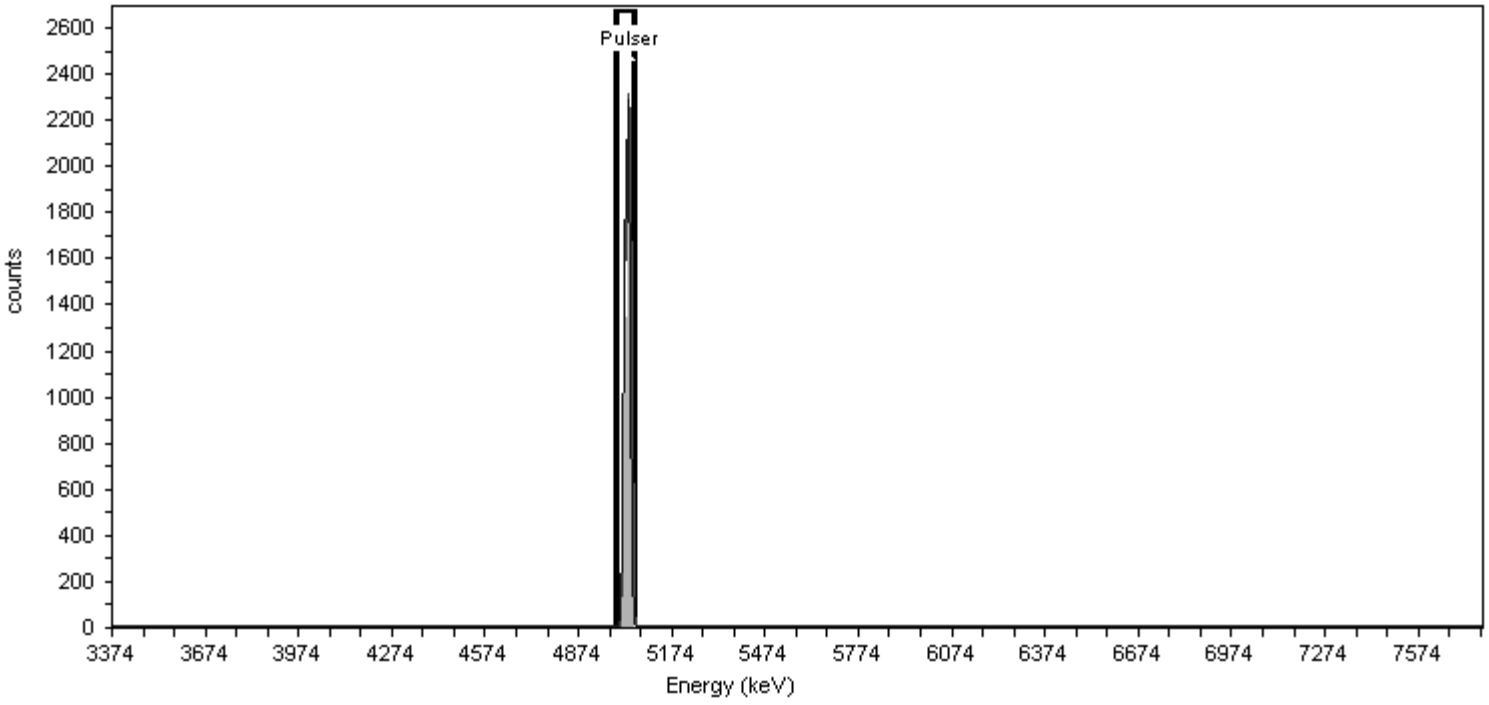
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV59 , SN: 49-155M7
Acquisition Start Date: 5/23/2014 8:55:31AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9795;AV59-20140504
Calibration Date: 5/5/2014 6:53:53PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.44% +/- 0.36% TPU(2 sigma)



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	5028.965	4998.997	5058.933	17.61	5,838.80	7,180.42

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:03:37AM 5/23/2014

Sample

Sample Name: Pulser;AV60
Comment:

Spectrum #4 Analysis #1

Batch

Batch Name: May2014bb
Description:

Analyst: 60040

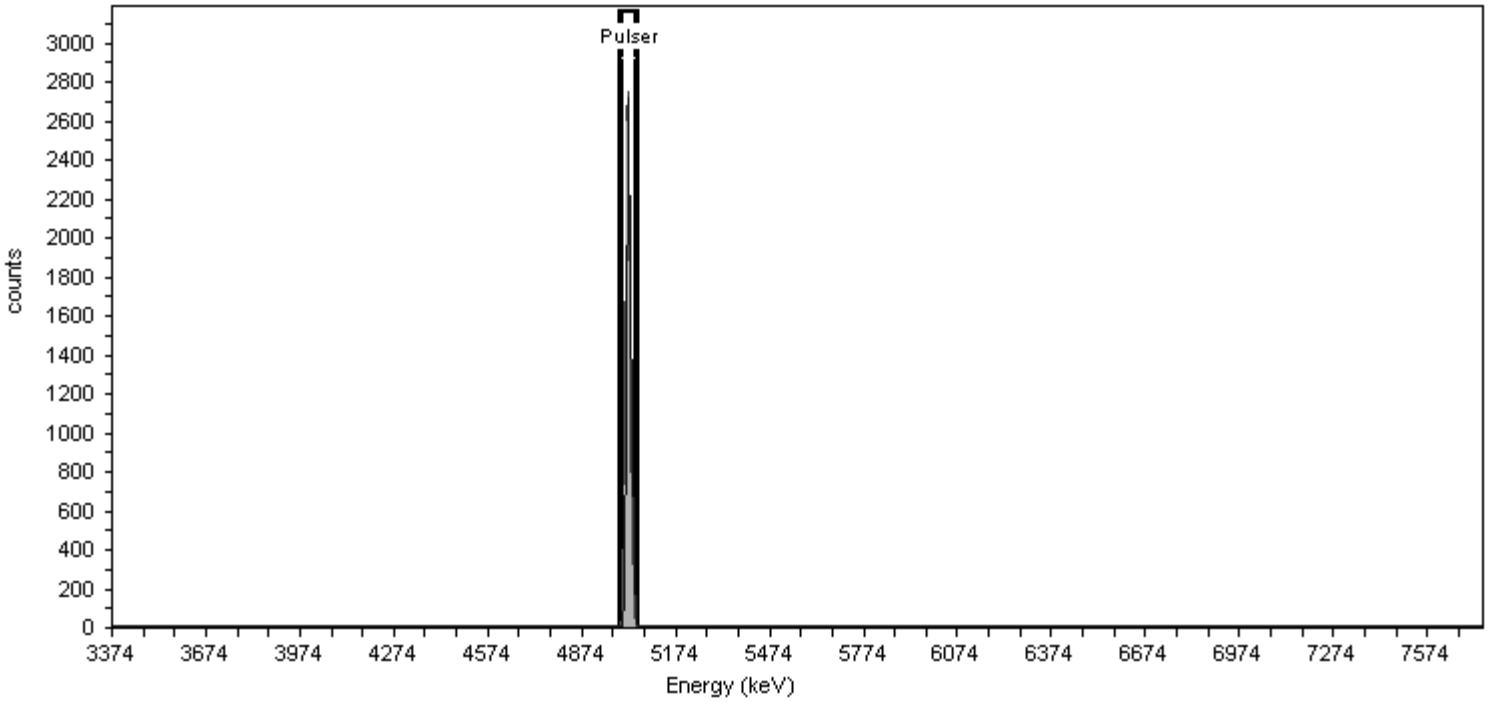
Acquisition

Detector: AV60 , SN: 49-027117
Acquisition Start Date: 5/23/2014 8:55:32AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9817;AV60-20140504
Calibration Date: 5/5/2014 6:53:59PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.33% +/- 0.32% TPU(2 sigma)



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	5023.627	4997.167	5050.088	15.55	6,133.69	7,233.86

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:02:17AM 5/23/2014

Sample

Sample Name: Pulser;AV61 Spectrum #4 Analysis #1
Comment:

Batch

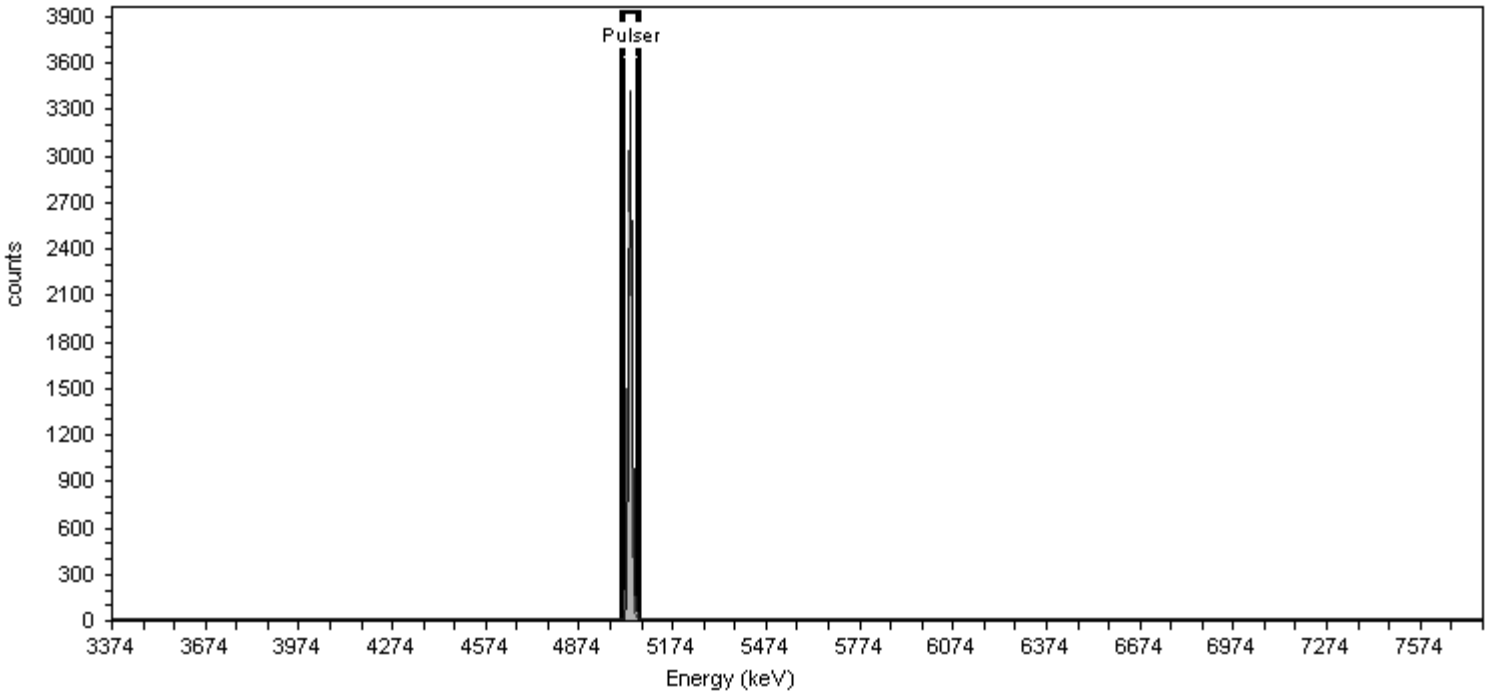
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV61 , SN: 5-051JJ3
Acquisition Start Date: 5/23/2014 8:55:34AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9884;AV61-20140504
Calibration Date: 5/5/2014 6:54:06PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.46% +/- 0.38% TPU(2 sigma)



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	5038.027	5014.130	5061.923	14.04	6,890.50	7,251.49

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:02:23AM 5/23/2014

Sample

Sample Name: Pulser;AV62 Spectrum #4 Analysis #1
Comment:

Batch

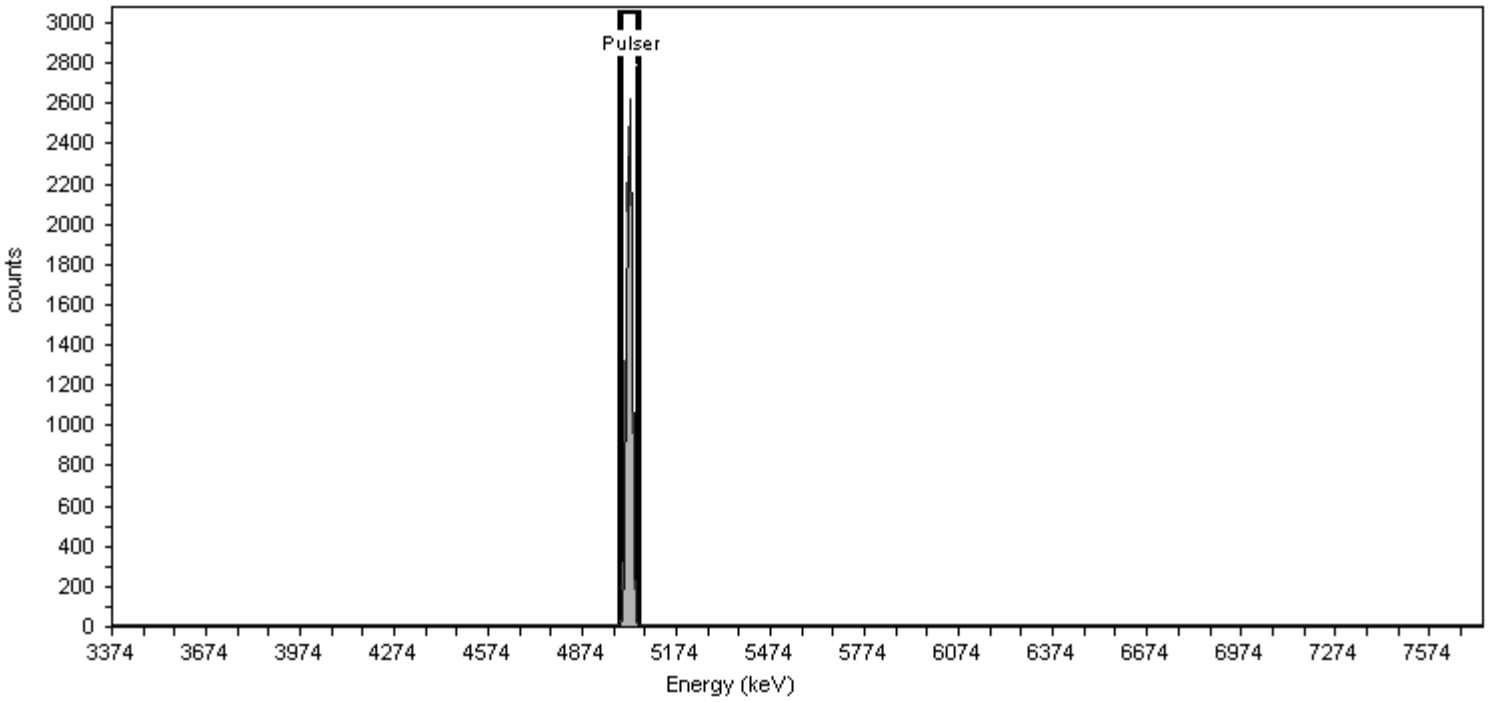
Batch Name: May2014bb Analyst: 60040
Description:

Acquisition

Detector: AV62 , SN: 52-060FF2
Acquisition Start Date: 5/23/2014 8:55:35AM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9885;AV62-20140504
Calibration Date: 5/5/2014 6:54:13PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.34% +/- 0.38% TPU(2 sigma)



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	5023.042	4992.885	5053.200	17.72	6,653.58	7,212.95

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:21:54PM 5/21/2014

Sample

Sample Name: Pulser;AV78 Spectrum #2 Analysis #1
Comment:

Batch

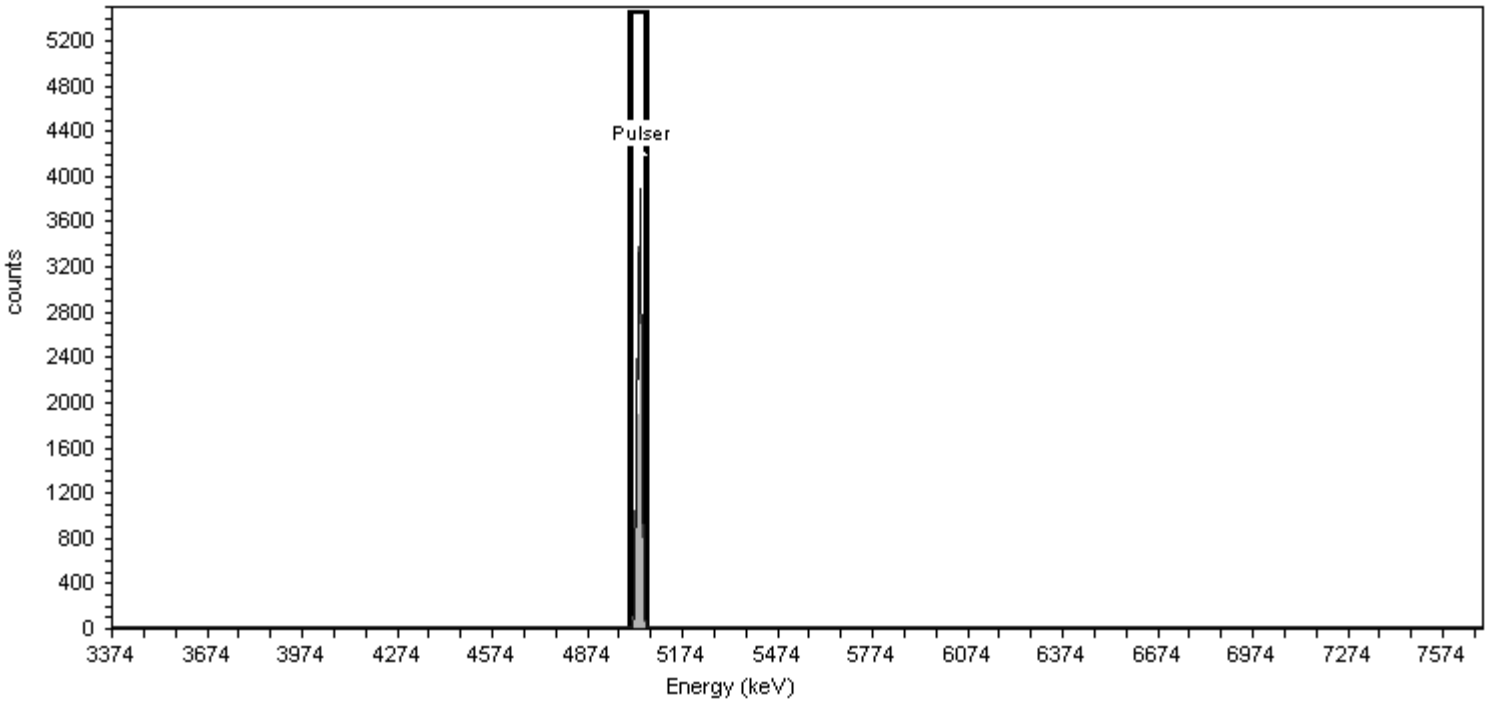
Batch Name: May2014cc Analyst: 60040
Description:

Acquisition

Detector: AV78 , SN: 46-033FF4
Acquisition Start Date: 5/21/2014 4:01:53PM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9886;AV78-20140504
Calibration Date: 5/4/2014 8:45:34PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.71% +/- 0.34% TPU(2 sigma)



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	5037.510	5014.599	5060.422	13.46	7,501.49	7,550.73

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:22:00PM 5/21/2014

Sample

Sample Name: Pulser;AV79 Spectrum #2 Analysis #1
Comment:

Batch

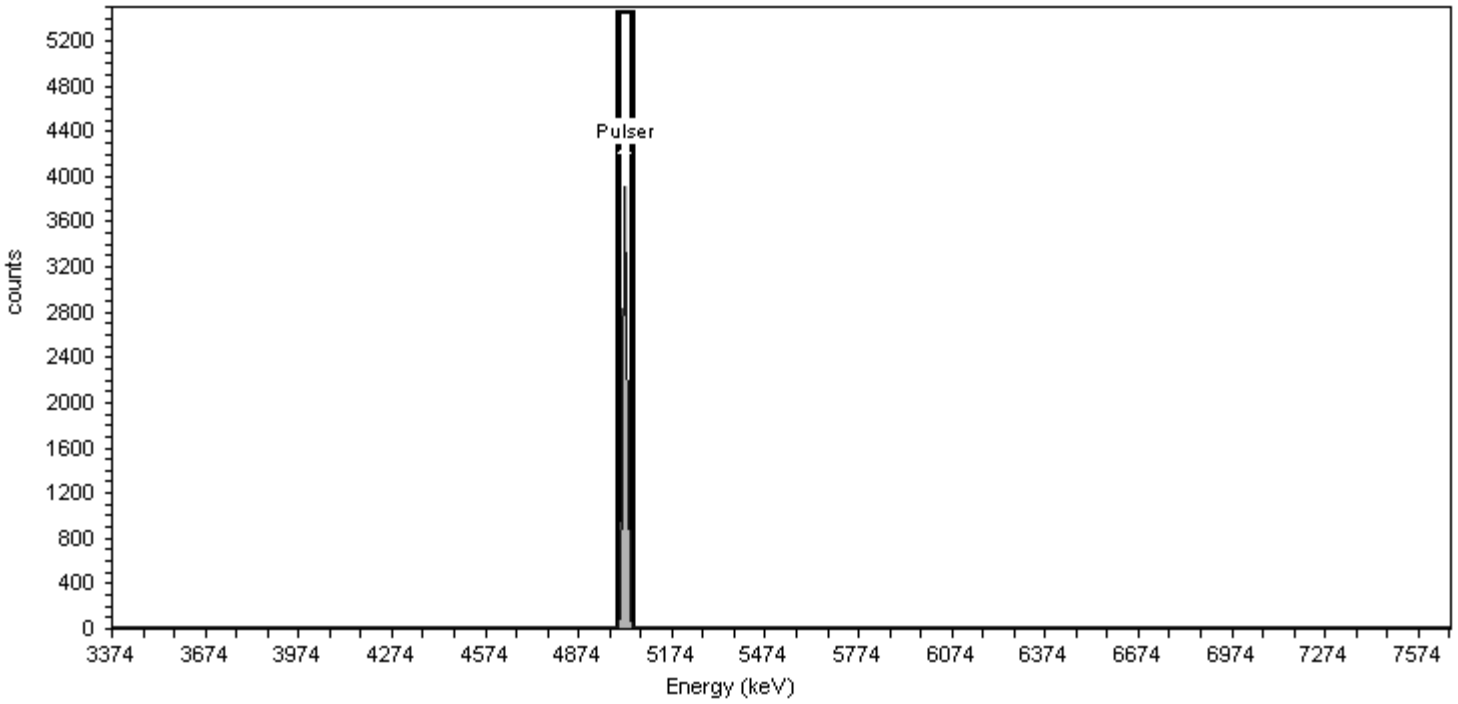
Batch Name: May2014cc Analyst: 60040
Description:

Acquisition

Detector: AV79 , SN: 46-033Q5
Acquisition Start Date: 5/21/2014 4:01:55PM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-7107;AV79-20140501
Calibration Date: 5/4/2014 5:31:27PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.05% +/- 0.30% TPU(2 sigma)



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	5022.567	5000.189	5044.945	13.15	7,366.22	7,432.50

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:22:16PM 5/21/2014

Sample

Sample Name: Pulser;AV82 Spectrum #2 Analysis #1
Comment:

Batch

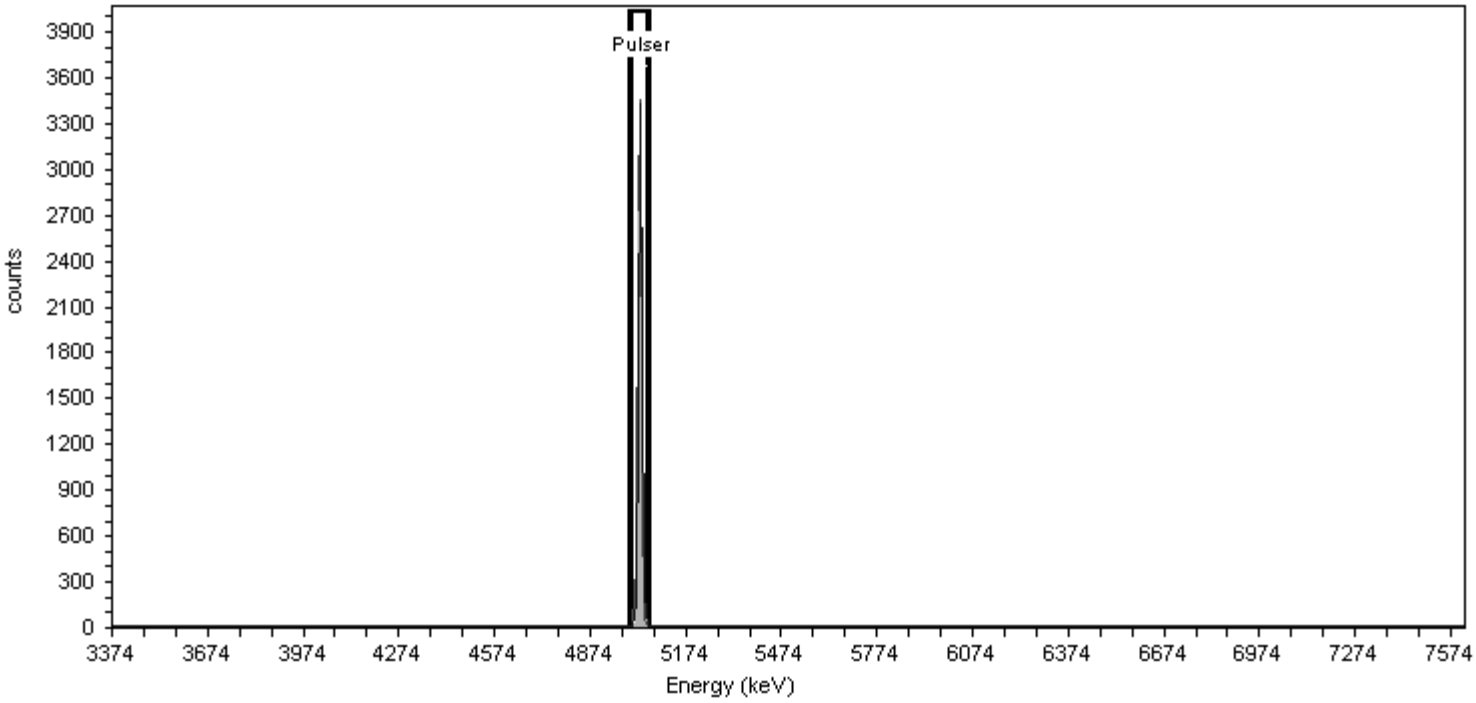
Batch Name: May2014cc Analyst: 60040
Description:

Acquisition

Detector: AV82 , SN: 46-032EE5
Acquisition Start Date: 5/21/2014 4:02:01PM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-8876;AV82-20140501
Calibration Date: 5/4/2014 5:31:49PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.76% +/- 0.30% TPU(2 sigma)



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	5030.539	5006.126	5054.952	14.34	7,092.75	7,539.01

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Alpha-Spectroscopy Pulser Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:22:27PM 5/21/2014

Sample

Sample Name: Pulser;AV84 Spectrum #2 Analysis #1
Comment:

Batch

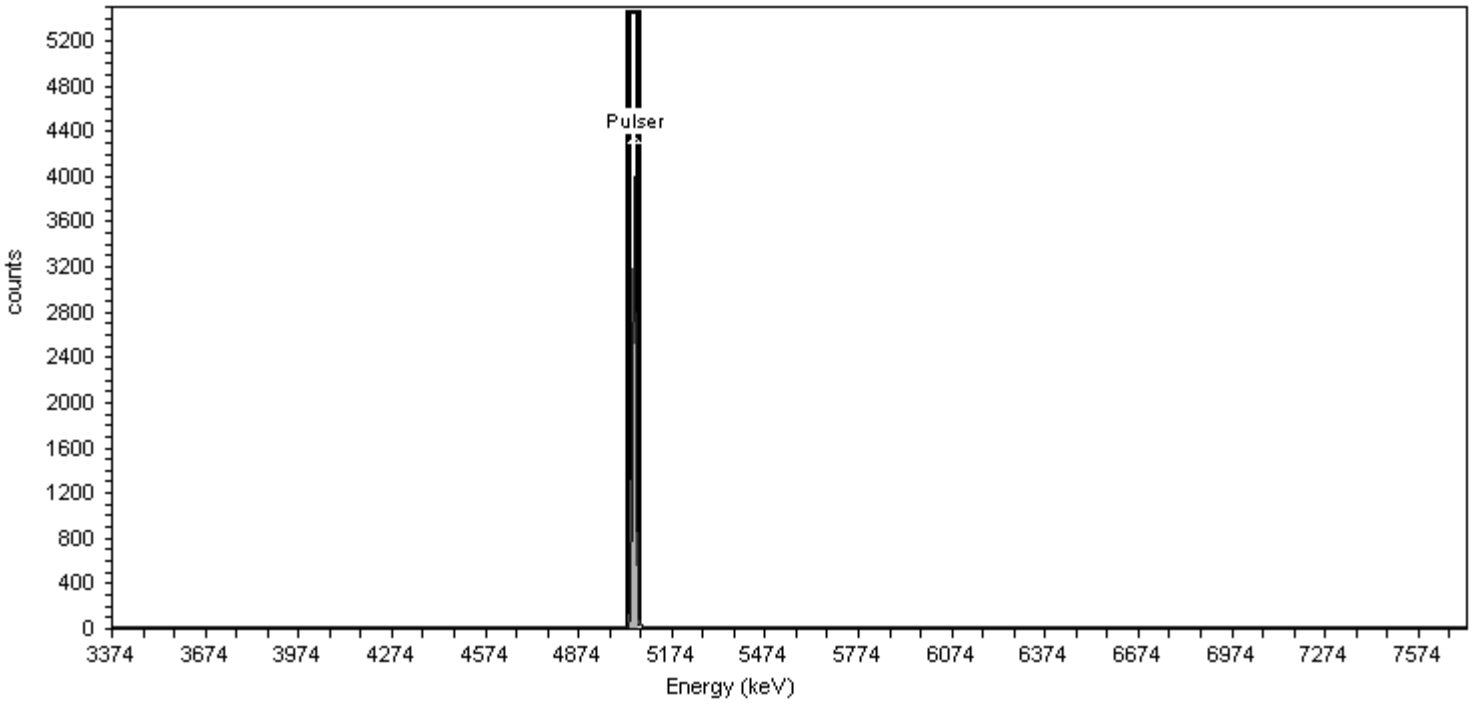
Batch Name: May2014cc Analyst: 60040
Description:

Acquisition

Detector: AV84 , SN: 46-033FF3
Acquisition Start Date: 5/21/2014 4:02:05PM
Live Time: 1.00 min.
Real Time: 1.02 min.
Calibration Name: IC-9520;AV84-20140501
Calibration Date: 5/4/2014 5:32:01PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.40% +/- 0.36% TPU(2 sigma)



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	5052.565	5031.179	5073.952	12.56	7,190.86	7,487.59

Initial Calibrations

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:38:19PM 5/6/2014

Calibration

Sample Name: IC-7107;AV1-20140505
Description:
Detector: AV1

Calibration Date: 5/6/2014 5:38:14PM
Analyst: 60040

Source Info

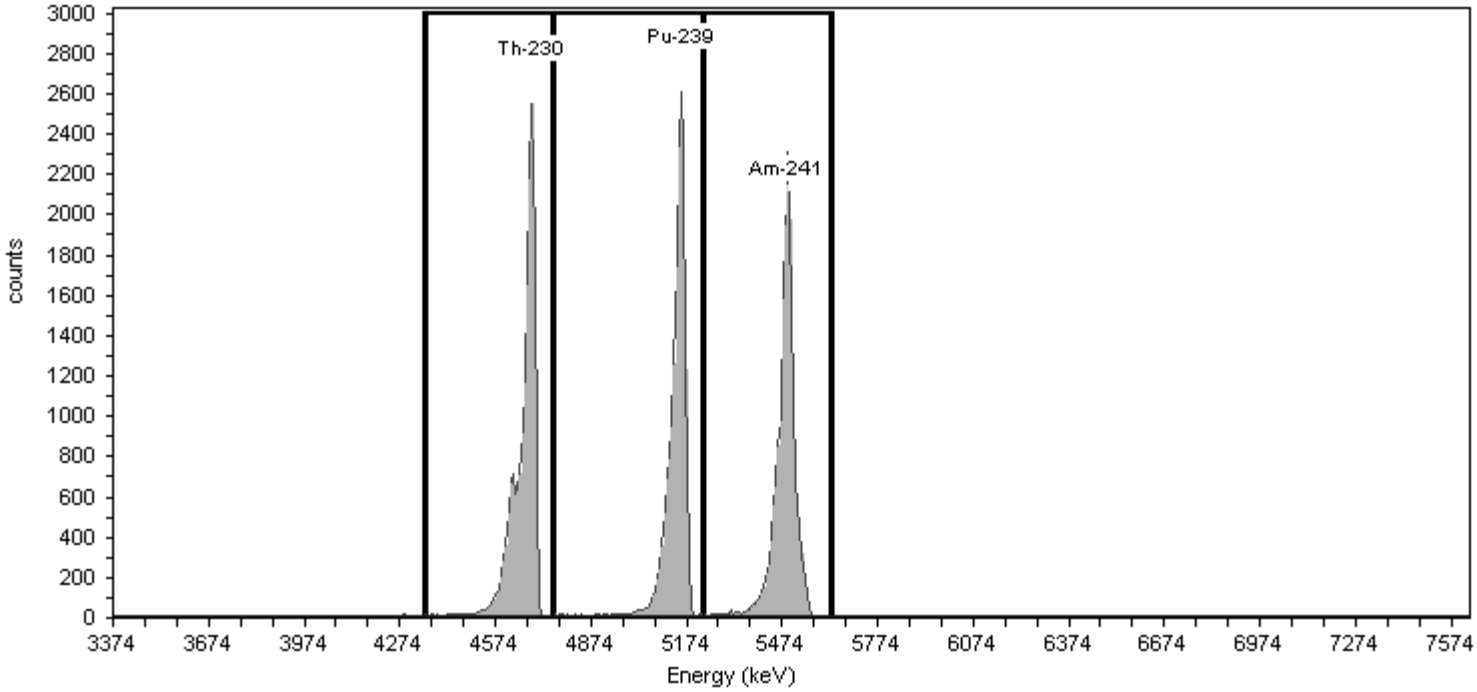
Certificate ID: 82232-334
Prepared by: Analytics

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

Acquisition

Detector: AV1 , SN: 49-188 AA4
Acquisition Start Date: 5/5/2014 10:25:57PM
Live Time: 140.00 min.
Real Time: 140.10 min.
Efficiency: 26.30% +/- 0.30% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	16,453.00	117.52
Pu-239	240	5.16	186	249	16,264.00	116.17
Am-241	284	5.49	249	303	15,950.00	113.93

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:39:19PM 5/6/2014

Calibration

Sample Name: IC-9795;AV11-20140505
Description:
Detector: AV11

Calibration Date: 5/6/2014 5:39:16PM
Analyst: 60040

Source Info

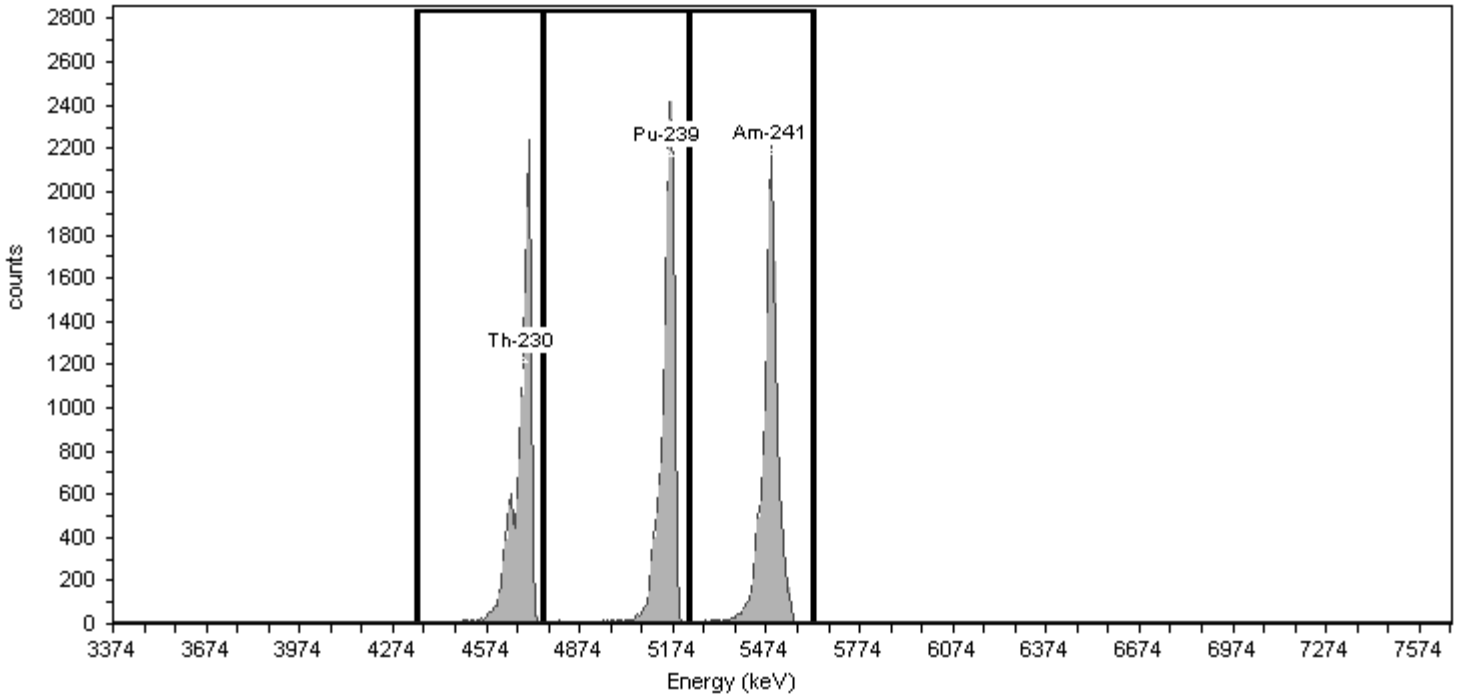
Certificate ID: 82243-334
Prepared by: Analytics

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

Acquisition

Detector: AV11 , SN: 49-155dd2
Acquisition Start Date: 5/5/2014 10:27:49PM
Live Time: 140.00 min.
Real Time: 140.10 min.
Efficiency: 26.88% +/- 0.35% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	13,230.00	94.50
Pu-239	240	5.16	186	249	13,518.00	96.56
Am-241	284	5.49	249	303	14,326.00	102.33

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:39:45PM 5/6/2014

Calibration

Sample Name: IC-9886;AV15-20140505
Description:
Detector: AV15

Calibration Date: 5/6/2014 5:39:42PM
Analyst: 60040

Source Info

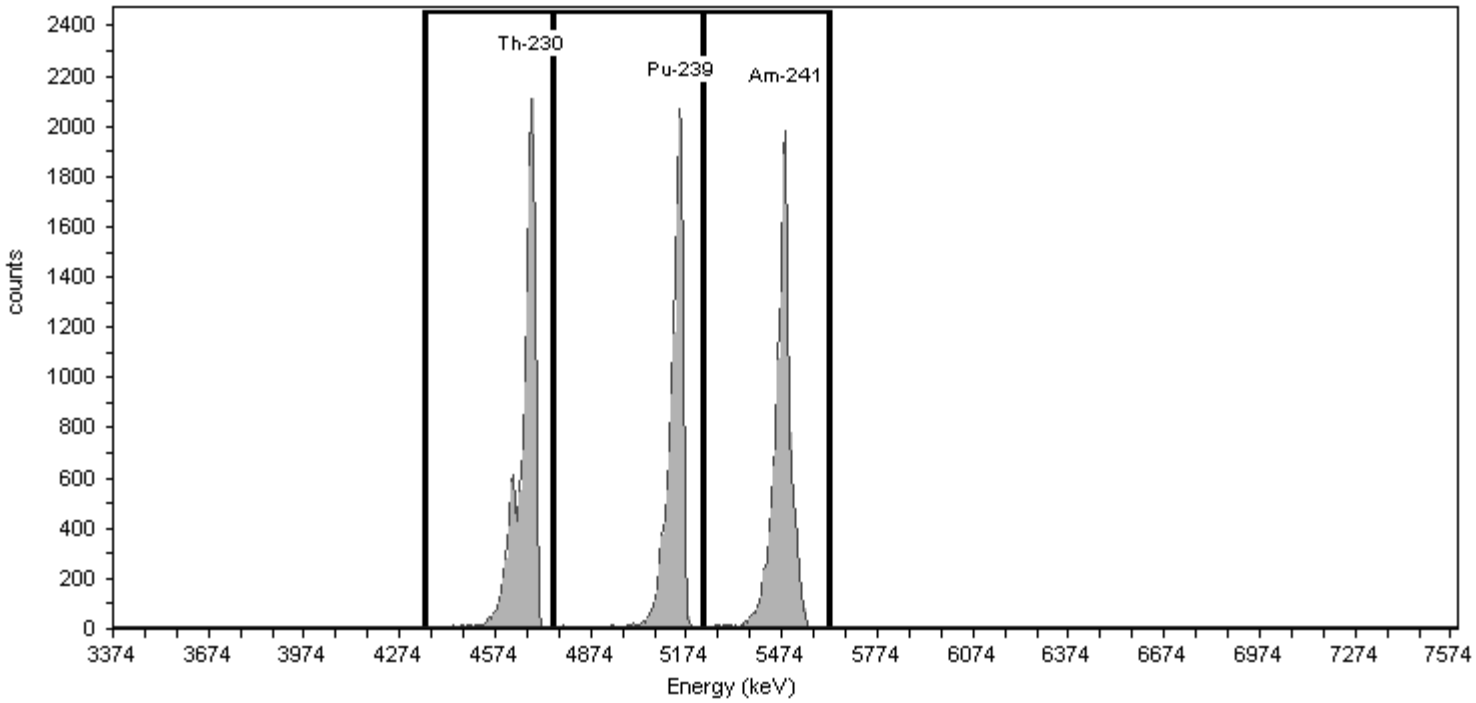
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV15 , SN: 41-172C5
Acquisition Start Date: 5/5/2014 10:28:49PM
Live Time: 140.00 min.
Real Time: 140.10 min.
Efficiency: 25.62% +/- 0.34% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	13,308.00	95.06
Pu-239	240	5.16	186	249	12,470.00	89.07
Am-241	284	5.49	249	303	13,519.00	96.56

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:08:45PM 5/5/2014

Calibration

Sample Name: IC-7107;AV16-20140505
Description:
Detector: AV16

Calibration Date: 5/5/2014 10:08:41PM
Analyst: 60040

Source Info

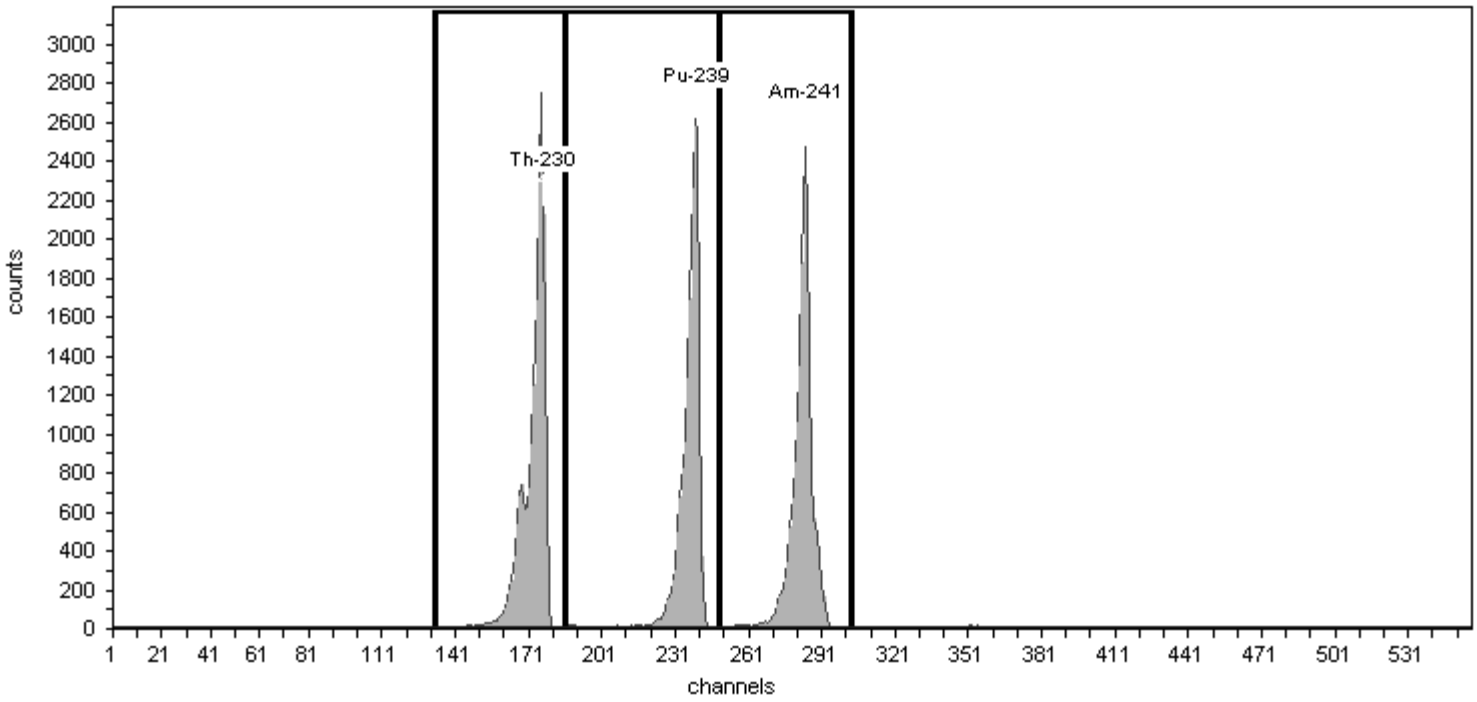
Certificate ID: 82232-334
Prepared by: Analytics

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

Acquisition

Detector: AV16 , SN: 51-082B6
Acquisition Start Date: 5/5/2014 7:27:49PM
Live Time: 140.00 min.
Real Time: 140.02 min.
Efficiency: 27.11% +/- 0.30% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	17,234.00	123.10
Pu-239	240	5.16	186	249	16,511.00	117.94
Am-241	284	5.49	249	303	16,391.00	117.08

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:08:53PM 5/5/2014

Calibration

Sample Name: IC-8874;AV17-20140505
Description:
Detector: AV17

Calibration Date: 5/5/2014 10:08:49PM
Analyst: 60040

Source Info

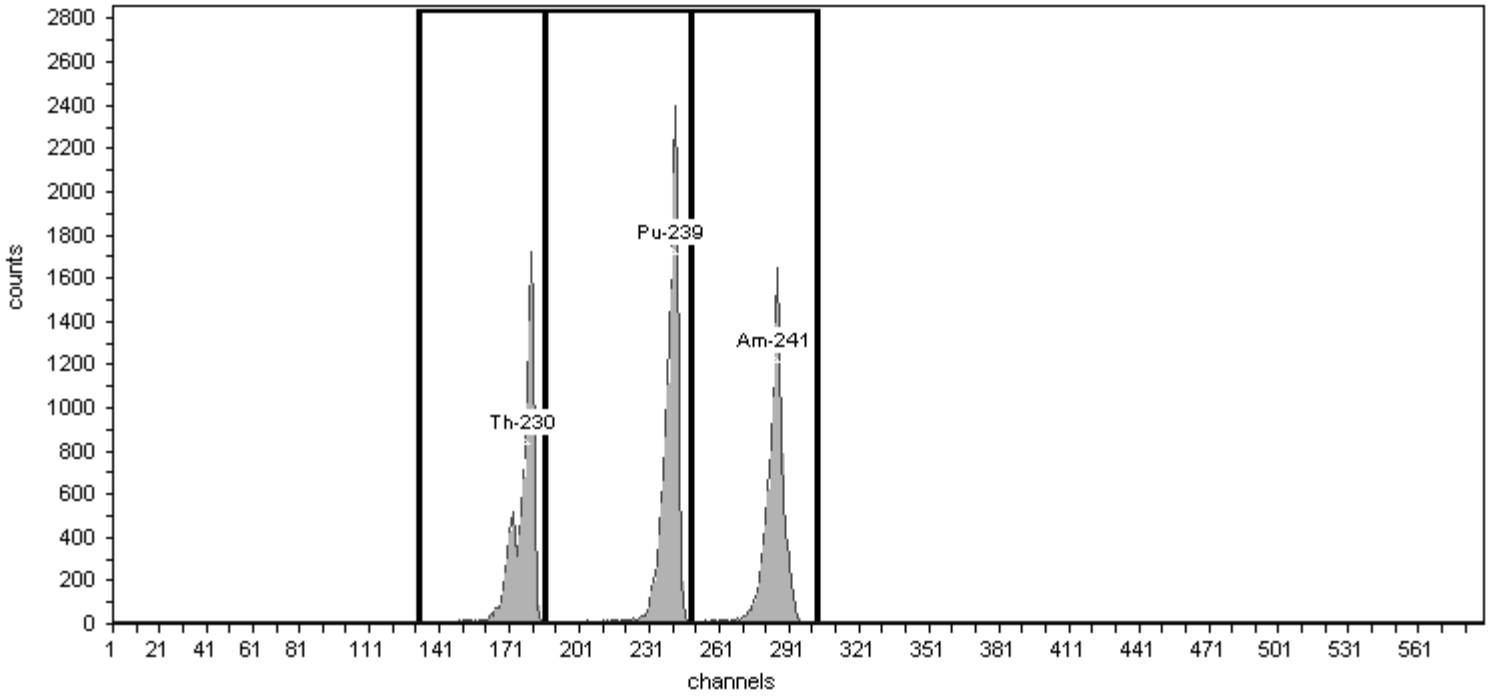
Certificate ID: 82233-334
Prepared by: Analytics

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

Acquisition

Detector: AV17 , SN: 50-051C4
Acquisition Start Date: 5/5/2014 7:28:08PM
Live Time: 140.00 min.
Real Time: 140.10 min.
Efficiency: 26.07% +/- 0.37% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	10,563.00	75.45
Pu-239	240	5.16	186	249	13,740.00	98.14
Am-241	284	5.49	249	303	10,934.00	78.10

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:09:15PM 5/5/2014

Calibration

Sample Name: IC-8875;AV18-20140505
Description:
Detector: AV18

Calibration Date: 5/5/2014 10:09:08PM
Analyst: 60040

Source Info

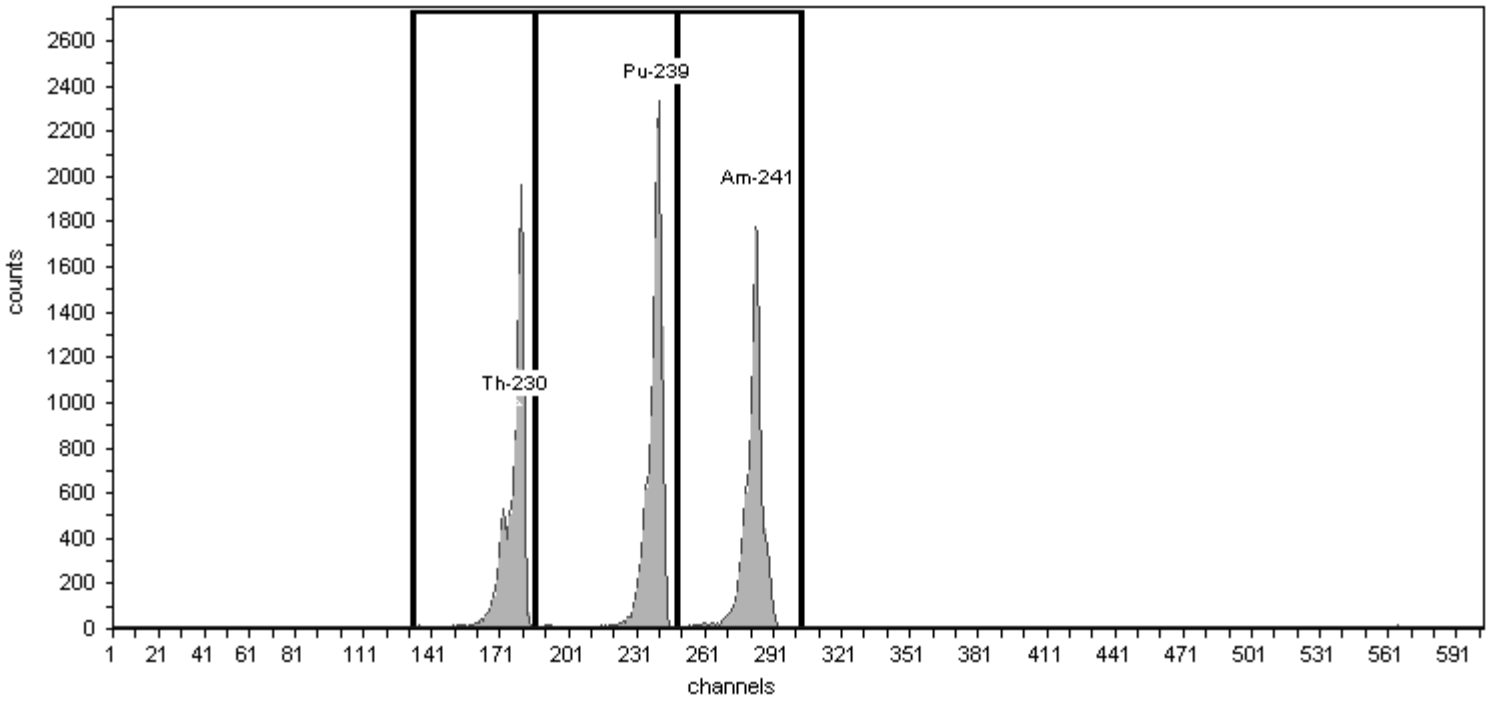
Certificate ID: 82234-334
Prepared by: Analytics

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

Acquisition

Detector: AV18 , SN: 51-082C5
Acquisition Start Date: 5/5/2014 7:28:19PM
Live Time: 140.00 min.
Real Time: 140.10 min.
Efficiency: 25.46% +/- 0.36% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	11,763.00	84.02
Pu-239	240	5.16	186	249	13,227.00	94.48
Am-241	284	5.49	249	303	11,935.00	85.25

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:09:08PM 5/5/2014

Calibration

Sample Name: IC-8876;AV19-20140505
Description:
Detector: AV19

Calibration Date: 5/5/2014 10:09:02PM
Analyst: 60040

Source Info

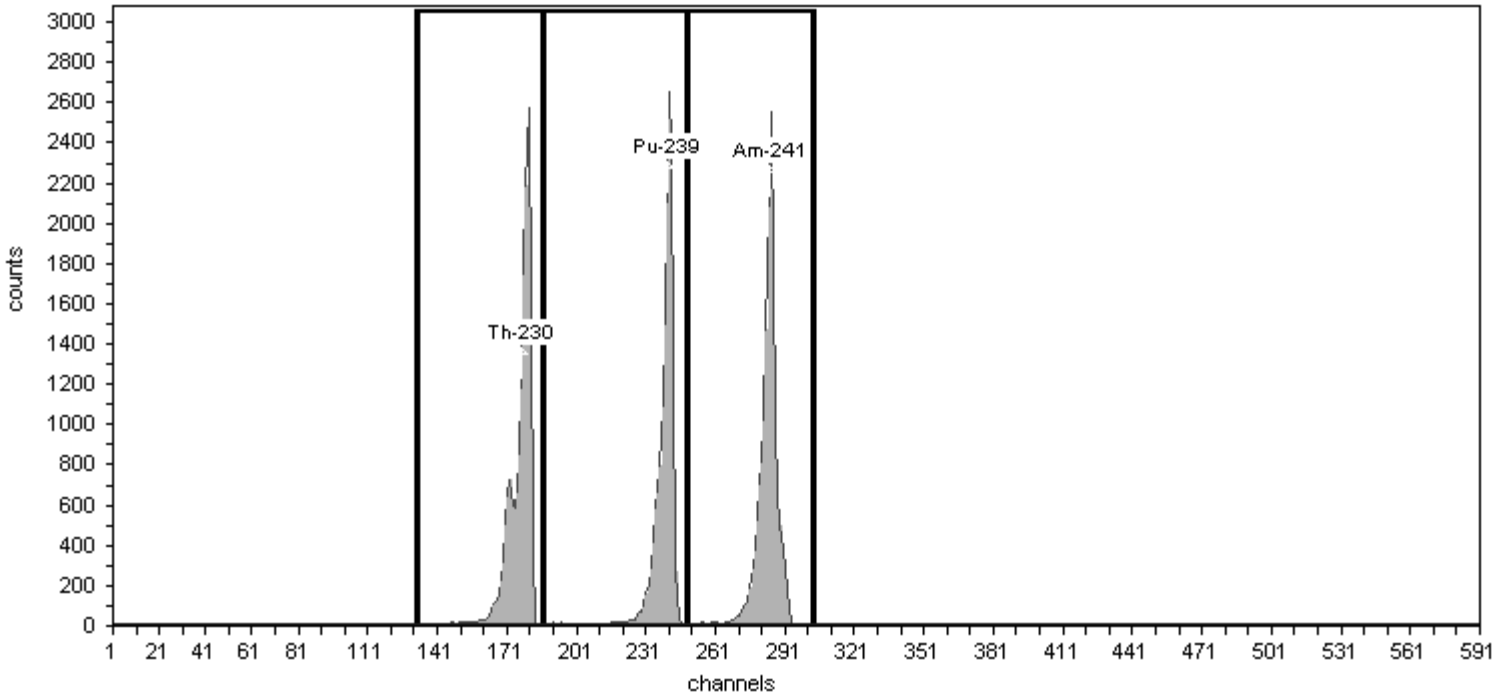
Certificate ID: 82235-334
Prepared by: Analytics

Certification Date: 6/4/2010 12:00:00PM
Description:

Acquisition

Detector: AV19 , SN: 50-025FF5
Acquisition Start Date: 5/5/2014 7:28:32PM
Live Time: 140.00 min.
Real Time: 140.10 min.
Efficiency: 25.34% +/- 0.30% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	15,406.00	110.04
Pu-239	240	5.16	186	249	14,896.00	106.40
Am-241	284	5.49	249	303	15,462.00	110.44

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:09:25PM 5/5/2014

Calibration

Sample Name: IC-8877;AV20-20140505
Description:
Detector: AV20

Calibration Date: 5/5/2014 10:09:21PM
Analyst: 60040

Source Info

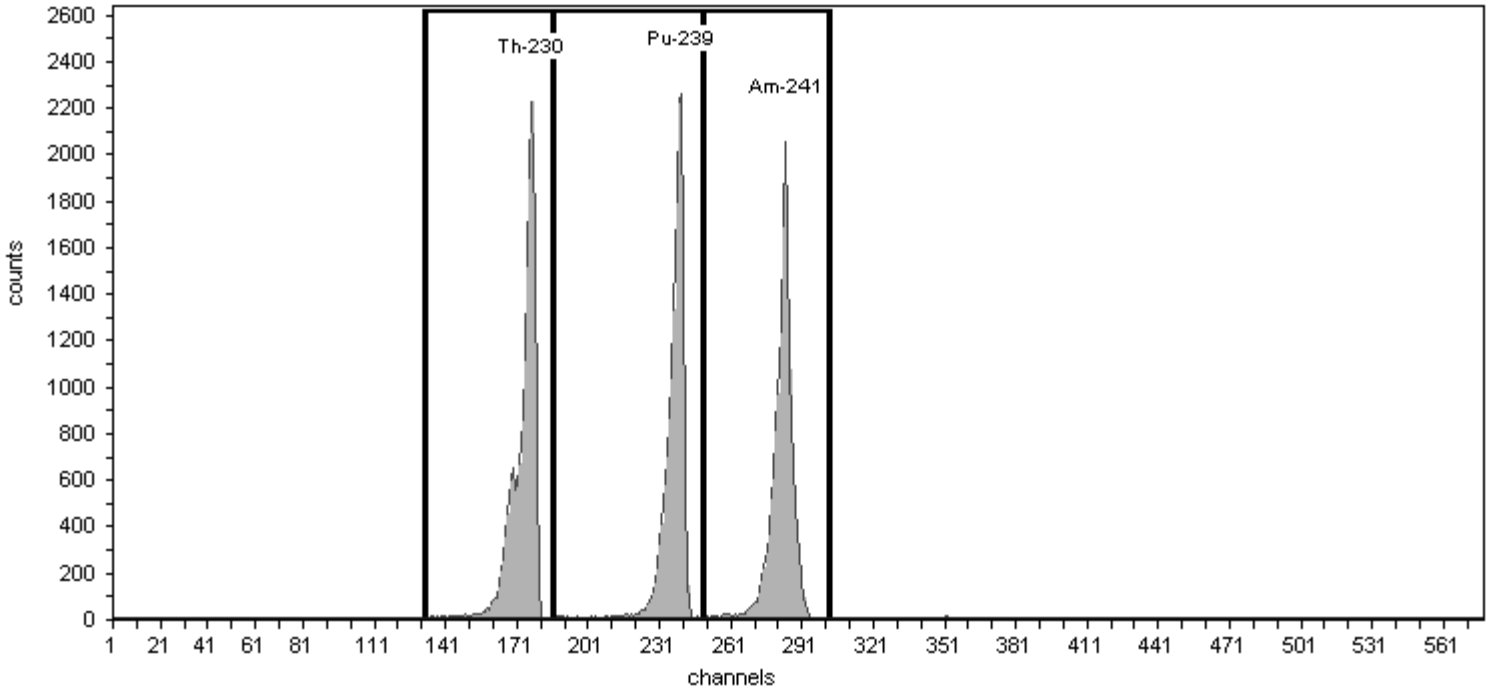
Certificate ID: 82236-334
Prepared by: Analytics

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

Acquisition

Detector: AV20 , SN: 48-121A7
Acquisition Start Date: 5/5/2014 7:28:49PM
Live Time: 140.00 min.
Real Time: 140.10 min.
Efficiency: 25.56% +/- 0.31% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	15,158.00	108.27
Pu-239	240	5.16	186	249	14,844.00	106.03
Am-241	284	5.49	249	303	14,347.00	102.48

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:09:51PM 5/5/2014

Calibration

Sample Name: IC-9794;AV43-20140505
Description:
Detector: AV43

Calibration Date: 5/5/2014 10:09:47PM
Analyst: 60040

Source Info

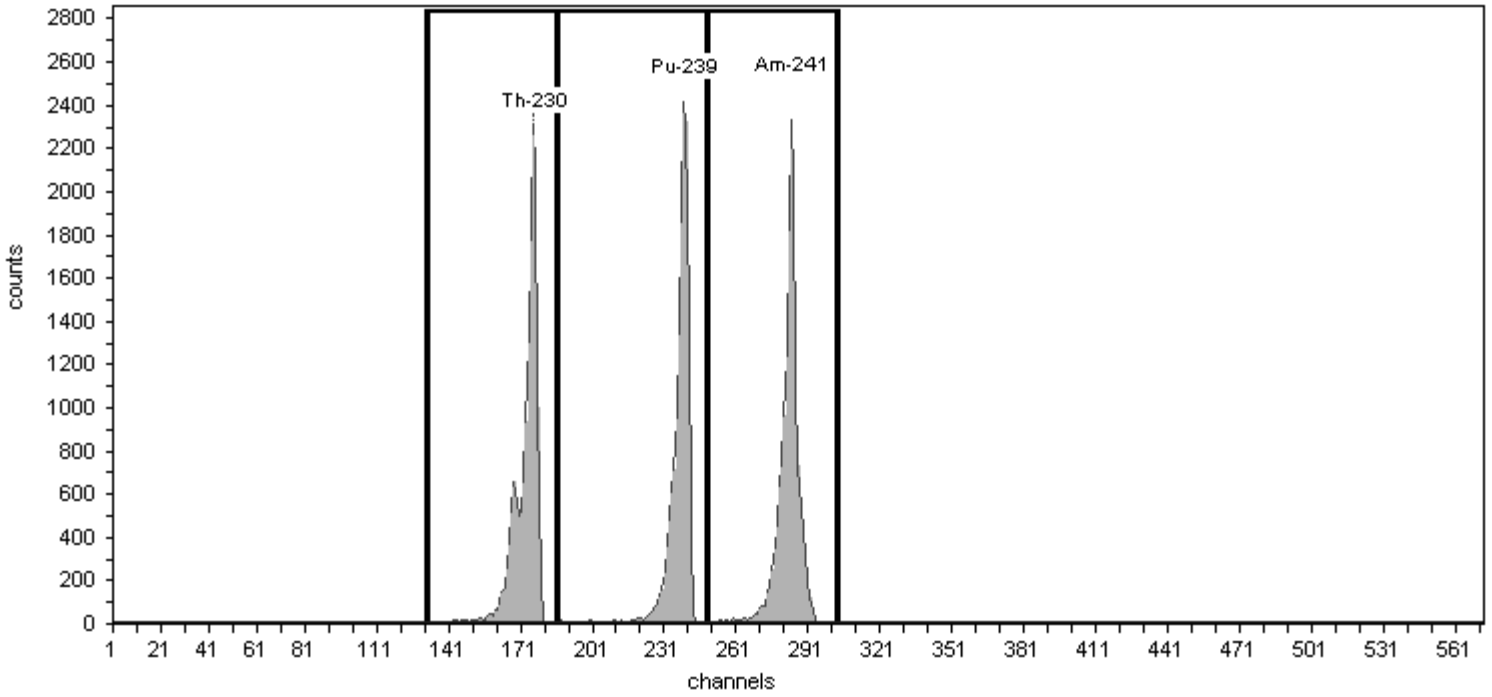
Certificate ID: 82242-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV43 , SN: 49-190X4
Acquisition Start Date: 5/5/2014 7:30:02PM
Live Time: 140.00 min.
Real Time: 140.08 min.
Efficiency: 25.74% +/- 0.32% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	14,478.00	103.41
Pu-239	240	5.16	186	249	13,913.00	99.38
Am-241	284	5.49	249	303	15,090.00	107.79

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:10:00PM 5/5/2014

Calibration

Sample Name: IC-9795;AV44-20140505
Description:
Detector: AV44

Calibration Date: 5/5/2014 10:09:57PM
Analyst: 60040

Source Info

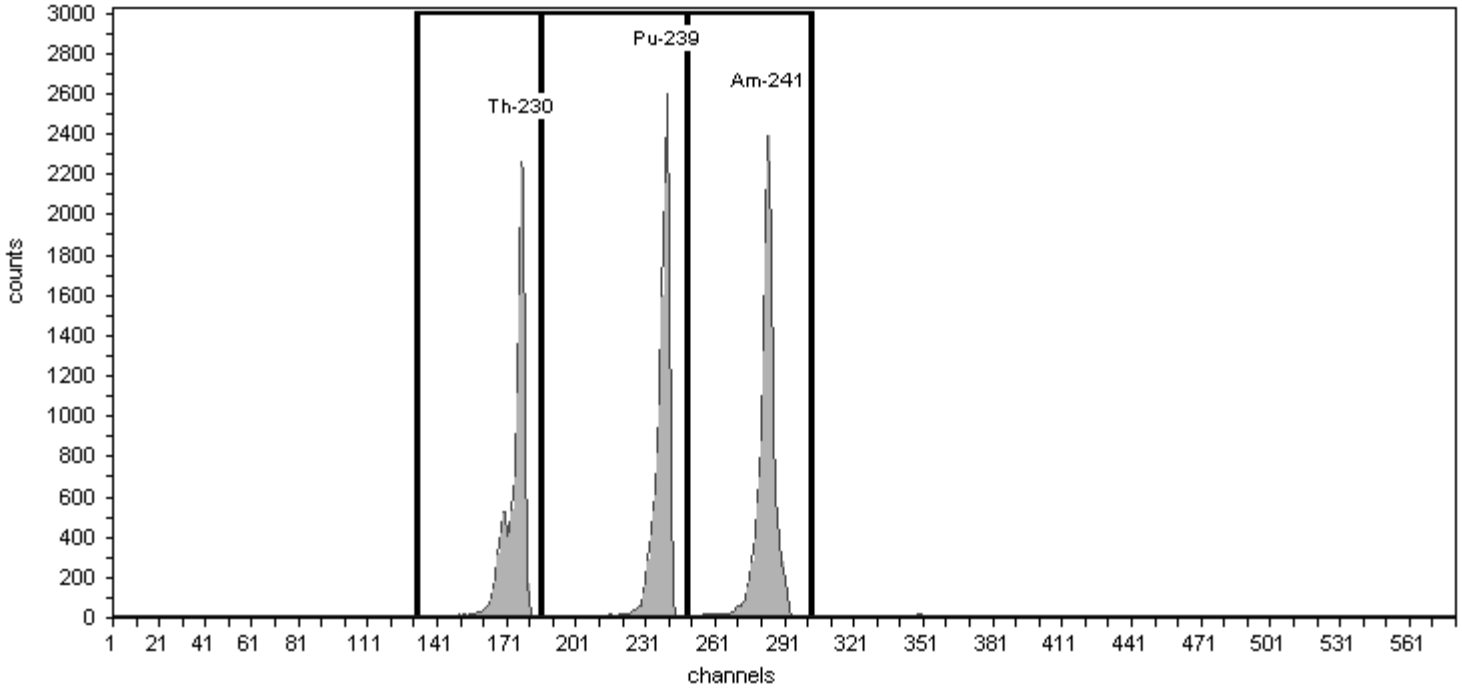
Certificate ID: 82243-334
Prepared by: Analytics

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

Acquisition

Detector: AV44 , SN: 50-051JJ1
Acquisition Start Date: 5/5/2014 7:30:18PM
Live Time: 140.00 min.
Real Time: 140.08 min.
Efficiency: 26.32% +/- 0.35% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	12,875.00	91.96
Pu-239	240	5.16	186	249	13,229.00	94.49
Am-241	284	5.49	249	303	14,113.00	100.81

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:10:06PM 5/5/2014

Calibration

Sample Name: IC-9817;AV45-20140505
Description:
Detector: AV45

Calibration Date: 5/5/2014 10:10:03PM
Analyst: 60040

Source Info

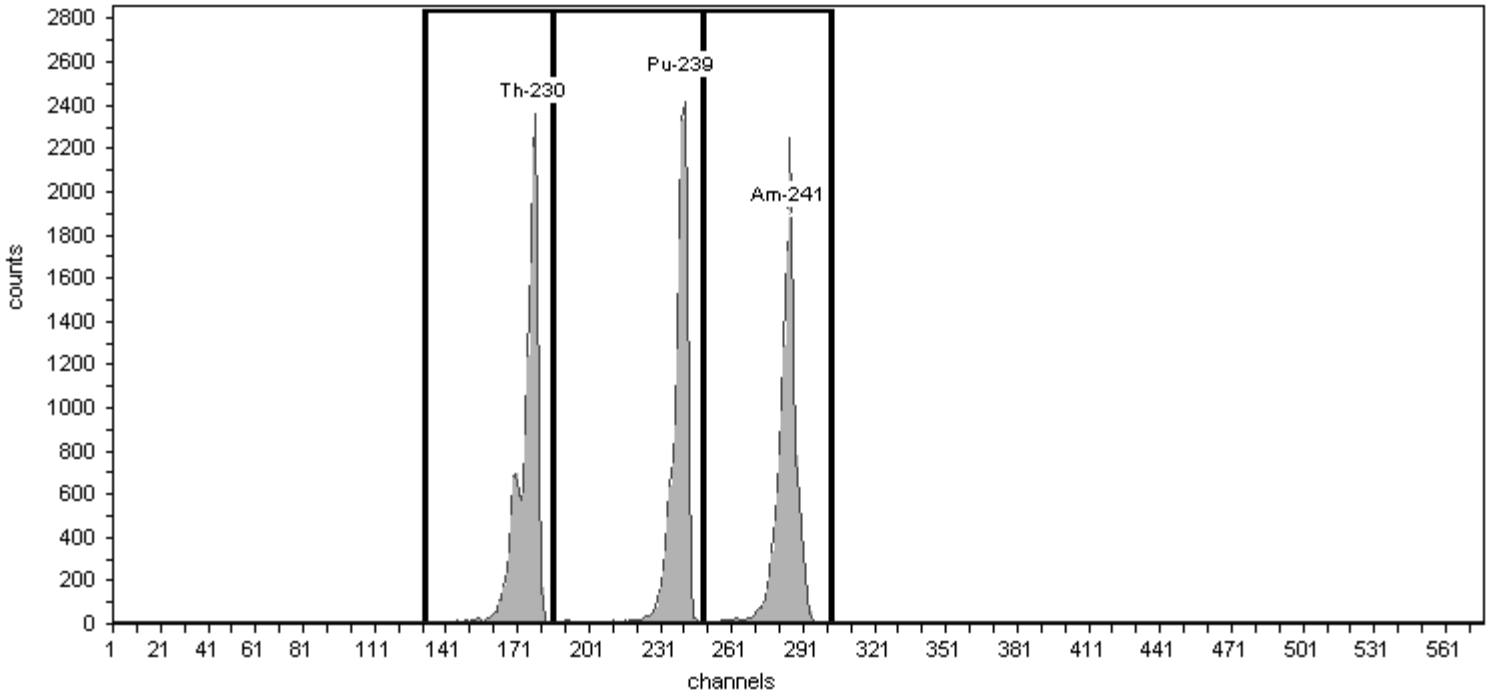
Certificate ID: 82244-334
Prepared by: Analytics

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

Acquisition

Detector: AV45 , SN: 48-158FF2
Acquisition Start Date: 5/5/2014 7:30:35PM
Live Time: 140.00 min.
Real Time: 140.08 min.
Efficiency: 26.06% +/- 0.31% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	16,022.00	114.44
Pu-239	240	5.16	186	249	14,730.00	105.21
Am-241	284	5.49	249	303	15,078.00	107.70

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:10:13PM 5/5/2014

Calibration

Sample Name: IC-9884;AV46-20140505
Description:
Detector: AV46

Calibration Date: 5/5/2014 10:10:09PM
Analyst: 60040

Source Info

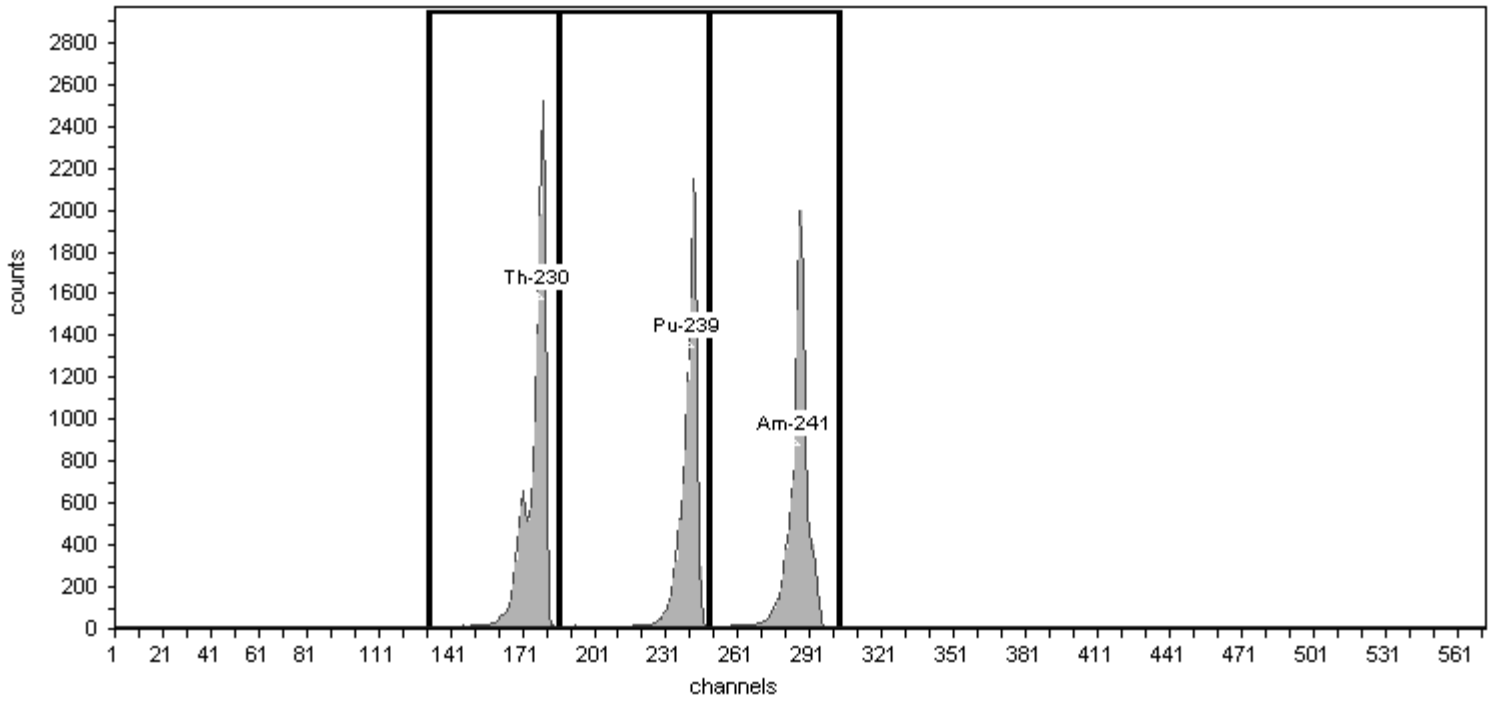
Certificate ID: 82245-334
Prepared by: Analytics

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

Acquisition

Detector: AV46 , SN: 49-202GG2
Acquisition Start Date: 5/5/2014 7:30:55PM
Live Time: 140.00 min.
Real Time: 140.08 min.
Efficiency: 26.80% +/- 0.38% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	14,928.00	106.63
Pu-239	240	5.16	186	249	12,228.00	87.34
Am-241	284	5.49	249	303	12,660.00	90.43

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:10:25PM 5/5/2014

Calibration

Sample Name: IC-9886;AV48-20140505
Description:
Detector: AV48

Calibration Date: 5/5/2014 10:10:22PM
Analyst: 60040

Source Info

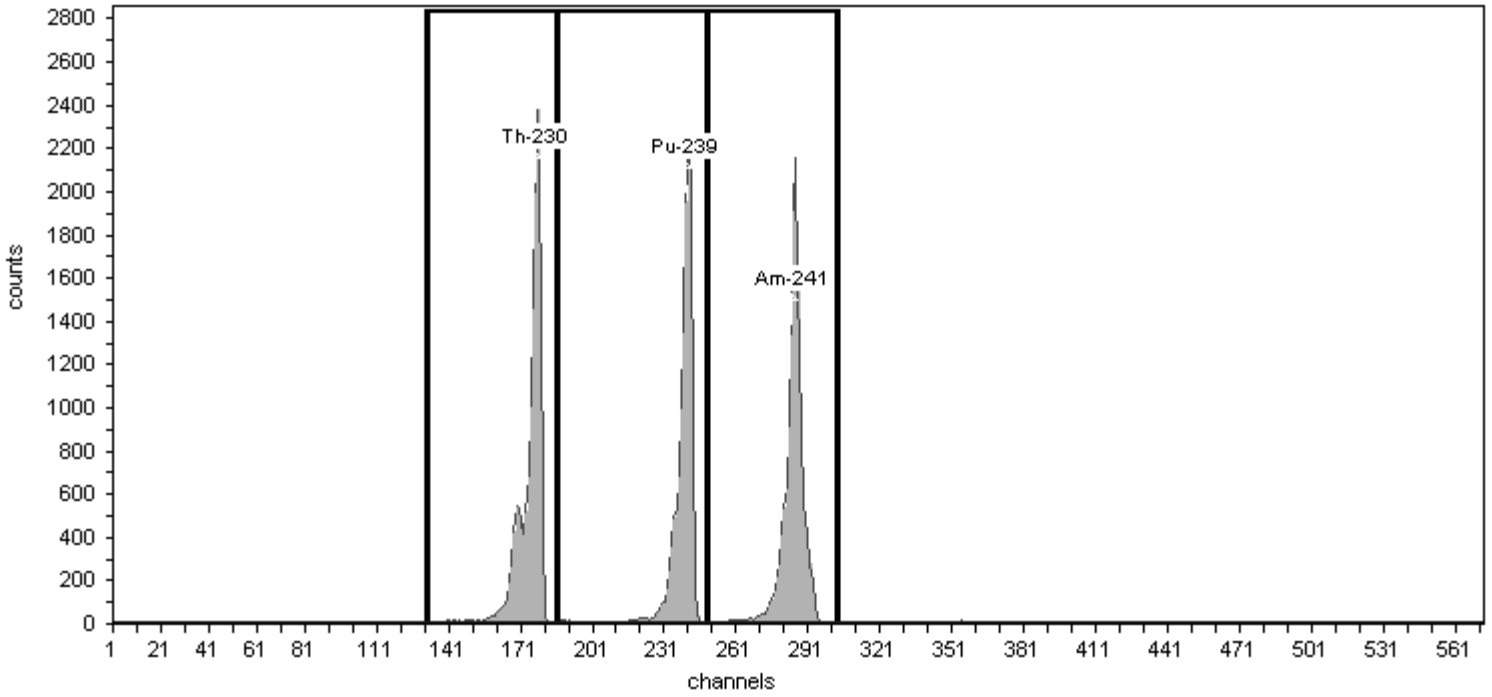
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV48 , SN: 50-051JJ4
Acquisition Start Date: 5/5/2014 7:32:02PM
Live Time: 140.00 min.
Real Time: 140.08 min.
Efficiency: 25.78% +/- 0.35% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	13,428.00	95.91
Pu-239	240	5.16	186	249	12,557.00	89.69
Am-241	284	5.49	249	303	13,561.00	96.86

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:53:44PM 5/5/2014

Calibration

Sample Name: IC-9793;AV57-20140504
Description:
Detector: AV57

Calibration Date: 5/5/2014 6:53:40PM
Analyst: 60040

Source Info

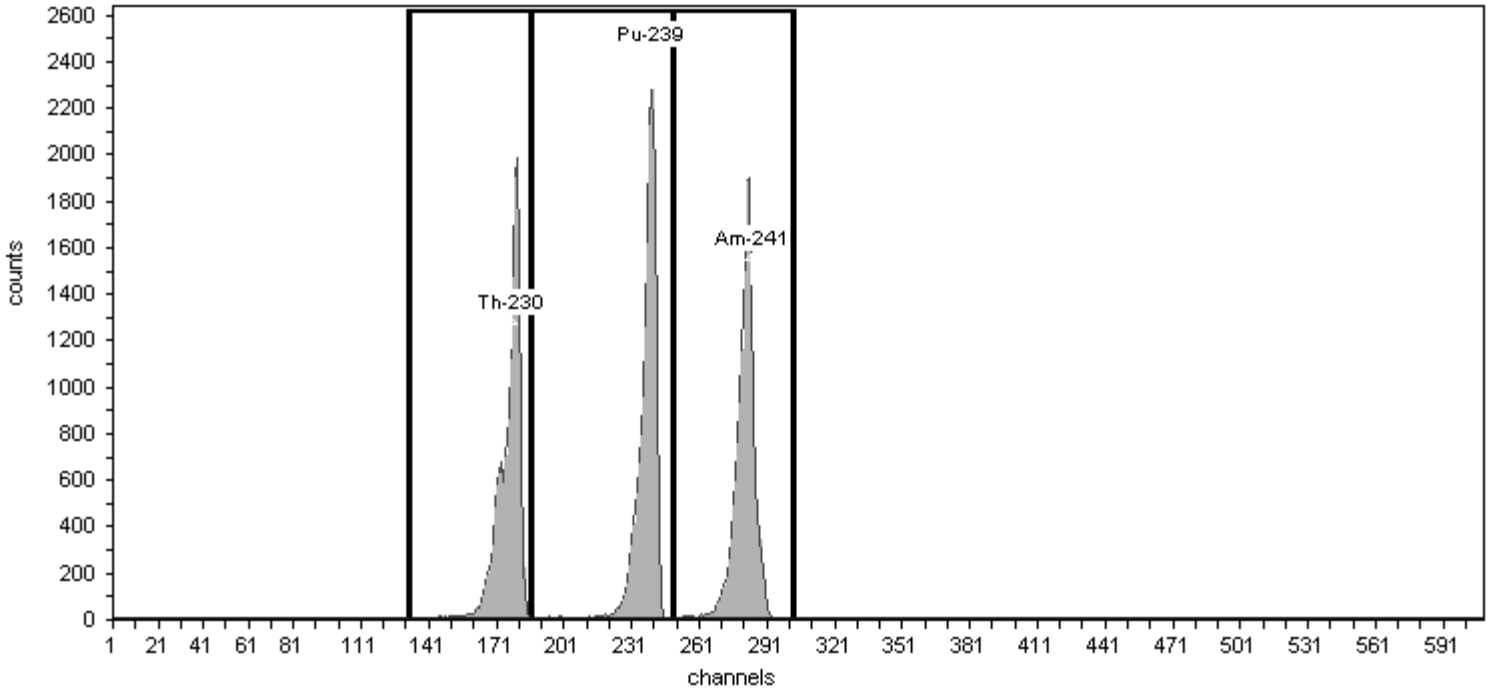
Certificate ID: 82241-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV57 , SN: 48-158EE3
Acquisition Start Date: 5/4/2014 9:05:08PM
Live Time: 140.00 min.
Real Time: 140.12 min.
Efficiency: 26.74% +/- 0.33% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	14,915.00	106.54
Pu-239	240	5.16	186	249	15,361.00	109.72
Am-241	284	5.49	249	303	14,709.00	105.06

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:53:50PM 5/5/2014

Calibration

Sample Name: IC-9794;AV58-20140504
Description:
Detector: AV58

Calibration Date: 5/5/2014 6:53:46PM
Analyst: 60040

Source Info

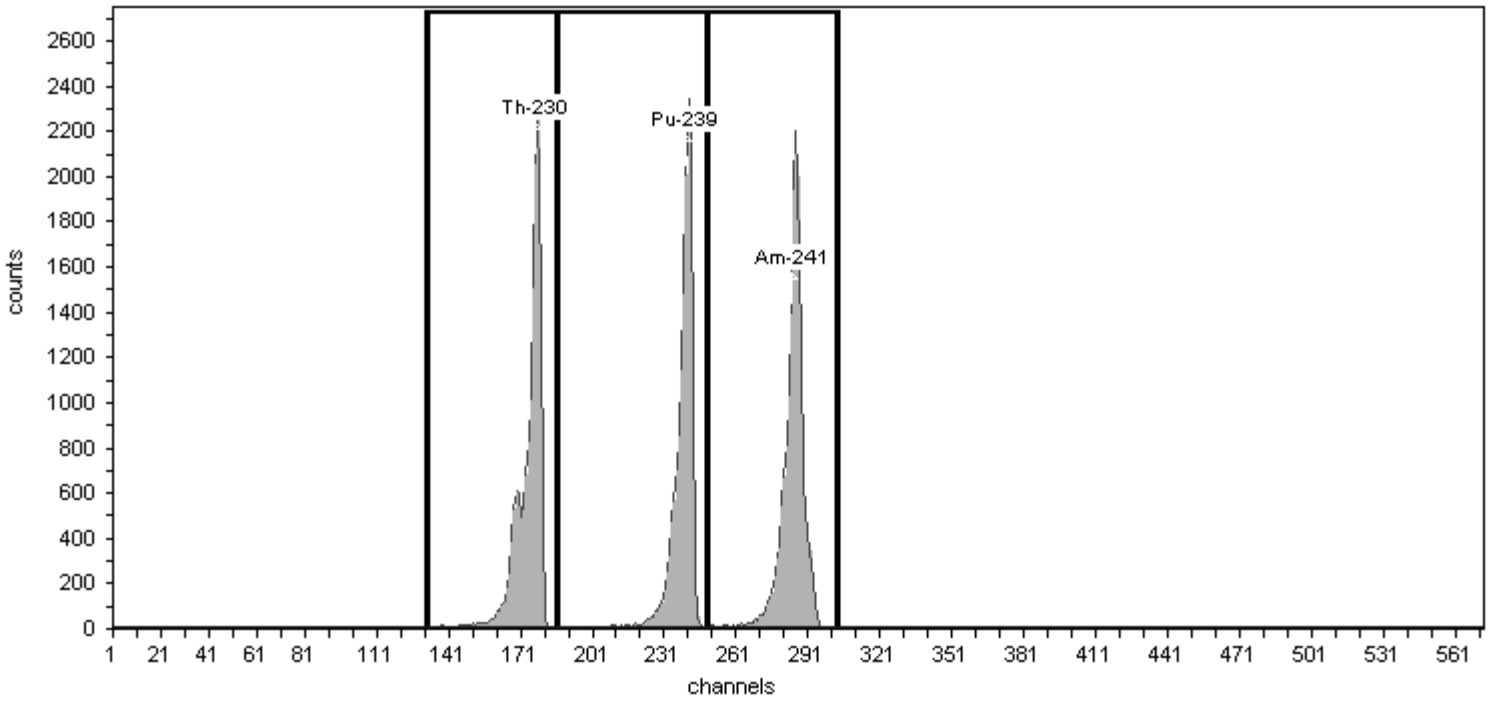
Certificate ID: 82242-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV58 , SN: 52-102 C5
Acquisition Start Date: 5/4/2014 9:05:25PM
Live Time: 140.00 min.
Real Time: 140.12 min.
Efficiency: 26.56% +/- 0.33% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	14,633.00	104.52
Pu-239	240	5.16	186	249	14,396.00	102.83
Am-241	284	5.49	249	303	15,822.00	113.01

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:53:56PM 5/5/2014

Calibration

Sample Name: IC-9795;AV59-20140504
Description:
Detector: AV59

Calibration Date: 5/5/2014 6:53:53PM
Analyst: 60040

Source Info

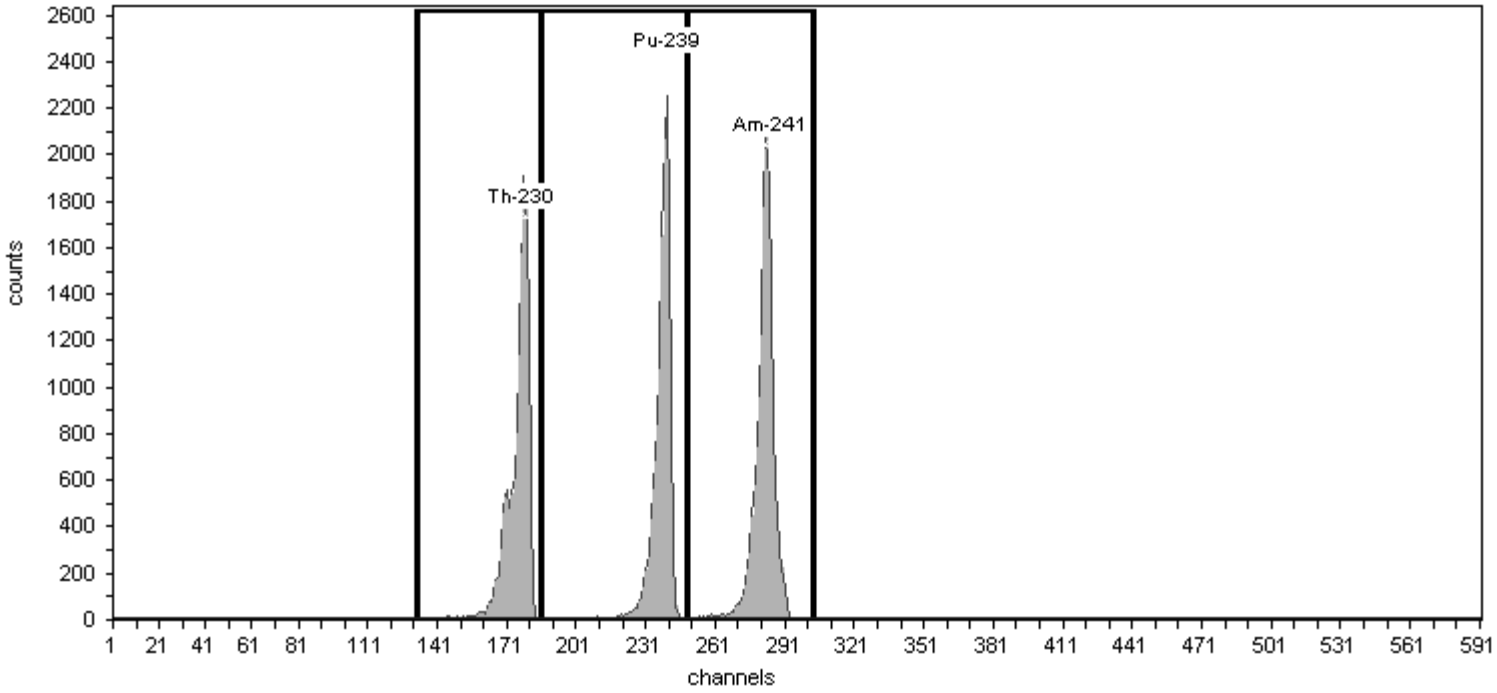
Certificate ID: 82243-334
Prepared by: Analytics

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

Acquisition

Detector: AV59 , SN: 49-155M7
Acquisition Start Date: 5/4/2014 9:05:42PM
Live Time: 140.00 min.
Real Time: 140.07 min.
Efficiency: 27.44% +/- 0.36% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	13,530.00	96.64
Pu-239	240	5.16	186	249	13,591.00	97.08
Am-241	284	5.49	249	303	14,815.00	105.82

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:54:03PM 5/5/2014

Calibration

Sample Name: IC-9817;AV60-20140504
Description:
Detector: AV60

Calibration Date: 5/5/2014 6:53:59PM
Analyst: 60040

Source Info

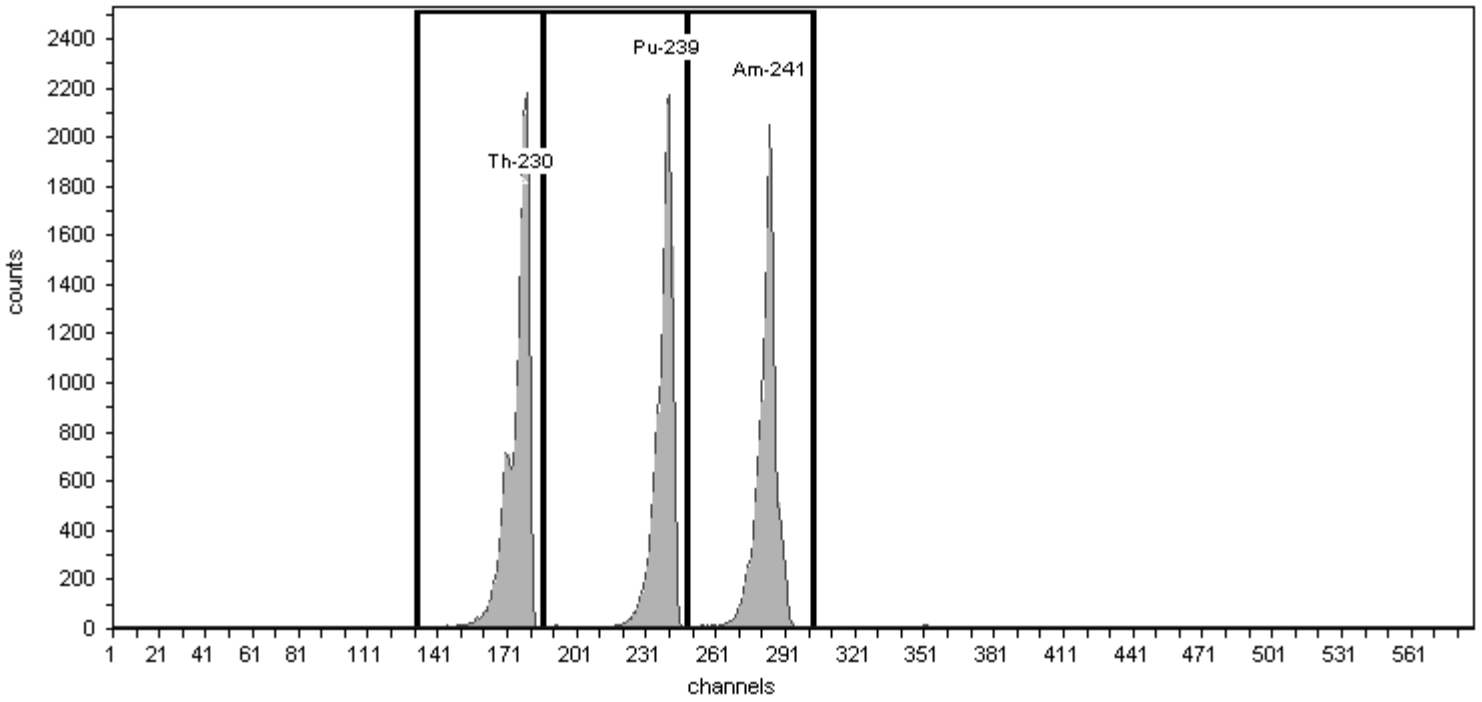
Certificate ID: 82244-334
Prepared by: Analytics

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

Acquisition

Detector: AV60 , SN: 49-027117
Acquisition Start Date: 5/4/2014 9:06:02PM
Live Time: 140.00 min.
Real Time: 140.07 min.
Efficiency: 26.33% +/- 0.32% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	16,279.00	116.28
Pu-239	240	5.16	186	249	14,858.00	106.13
Am-241	284	5.49	249	303	15,157.00	108.26

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:54:10PM 5/5/2014

Calibration

Sample Name: IC-9884;AV61-20140504
Description:
Detector: AV61

Calibration Date: 5/5/2014 6:54:06PM
Analyst: 60040

Source Info

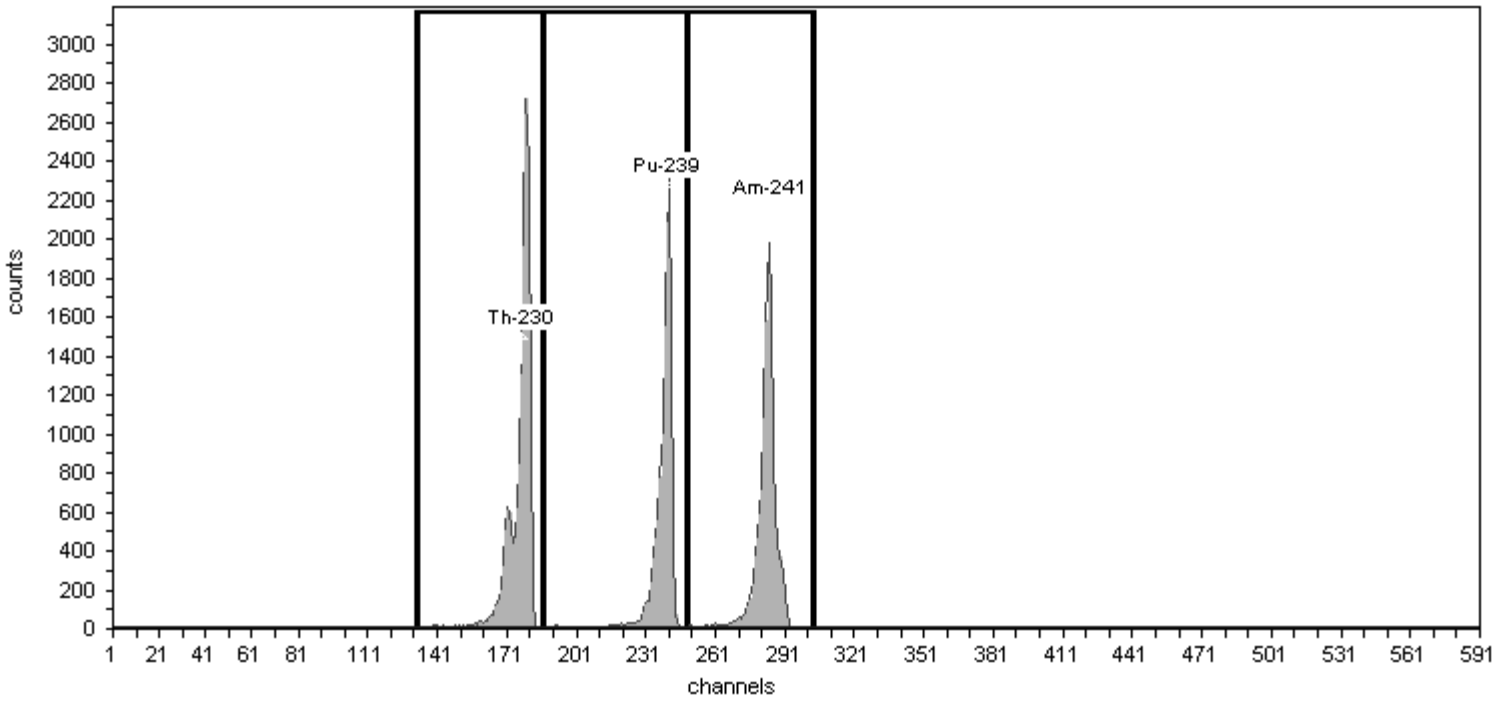
Certificate ID: 82245-334
Prepared by: Analytics

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

Acquisition

Detector: AV61 , SN: 5-051JJ3
Acquisition Start Date: 5/4/2014 9:06:04PM
Live Time: 140.00 min.
Real Time: 140.07 min.
Efficiency: 26.46% +/- 0.38% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	14,902.00	106.44
Pu-239	240	5.16	186	249	12,091.00	86.36
Am-241	284	5.49	249	303	12,283.00	87.74

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
6:54:16PM 5/5/2014

Calibration

Sample Name: IC-9885;AV62-20140504
Description:
Detector: AV62

Calibration Date: 5/5/2014 6:54:13PM
Analyst: 60040

Source Info

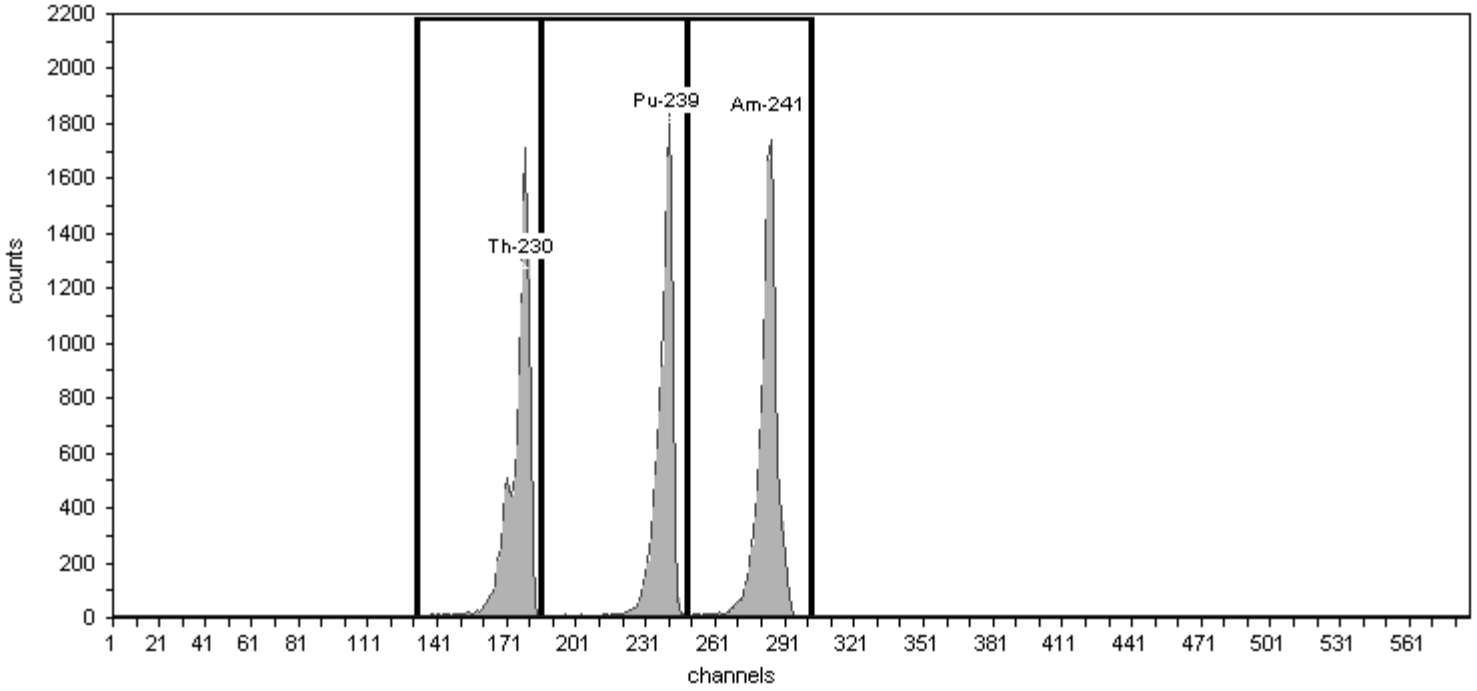
Certificate ID: 82246-334
Prepared by: Analytics

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

Acquisition

Detector: AV62 , SN: 52-060FF2
Acquisition Start Date: 5/4/2014 9:06:28PM
Live Time: 140.00 min.
Real Time: 140.07 min.
Efficiency: 26.34% +/- 0.38% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	12,181.00	87.01
Pu-239	240	5.16	186	249	12,037.00	85.98
Am-241	284	5.49	249	303	13,168.00	94.06

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:45:37PM 5/4/2014

Calibration

Sample Name: IC-9886;AV78-20140504
Description:
Detector: AV78

Calibration Date: 5/4/2014 8:45:34PM
Analyst: 60040

Source Info

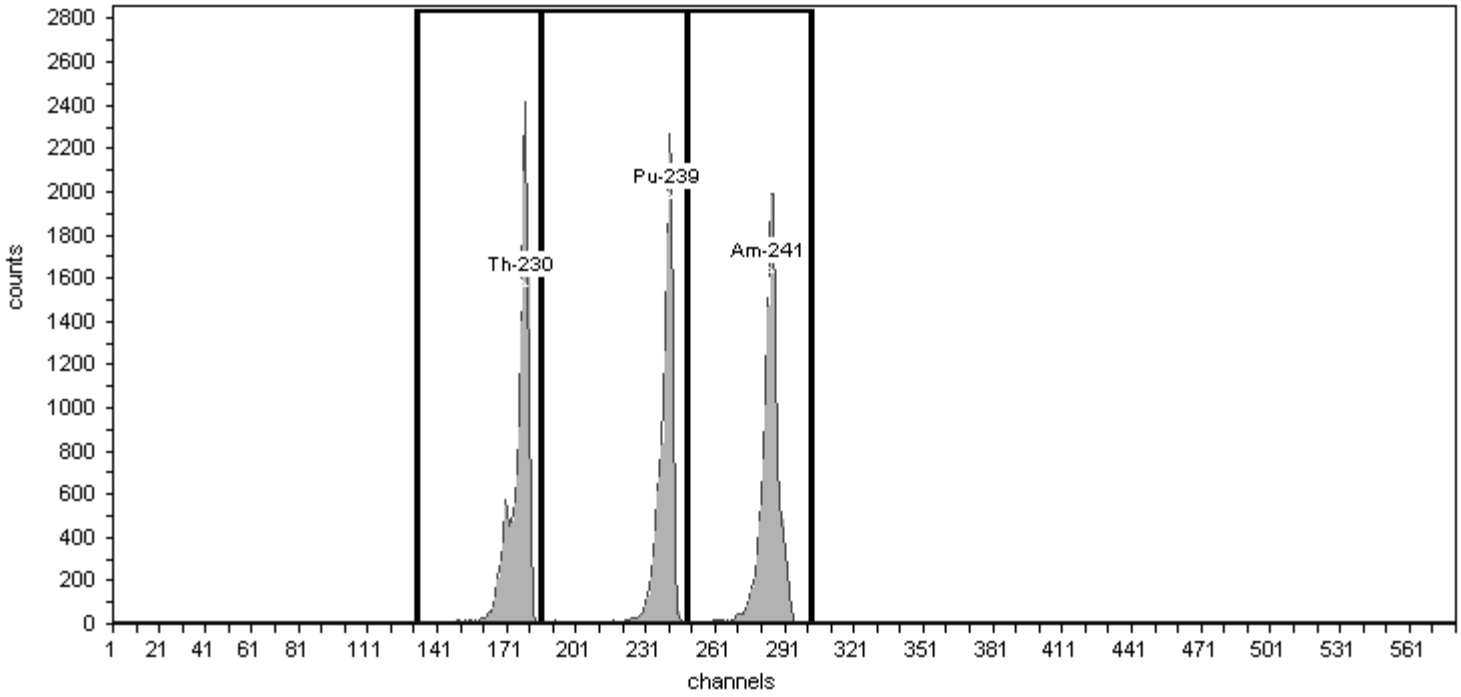
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV78 , SN: 46-033FF4
Acquisition Start Date: 5/4/2014 5:51:18PM
Live Time: 140.00 min.
Real Time: 140.06 min.
Efficiency: 25.71% +/- 0.34% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	13,586.00	97.04
Pu-239	240	5.16	186	249	12,514.00	89.39
Am-241	284	5.49	249	303	13,337.00	95.26

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:31:33PM 5/4/2014

Calibration

Sample Name: IC-7107;AV79-20140501
Description:
Detector: AV79

Calibration Date: 5/4/2014 5:31:27PM
Analyst: 60040

Source Info

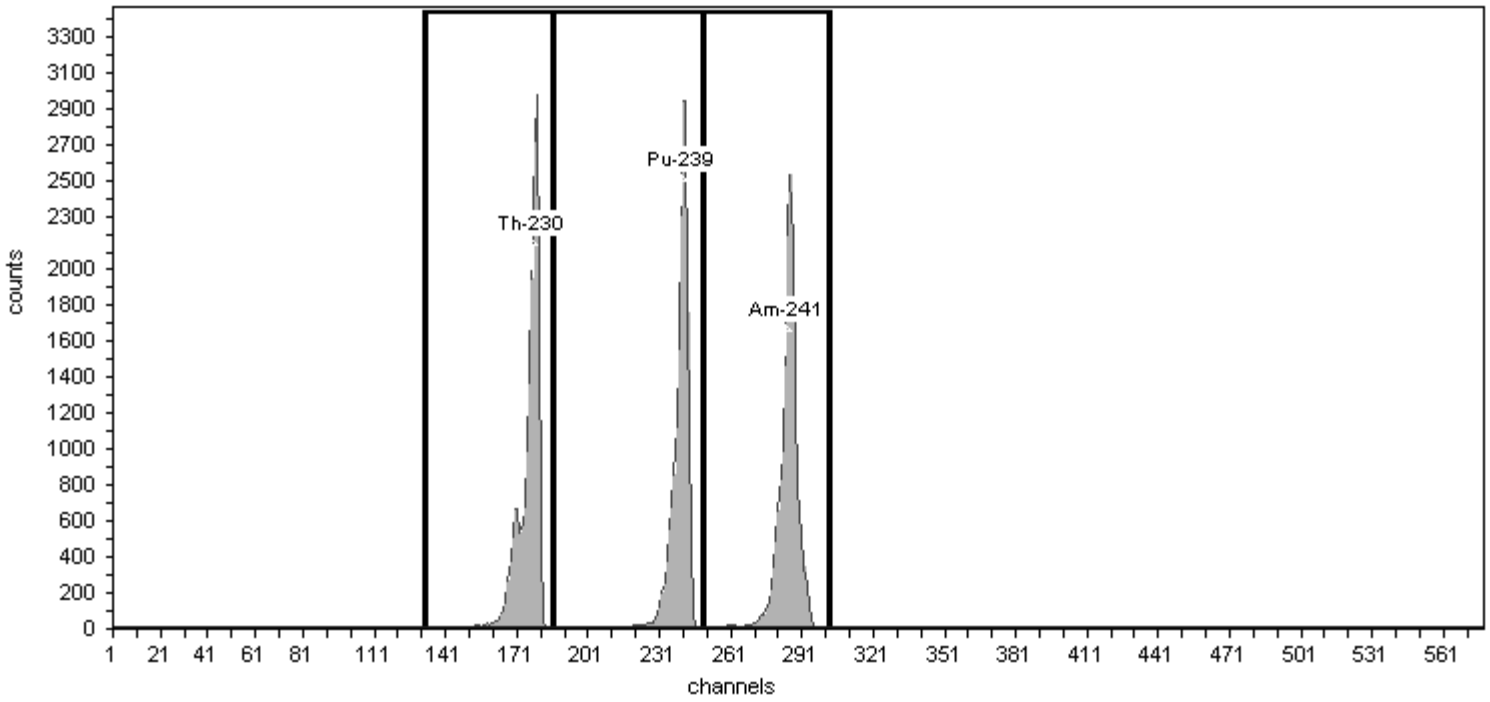
Certificate ID: 82232-334
Prepared by: Analytics

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

Acquisition

Detector: AV79 , SN: 46-033Q5
Acquisition Start Date: 5/1/2014 7:15:10PM
Live Time: 140.00 min.
Real Time: 140.06 min.
Efficiency: 27.05% +/- 0.30% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	17,161.00	122.58
Pu-239	240	5.16	186	249	16,466.00	117.61
Am-241	284	5.49	249	303	16,390.00	117.07

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:31:52PM 5/4/2014

Calibration

Sample Name: IC-8876;AV82-20140501
Description:
Detector: AV82

Calibration Date: 5/4/2014 5:31:49PM
Analyst: 60040

Source Info

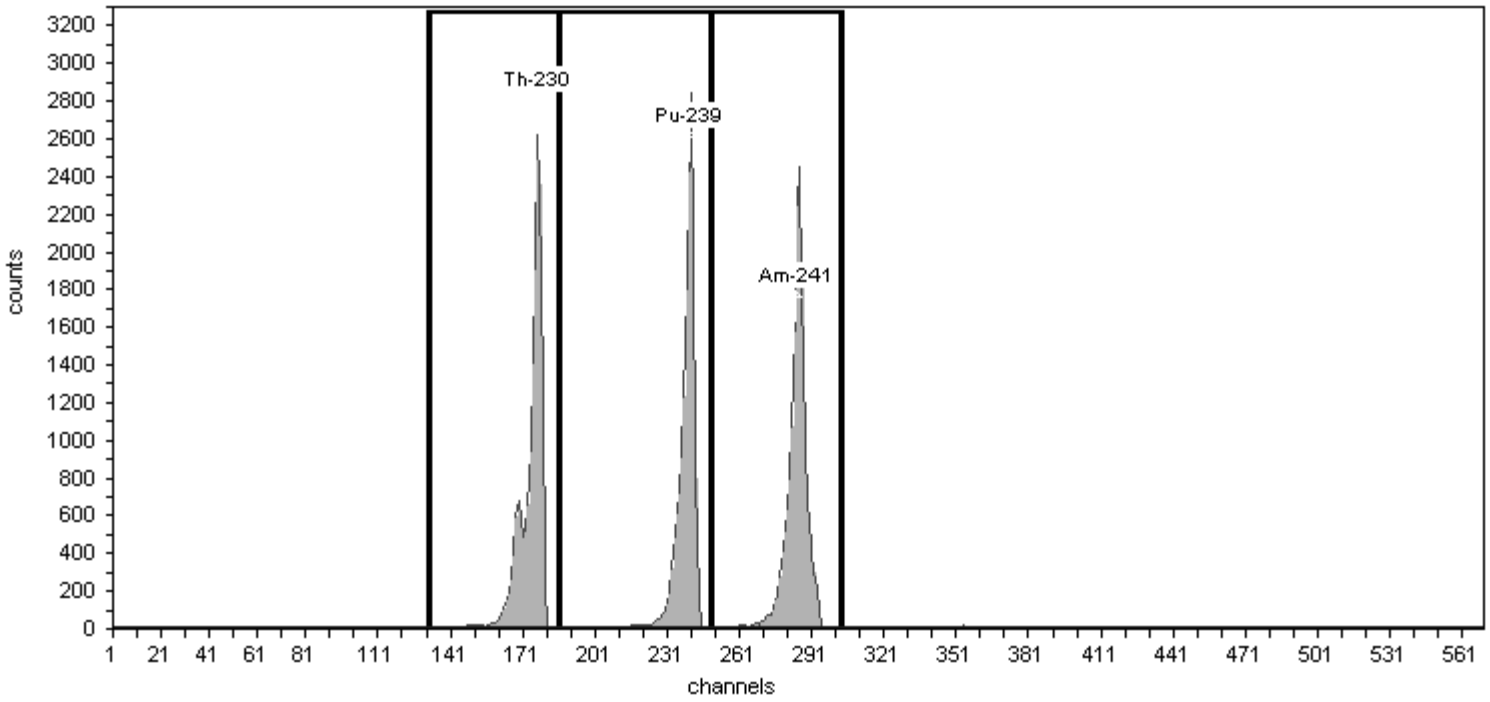
Certificate ID: 82235-334
Prepared by: Analytics

Certification Date: 6/4/2010 12:00:00PM
Description:

Acquisition

Detector: AV82 , SN: 46-032EE5
Acquisition Start Date: 5/1/2014 7:15:43PM
Live Time: 140.00 min.
Real Time: 140.06 min.
Efficiency: 25.76% +/- 0.30% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	15,627.00	111.62
Pu-239	240	5.16	186	249	15,112.00	107.94
Am-241	284	5.49	249	303	15,786.00	112.76

Initial Calibration Verifications

Alpha Spectroscopy Calibration Summary

Detector: AV1

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120511/1	05/05/14 22:25	82232-334_00001	0.2630	0.20-0.32		
ICV 160-120846/1	05/07/14 23:01	82247-334_00001	0.2524	0.20-0.32	96.0	95-105
CCV 160-122944/1	05/18/14 19:19	82232-334_00001	0.2651	0.20-0.32	100.8	95-105

Detector: AV11

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120513/1	05/05/14 22:27	82243-334_00001	0.2688	0.20-0.32		
ICV 160-120848/1	05/07/14 23:04	82242-334_00001	0.2598	0.20-0.32	96.6	95-105
CCV 160-122963/1	05/19/14 17:57	82243-334_00001	0.2673	0.20-0.32	99.5	95-105

Detector: AV15

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120517/1	05/05/14 22:28	82247-334_00001	0.2562	0.20-0.32		
ICV 160-120852/1	05/07/14 23:04	82246-334_00001	0.2590	0.20-0.32	101.1	95-105
CCV 160-122950/1	05/18/14 19:22	82247-334_00001	0.2580	0.20-0.32	100.7	95-105

Detector: AV16

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120398/1	05/05/14 19:27	82232-334_00001	0.2711	0.20-0.32		
ICV 160-121072/1	05/08/14 00:14	82247-334_00001	0.2609	0.20-0.32	96.2	95-105
CCV 160-122951/1	05/18/14 20:51	82232-334_00001	0.2727	0.20-0.32	100.6	95-105

Detector: AV17

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120399/1	05/05/14 19:28	82233-334_00001	0.2607	0.20-0.32		
ICV 160-121073/1	05/08/14 00:14	82232-334_00001	0.2633	0.20-0.32	101.0	95-105
CCV 160-122952/1	05/18/14 19:22	82233-334_00001	0.2571	0.20-0.32	98.6	95-105

Detector: AV18

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120400/1	05/05/14 19:28	82234-334_00001	0.2546	0.20-0.32		
ICV 160-121074/1	05/08/14 00:14	82233-334_00001	0.2618	0.20-0.32	102.8	95-105
CCV 160-122953/1	05/18/14 20:51	82234-334_00001	0.2515	0.20-0.32	98.8	95-105

Detector: AV19

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120401/1	05/05/14 19:28	82235-334_00001	0.2534	0.20-0.32		
ICV 160-121361/1	05/08/14 14:33	82235-334_00001	0.2496	0.20-0.32	98.5	95-105
CCV 160-122965/1	05/19/14 17:58	82235-334_00001	0.2512	0.20-0.32	99.2	95-105

Detector: AV20

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120402/1	05/05/14 19:28	82236-334_00001	0.2556	0.20-0.32		
ICV 160-120854/1	05/07/14 23:05	82235-334_00001	0.2551	0.20-0.32	99.8	95-105
CCV 160-122954/1	05/18/14 20:52	82236-334_00001	0.2535	0.20-0.32	99.2	95-105

Alpha Spectroscopy Calibration Summary

Detector: AV43

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120406/1	05/05/14 19:30	82242-334_00001	0.2574	0.20-0.32		
ICV 160-121077/1	05/08/14 00:16	82241-334_00001	0.2568	0.20-0.32	99.8	95-105
CCV 160-122515/1	05/15/14 19:01	82242-334_00001	0.2587	0.20-0.32	100.5	95-105

Detector: AV44

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120407/1	05/05/14 19:30	82243-334_00001	0.2632	0.20-0.32		
ICV 160-121078/1	05/08/14 00:17	82242-334_00001	0.2594	0.20-0.32	98.6	95-105
CCV 160-122516/1	05/15/14 19:01	82243-334_00001	0.2639	0.20-0.32	100.3	95-105

Detector: AV45

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120408/1	05/05/14 19:30	82244-334_00001	0.2606	0.20-0.32		
ICV 160-121363/1	05/08/14 14:32	82243-334_00001	0.2658	0.20-0.32	102.0	95-105
CCV 160-122517/1	05/15/14 19:02	82244-334_00001	0.2585	0.20-0.32	99.2	95-105

Detector: AV46

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120409/1	05/05/14 19:30	82245-334_00001	0.2680	0.20-0.32		
ICV 160-121079/1	05/08/14 00:18	82244-334_00001	0.2610	0.20-0.32	97.4	95-105
CCV 160-122518/1	05/15/14 19:02	82245-334_00001	0.2624	0.20-0.32	97.9	95-105

Detector: AV48

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120411/1	05/05/14 19:32	82247-334_00001	0.2578	0.20-0.32		
ICV 160-121081/1	05/08/14 00:18	82246-334_00001	0.2600	0.20-0.32	100.9	95-105
CCV 160-122520/1	05/15/14 19:03	82247-334_00001	0.2591	0.20-0.32	100.5	95-105

Detector: AV57

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120279/1	05/04/14 21:05	82241-334_00001	0.2674	0.20-0.32		
ICV 160-121370/1	05/08/14 14:35	82240-334_00001	0.2676	0.20-0.32	100.1	95-105
CCV 160-122526/1	05/15/14 19:05	82241-334_00001	0.2706	0.20-0.32	101.2	95-105

Detector: AV58

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120280/1	05/04/14 21:05	82242-334_00001	0.2656	0.20-0.32		
ICV 160-121371/1	05/08/14 14:35	82241-334_00001	0.2710	0.20-0.32	102.0	95-105
CCV 160-122530/1	05/15/14 20:43	82242-334_00001	0.2645	0.20-0.32	99.6	95-105

Detector: AV59

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120281/1	05/04/14 21:05	82243-334_00001	0.2744	0.20-0.32		
ICV 160-121372/1	05/08/14 14:36	82242-334_00001	0.2677	0.20-0.32	97.5	95-105
CCV 160-122531/1	05/15/14 20:44	82243-334_00001	0.2748	0.20-0.32	100.1	95-105

Alpha Spectroscopy Calibration Summary

Detector: AV60

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120282/1	05/04/14 21:06	82244-334_00001	0.2633	0.20-0.32		
ICV 160-121373/1	05/08/14 17:21	82243-334_00001	0.2725	0.20-0.32	103.5	95-105
CCV 160-122532/1	05/15/14 20:44	82244-334_00001	0.2625	0.20-0.32	99.7	95-105

Detector: AV61

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120283/1	05/04/14 21:06	82245-334_00001	0.2646	0.20-0.32		
ICV 160-121374/1	05/08/14 14:36	82244-334_00001	0.2581	0.20-0.32	97.5	95-105
CCV 160-122533/1	05/15/14 20:44	82244-334_00001	0.2632	0.20-0.32	99.5	95-105

Detector: AV62

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120284/1	05/04/14 21:06	82246-334_00001	0.2634	0.20-0.32		
ICV 160-121375/1	05/08/14 14:36	82245-334_00001	0.2622	0.20-0.32	99.6	95-105
CCV 160-122534/1	05/15/14 20:44	82246-334_00001	0.2641	0.20-0.32	100.3	95-105

Detector: AV78

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-120055/1	05/04/14 17:51	82247-334_00001	0.2571	0.20-0.32		
ICV 160-121385/1	05/08/14 17:20	82246-334_00001	0.2600	0.20-0.32	101.1	95-105
CCV 160-122550/1	05/15/14 21:58	82247-334_00001	0.2604	0.20-0.32	101.3	95-105

Detector: AV79

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-119923/1	05/01/14 19:15	82232-334_00001	0.2705	0.20-0.32		
ICV 160-121432/1	05/11/14 20:47	82247-334_00001	0.2634	0.20-0.32	97.4	95-105
CCV 160-122647/1	05/15/14 23:08	82232-334_00001	0.2761	0.20-0.32	102.1	95-105

Detector: AV82

Lab Sample ID	Analysis Date	Reagent ID	Efficiency	Efficiency Limits	Efficiency Recovery	Recovery Limits
IC 160-119926/1	05/01/14 19:15	82235-334_00001	0.2576	0.20-0.32		
ICV 160-121434/1	05/11/14 20:48	82234-334_00001	0.2576	0.20-0.32	100.0	95-105
CCV 160-122665/1	05/16/14 15:28	82235-334_00001	0.2594	0.20-0.32	100.7	95-105

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
12:05:34AM 5/8/2014

Calibration

Sample Name: ICV-9886;AV1-20140507
Description:
Detector: AV1

Calibration Date: 5/8/2014 12:05:29AM
Analyst: 60040

Source Info

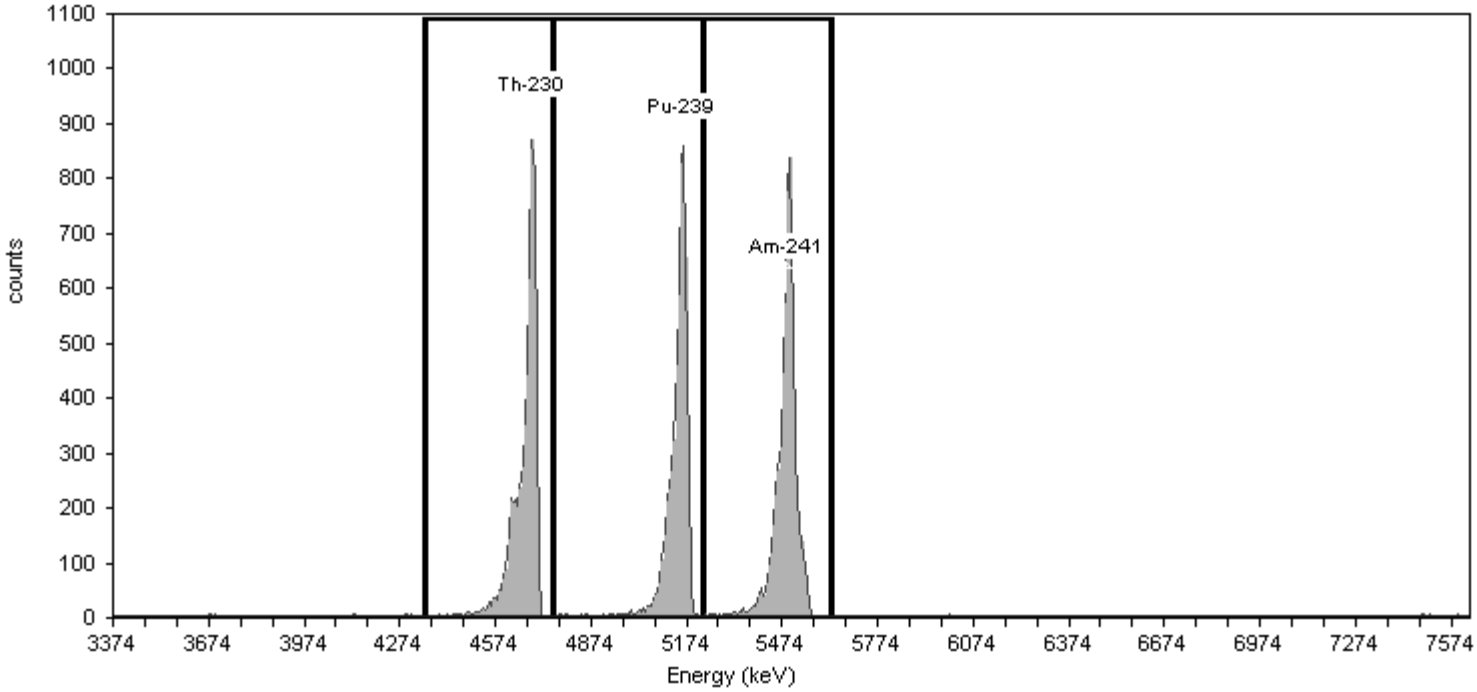
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV1 , SN: 49-188 AA4
Acquisition Start Date: 5/7/2014 11:01:59PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 25.24% +/- 0.45% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,533.00	92.22
Pu-239	240	5.16	186	249	5,365.00	89.42
Am-241	284	5.49	249	303	5,699.00	94.98

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
12:06:26AM 5/8/2014

Calibration

Sample Name: ICV-9794;AV11-20140507
Description:
Detector: AV11

Calibration Date: 5/8/2014 12:06:22AM
Analyst: 60040

Source Info

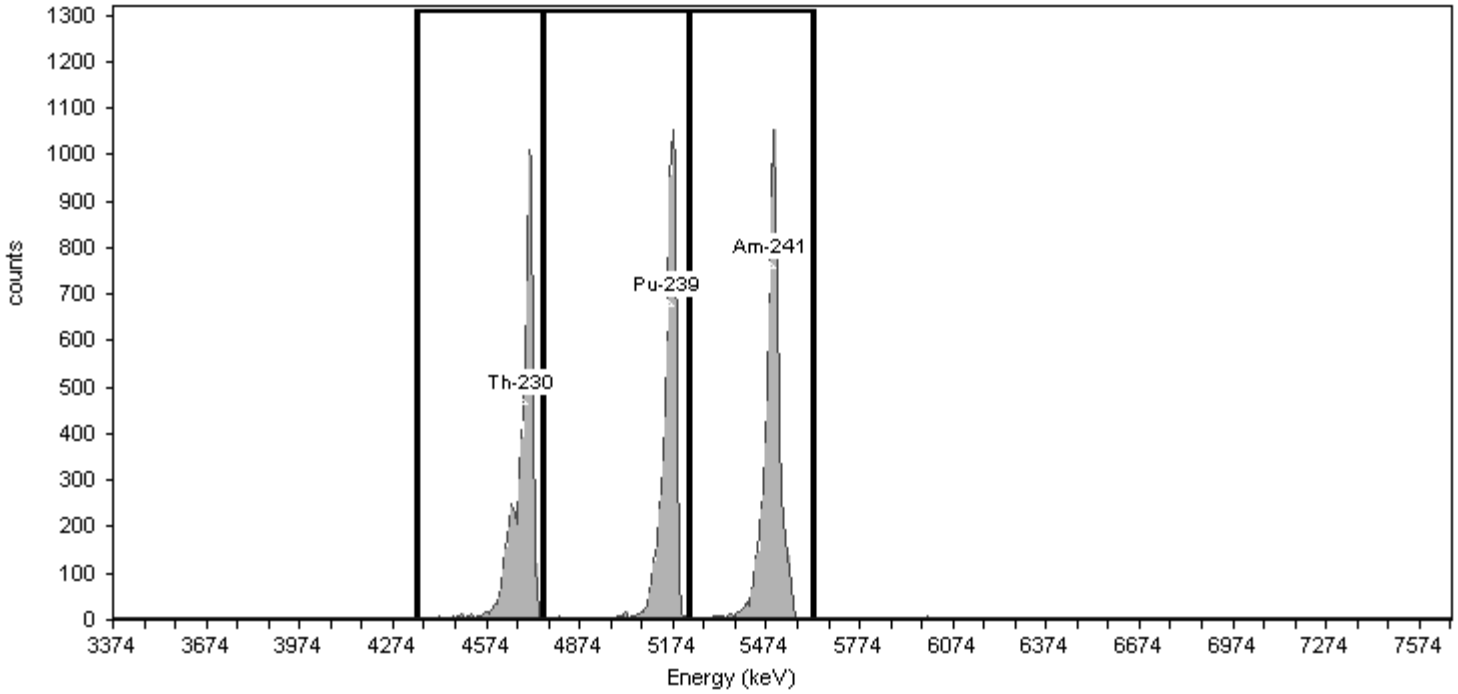
Certificate ID: 82242-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV11 , SN: 49-155dd2
Acquisition Start Date: 5/7/2014 11:04:13PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 25.98% +/- 0.43% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,238.00	103.97
Pu-239	240	5.16	186	249	5,922.00	98.70
Am-241	284	5.49	249	303	6,644.00	110.73

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
12:06:50AM 5/8/2014

Calibration

Sample Name: ICV-9885;AV15-20140507
Description:
Detector: AV15

Calibration Date: 5/8/2014 12:06:47AM
Analyst: 60040

Source Info

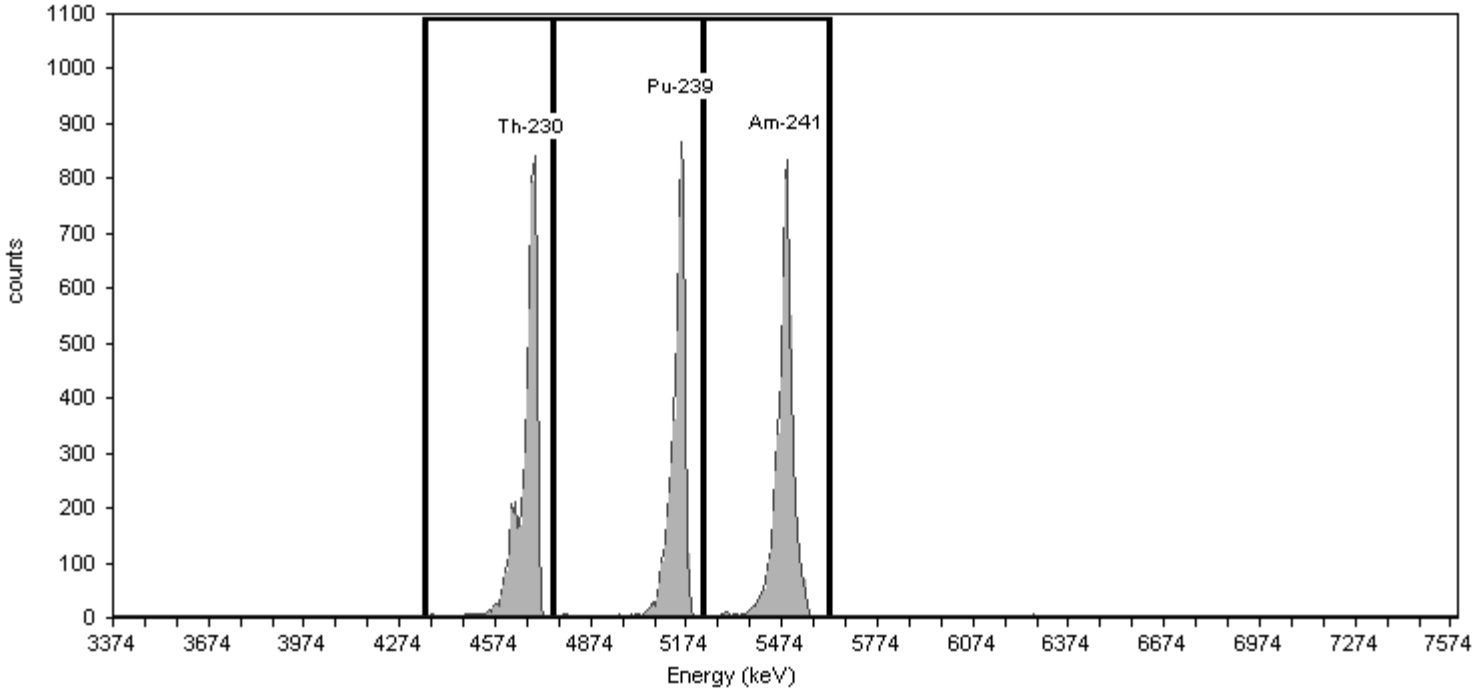
Certificate ID: 82246-334
Prepared by: Analytics

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

Acquisition

Detector: AV15 , SN: 41-172C5
Acquisition Start Date: 5/7/2014 11:04:58PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 25.90% +/- 0.49% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,224.00	87.07
Pu-239	240	5.16	186	249	4,981.00	83.02
Am-241	284	5.49	249	303	5,544.00	92.40

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:19:38PM 5/8/2014

Calibration

Sample Name: ICV-9886;AV16-20140507
Description:
Detector: AV16

Calibration Date: 5/8/2014 2:19:34PM
Analyst: 60040

Source Info

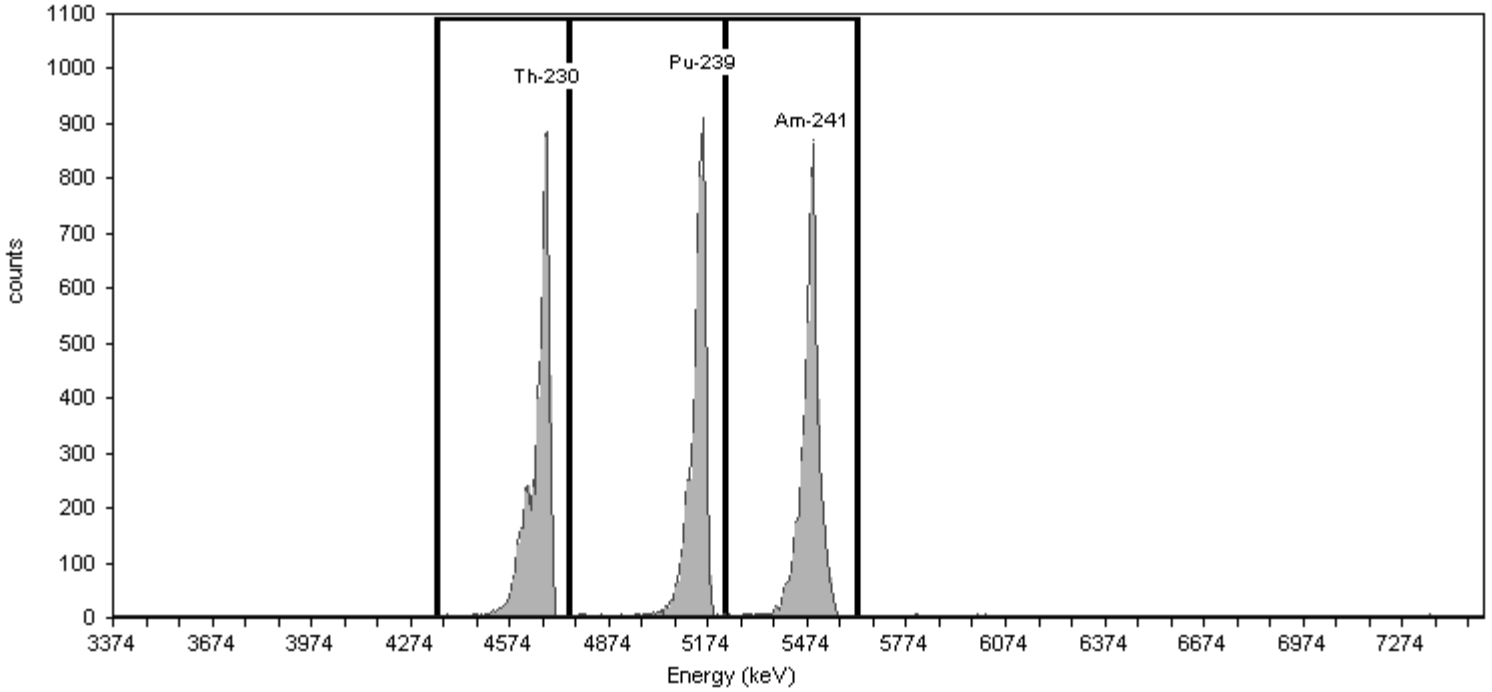
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV16 , SN: 51-082B6
Acquisition Start Date: 5/8/2014 12:14:17AM
Live Time: 60.00 min.
Real Time: 60.01 min.
Efficiency: 26.09% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,829.00	97.15
Pu-239	240	5.16	186	249	5,478.00	91.30
Am-241	284	5.49	249	303	5,844.00	97.40

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:19:44PM 5/8/2014

Calibration

Sample Name: ICV-7107;AV17-20140507
Description:
Detector: AV17

Calibration Date: 5/8/2014 2:19:41PM
Analyst: 60040

Source Info

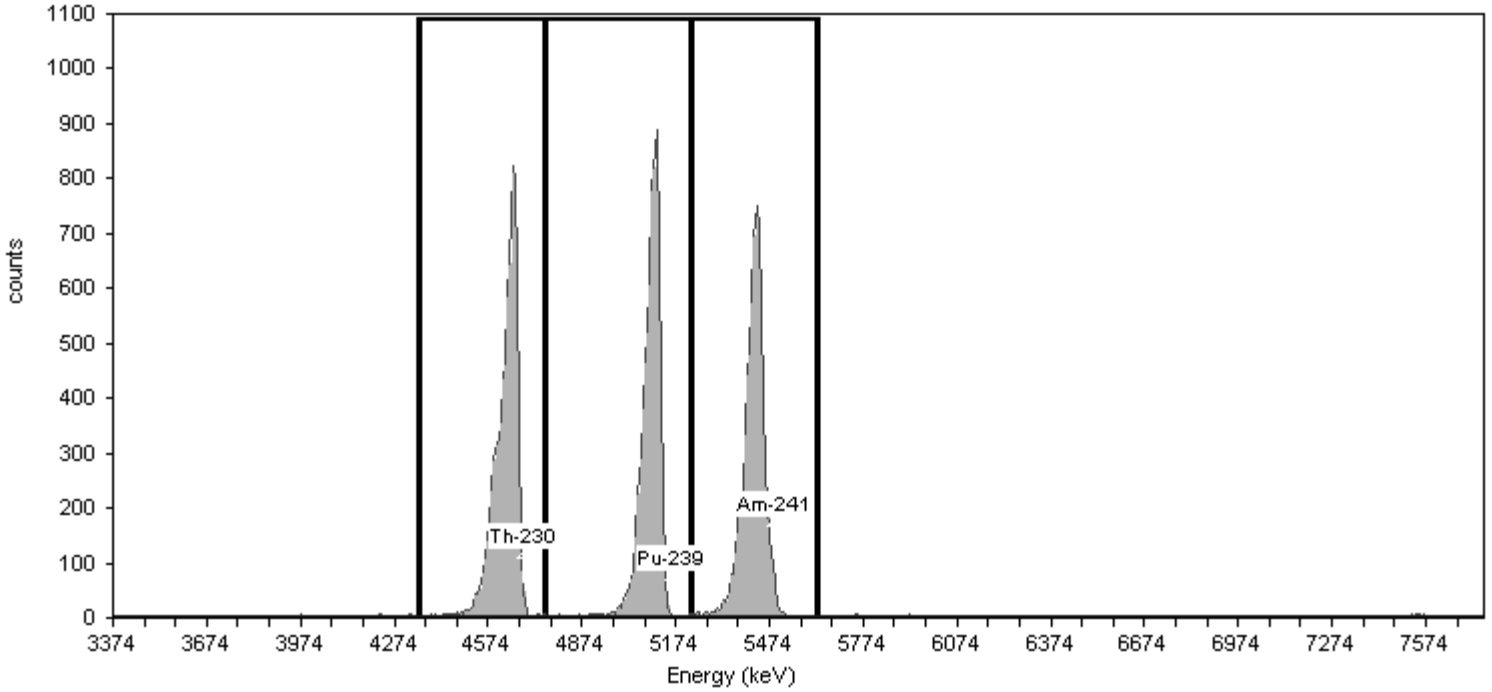
Certificate ID: 82232-334
Prepared by: Analytics

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

Acquisition

Detector: AV17 , SN: 50-051C4
Acquisition Start Date: 5/8/2014 12:14:34AM
Live Time: 60.00 min.
Real Time: 60.03 min.
Efficiency: 26.33% +/- 0.41% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	7,156.00	119.27
Pu-239	240	5.16	186	249	6,932.00	115.53
Am-241	284	5.49	249	303	6,785.00	113.08

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:19:50PM 5/8/2014

Calibration

Sample Name: ICV-8874;AV18-20140507
Description:
Detector: AV18

Calibration Date: 5/8/2014 2:19:46PM
Analyst: 60040

Source Info

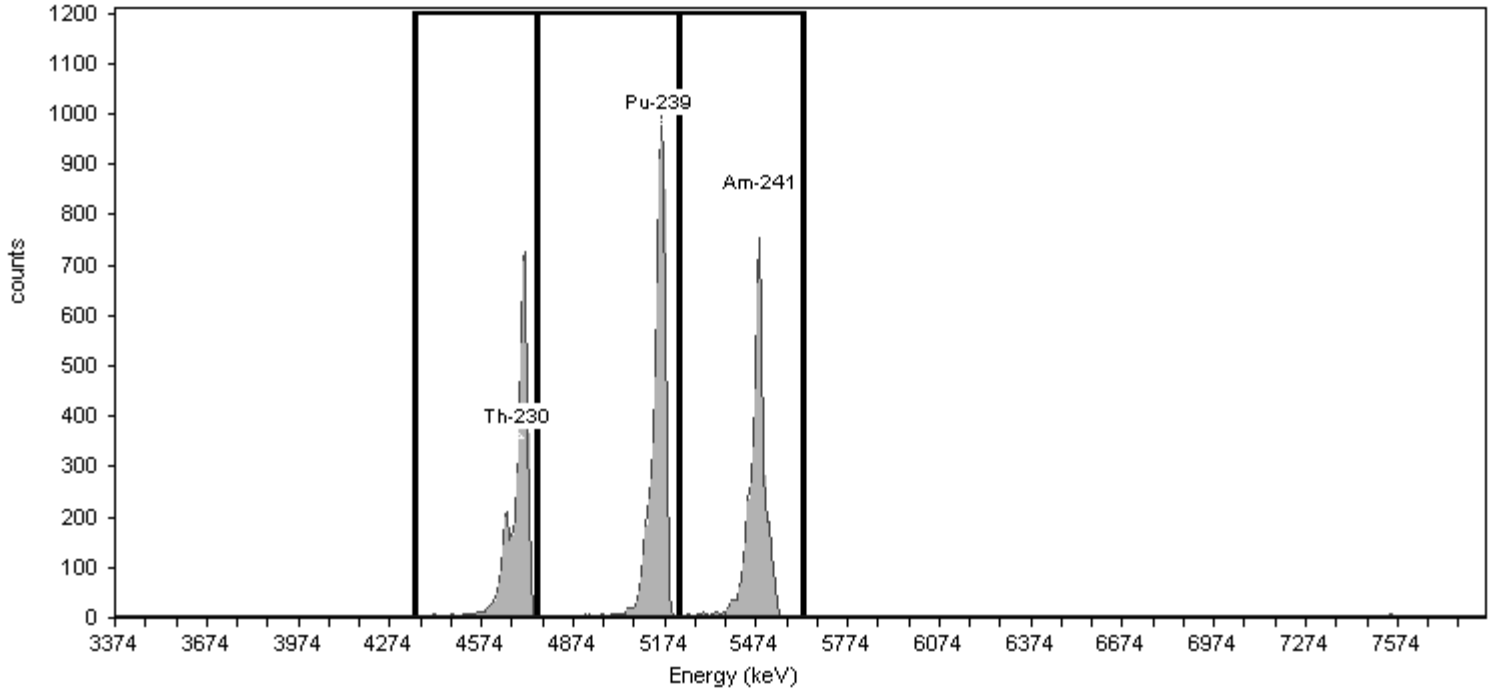
Certificate ID: 82233-334
Prepared by: Analytics

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

Acquisition

Detector: AV18 , SN: 51-082C5
Acquisition Start Date: 5/8/2014 12:14:45AM
Live Time: 60.00 min.
Real Time: 60.03 min.
Efficiency: 26.18% +/- 0.49% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	4,525.00	75.42
Pu-239	240	5.16	186	249	5,794.00	96.57
Am-241	284	5.49	249	303	4,855.00	80.92

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:56:20PM 5/8/2014

Calibration

Sample Name: ICV-8876;AV19-050814
Description:
Detector: AV19

Calibration Date: 5/8/2014 4:56:13PM
Analyst: 60040

Source Info

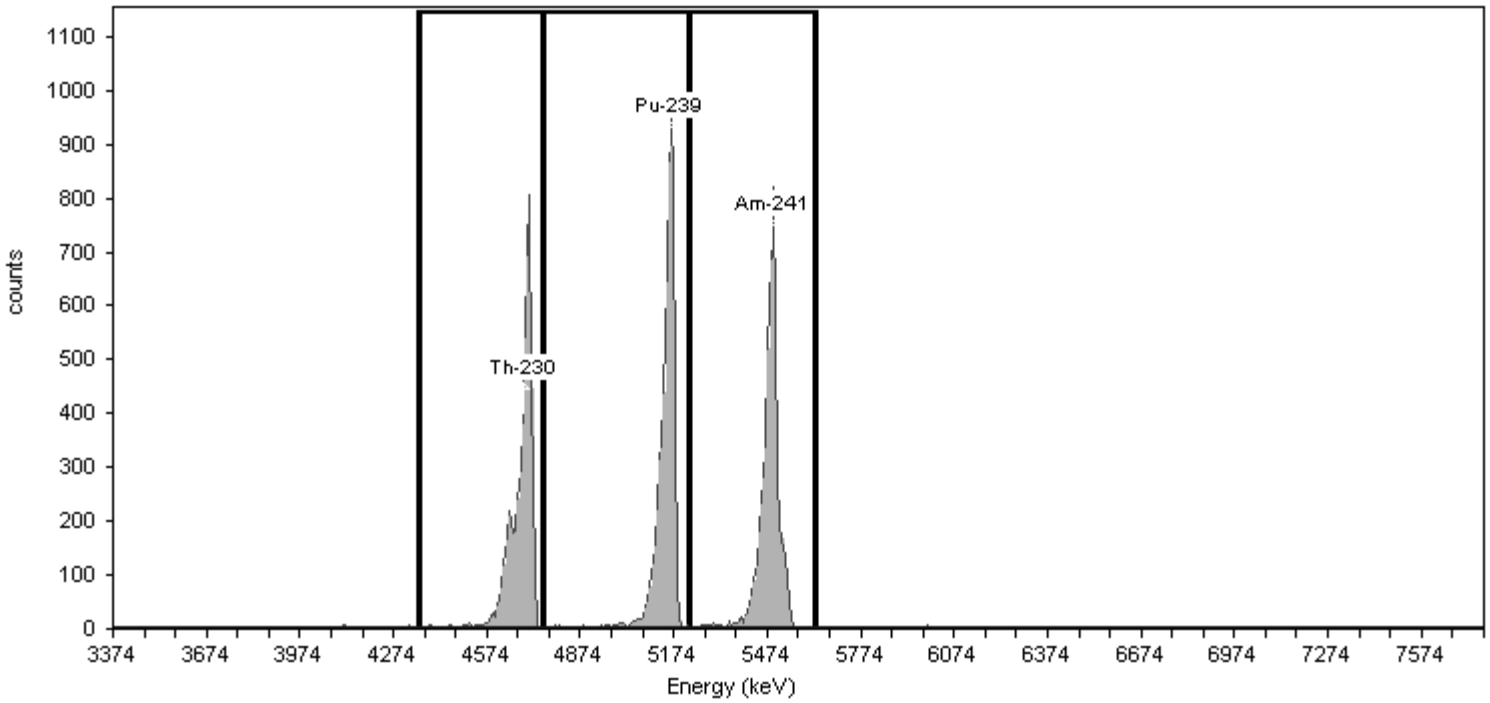
Certificate ID: 82234-334
Prepared by: Analytics

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

Acquisition

Detector: AV19 , SN: 50-025FF5
Acquisition Start Date: 5/8/2014 2:33:29PM
Live Time: 60.00 min.
Real Time: 60.01 min.
Efficiency: 24.96% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	4,852.00	80.87
Pu-239	240	5.16	186	249	5,673.00	94.55
Am-241	284	5.49	249	303	5,012.00	83.53

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
12:06:56AM 5/8/2014

Calibration

Sample Name: ICV-8876;AV20-20140507
Description:
Detector: AV20

Calibration Date: 5/8/2014 12:06:53AM
Analyst: 60040

Source Info

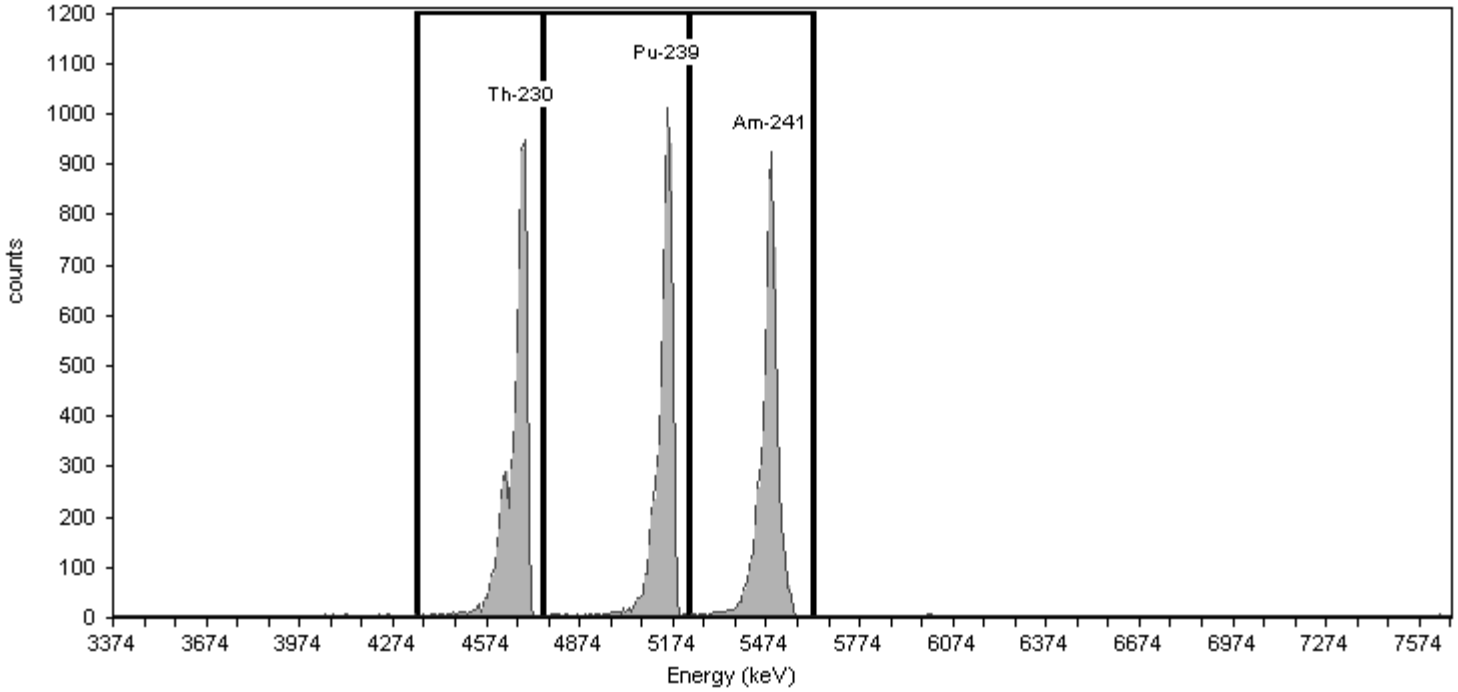
Certificate ID: 82235-334
Prepared by: Analytics

Certification Date: 6/4/2010 12:00:00PM
Description:

Acquisition

Detector: AV20 , SN: 48-121A7
Acquisition Start Date: 5/7/2014 11:05:20PM
Live Time: 60.00 min.
Real Time: 60.01 min.
Efficiency: 25.51% +/- 0.41% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,706.00	111.77
Pu-239	240	5.16	186	249	6,368.00	106.13
Am-241	284	5.49	249	303	6,673.00	111.22

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:20:08PM 5/8/2014

Calibration

Sample Name: ICV-9793;AV43-20140507
Description:
Detector: AV43

Calibration Date: 5/8/2014 2:20:05PM
Analyst: 60040

Source Info

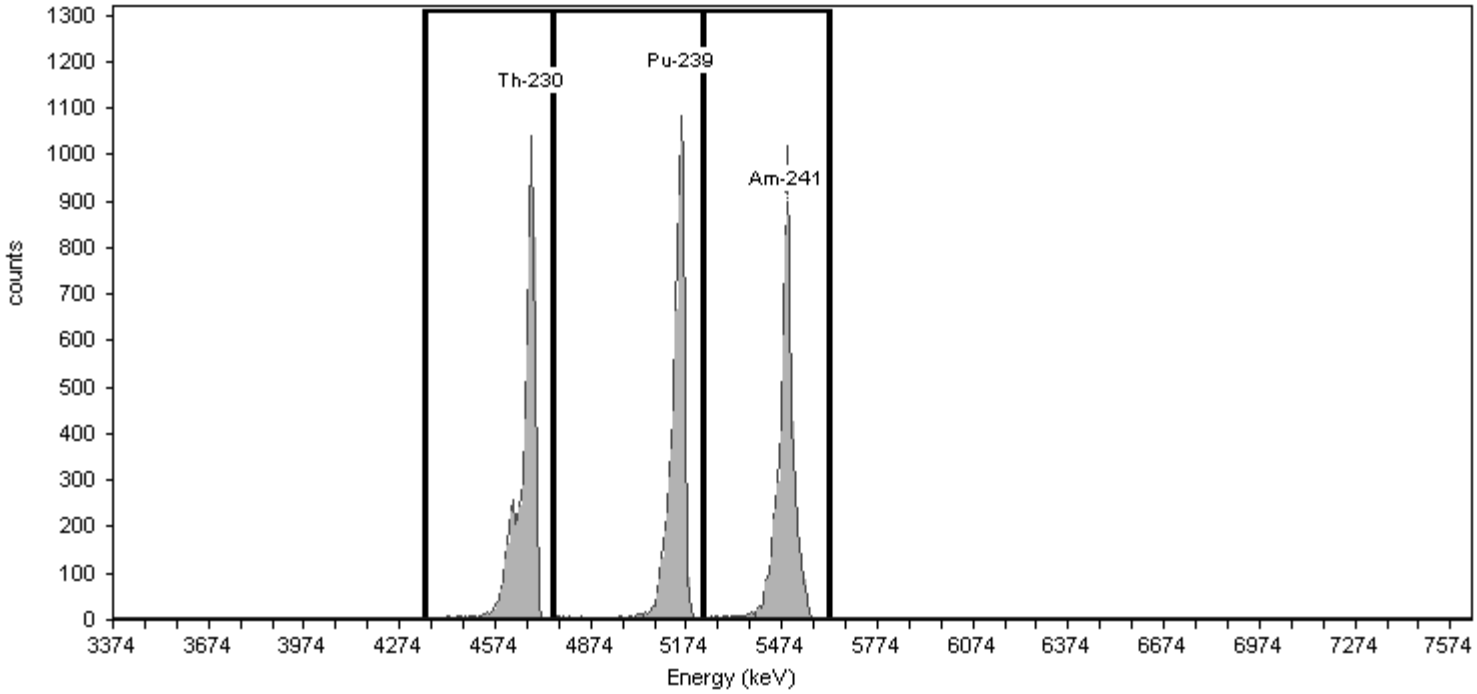
Certificate ID: 82241-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV43 , SN: 49-190X4
Acquisition Start Date: 5/8/2014 12:16:52AM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 25.68% +/- 0.43% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,093.00	101.55
Pu-239	240	5.16	186	249	6,250.00	104.17
Am-241	284	5.49	249	303	6,174.00	102.90

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:20:18PM 5/8/2014

Calibration

Sample Name: ICV-9794;AV44-20140507
Description:
Detector: AV44

Calibration Date: 5/8/2014 2:20:13PM
Analyst: 60040

Source Info

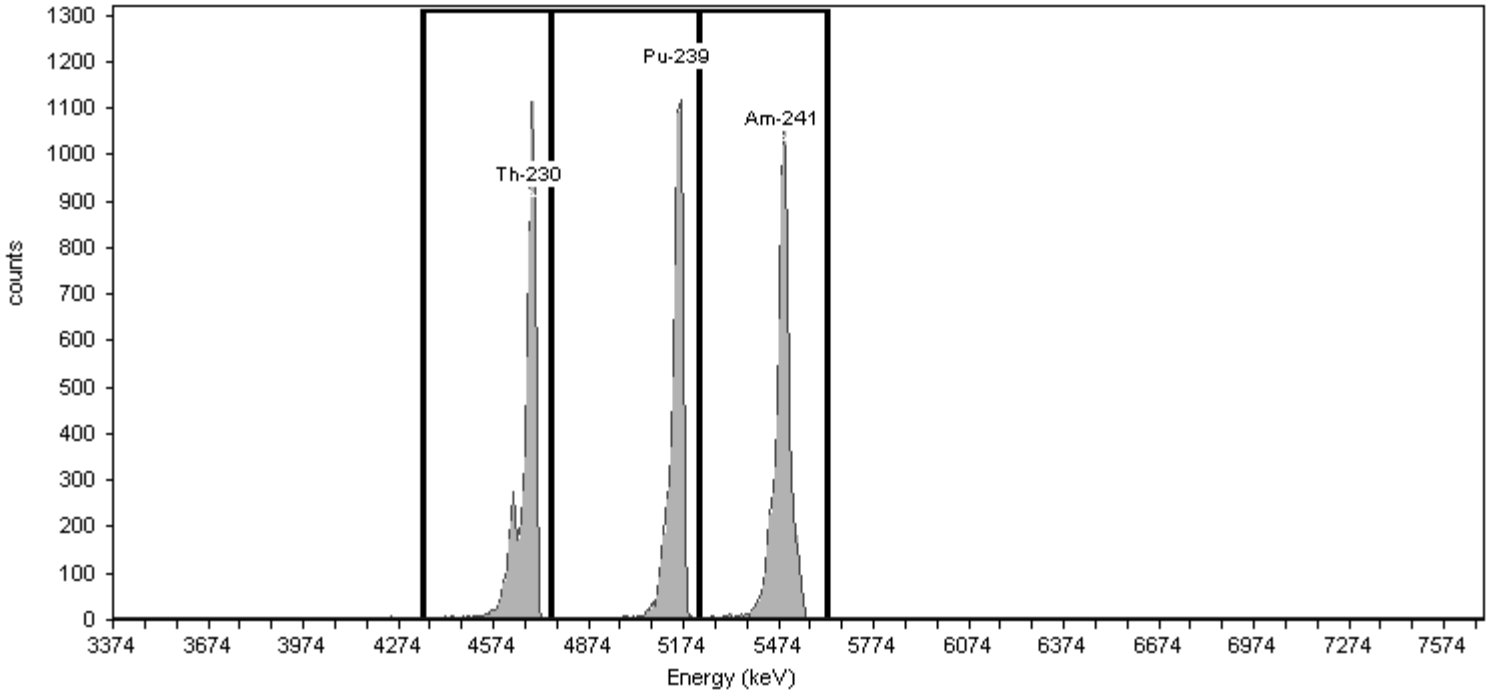
Certificate ID: 82242-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV44 , SN: 50-051JJ1
Acquisition Start Date: 5/8/2014 12:17:17AM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 25.94% +/- 0.43% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,074.00	101.23
Pu-239	240	5.16	186	249	5,990.00	99.83
Am-241	284	5.49	249	303	6,711.00	111.85

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:56:13PM 5/8/2014

Calibration

Sample Name: ICV-9795;AV45-050814
Description:
Detector: AV45

Calibration Date: 5/8/2014 4:56:08PM
Analyst: 60040

Source Info

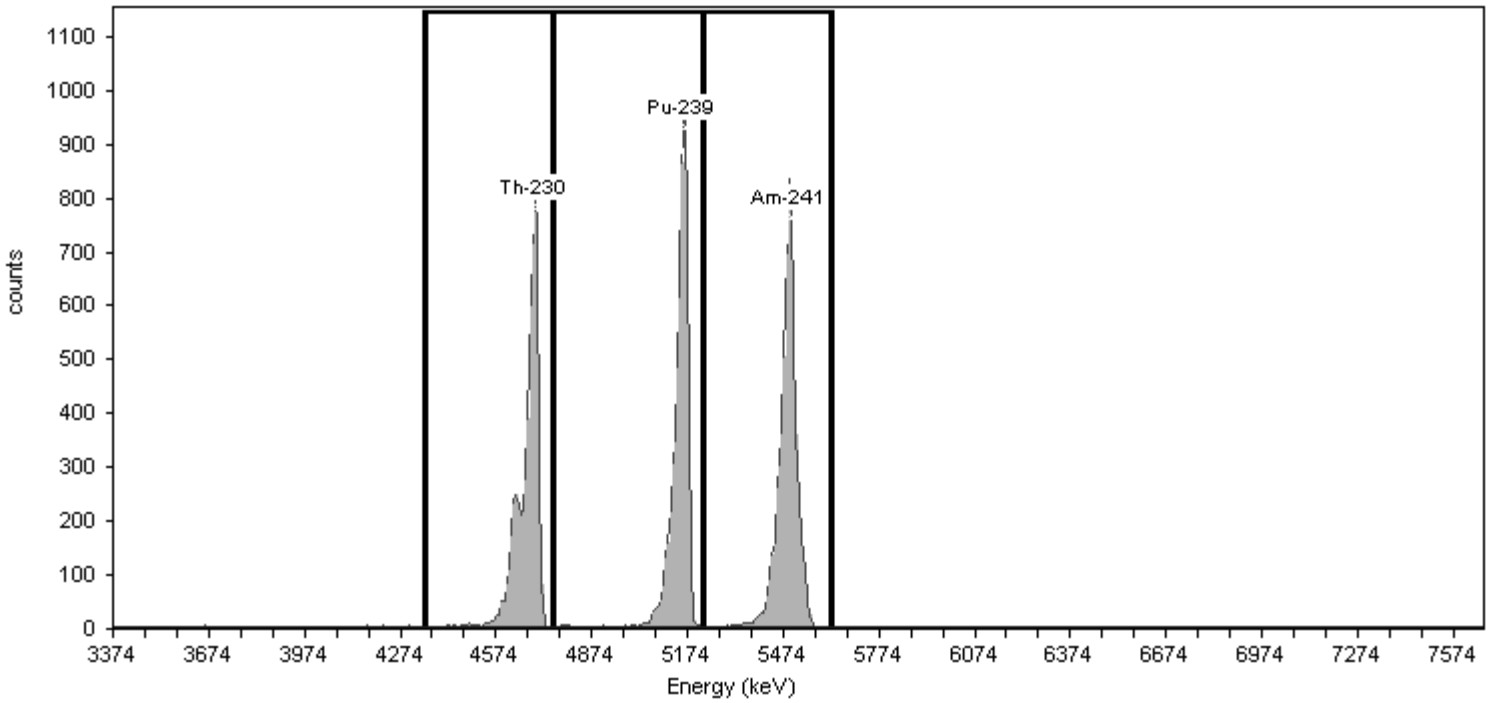
Certificate ID: 82243-334
Prepared by: Analytics

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

Acquisition

Detector: AV45 , SN: 48-158FF2
Acquisition Start Date: 5/8/2014 2:32:48PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 26.58% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,659.00	94.32
Pu-239	240	5.16	186	249	5,682.00	94.70
Am-241	284	5.49	249	303	6,066.00	101.10

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:20:40PM 5/8/2014

Calibration

Sample Name: ICV-9817;AV46-20140507
Description:
Detector: AV46

Calibration Date: 5/8/2014 2:20:37PM
Analyst: 60040

Source Info

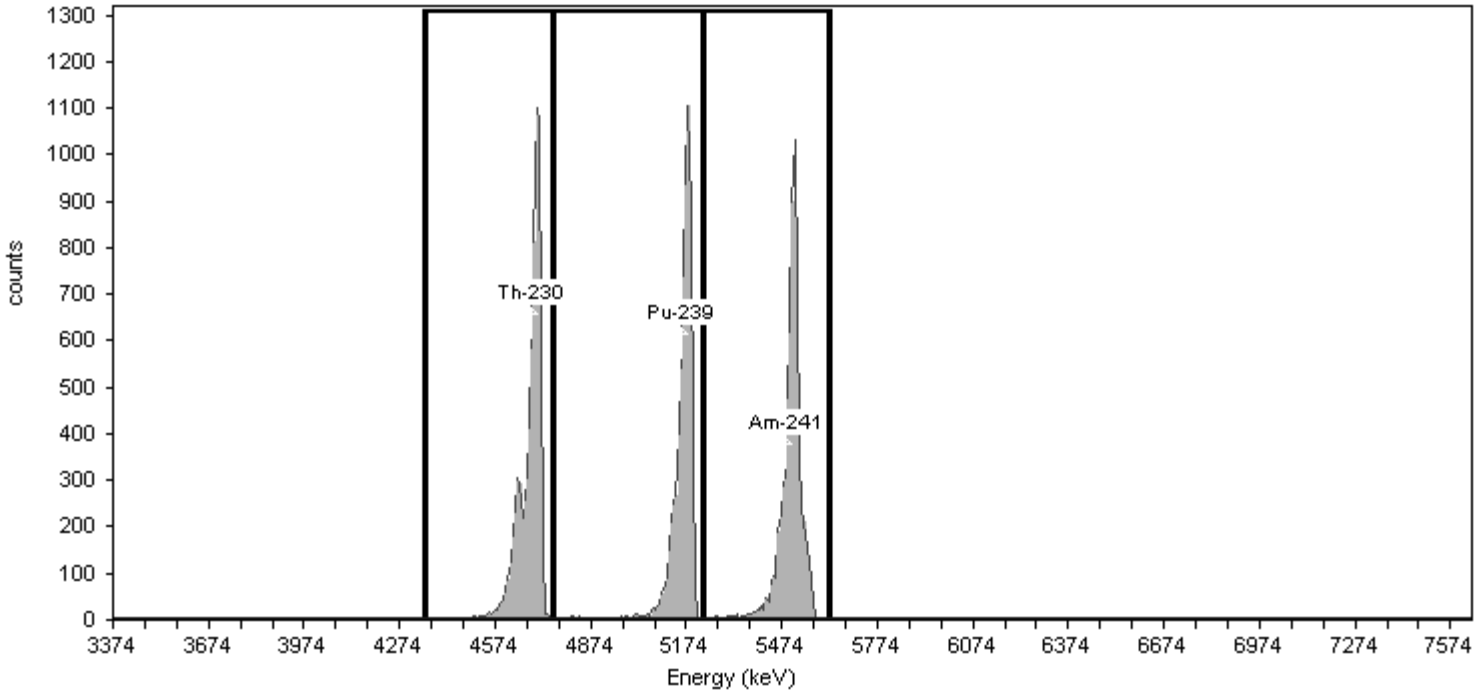
Certificate ID: 82244-334
Prepared by: Analytics

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

Acquisition

Detector: AV46 , SN: 49-202GG2
Acquisition Start Date: 5/8/2014 12:18:27AM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 26.10% +/- 0.42% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,959.00	115.98
Pu-239	240	5.16	186	249	6,287.00	104.78
Am-241	284	5.49	249	303	6,423.00	107.05

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
2:20:52PM 5/8/2014

Calibration

Sample Name: ICV-9885;AV48-20140507
Description:
Detector: AV48

Calibration Date: 5/8/2014 2:20:49PM
Analyst: 60040

Source Info

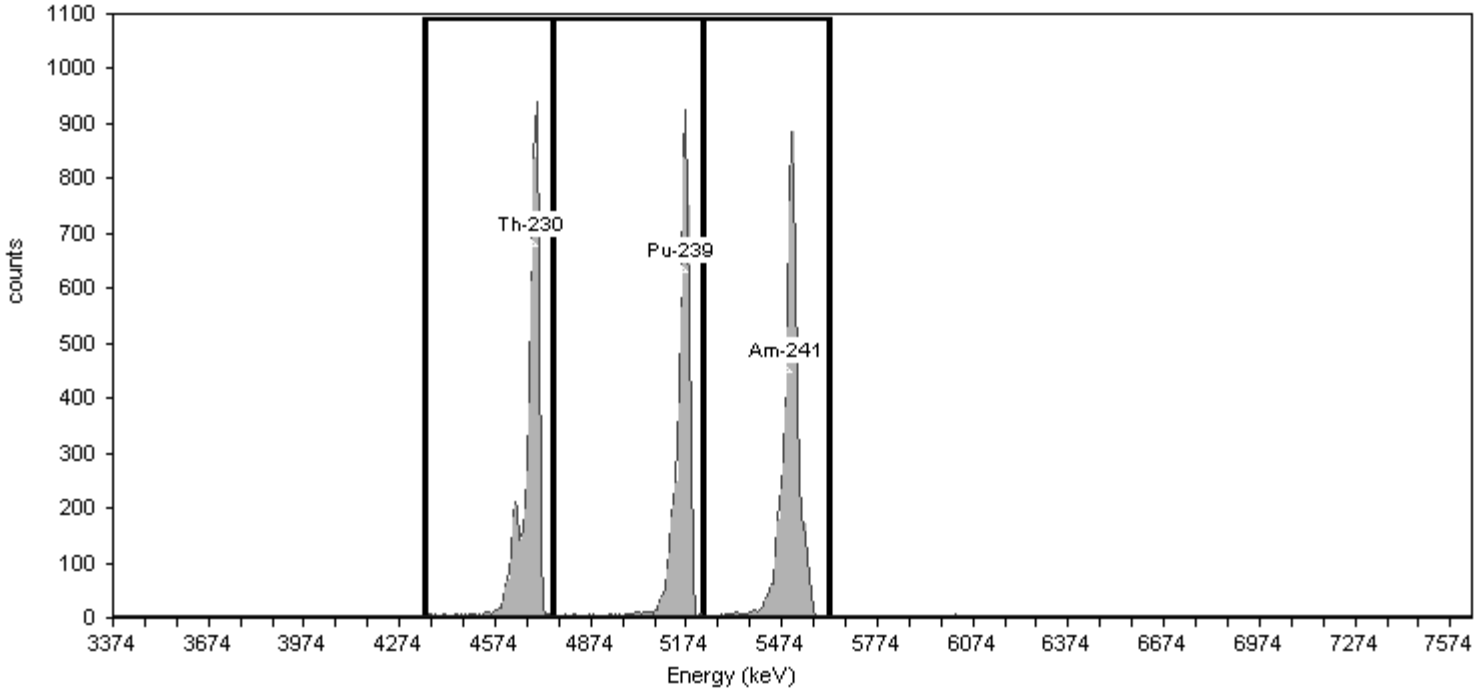
Certificate ID: 82246-334
Prepared by: Analytics

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

Acquisition

Detector: AV48 , SN: 50-051JJ4
Acquisition Start Date: 5/8/2014 12:18:29AM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 26.00% +/- 0.49% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,274.00	87.90
Pu-239	240	5.16	186	249	4,946.00	82.43
Am-241	284	5.49	249	303	5,595.00	93.25

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:56:53PM 5/8/2014

Calibration

Sample Name: ICV-9792;AV57-050814
Description:
Detector: AV57

Calibration Date: 5/8/2014 4:56:50PM
Analyst: 60040

Source Info

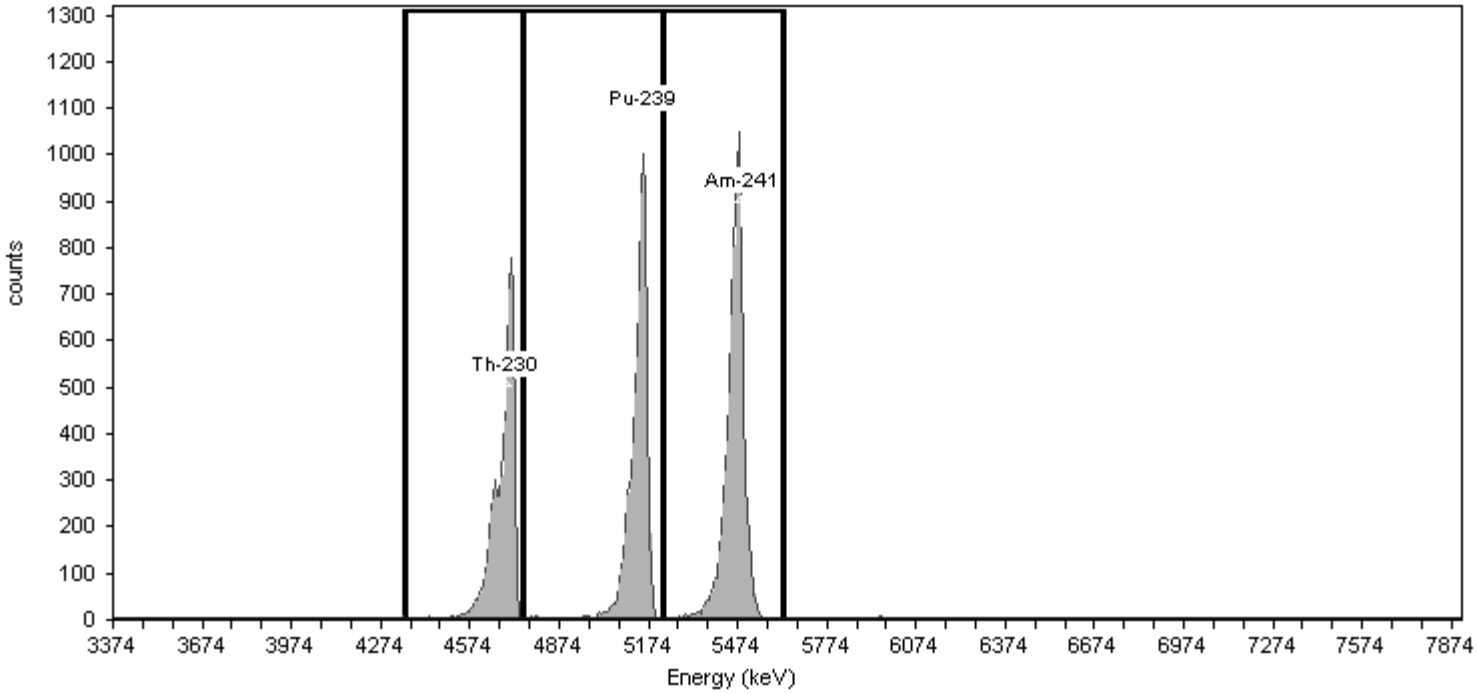
Certificate ID: 82240-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV57 , SN: 48-158EE3
Acquisition Start Date: 5/8/2014 2:35:05PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 26.76% +/- 0.42% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,940.00	99.00
Pu-239	240	5.16	186	249	7,041.00	117.35
Am-241	284	5.49	249	303	7,940.00	132.33

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:56:59PM 5/8/2014

Calibration

Sample Name: ICV-9793;AV58-050814
Description:
Detector: AV58

Calibration Date: 5/8/2014 4:56:56PM
Analyst: 60040

Source Info

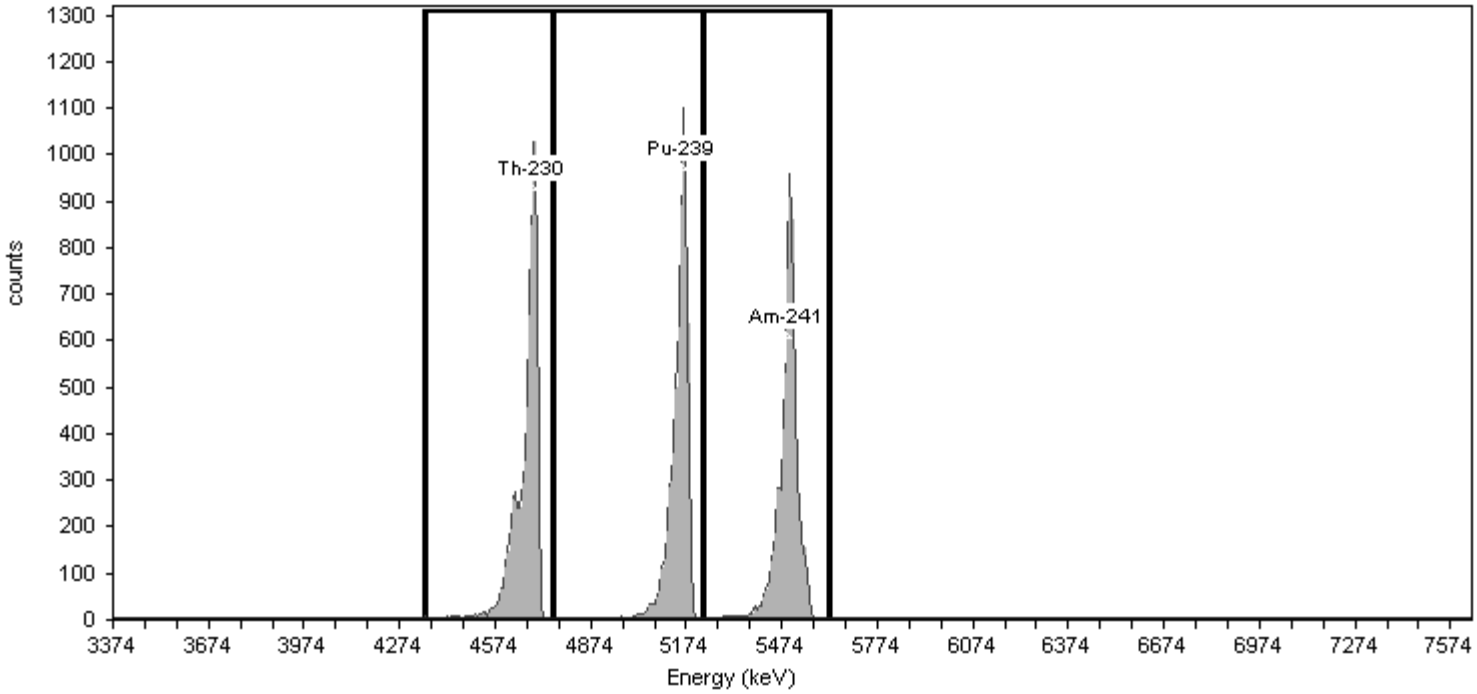
Certificate ID: 82241-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV58 , SN: 52-102 C5
Acquisition Start Date: 5/8/2014 2:35:18PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 27.10% +/- 0.44% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,559.00	109.32
Pu-239	240	5.16	186	249	6,569.00	109.48
Am-241	284	5.49	249	303	6,413.00	106.88

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:57:08PM 5/8/2014

Calibration

Sample Name: ICV-9794;AV59-050814
Description:
Detector: AV59

Calibration Date: 5/8/2014 4:57:05PM
Analyst: 60040

Source Info

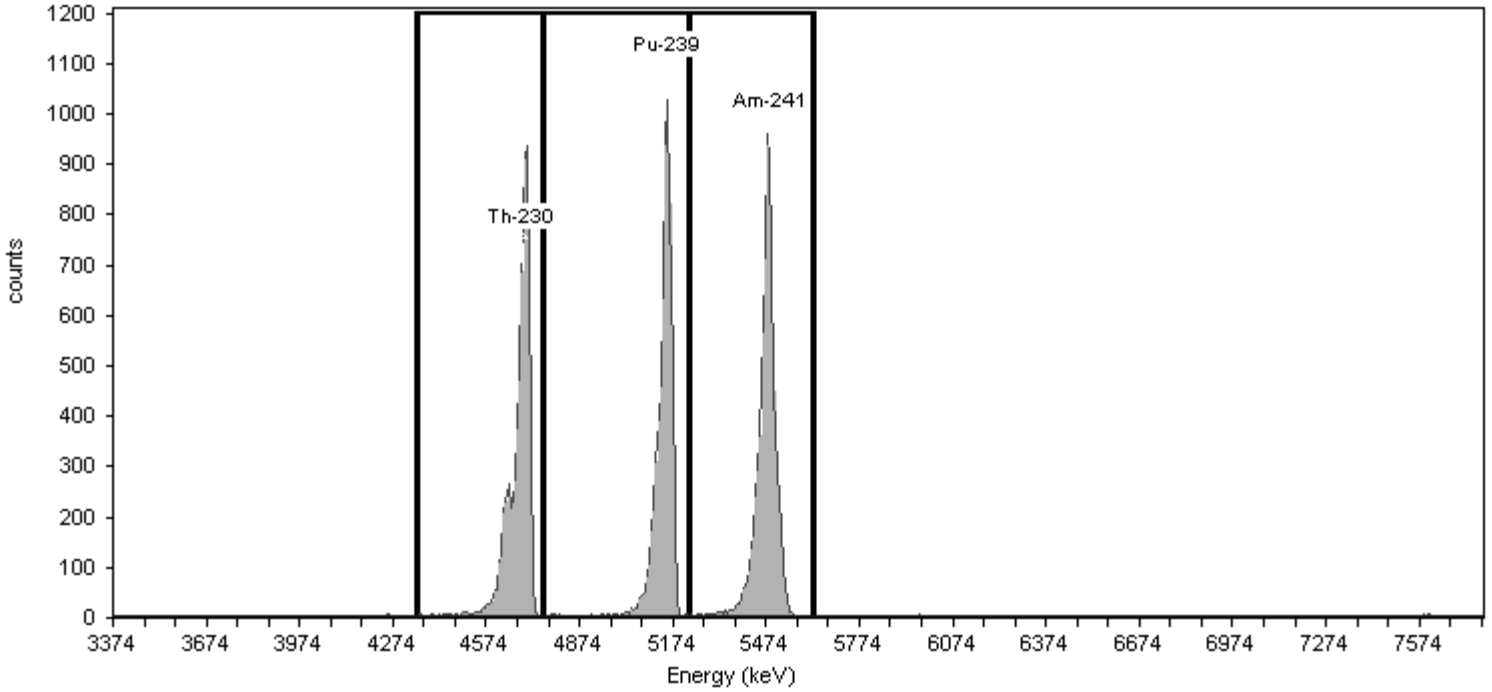
Certificate ID: 82242-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV59 , SN: 49-155M7
Acquisition Start Date: 5/8/2014 2:36:11PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 26.77% +/- 0.44% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,424.00	107.07
Pu-239	240	5.16	186	249	6,120.00	102.00
Am-241	284	5.49	249	303	6,829.00	113.82

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
7:24:44PM 5/11/2014

Calibration

Sample Name: ICV-9795;AV60-20140508
Description:
Detector: AV60

Calibration Date: 5/11/2014 7:13:44PM
Analyst: 60040

Source Info

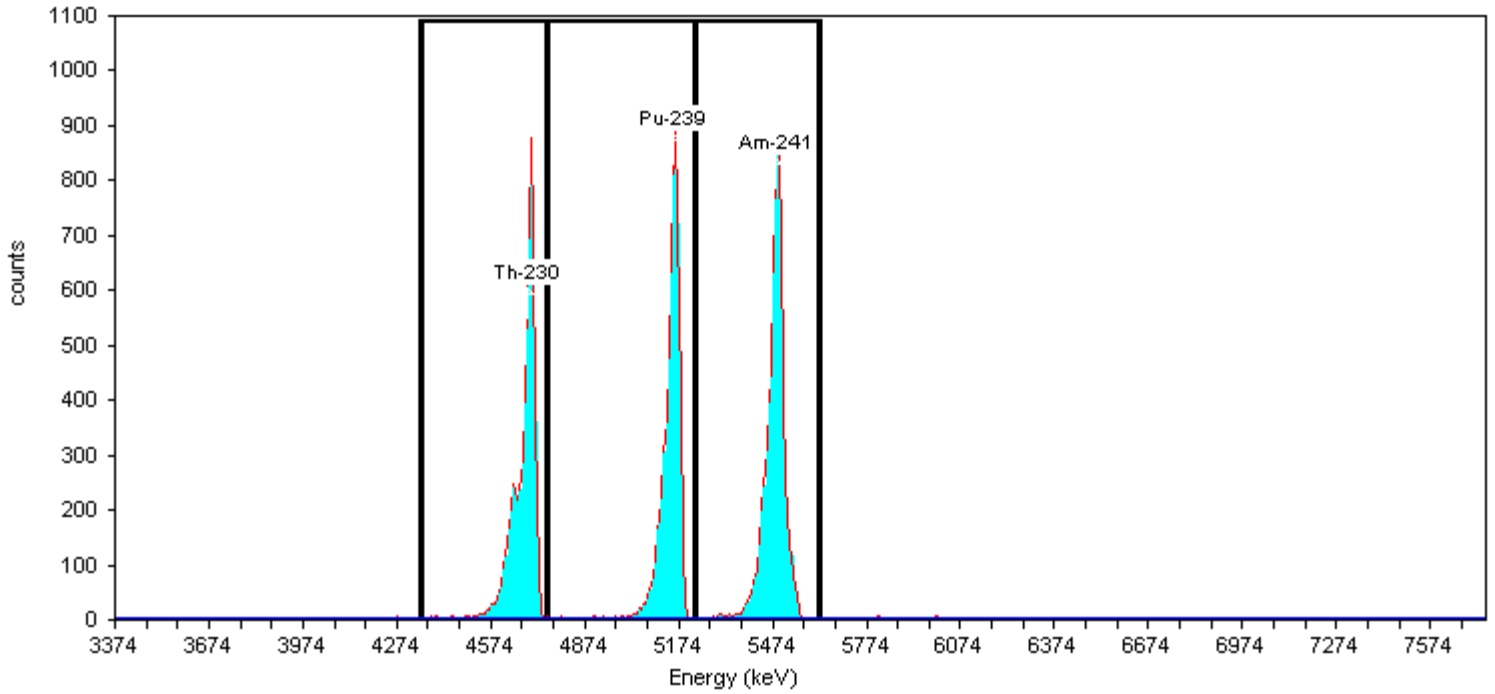
Certificate ID: 82243-334
Prepared by: Analytics

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

Acquisition

Detector: AV60 , SN: 49-027117
Acquisition Start Date: 5/8/2014 5:21:42PM
Live Time: 60.00 min.
Real Time: 60.01 min.
Efficiency: 27.25% +/- 0.47% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,727.00	95.45
Pu-239	240	5.16	186	249	5,760.00	96.00
Am-241	284	5.49	249	303	6,362.00	106.03

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:57:49PM 5/8/2014

Calibration

Sample Name: ICV-9817;AV61-050814
Description:
Detector: AV61

Calibration Date: 5/8/2014 4:57:46PM
Analyst: 60040

Source Info

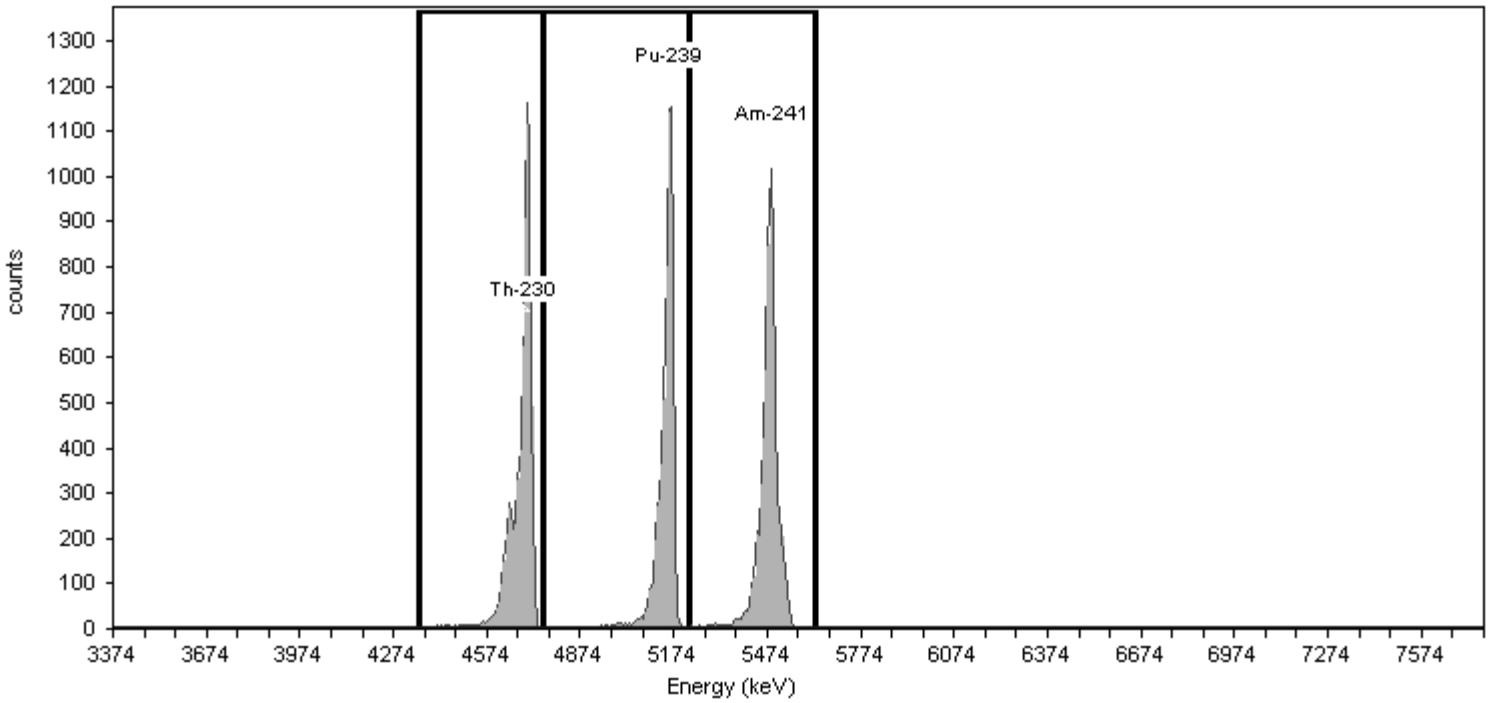
Certificate ID: 82244-334
Prepared by: Analytics

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

Acquisition

Detector: AV61 , SN: 5-051JJ3
Acquisition Start Date: 5/8/2014 2:36:18PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 25.81% +/- 0.42% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,807.00	113.45
Pu-239	240	5.16	186	249	6,203.00	103.38
Am-241	284	5.49	249	303	6,437.00	107.28

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:57:55PM 5/8/2014

Calibration

Sample Name: ICV-9884;AV62-050814
Description:
Detector: AV62

Calibration Date: 5/8/2014 4:57:52PM
Analyst: 60040

Source Info

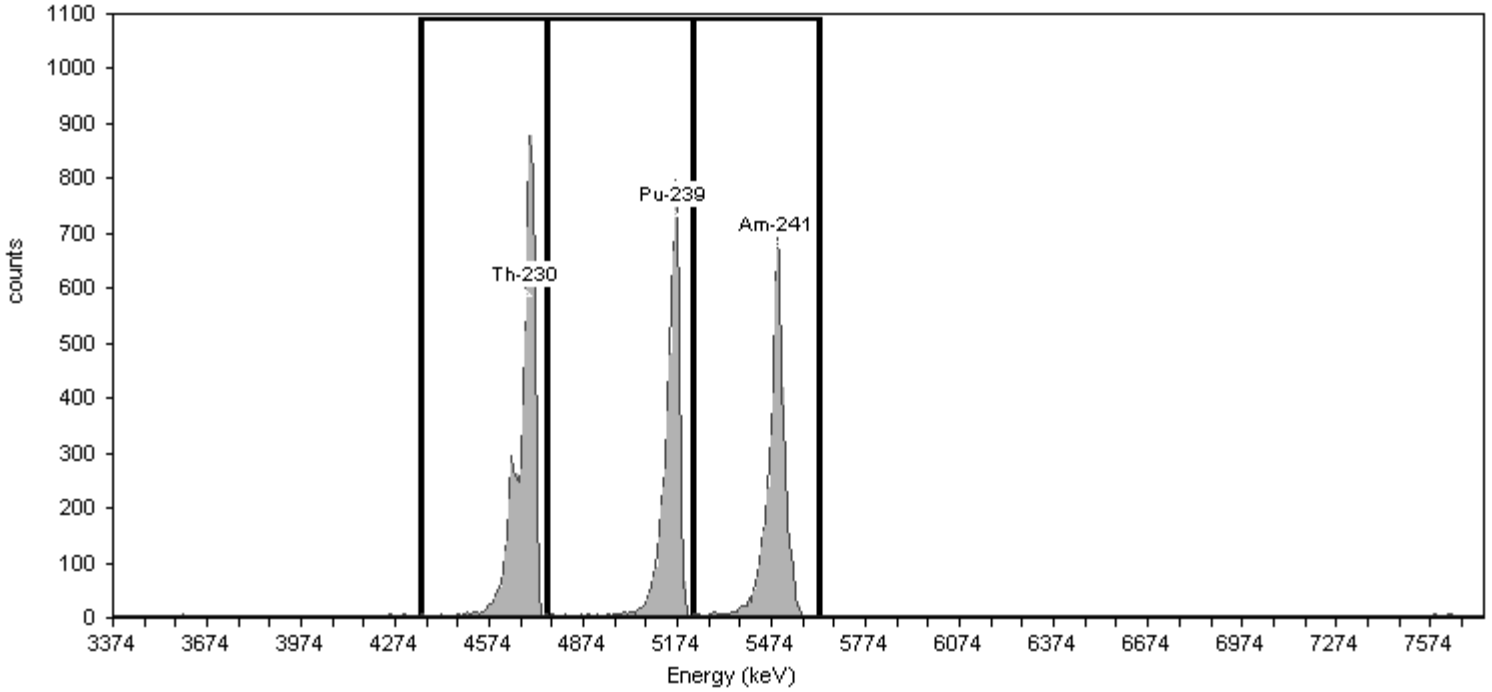
Certificate ID: 82245-334
Prepared by: Analytics

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

Acquisition

Detector: AV62 , SN: 52-060FF2
Acquisition Start Date: 5/8/2014 2:36:19PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 26.22% +/- 0.48% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,368.00	106.13
Pu-239	240	5.16	186	249	5,206.00	86.77
Am-241	284	5.49	249	303	5,104.00	85.07

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
7:25:47PM 5/11/2014

Calibration

Sample Name: ICV-9885;AV78-20140508
Description:
Detector: AV78

Calibration Date: 5/11/2014 7:13:19PM
Analyst: 60040

Source Info

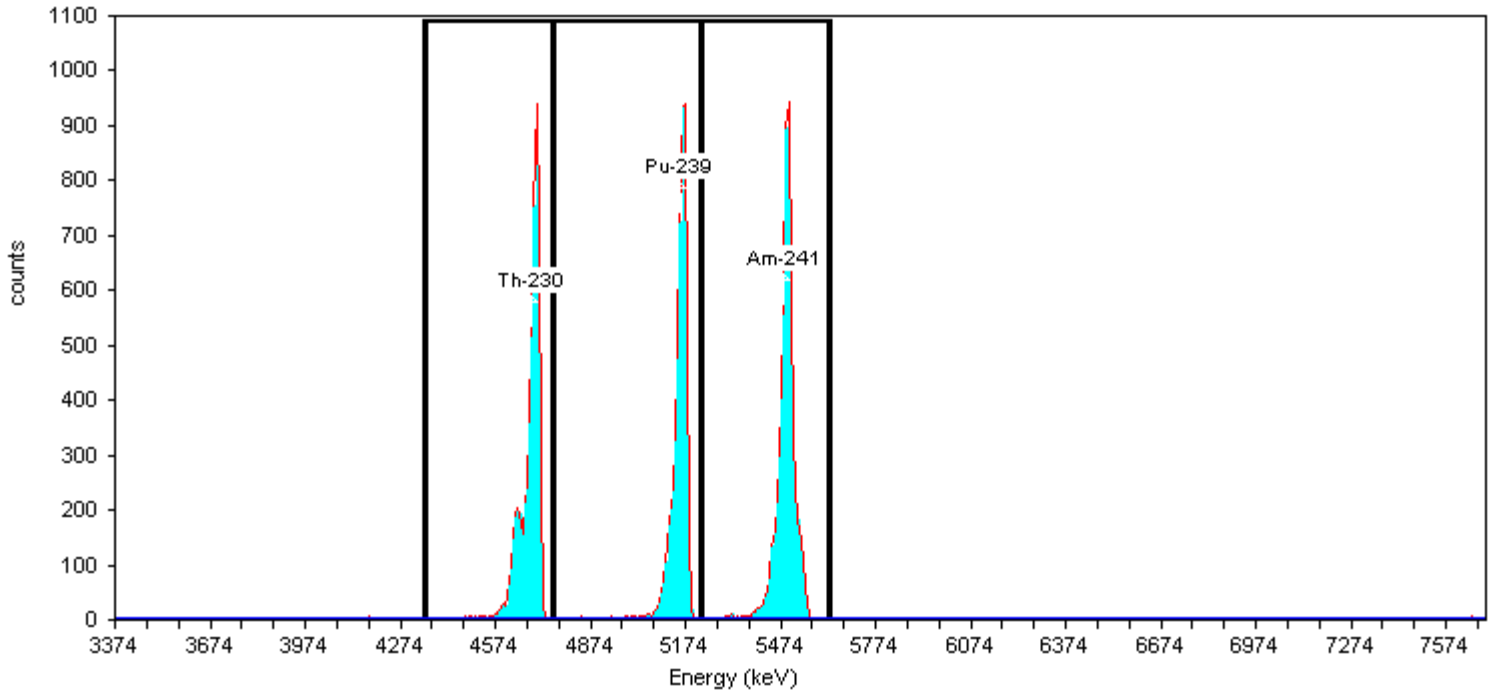
Certificate ID: 82246-334
Prepared by: Analytics

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

Acquisition

Detector: AV78 , SN: 46-033FF4
Acquisition Start Date: 5/8/2014 5:20:32PM
Live Time: 60.00 min.
Real Time: 60.01 min.
Efficiency: 26.00% +/- 0.49% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,193.00	86.55
Pu-239	240	5.16	186	249	5,036.00	83.93
Am-241	284	5.49	249	303	5,583.00	93.05

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:53:16PM 5/11/2014

Calibration

Sample Name: ICV-9886;AV79-20140511
Description:
Detector: AV79

Calibration Date: 5/11/2014 9:53:12PM
Analyst: 60040

Source Info

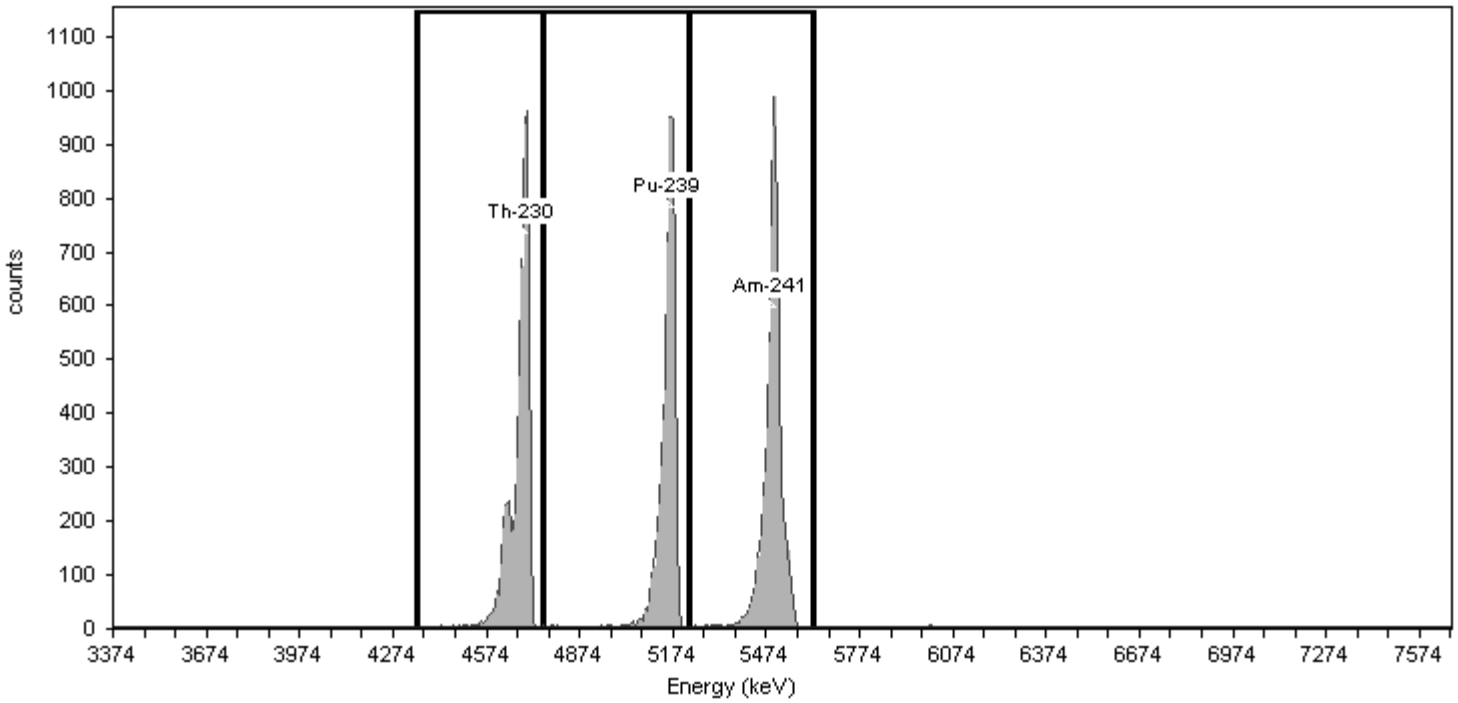
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV79 , SN: 46-033Q5
Acquisition Start Date: 5/11/2014 8:47:29PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 26.34% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,837.00	97.28
Pu-239	240	5.16	186	249	5,415.00	90.25
Am-241	284	5.49	249	303	6,065.00	101.08

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:53:31PM 5/11/2014

Calibration

Sample Name: ICV-8875;AV82-20140511
Description:
Detector: AV82

Calibration Date: 5/11/2014 9:53:28PM
Analyst: 60040

Source Info

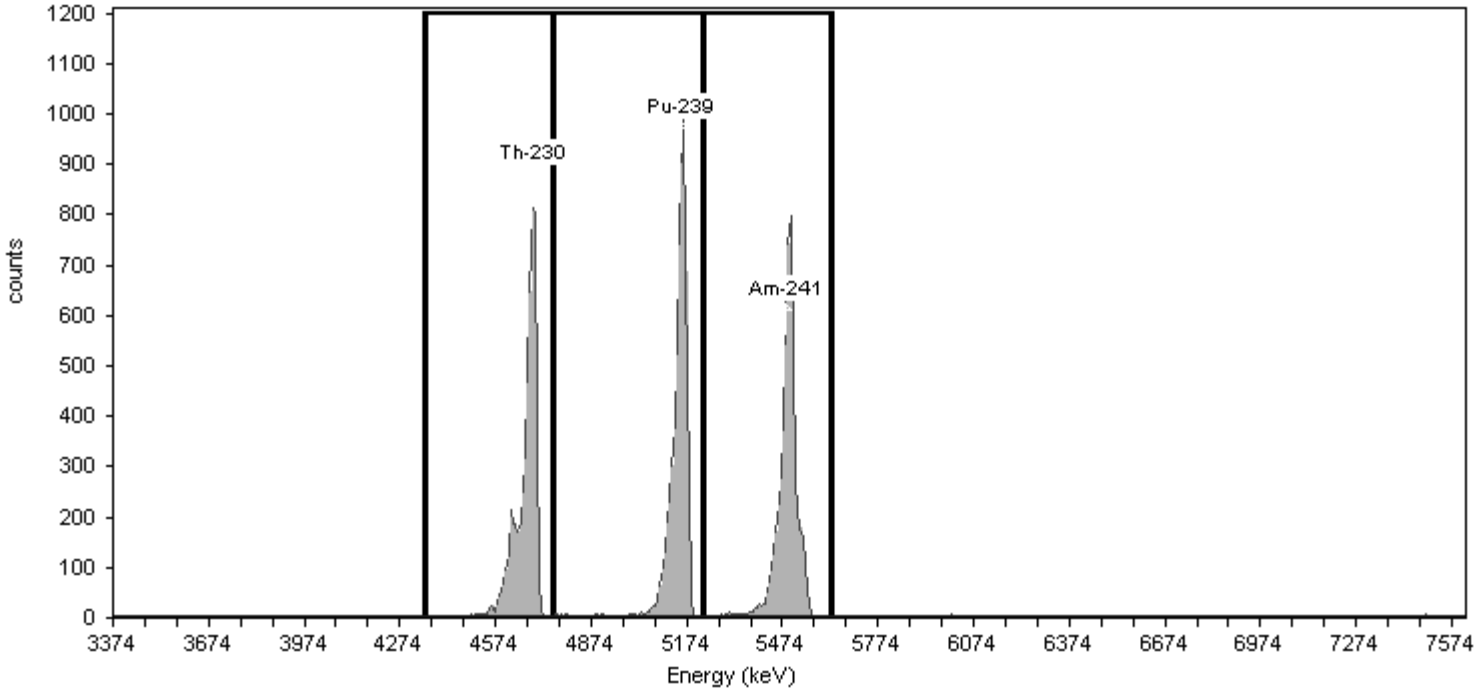
Certificate ID: 82234-334
Prepared by: Analytics

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

Acquisition

Detector: AV82 , SN: 46-032EE5
Acquisition Start Date: 5/11/2014 8:48:04PM
Live Time: 60.01 min.
Real Time: 60.03 min.
Efficiency: 25.76% +/- 0.47% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,130.00	85.49
Pu-239	240	5.16	186	249	5,712.00	95.19
Am-241	284	5.49	249	303	5,161.00	86.00

Monthly Calibration Verifications

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:37:10PM 5/18/2014

Calibration

Sample Name: CCV-7107;AV1-20140518
Description:
Detector: AV1

Calibration Date: 5/18/2014 8:37:07PM
Analyst: 60040

Source Info

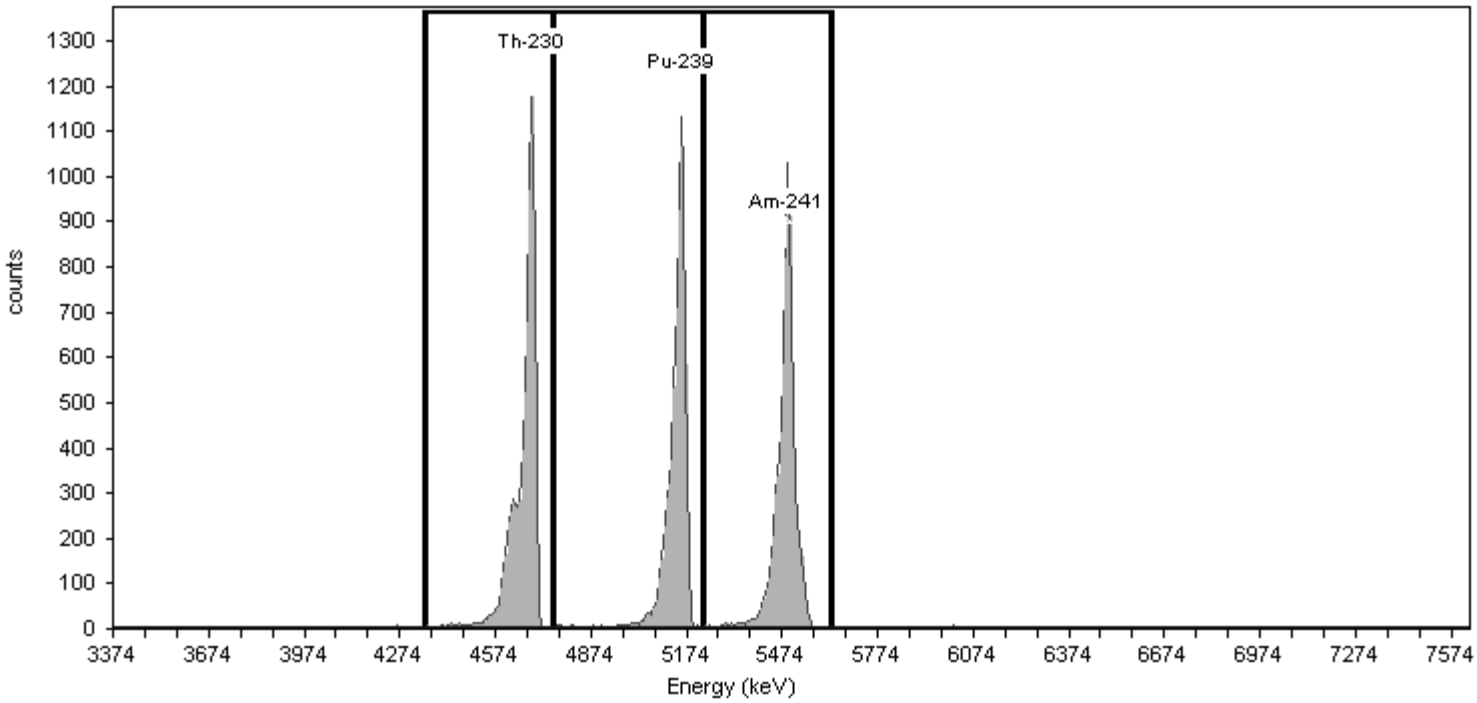
Certificate ID: 82232-334
Prepared by: Analytics

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

Acquisition

Detector: AV1 , SN: 49-188 AA4
Acquisition Start Date: 5/18/2014 7:19:05PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 26.51% +/- 0.41% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	7,273.00	121.22
Pu-239	240	5.16	186	249	6,910.00	115.17
Am-241	284	5.49	249	303	6,824.00	113.73

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
7:20:50PM 5/19/2014

Calibration

Sample Name: CCV-9795;AV11-20140519
Description:
Detector: AV11

Calibration Date: 5/19/2014 7:20:47PM
Analyst: 60040

Source Info

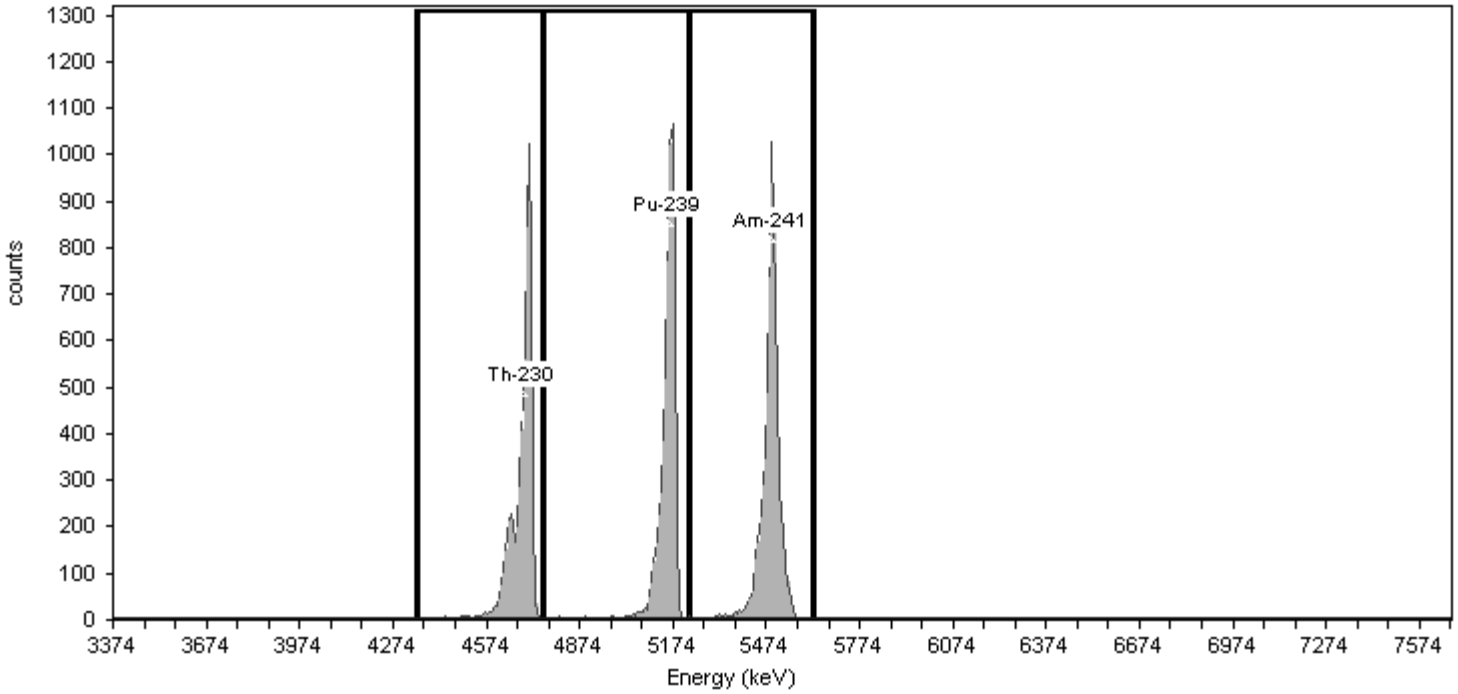
Certificate ID: 82243-334
Prepared by: Analytics

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

Acquisition

Detector: AV11 , SN: 49-155dd2
Acquisition Start Date: 5/19/2014 5:57:32PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 26.73% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,707.00	95.12
Pu-239	240	5.16	186	249	5,760.00	96.00
Am-241	284	5.49	249	303	6,043.00	100.72

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:38:22PM 5/18/2014

Calibration

Sample Name: CCV-9886;AV15-20140518
Description:
Detector: AV15

Calibration Date: 5/18/2014 8:38:19PM
Analyst: 60040

Source Info

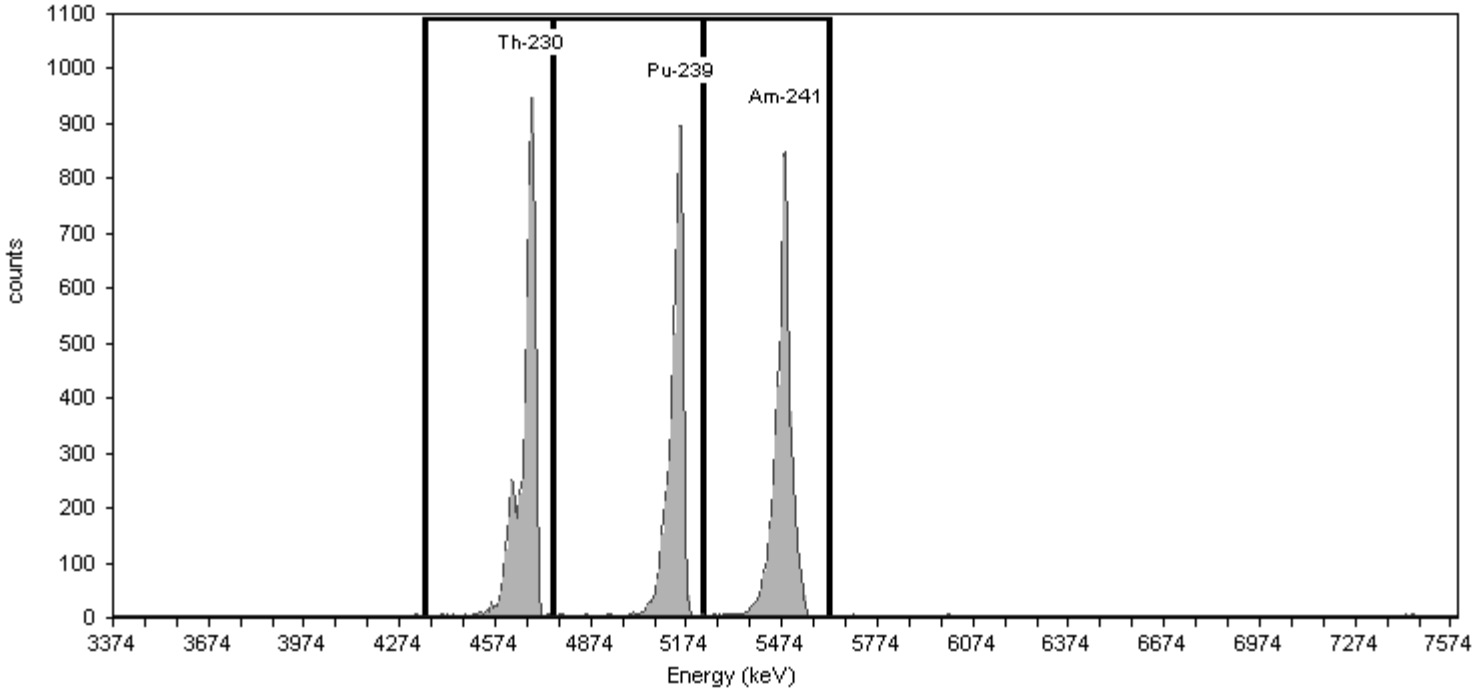
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV15 , SN: 41-172C5
Acquisition Start Date: 5/18/2014 7:22:13PM
Live Time: 60.00 min.
Real Time: 60.03 min.
Efficiency: 25.80% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,693.00	94.88
Pu-239	240	5.16	186	249	5,436.00	90.60
Am-241	284	5.49	249	303	5,834.00	97.23

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:43:46PM 5/19/2014

Calibration

Sample Name: CCV-7107;AV16-20140518
Description:
Detector: AV16

Calibration Date: 5/19/2014 5:43:43PM
Analyst: 60040

Source Info

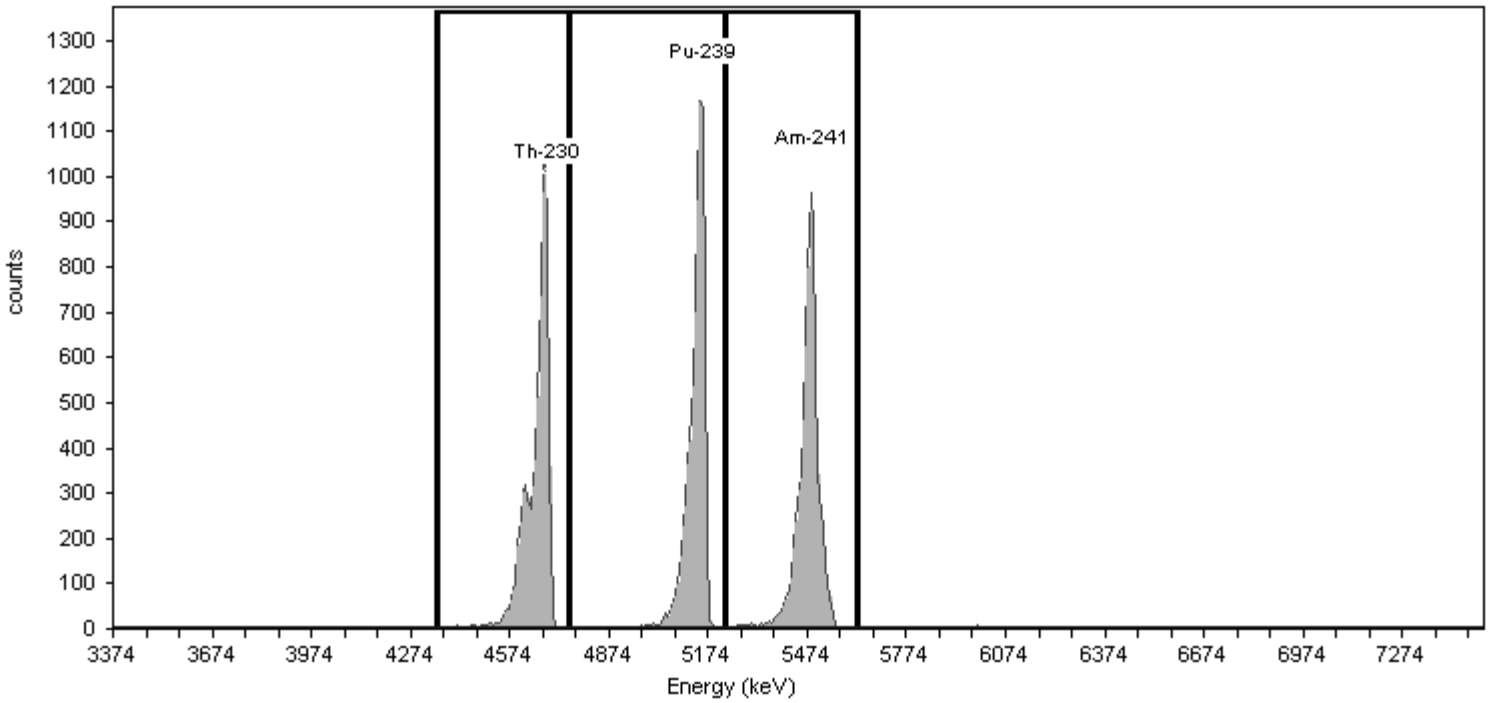
Certificate ID: 82232-334
Prepared by: Analytics

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

Acquisition

Detector: AV16 , SN: 51-082B6
Acquisition Start Date: 5/18/2014 8:51:47PM
Live Time: 60.00 min.
Real Time: 60.03 min.
Efficiency: 27.27% +/- 0.41% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	7,339.00	122.32
Pu-239	240	5.16	186	249	7,255.00	120.92
Am-241	284	5.49	249	303	7,031.00	117.18

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:38:28PM 5/18/2014

Calibration

Sample Name: CCV-8874;AV17-20140518
Description:
Detector: AV17

Calibration Date: 5/18/2014 8:38:25PM
Analyst: 60040

Source Info

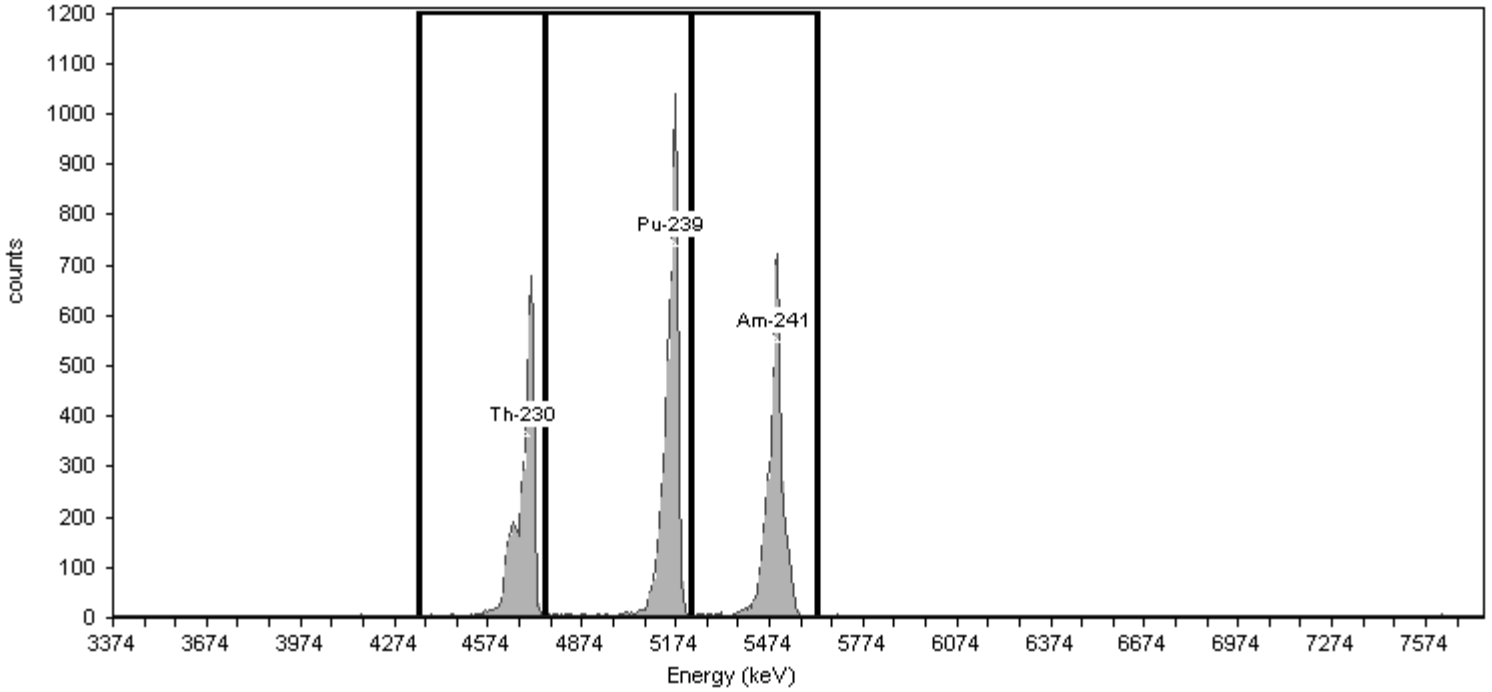
Certificate ID: 82233-334
Prepared by: Analytics

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

Acquisition

Detector: AV17 , SN: 50-051C4
Acquisition Start Date: 5/18/2014 7:22:34PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 25.71% +/- 0.49% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	4,373.00	72.88
Pu-239	240	5.16	186	249	5,836.00	97.27
Am-241	284	5.49	249	303	4,699.00	78.32

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:43:52PM 5/19/2014

Calibration

Sample Name: CCV-8875;AV18-20140518
Description:
Detector: AV18

Calibration Date: 5/19/2014 5:43:49PM
Analyst: 60040

Source Info

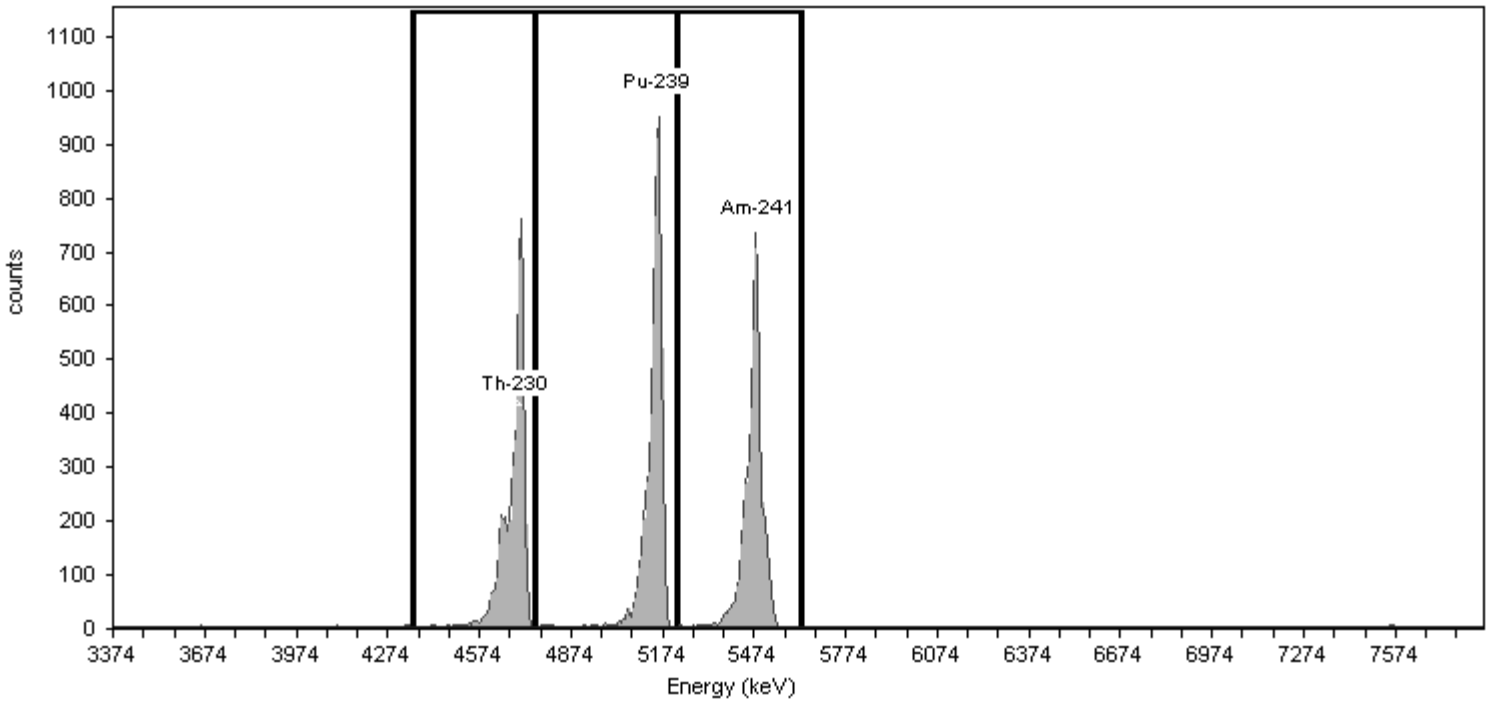
Certificate ID: 82234-334
Prepared by: Analytics

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

Acquisition

Detector: AV18 , SN: 51-082C5
Acquisition Start Date: 5/18/2014 8:51:48PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 25.15% +/- 0.47% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	4,999.00	83.32
Pu-239	240	5.16	186	249	5,630.00	93.83
Am-241	284	5.49	249	303	5,000.00	83.33

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
7:21:07PM 5/19/2014

Calibration

Sample Name: CCV-8876;AV19-20140519
Description:
Detector: AV19

Calibration Date: 5/19/2014 7:20:59PM
Analyst: 60040

Source Info

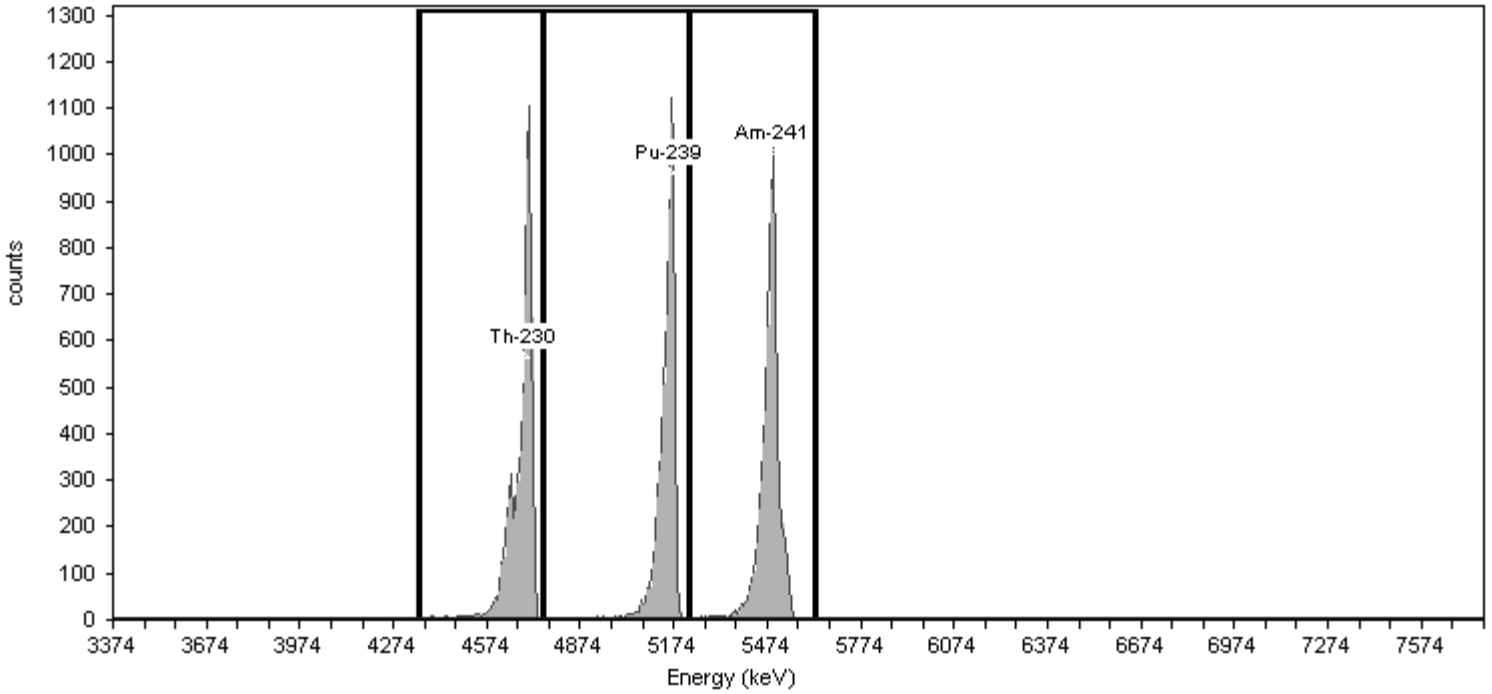
Certificate ID: 82235-334
Prepared by: Analytics

Certification Date: 6/4/2010 12:00:00PM
Description:

Acquisition

Detector: AV19 , SN: 50-025FF5
Acquisition Start Date: 5/19/2014 5:58:04PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 25.12% +/- 0.40% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,507.00	108.45
Pu-239	240	5.16	186	249	6,354.00	105.90
Am-241	284	5.49	249	303	6,584.00	109.73

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:43:58PM 5/19/2014

Calibration

Sample Name: CCV-8877;AV20-20140518
Description:
Detector: AV20

Calibration Date: 5/19/2014 5:43:55PM
Analyst: 60040

Source Info

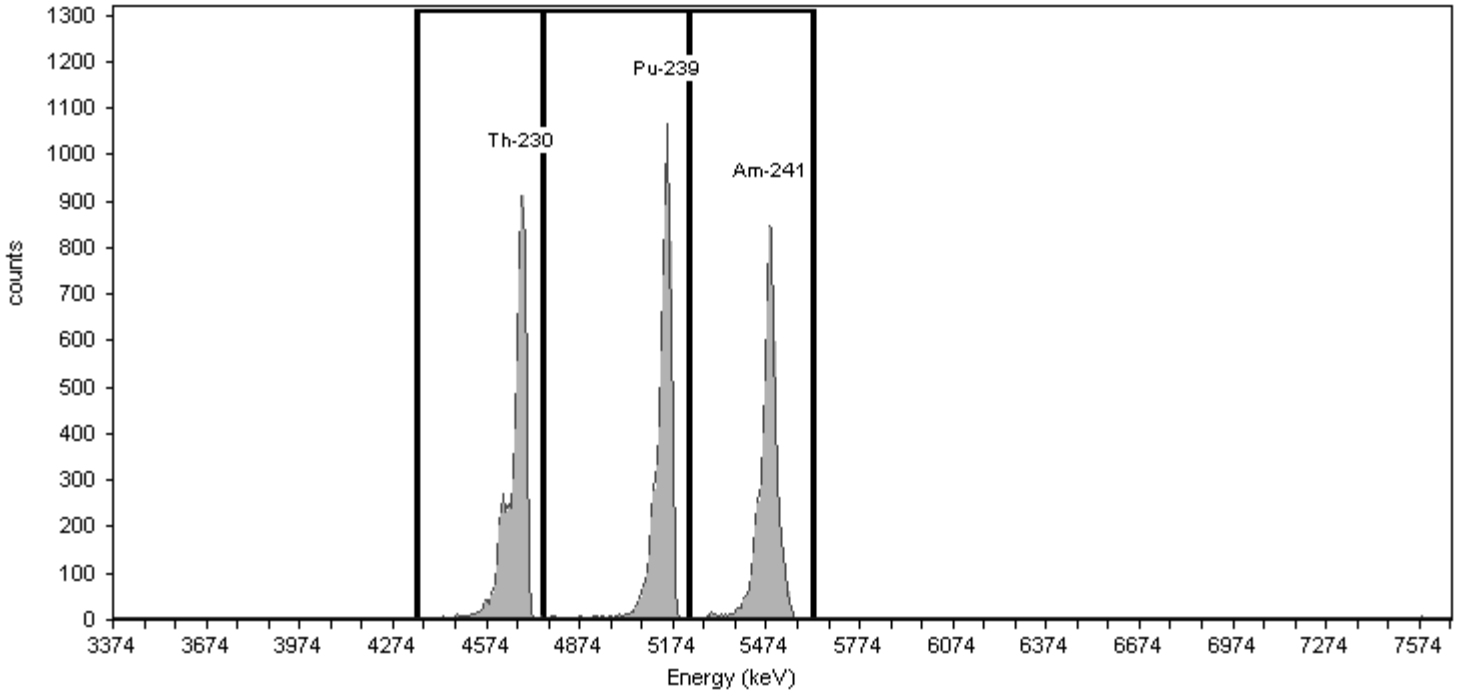
Certificate ID: 82236-334
Prepared by: Analytics

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

Acquisition

Detector: AV20 , SN: 48-121A7
Acquisition Start Date: 5/18/2014 8:52:01PM
Live Time: 60.00 min.
Real Time: 60.02 min.
Efficiency: 25.35% +/- 0.41% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,185.00	103.08
Pu-239	240	5.16	186	249	6,464.00	107.73
Am-241	284	5.49	249	303	6,229.00	103.82

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:30:35PM 5/15/2014

Calibration

Sample Name: CCV-9794;AV43-05152014
Description:
Detector: AV43

Calibration Date: 5/15/2014 8:26:42PM
Analyst: 60040

Source Info

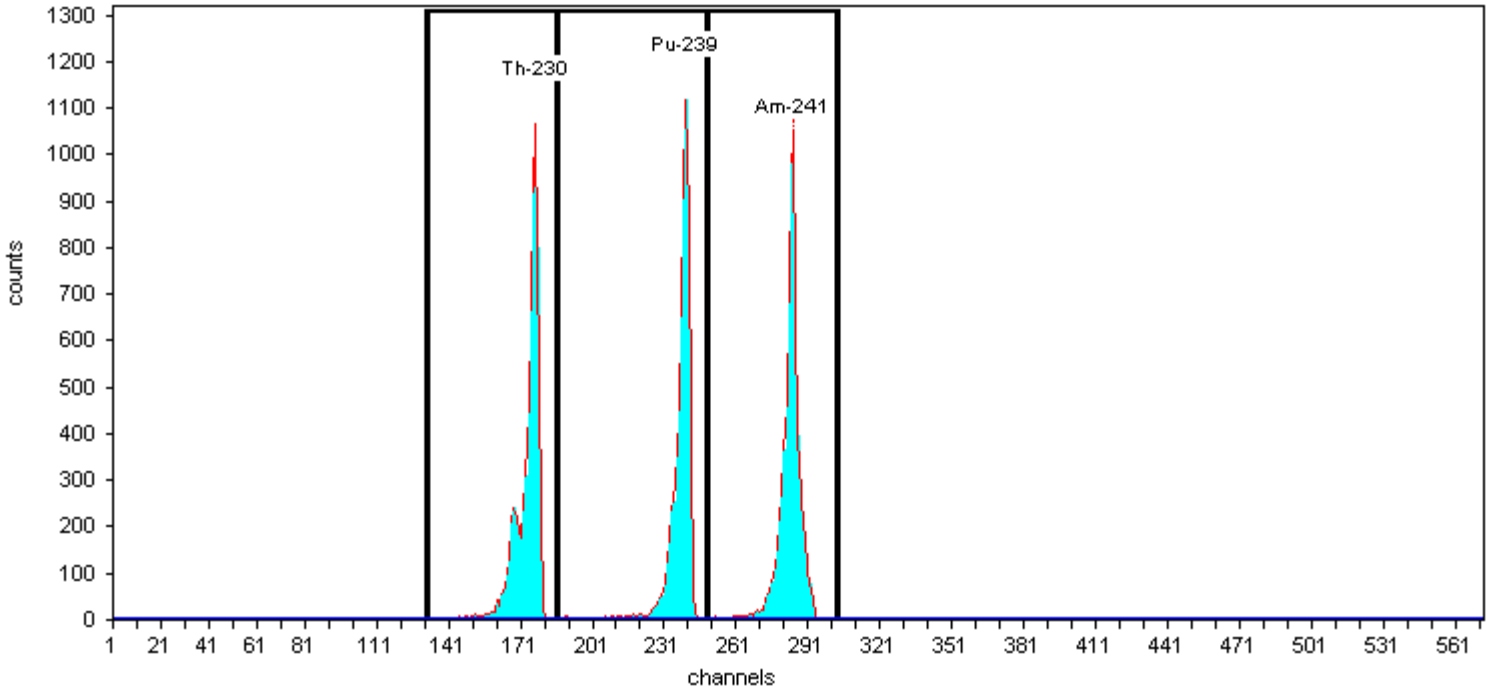
Certificate ID: 82242-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV43 , SN: 49-190X4
Acquisition Start Date: 5/15/2014 7:01:21PM
Live Time: 60.00 min.
Real Time: 60.05 min.
Efficiency: 25.87% +/- 0.43% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,227.00	103.78
Pu-239	240	5.16	186	249	5,920.00	98.67
Am-241	284	5.49	249	303	6,581.00	109.68

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:30:59PM 5/15/2014

Calibration

Sample Name: CCV-9795;AV44-05152014
Description:
Detector: AV44

Calibration Date: 5/15/2014 8:30:53PM
Analyst: 60040

Source Info

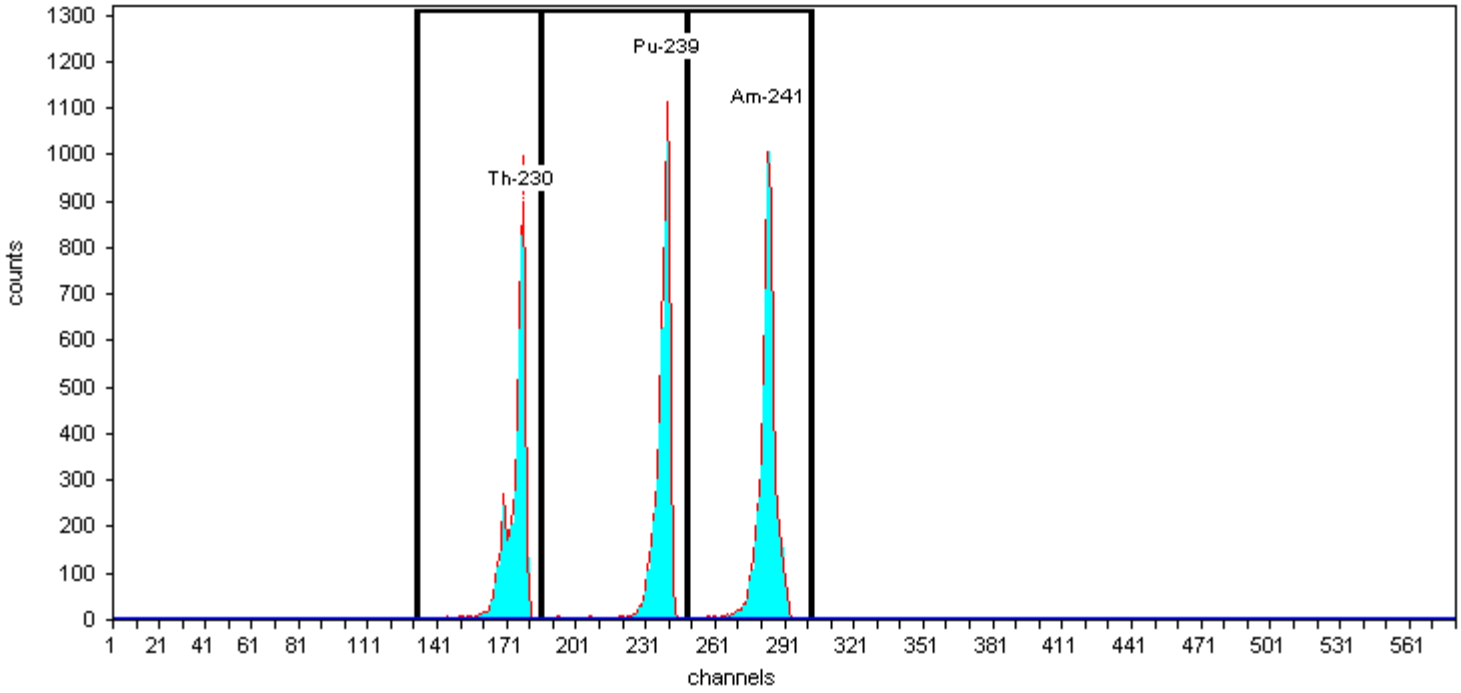
Certificate ID: 82243-334
Prepared by: Analytics

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

Acquisition

Detector: AV44 , SN: 50-051JJ1
Acquisition Start Date: 5/15/2014 7:01:23PM
Live Time: 60.00 min.
Real Time: 60.05 min.
Efficiency: 26.39% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,468.00	91.13
Pu-239	240	5.16	186	249	5,733.00	95.55
Am-241	284	5.49	249	303	6,085.00	101.42

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:31:20PM 5/15/2014

Calibration

Sample Name: CCV-9817;AV45-05152014a
Description:
Detector: AV45

Calibration Date: 5/15/2014 8:31:14PM
Analyst: 60040

Source Info

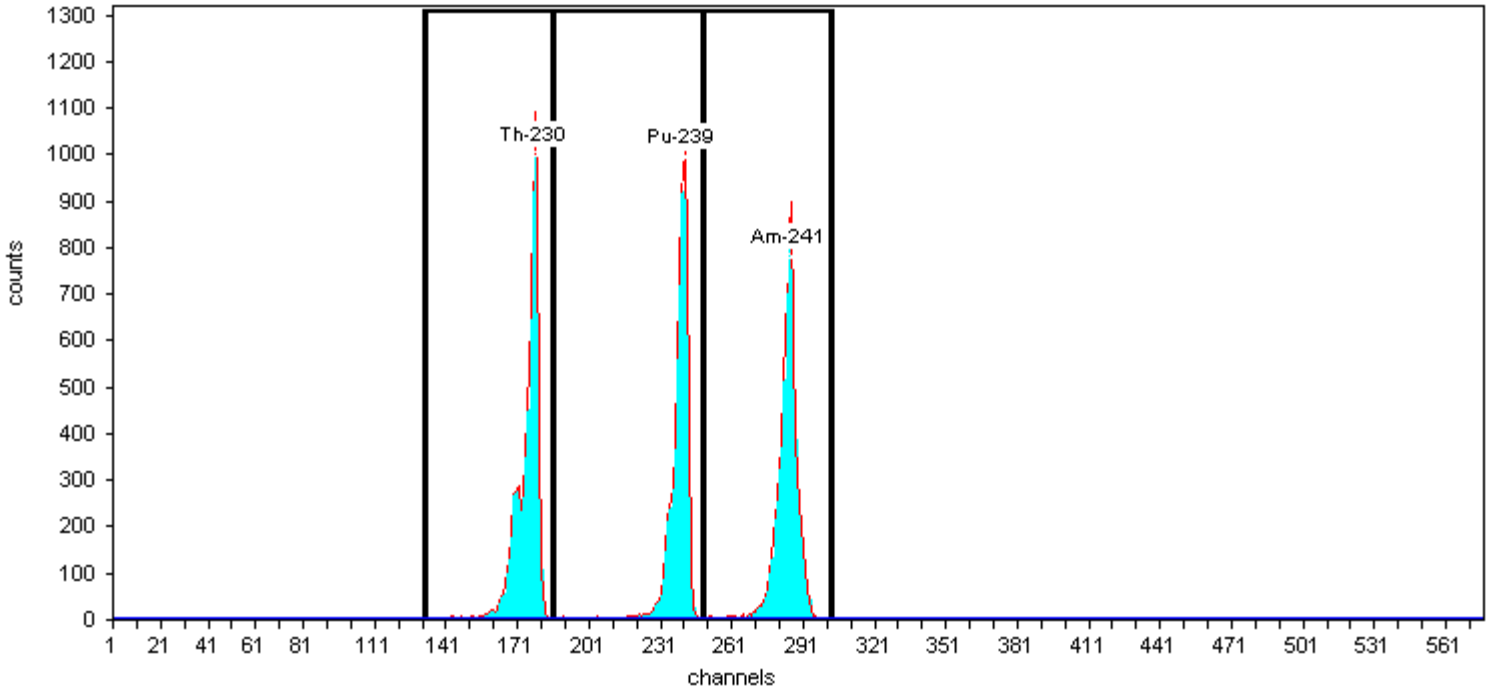
Certificate ID: 82244-334
Prepared by: Analytics

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

Acquisition

Detector: AV45 , SN: 48-158FF2
Acquisition Start Date: 5/15/2014 7:02:36PM
Live Time: 60.00 min.
Real Time: 60.05 min.
Efficiency: 25.85% +/- 0.42% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,888.00	114.80
Pu-239	240	5.16	186	249	6,161.00	102.68
Am-241	284	5.49	249	303	6,432.00	107.20

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:31:40PM 5/15/2014

Calibration

Sample Name: CCV-9884;AV46-05152014
Description:
Detector: AV46

Calibration Date: 5/15/2014 8:31:33PM
Analyst: 60040

Source Info

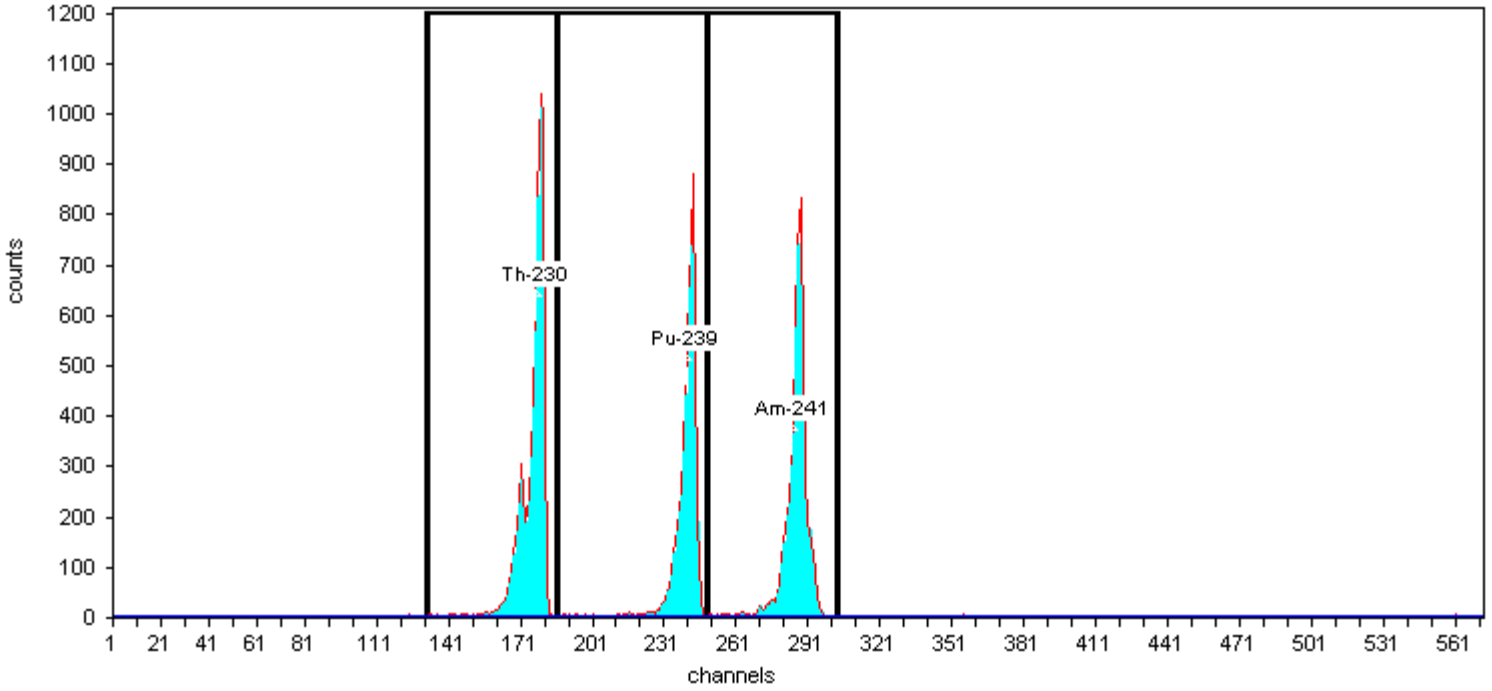
Certificate ID: 82245-334
Prepared by: Analytics

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

Acquisition

Detector: AV46 , SN: 49-202GG2
Acquisition Start Date: 5/15/2014 7:02:38PM
Live Time: 60.00 min.
Real Time: 60.05 min.
Efficiency: 26.24% +/- 0.48% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,490.00	108.17
Pu-239	240	5.16	186	249	4,950.00	82.50
Am-241	284	5.49	249	303	5,252.00	87.53

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:32:21PM 5/15/2014

Calibration

Sample Name: CCV-9886;AV48-05152014
Description:
Detector: AV48

Calibration Date: 5/15/2014 8:32:16PM
Analyst: 60040

Source Info

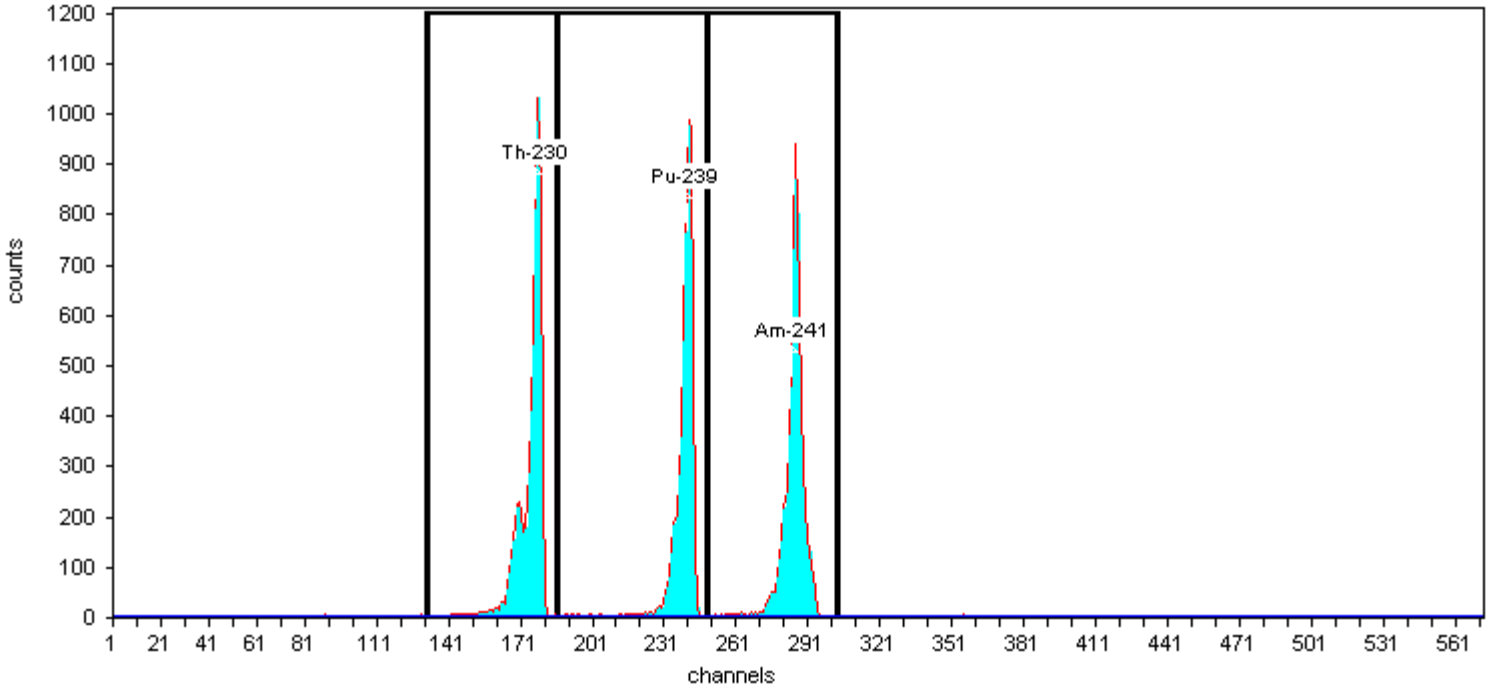
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV48 , SN: 50-051JJ4
Acquisition Start Date: 5/15/2014 7:03:45PM
Live Time: 60.00 min.
Real Time: 60.05 min.
Efficiency: 25.91% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,841.00	97.35
Pu-239	240	5.16	186	249	5,457.00	90.95
Am-241	284	5.49	249	303	5,733.00	95.55

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
8:35:30PM 5/15/2014

Calibration

Sample Name: CCV-9793;AV57-05152014
Description:
Detector: AV57

Calibration Date: 5/15/2014 8:35:25PM
Analyst: 60040

Source Info

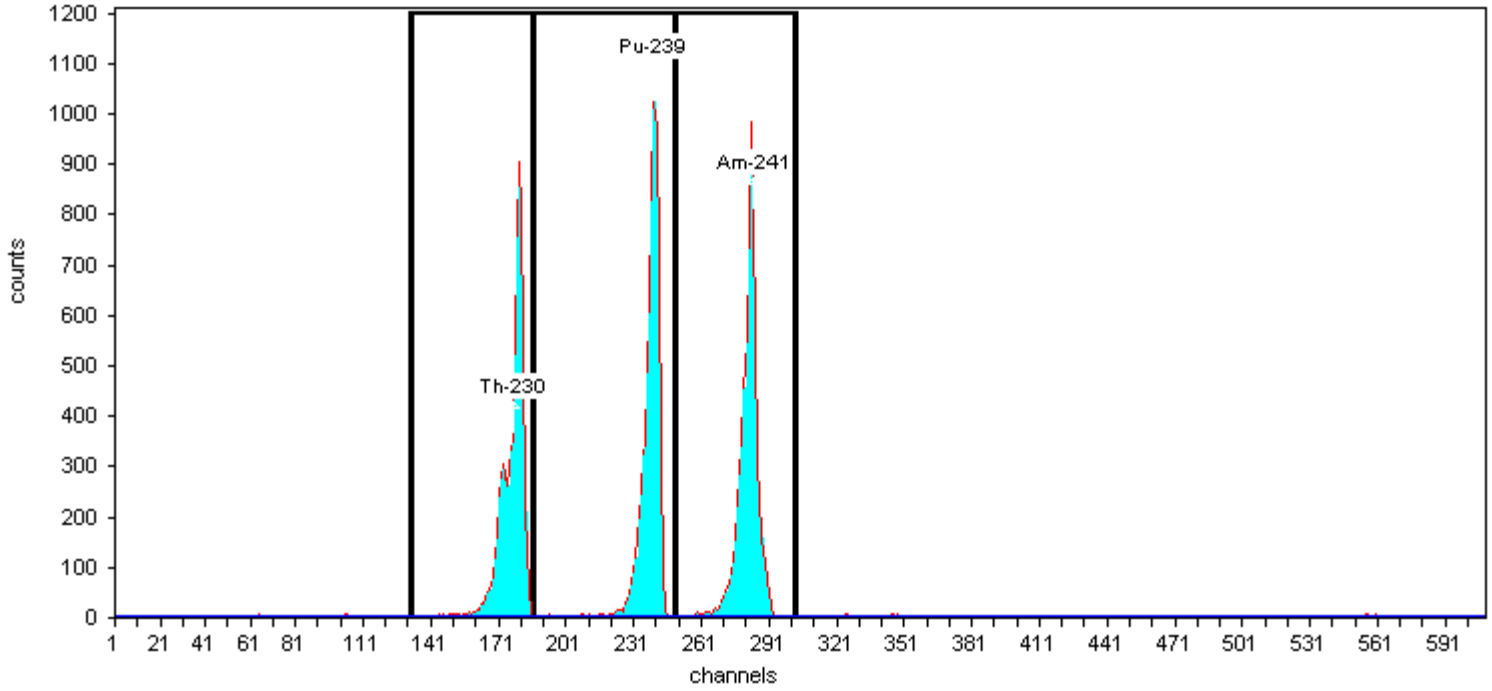
Certificate ID: 82241-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV57 , SN: 48-158EE3
Acquisition Start Date: 5/15/2014 7:05:02PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 27.06% +/- 0.44% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,450.00	107.50
Pu-239	240	5.16	186	249	6,583.00	109.72
Am-241	284	5.49	249	303	6,480.00	108.00

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:45:57PM 5/15/2014

Calibration

Sample Name: CCV-9794;AV58-05152014
Description:
Detector: AV58

Calibration Date: 5/15/2014 9:45:54PM
Analyst: 60040

Source Info

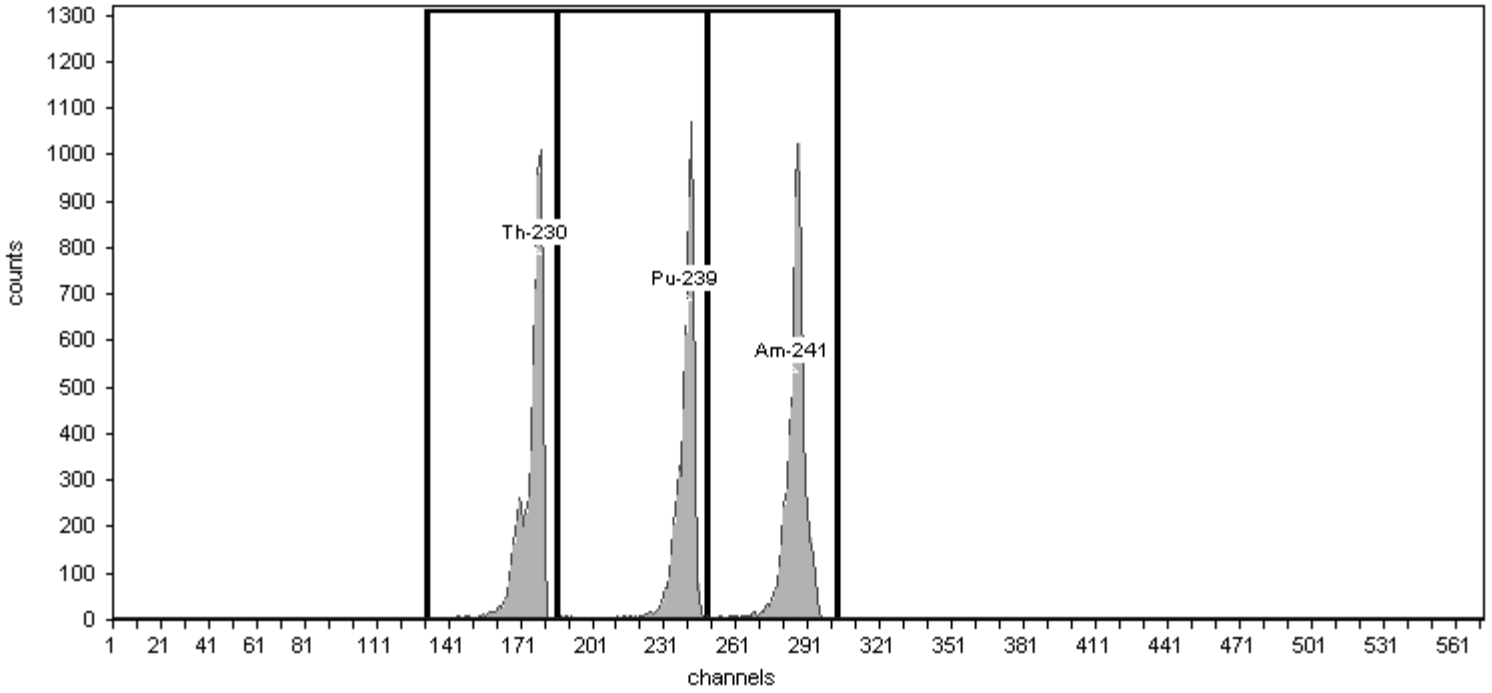
Certificate ID: 82242-334
Prepared by: Analytics

Certification Date: 6/8/2010 12:00:00PM
Description:

Acquisition

Detector: AV58 , SN: 52-102 C5
Acquisition Start Date: 5/15/2014 8:43:36PM
Live Time: 60.00 min.
Real Time: 60.03 min.
Efficiency: 26.45% +/- 0.44% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,375.00	106.25
Pu-239	240	5.16	186	249	5,999.00	99.98
Am-241	284	5.49	249	303	6,769.00	112.82

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:46:03PM 5/15/2014

Calibration

Sample Name: CCV-9795;AV59-05152014
Description:
Detector: AV59

Calibration Date: 5/15/2014 9:46:00PM
Analyst: 60040

Source Info

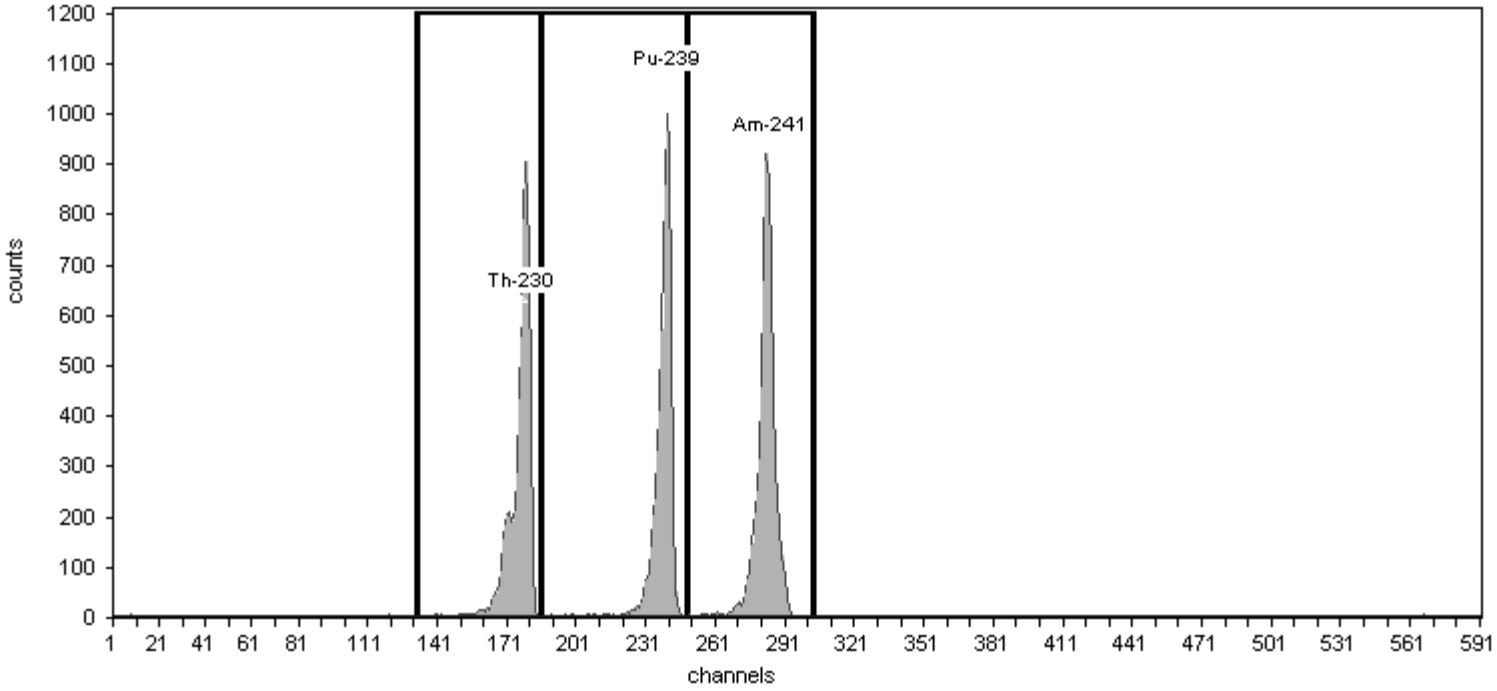
Certificate ID: 82243-334
Prepared by: Analytics

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

Acquisition

Detector: AV59 , SN: 49-155M7
Acquisition Start Date: 5/15/2014 8:44:02PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 27.48% +/- 0.47% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,753.00	95.88
Pu-239	240	5.16	186	249	5,932.00	98.87
Am-241	284	5.49	249	303	6,311.00	105.18

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:46:09PM 5/15/2014

Calibration

Sample Name: CCV-9817;AV60-05152014
Description:
Detector: AV60

Calibration Date: 5/15/2014 9:46:06PM
Analyst: 60040

Source Info

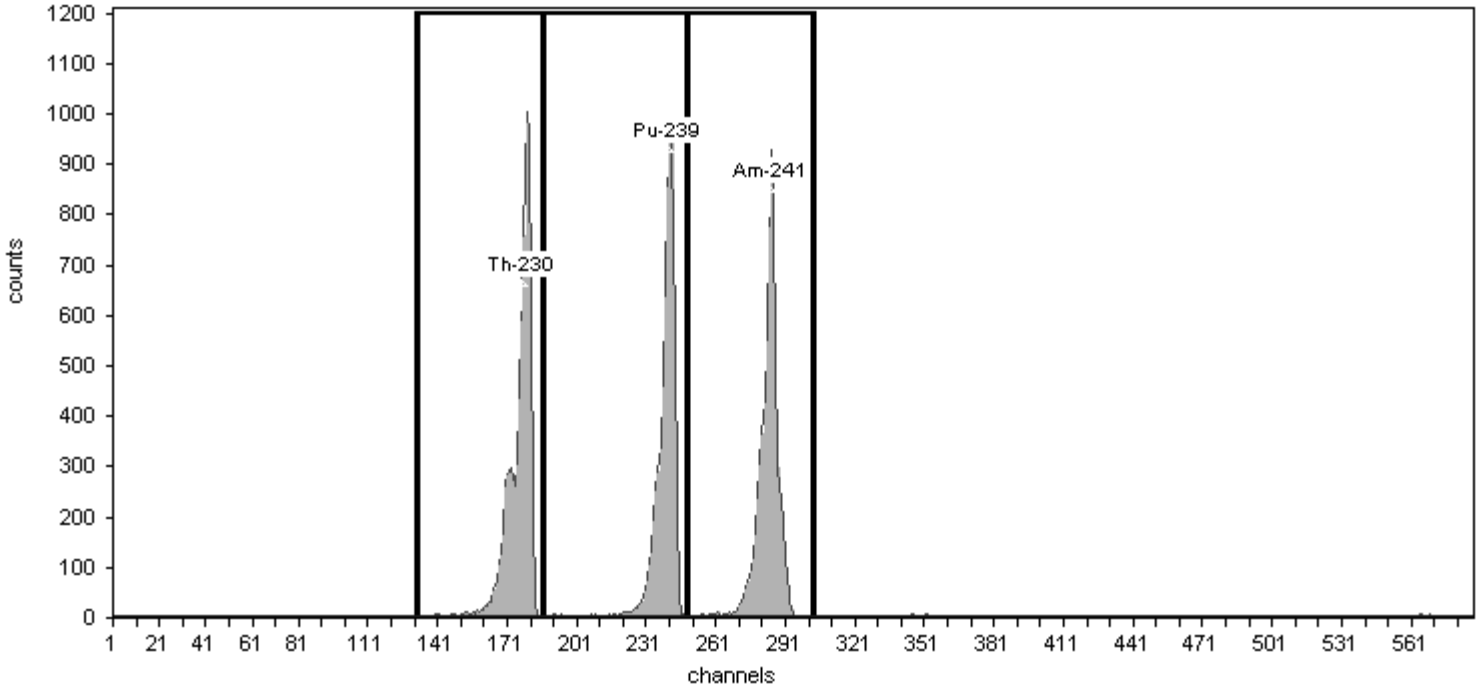
Certificate ID: 82244-334
Prepared by: Analytics

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

Acquisition

Detector: AV60 , SN: 49-027117
Acquisition Start Date: 5/15/2014 8:44:03PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 26.25% +/- 0.42% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,963.00	116.05
Pu-239	240	5.16	186	249	6,288.00	104.80
Am-241	284	5.49	249	303	6,530.00	108.83

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:46:16PM 5/15/2014

Calibration

Sample Name: CCV-9817;AV61-05152014
Description:
Detector: AV61

Calibration Date: 5/15/2014 9:46:12PM
Analyst: 60040

Source Info

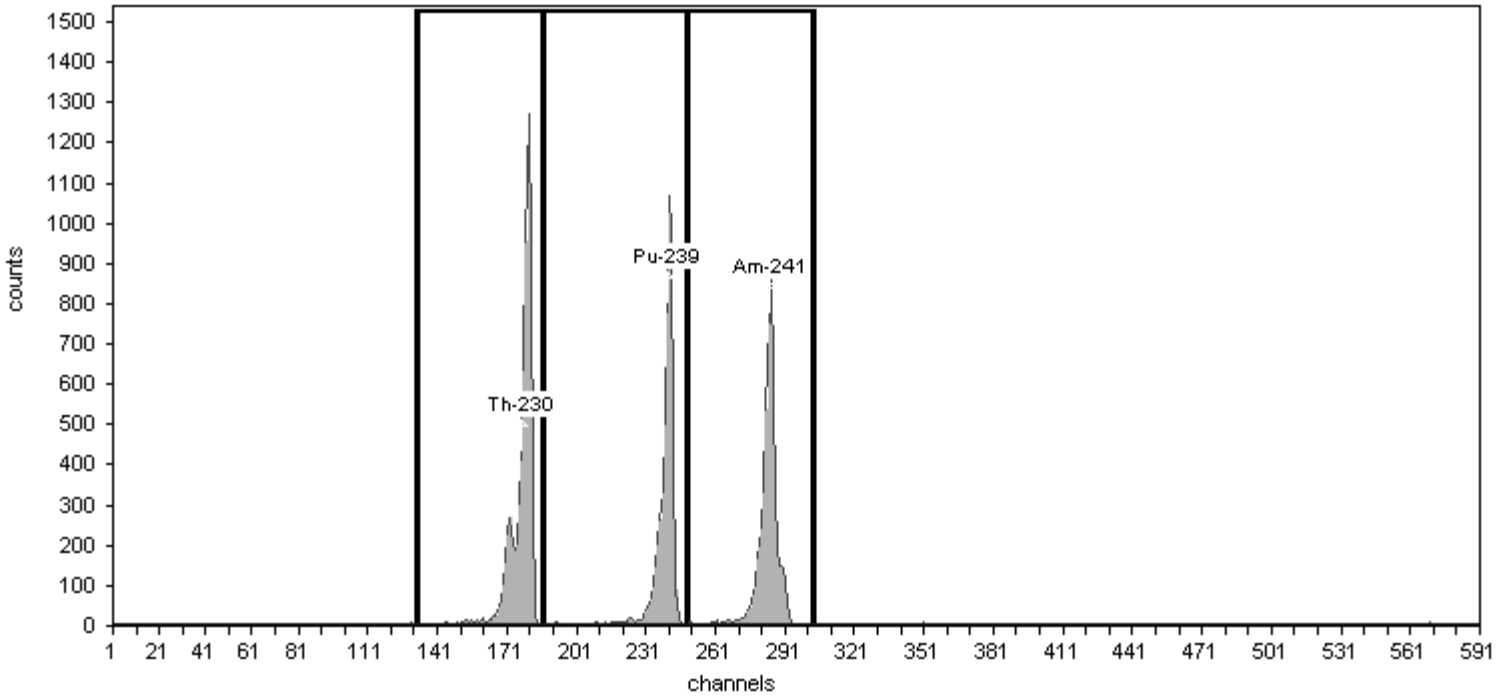
Certificate ID: 82245-334
Prepared by: Analytics

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

Acquisition

Detector: AV61 , SN: 5-051JJ3
Acquisition Start Date: 5/15/2014 8:44:25PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 26.32% +/- 0.48% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,448.00	107.47
Pu-239	240	5.16	186	249	5,211.00	86.85
Am-241	284	5.49	249	303	5,078.00	84.63

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
9:46:23PM 5/15/2014

Calibration

Sample Name: CCV-9885;AV62-05152014
Description:
Detector: AV62

Calibration Date: 5/15/2014 9:46:19PM
Analyst: 60040

Source Info

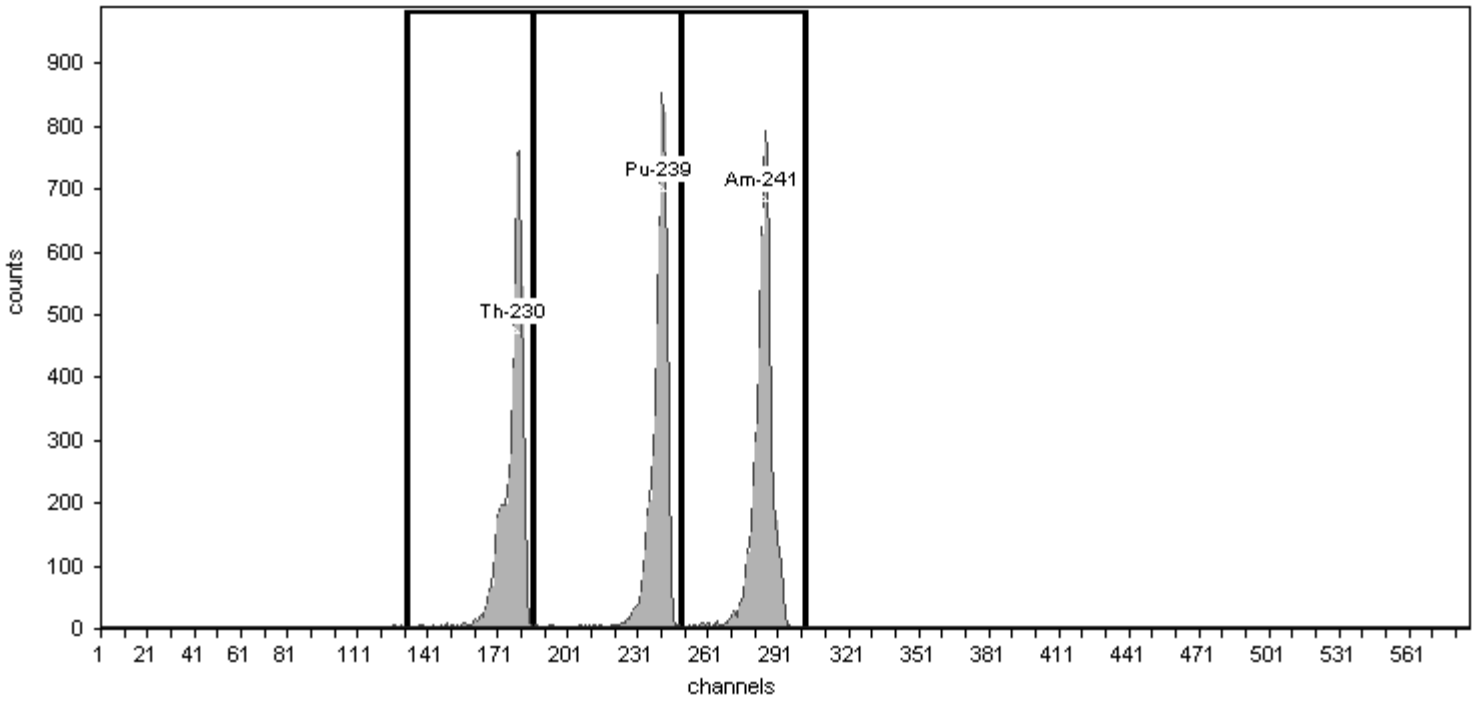
Certificate ID: 82246-334
Prepared by: Analytics

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

Acquisition

Detector: AV62 , SN: 52-060FF2
Acquisition Start Date: 5/15/2014 8:44:26PM
Live Time: 60.00 min.
Real Time: 60.04 min.
Efficiency: 26.41% +/- 0.50% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,213.00	86.88
Pu-239	240	5.16	186	249	5,235.00	87.25
Am-241	284	5.49	249	303	5,623.00	93.72

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
10:59:57PM 5/15/2014

Calibration

Sample Name: CCV-9886;AV78-05152014
Description:
Detector: AV78

Calibration Date: 5/15/2014 10:59:54PM
Analyst: 60040

Source Info

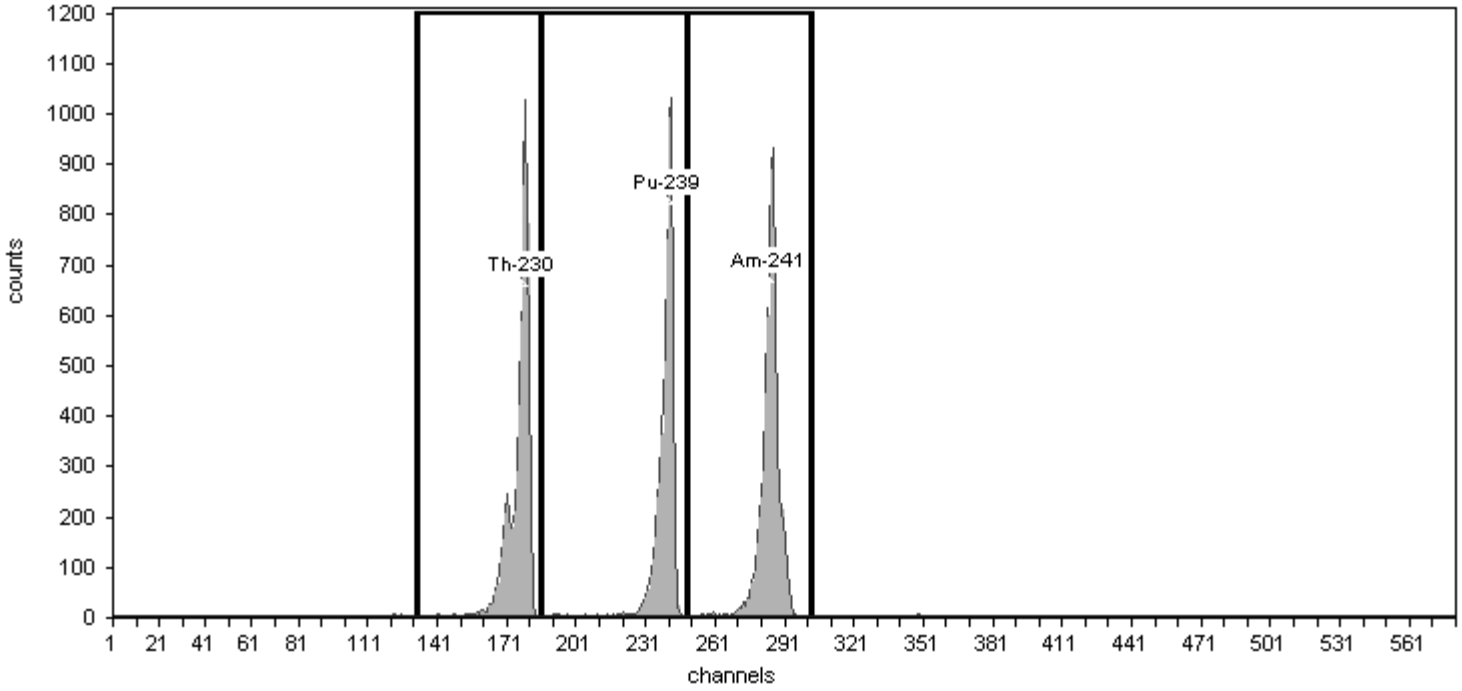
Certificate ID: 82247-334
Prepared by: Analytics

Certification Date: 6/10/2010 12:00:00PM
Description:

Acquisition

Detector: AV78 , SN: 46-033FF4
Acquisition Start Date: 5/15/2014 9:58:10PM
Live Time: 60.00 min.
Real Time: 60.03 min.
Efficiency: 26.04% +/- 0.46% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	5,789.00	96.48
Pu-239	240	5.16	186	249	5,444.00	90.73
Am-241	284	5.49	249	303	5,885.00	98.08

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
3:03:08PM 5/16/2014

Calibration

Sample Name: CCV-7107;AV79-05152014
Description:
Detector: AV79

Calibration Date: 5/16/2014 3:03:04PM
Analyst: 60040

Source Info

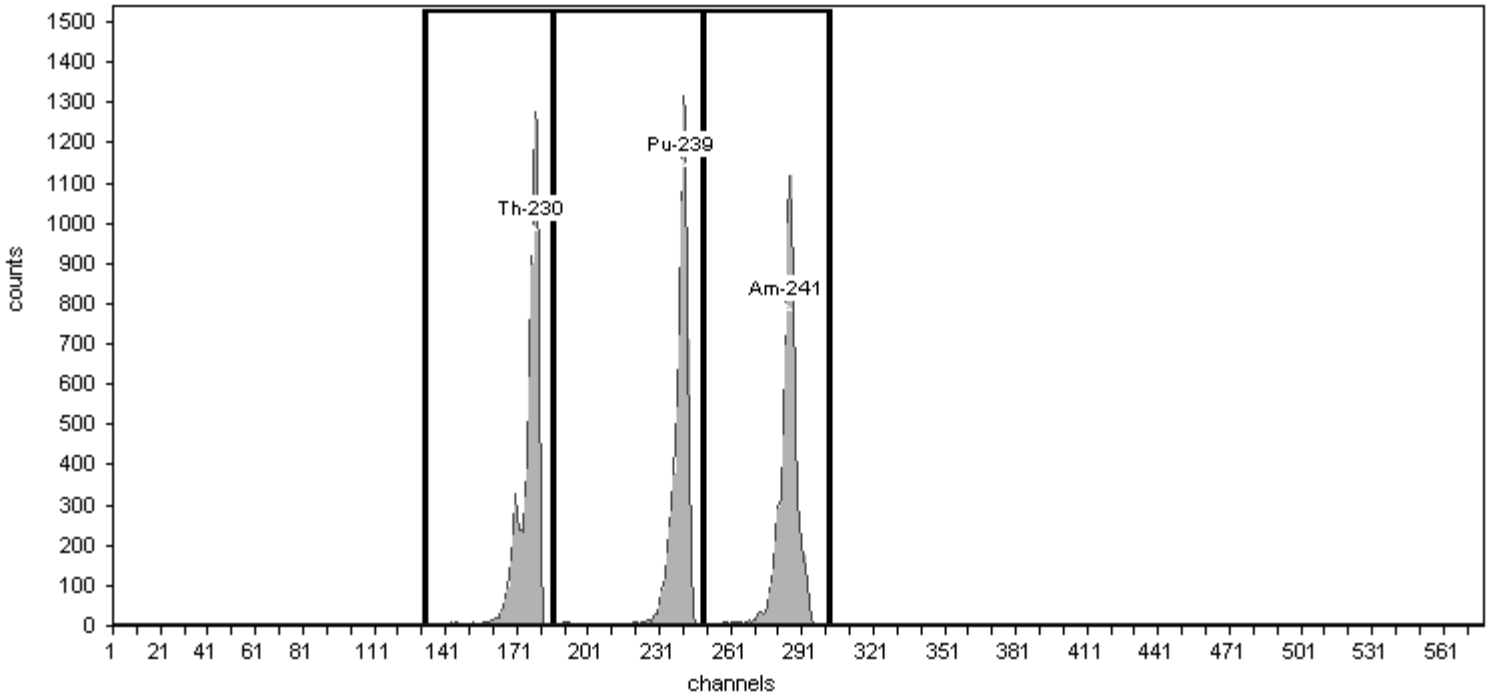
Certificate ID: 82232-334
Prepared by: Analytics

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

Acquisition

Detector: AV79 , SN: 46-033Q5
Acquisition Start Date: 5/15/2014 11:08:30PM
Live Time: 60.00 min.
Real Time: 60.01 min.
Efficiency: 27.61% +/- 0.42% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	7,452.00	124.20
Pu-239	240	5.16	186	249	7,297.00	121.62
Am-241	284	5.49	249	303	7,144.00	119.07

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THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Calibration Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
4:33:22PM 5/16/2014

Calibration

Sample Name: CCV-8876;AV82-20140516
Description:
Detector: AV82

Calibration Date: 5/16/2014 4:33:16PM
Analyst: 60040

Source Info

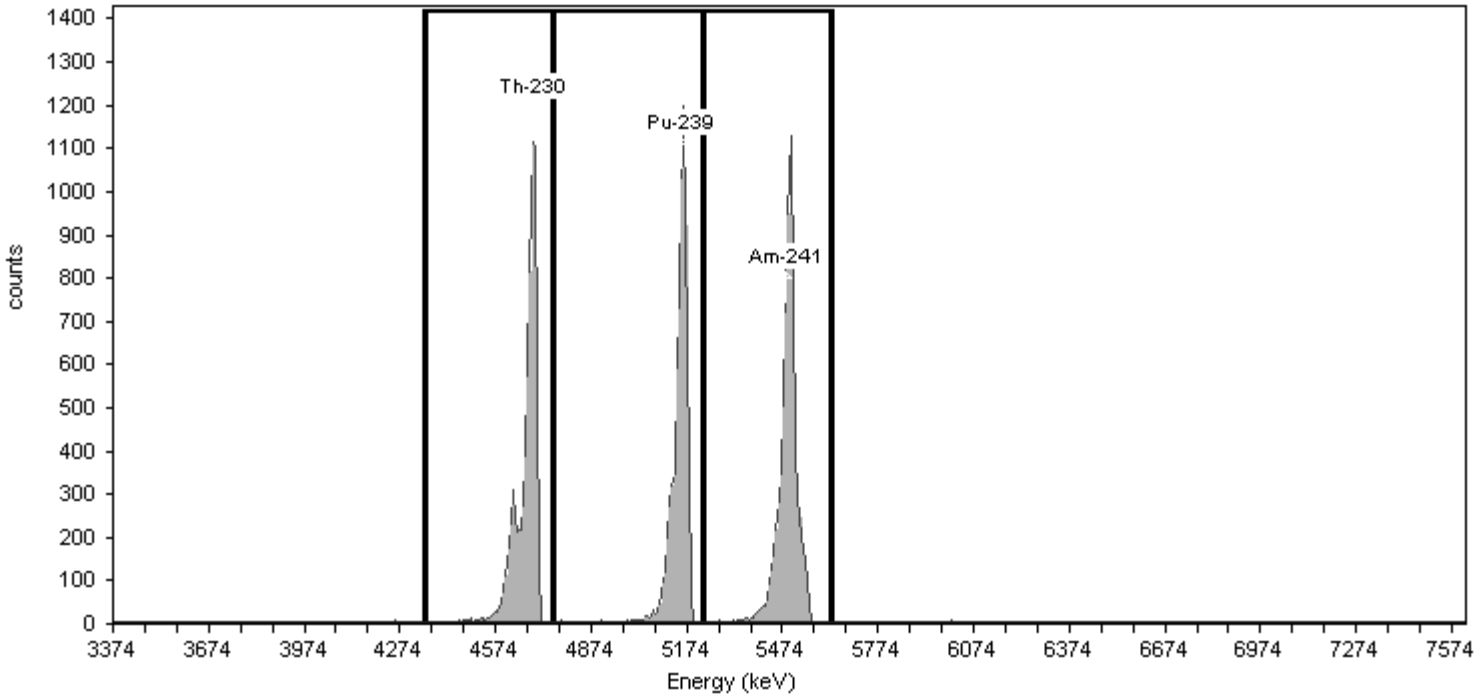
Certificate ID: 82235-334
Prepared by: Analytics

Certification Date: 6/4/2010 12:00:00PM
Description:

Acquisition

Detector: AV82 , SN: 46-032EE5
Acquisition Start Date: 5/16/2014 3:28:55PM
Live Time: 60.00 min.
Real Time: 60.01 min.
Efficiency: 25.94% +/- 0.41% TPU(2 sigma)

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2



General Analysis

Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: No
Shelf: 1

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	177	4.69	132	186	6,704.00	111.73
Pu-239	240	5.16	186	249	6,446.00	107.43
Am-241	284	5.49	249	303	6,919.00	115.32

Monthly Backgrounds

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:38:56PM 5/15/2014

Sample

Sample Name: ICB;AV1
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

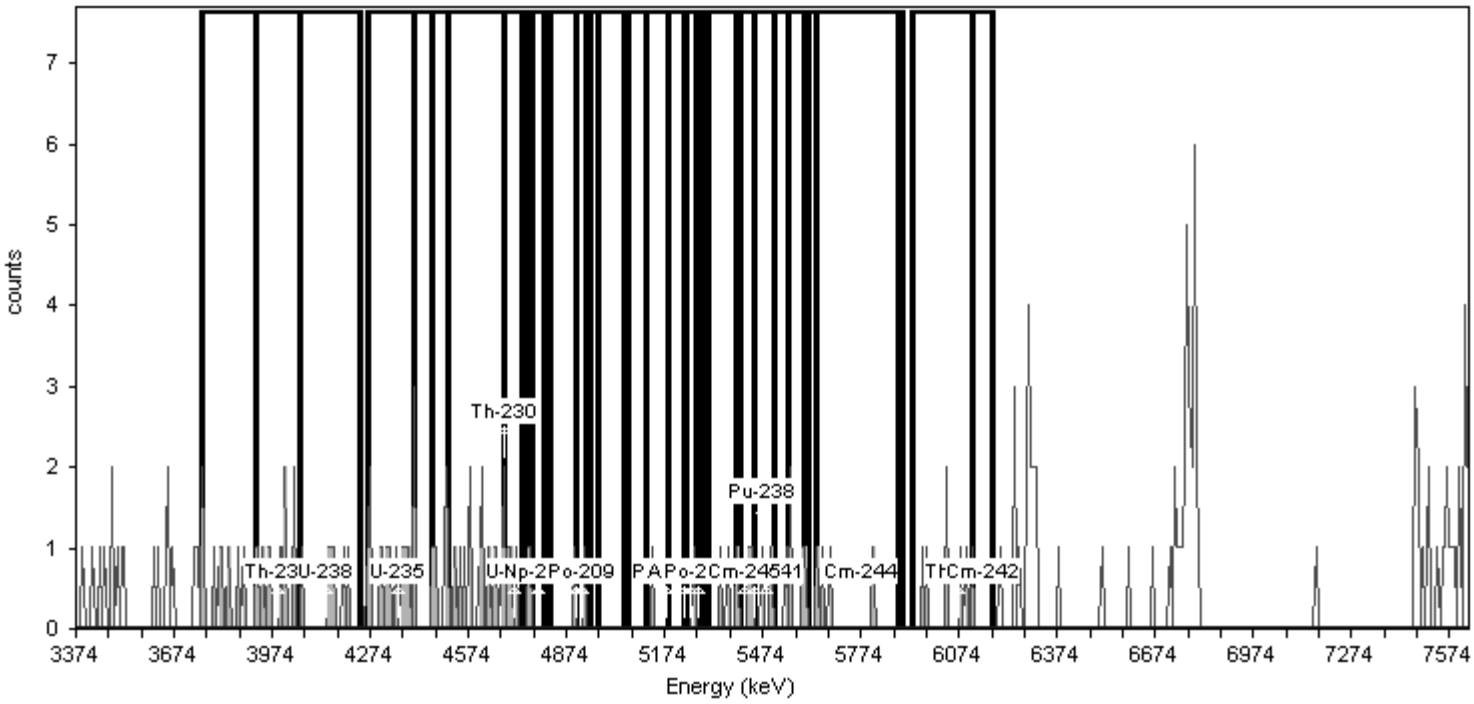
Analyst: 60040

Acquisition

Detector: AV1 , SN: 49-188 AA4
Acquisition Start Date: 5/15/2014 1:20:59AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-7107;AV1-20140505
Calibration Date: 5/6/2014 5:38:14PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.30% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 181.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	19.00	1.979E-002	4.658E-003
U-238	4.14	3.92	4.24	16.00	1.667E-002	4.295E-003
U-235	4.36	4.26	4.46	16.00	1.667E-002	4.295E-003
Th-230	4.68	4.40	4.75	25.00	2.604E-002	5.311E-003
U-234	4.71	4.51	4.82	20.00	2.083E-002	4.774E-003
Pu-242	4.90	4.68	4.95	9.00	9.375E-003	3.294E-003
Th-229	4.86	4.74	5.12	4.00	4.167E-003	2.329E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	1.00	1.042E-003	1.473E-003
Pu-239	5.18	4.97	5.24	1.00	1.042E-003	1.473E-003
Am-243	5.23	5.05	5.31	2.00	2.083E-003	1.804E-003
U-232	5.25	5.06	5.40	5.00	5.208E-003	2.552E-003
Th-228	5.45	5.19	5.51	8.00	8.333E-003	3.125E-003
Po-210	5.28	5.23	5.29	1.00	1.042E-003	1.473E-003
Pu-238	5.47	5.27	5.55	8.00	8.333E-003	3.125E-003
Am-241	5.48	5.30	5.60	12.00	1.250E-002	3.756E-003
Cm-245	5.42	5.40	5.45	3.00	3.125E-003	2.083E-003
Pu-236	5.76	5.61	5.89	4.00	4.167E-003	2.329E-003
Cm-244	5.78	5.64	5.90	4.00	4.167E-003	2.329E-003
Th-227	6.07	5.93	6.18	7.00	7.292E-003	2.946E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:39:53PM 5/15/2014

Sample

Sample Name: ICB;AV11
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

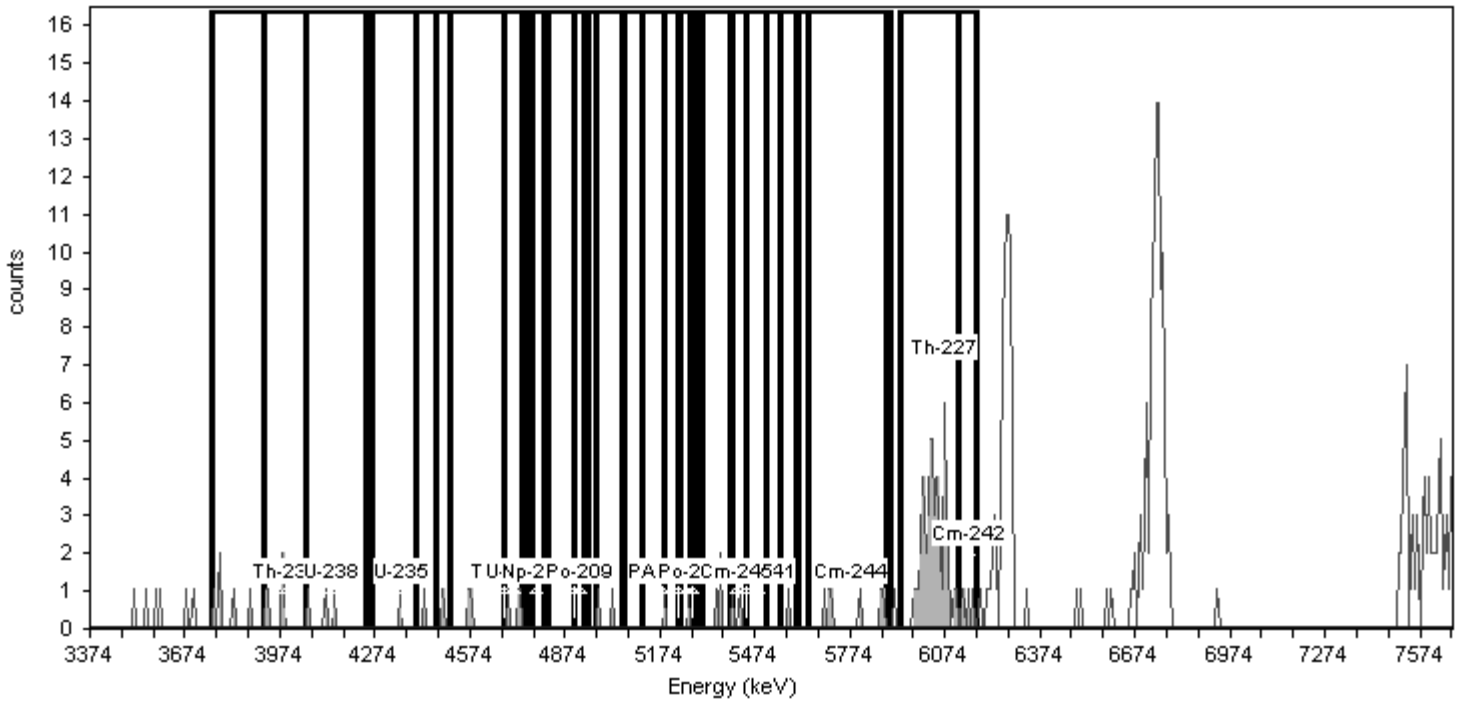
Analyst: 60040

Acquisition

Detector: AV11 , SN: 49-155dd2
Acquisition Start Date: 5/15/2014 1:18:01AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-9795;AV11-20140505
Calibration Date: 5/6/2014 5:39:16PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.88% +/- 0.35% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 308.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	9.00	9.375E-003	3.294E-003
U-238	4.14	3.92	4.24	7.00	7.292E-003	2.946E-003
U-235	4.36	4.26	4.46	2.00	2.083E-003	1.804E-003
Th-230	4.68	4.40	4.75	7.00	7.292E-003	2.946E-003
U-234	4.71	4.51	4.82	5.00	5.208E-003	2.552E-003
Pu-242	4.90	4.68	4.95	3.00	3.125E-003	2.083E-003
Th-229	4.86	4.74	5.12	2.00	2.083E-003	1.804E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	3.00	3.125E-003	2.083E-003
Am-243	5.23	5.05	5.31	2.00	2.083E-003	1.804E-003
U-232	5.25	5.06	5.40	6.00	6.250E-003	2.756E-003
Th-228	5.45	5.19	5.51	7.00	7.292E-003	2.946E-003
Po-210	5.28	5.23	5.29	1.00	1.042E-003	1.473E-003
Pu-238	5.47	5.27	5.55	5.00	5.208E-003	2.552E-003
Am-241	5.48	5.30	5.60	6.00	6.250E-003	2.756E-003
Cm-245	5.42	5.40	5.45	2.00	2.083E-003	1.804E-003
Pu-236	5.76	5.61	5.89	6.00	6.250E-003	2.756E-003
Cm-244	5.78	5.64	5.90	6.00	6.250E-003	2.756E-003
Th-227	6.07	5.93	6.18	50.00	5.208E-002	7.439E-003
Cm-242	6.15	6.12	6.18	3.00	3.125E-003	2.083E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:40:16PM 5/15/2014

Sample

Sample Name: ICB;AV15
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

Analyst: 60040

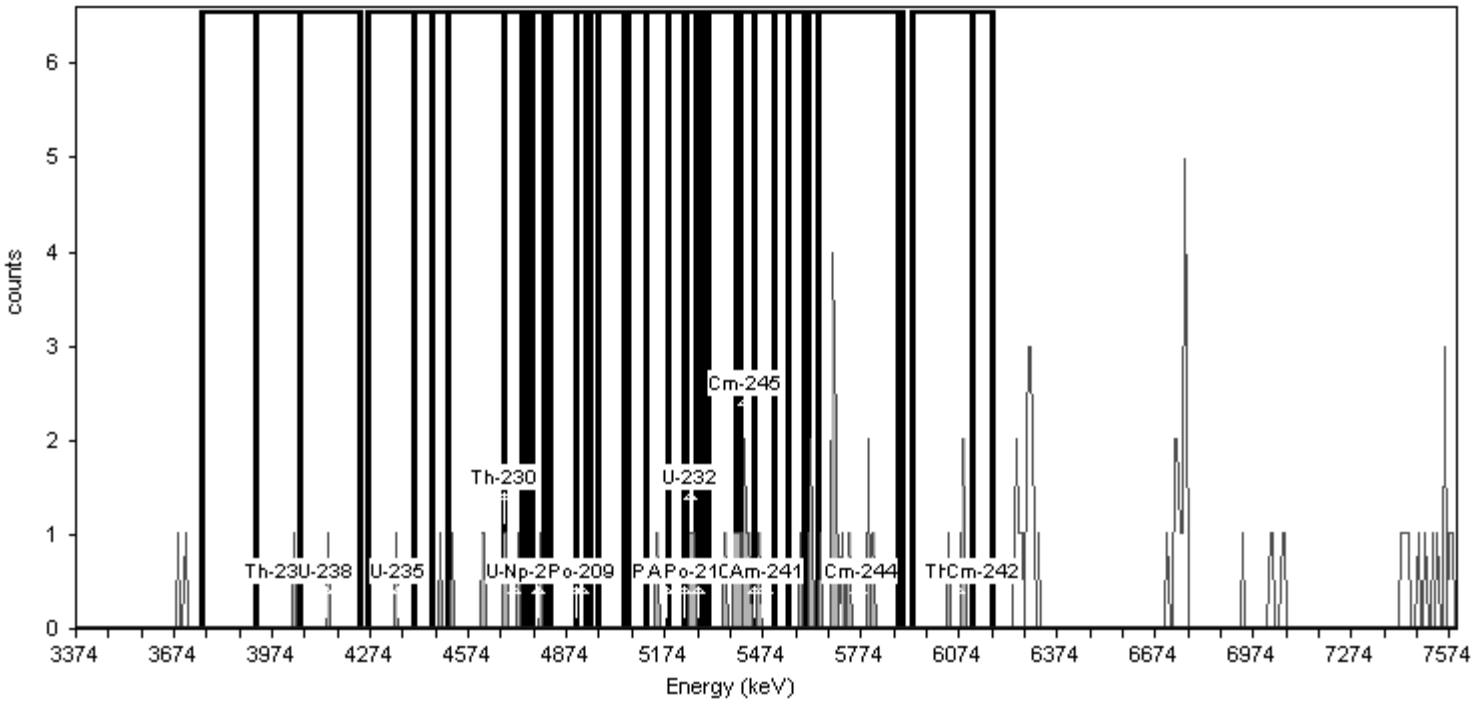
Acquisition

Detector: AV15 , SN: 41-172C5
Acquisition Start Date: 5/15/2014 1:17:55AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-9886;AV15-20140505
Calibration Date: 5/6/2014 5:39:42PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.62% +/- 0.34% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 95.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	2.00	2.083E-003	1.804E-003
U-235	4.36	4.26	4.46	1.00	1.042E-003	1.473E-003
Th-230	4.68	4.40	4.75	7.00	7.292E-003	2.946E-003
U-234	4.71	4.51	4.82	7.00	7.292E-003	2.946E-003
Pu-242	4.90	4.68	4.95	4.00	4.167E-003	2.329E-003
Th-229	4.86	4.74	5.12	1.00	1.042E-003	1.473E-003
Np-237	4.78	4.77	4.81	1.00	1.042E-003	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	1.00	1.042E-003	1.473E-003
Am-243	5.23	5.05	5.31	3.00	3.125E-003	2.083E-003
U-232	5.25	5.06	5.40	7.00	7.292E-003	2.946E-003
Th-228	5.45	5.19	5.51	11.00	1.146E-002	3.608E-003
Po-210	5.28	5.23	5.29	2.00	2.083E-003	1.804E-003
Pu-238	5.47	5.27	5.55	9.00	9.375E-003	3.294E-003
Am-241	5.48	5.30	5.60	10.00	1.042E-002	3.455E-003
Cm-245	5.42	5.40	5.45	6.00	6.250E-003	2.756E-003
Pu-236	5.76	5.61	5.89	18.00	1.875E-002	4.541E-003
Cm-244	5.78	5.64	5.90	15.00	1.563E-002	4.167E-003
Th-227	6.07	5.93	6.18	3.00	3.125E-003	2.083E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:40:22PM 5/15/2014

Sample

Sample Name: ICB;AV16
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

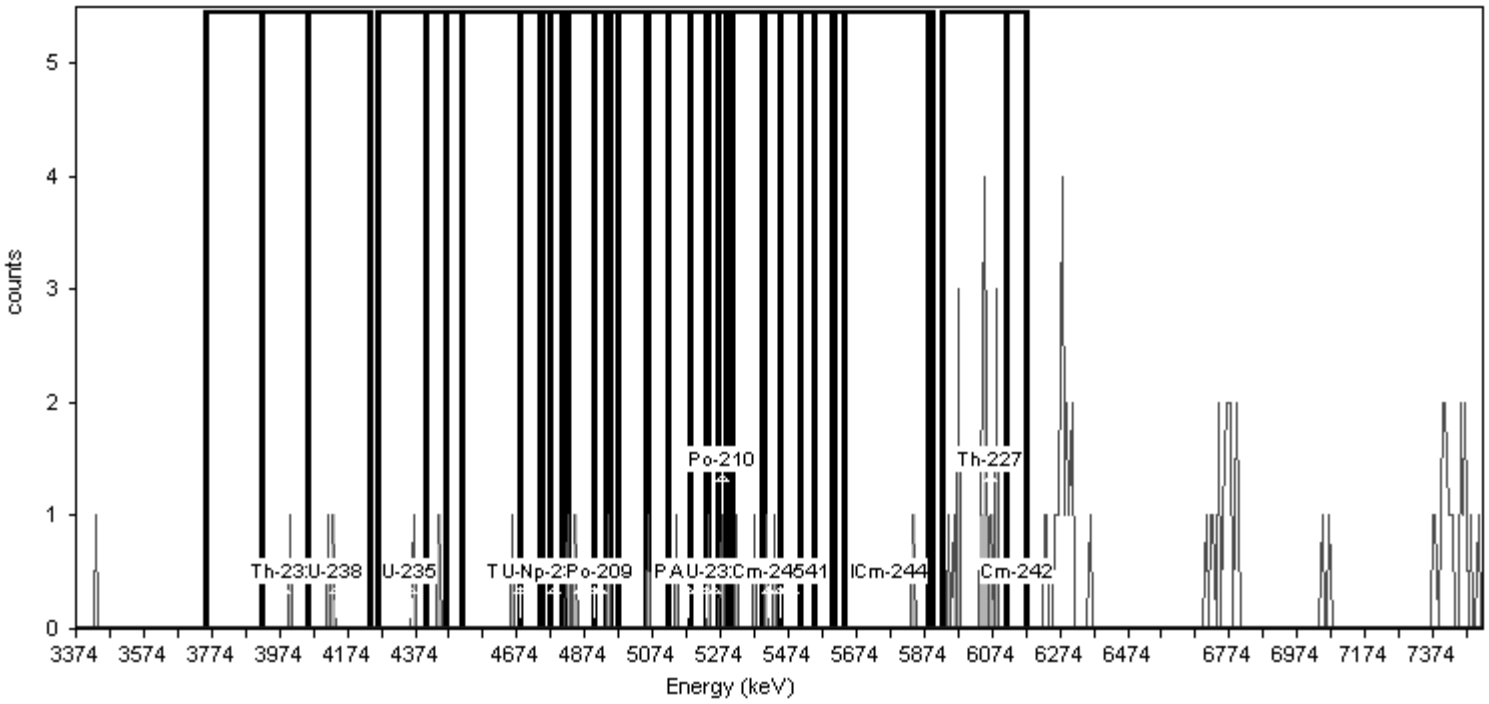
Analyst: 60040

Acquisition

Detector: AV16 , SN: 51-082B6
Acquisition Start Date: 5/15/2014 1:17:57AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-7107;AV16-20140505
Calibration Date: 5/5/2014 10:08:41PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.11% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 85.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	3.00	3.125E-003	2.083E-003
U-235	4.36	4.26	4.46	2.00	2.083E-003	1.804E-003
Th-230	4.68	4.40	4.75	2.00	2.083E-003	1.804E-003
U-234	4.71	4.51	4.82	2.00	2.083E-003	1.804E-003
Pu-242	4.90	4.68	4.95	3.00	3.125E-003	2.083E-003
Th-229	4.86	4.74	5.12	4.00	4.167E-003	2.329E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	3.00	3.125E-003	2.083E-003
Am-243	5.23	5.05	5.31	4.00	4.167E-003	2.329E-003
U-232	5.25	5.06	5.40	6.00	6.250E-003	2.756E-003
Th-228	5.45	5.19	5.51	6.00	6.250E-003	2.756E-003
Po-210	5.28	5.23	5.29	2.00	2.083E-003	1.804E-003
Pu-238	5.47	5.27	5.55	5.00	5.208E-003	2.552E-003
Am-241	5.48	5.30	5.60	4.00	4.167E-003	2.329E-003
Cm-245	5.42	5.40	5.45	2.00	2.083E-003	1.804E-003
Pu-236	5.76	5.61	5.89	1.00	1.042E-003	1.473E-003
Cm-244	5.78	5.64	5.90	1.00	1.042E-003	1.473E-003
Th-227	6.07	5.93	6.18	16.00	1.667E-002	4.295E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:40:27PM 5/15/2014

Sample

Sample Name: ICB;AV17
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

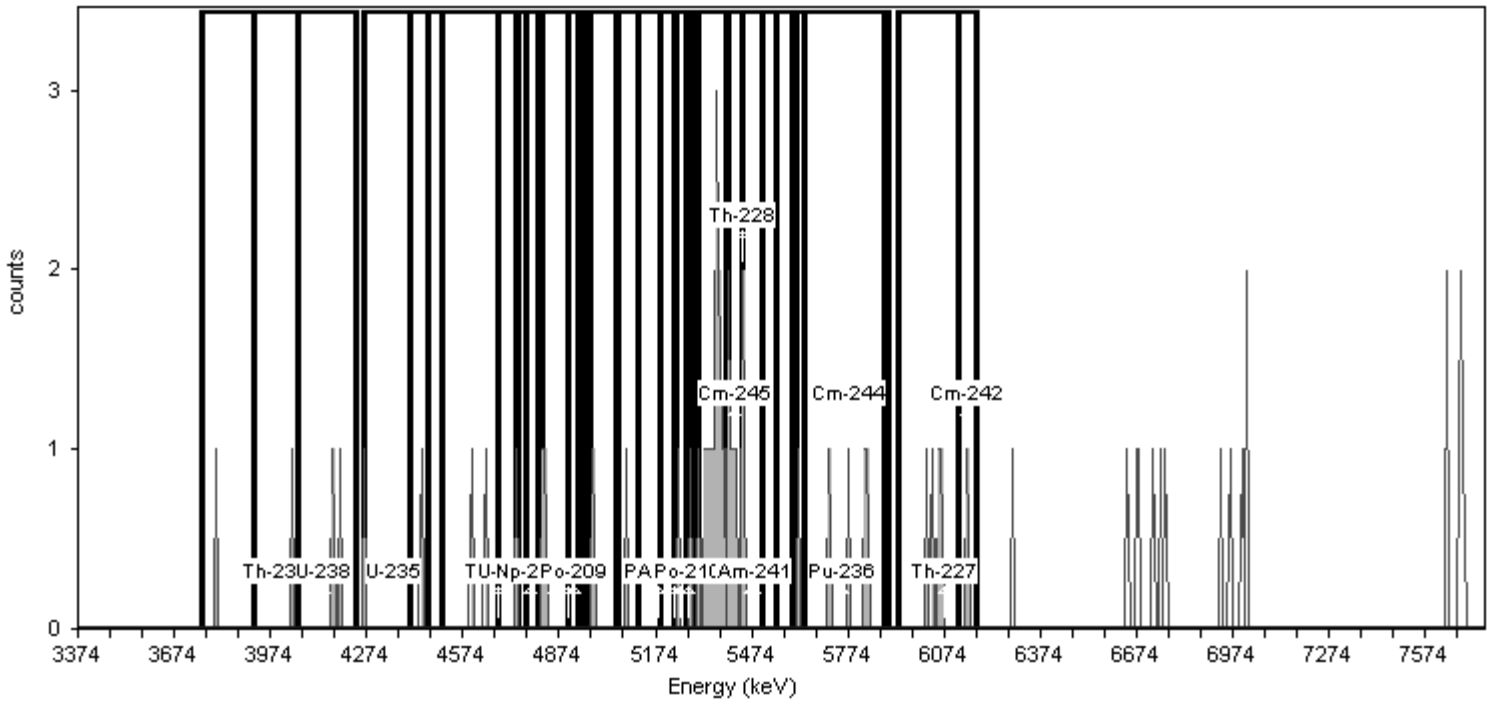
Analyst: 60040

Acquisition

Detector: AV17 , SN: 50-051C4
Acquisition Start Date: 5/15/2014 1:17:59AM
Live Time: 960.00 min.
Real Time: 960.06 min.
Calibration Name: IC-8874;AV17-20140505
Calibration Date: 5/5/2014 10:08:49PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.07% +/- 0.37% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 63.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	2.00	2.083E-003	1.804E-003
U-238	4.14	3.92	4.24	3.00	3.125E-003	2.083E-003
U-235	4.36	4.26	4.46	2.00	2.083E-003	1.804E-003
Th-230	4.68	4.40	4.75	4.00	4.167E-003	2.329E-003
U-234	4.71	4.51	4.82	4.00	4.167E-003	2.329E-003
Pu-242	4.90	4.68	4.95	3.00	3.125E-003	2.083E-003
Th-229	4.86	4.74	5.12	5.00	5.208E-003	2.552E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	2.00	2.083E-003	1.804E-003
Am-243	5.23	5.05	5.31	4.00	4.167E-003	2.329E-003
U-232	5.25	5.06	5.40	18.00	1.875E-002	4.541E-003
Th-228	5.45	5.19	5.51	22.00	2.292E-002	4.996E-003
Po-210	5.28	5.23	5.29	2.00	2.083E-003	1.804E-003
Pu-238	5.47	5.27	5.55	21.00	2.187E-002	4.886E-003
Am-241	5.48	5.30	5.60	20.00	2.083E-002	4.774E-003
Cm-245	5.42	5.40	5.45	7.00	7.292E-003	2.946E-003
Pu-236	5.76	5.61	5.89	5.00	5.208E-003	2.552E-003
Cm-244	5.78	5.64	5.90	4.00	4.167E-003	2.329E-003
Th-227	6.07	5.93	6.18	5.00	5.208E-003	2.552E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:40:33PM 5/15/2014

Sample

Sample Name: ICB;AV18
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

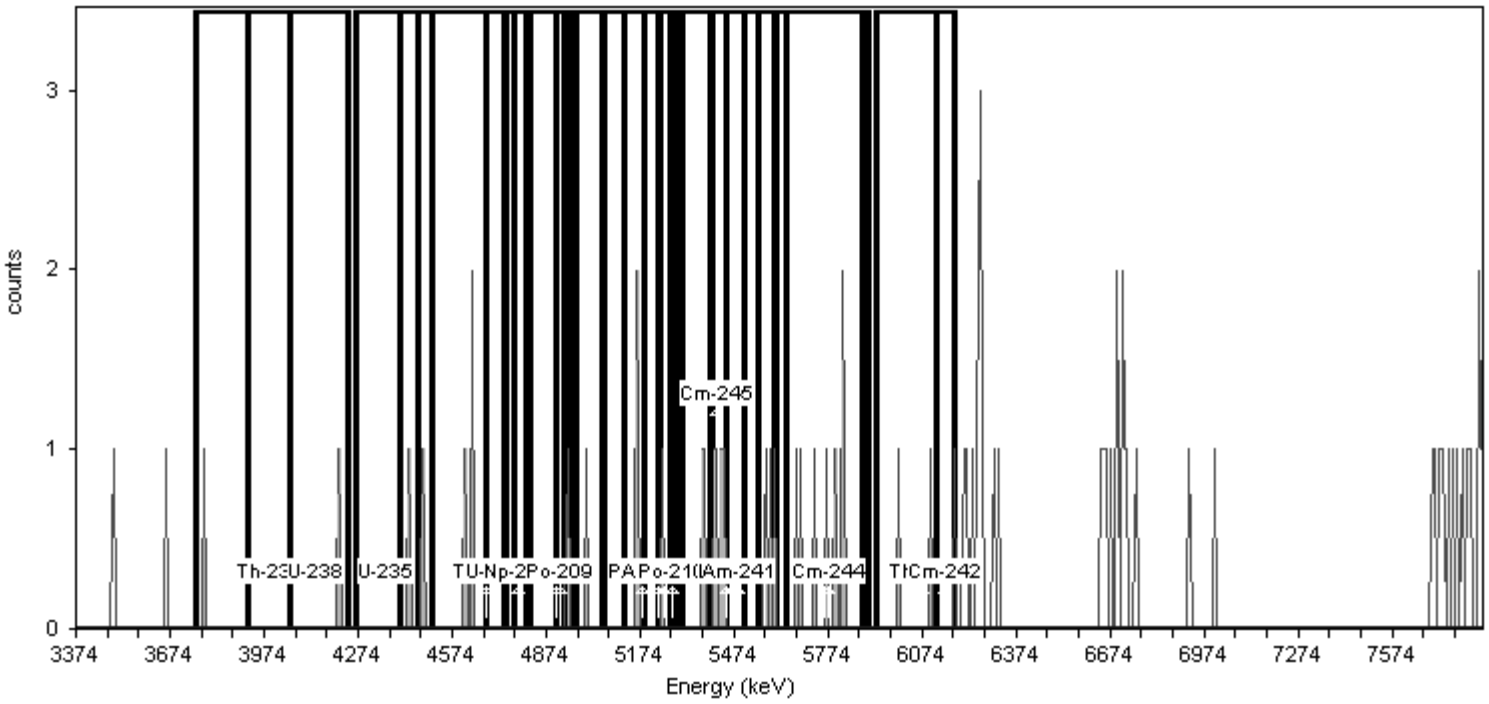
Analyst: 60040

Acquisition

Detector: AV18 , SN: 51-082C5
Acquisition Start Date: 5/15/2014 1:18:01AM
Live Time: 960.00 min.
Real Time: 960.06 min.
Calibration Name: IC-8875;AV18-20140505
Calibration Date: 5/5/2014 10:09:08PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.46% +/- 0.36% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 72.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	1.00	1.042E-003	1.473E-003
U-235	4.36	4.26	4.46	1.00	1.042E-003	1.473E-003
Th-230	4.68	4.40	4.75	5.00	5.208E-003	2.552E-003
U-234	4.71	4.51	4.82	3.00	3.125E-003	2.083E-003
Pu-242	4.90	4.68	4.95	1.00	1.042E-003	1.473E-003
Th-229	4.86	4.74	5.12	2.00	2.083E-003	1.804E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	3.00	3.125E-003	2.083E-003
Am-243	5.23	5.05	5.31	3.00	3.125E-003	2.083E-003
U-232	5.25	5.06	5.40	5.00	5.208E-003	2.552E-003
Th-228	5.45	5.19	5.51	7.00	7.292E-003	2.946E-003
Po-210	5.28	5.23	5.29	1.00	1.042E-003	1.473E-003
Pu-238	5.47	5.27	5.55	6.00	6.250E-003	2.756E-003
Am-241	5.48	5.30	5.60	9.00	9.375E-003	3.294E-003
Cm-245	5.42	5.40	5.45	4.00	4.167E-003	2.329E-003
Pu-236	5.76	5.61	5.89	8.00	8.333E-003	3.125E-003
Cm-244	5.78	5.64	5.90	8.00	8.333E-003	3.125E-003
Th-227	6.07	5.93	6.18	3.00	3.125E-003	2.083E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:40:56PM 5/15/2014

Sample

Sample Name: ICB;AV19
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

Analyst: 60040

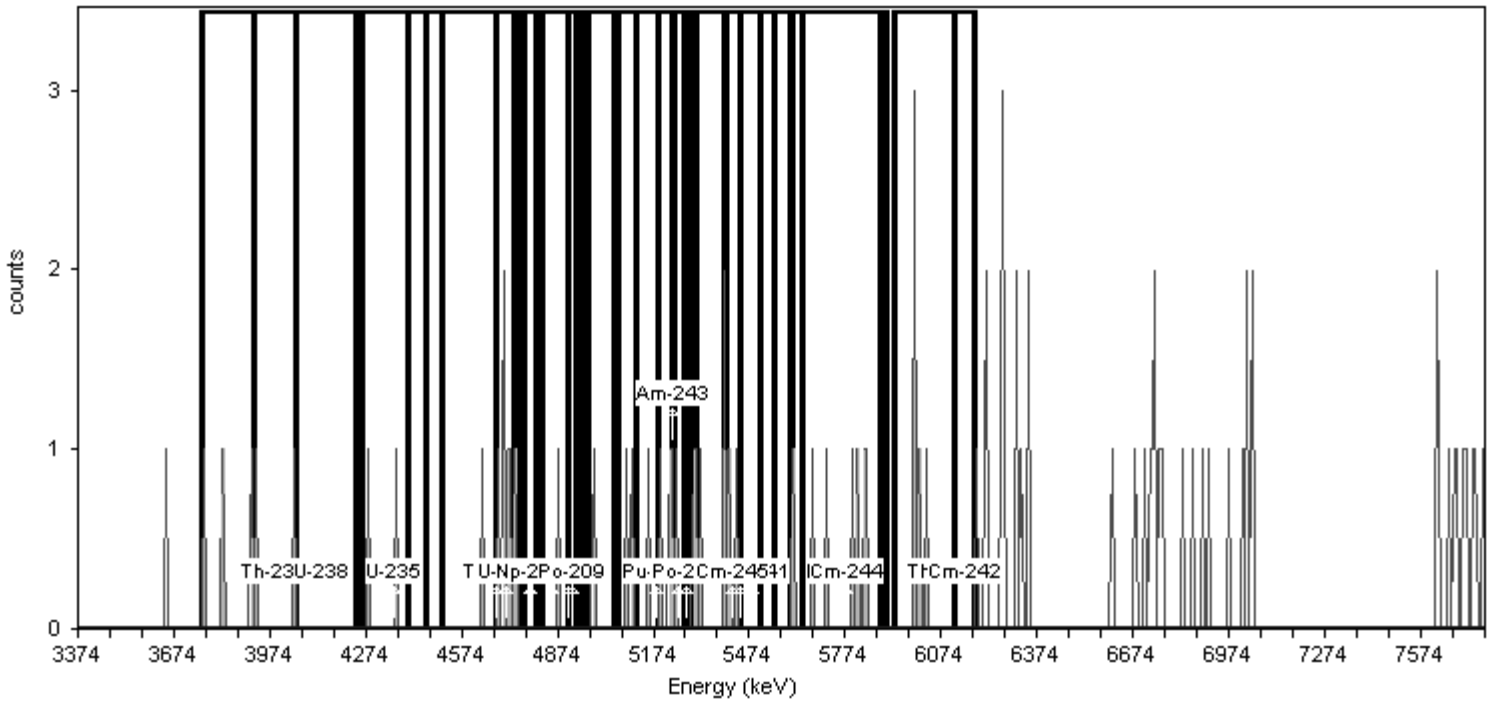
Acquisition

Detector: AV19 , SN: 50-025FF5
Acquisition Start Date: 5/15/2014 1:18:02AM
Live Time: 960.00 min.
Real Time: 960.06 min.
Calibration Name: IC-8876;AV19-20140505
Calibration Date: 5/5/2014 10:09:02PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.34% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 85.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	5.00	5.208E-003	2.552E-003
U-238	4.14	3.92	4.24	2.00	2.083E-003	1.804E-003
U-235	4.36	4.26	4.46	2.00	2.083E-003	1.804E-003
Th-230	4.68	4.40	4.75	7.00	7.292E-003	2.946E-003
U-234	4.71	4.51	4.82	7.00	7.292E-003	2.946E-003
Pu-242	4.90	4.68	4.95	7.00	7.292E-003	2.946E-003
Th-229	4.86	4.74	5.12	5.00	5.208E-003	2.552E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	7.00	7.292E-003	2.946E-003
Am-243	5.23	5.05	5.31	9.00	9.375E-003	3.294E-003
U-232	5.25	5.06	5.40	12.00	1.250E-002	3.756E-003
Th-228	5.45	5.19	5.51	11.00	1.146E-002	3.608E-003
Po-210	5.28	5.23	5.29	2.00	2.083E-003	1.804E-003
Pu-238	5.47	5.27	5.55	7.00	7.292E-003	2.946E-003
Am-241	5.48	5.30	5.60	7.00	7.292E-003	2.946E-003
Cm-245	5.42	5.40	5.45	4.00	4.167E-003	2.329E-003
Pu-236	5.76	5.61	5.89	7.00	7.292E-003	2.946E-003
Cm-244	5.78	5.64	5.90	6.00	6.250E-003	2.756E-003
Th-227	6.07	5.93	6.18	5.00	5.208E-003	2.552E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:40:39PM 5/15/2014

Sample

Sample Name: ICB;AV20
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

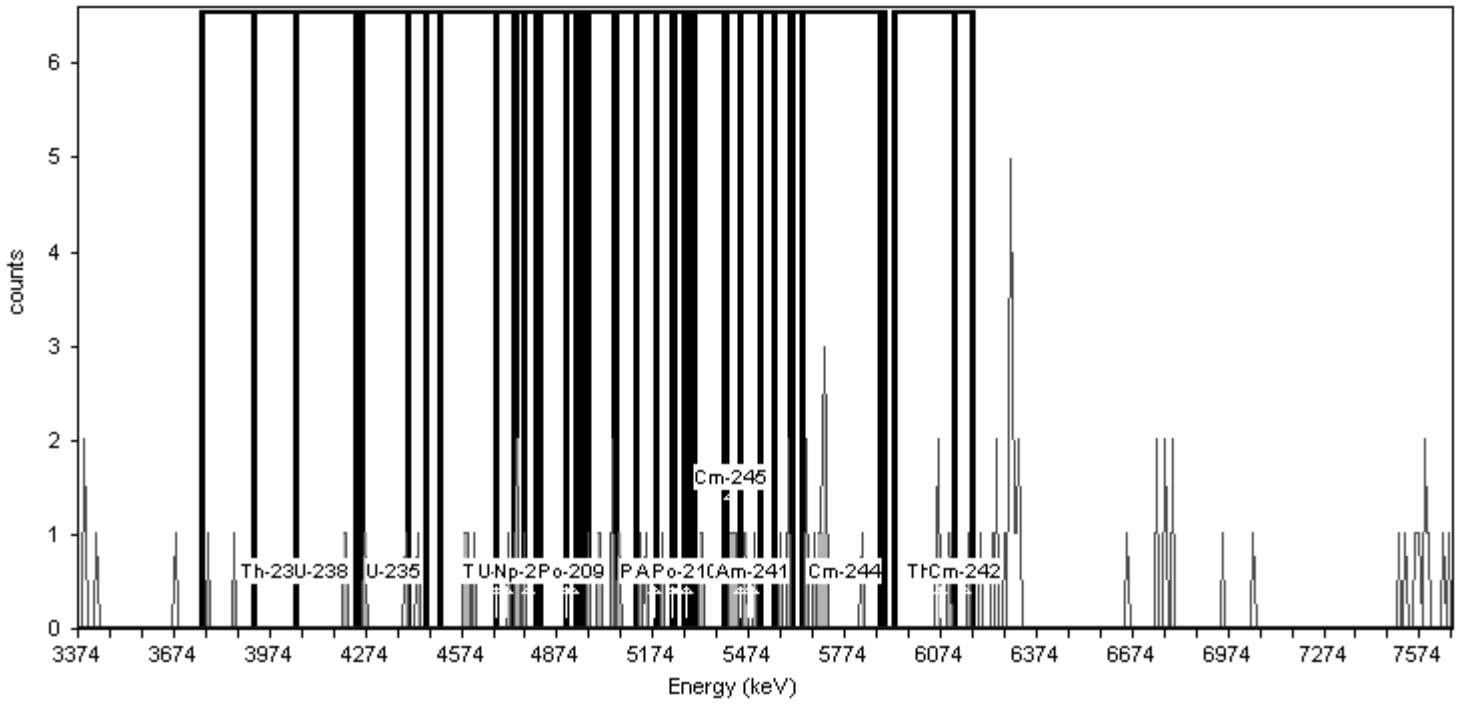
Analyst: 60040

Acquisition

Detector: AV20 , SN: 48-121A7
Acquisition Start Date: 5/15/2014 1:18:04AM
Live Time: 960.00 min.
Real Time: 960.06 min.
Calibration Name: IC-8877;AV20-20140505
Calibration Date: 5/5/2014 10:09:21PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.56% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 89.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	2.00	2.083E-003	1.804E-003
U-238	4.14	3.92	4.24	2.00	2.083E-003	1.804E-003
U-235	4.36	4.26	4.46	3.00	3.125E-003	2.083E-003
Th-230	4.68	4.40	4.75	7.00	7.292E-003	2.946E-003
U-234	4.71	4.51	4.82	7.00	7.292E-003	2.946E-003
Pu-242	4.90	4.68	4.95	4.00	4.167E-003	2.329E-003
Th-229	4.86	4.74	5.12	9.00	9.375E-003	3.294E-003
Np-237	4.78	4.77	4.81	1.00	1.042E-003	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	9.00	9.375E-003	3.294E-003
Am-243	5.23	5.05	5.31	4.00	4.167E-003	2.329E-003
U-232	5.25	5.06	5.40	6.00	6.250E-003	2.756E-003
Th-228	5.45	5.19	5.51	8.00	8.333E-003	3.125E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	7.00	7.292E-003	2.946E-003
Am-241	5.48	5.30	5.60	10.00	1.042E-002	3.455E-003
Cm-245	5.42	5.40	5.45	3.00	3.125E-003	2.083E-003
Pu-236	5.76	5.61	5.89	11.00	1.146E-002	3.608E-003
Cm-244	5.78	5.64	5.90	11.00	1.146E-002	3.608E-003
Th-227	6.07	5.93	6.18	4.00	4.167E-003	2.329E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:41:07PM 5/15/2014

Sample

Sample Name: ICB;AV43
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

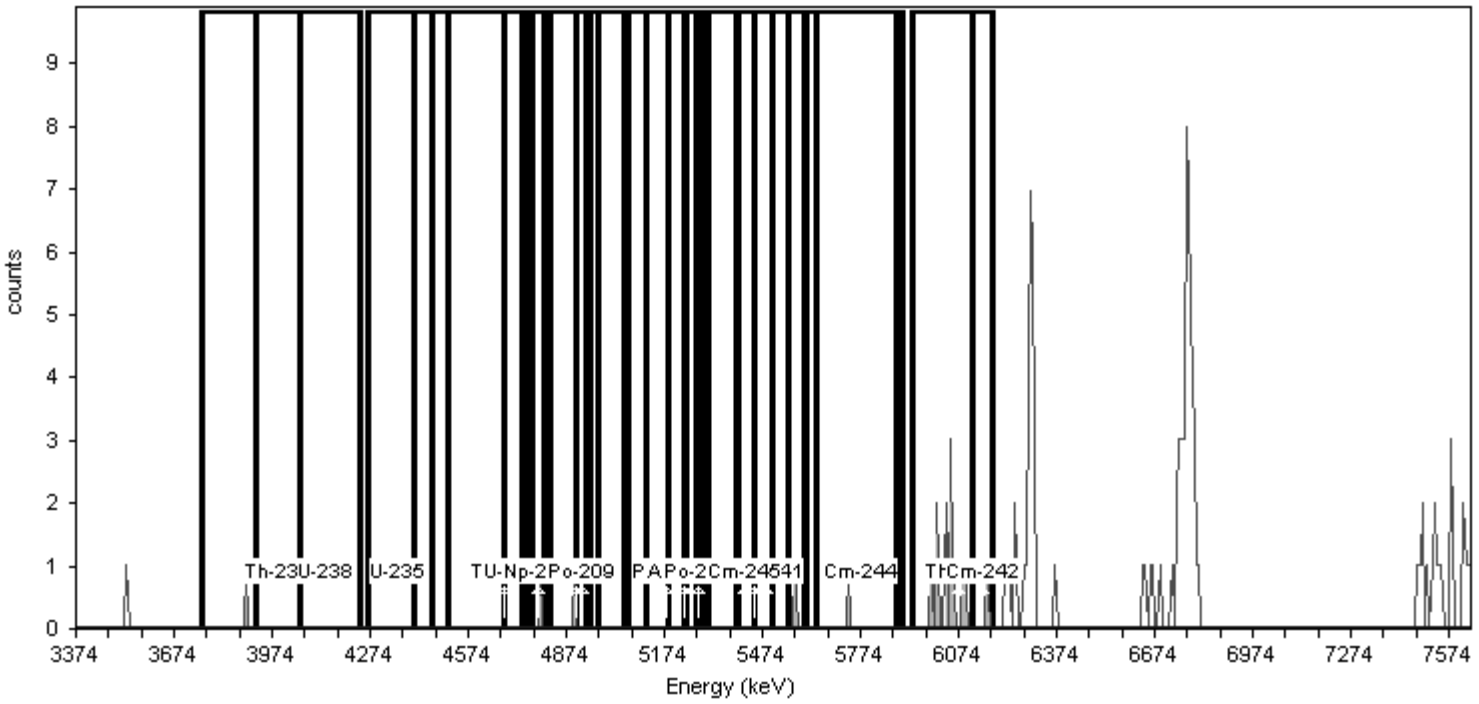
Analyst: 60040

Acquisition

Detector: AV43 , SN: 49-190X4
Acquisition Start Date: 5/15/2014 1:18:19AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9794;AV43-20140505
Calibration Date: 5/5/2014 10:09:47PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.74% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 105.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	0.00	0.000E+000	1.473E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	0.00	0.000E+000	1.473E-003
U-234	4.71	4.51	4.82	1.00	1.042E-003	1.473E-003
Pu-242	4.90	4.68	4.95	2.00	2.083E-003	1.804E-003
Th-229	4.86	4.74	5.12	2.00	2.083E-003	1.804E-003
Np-237	4.78	4.77	4.81	1.00	1.042E-003	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	0.00	0.000E+000	1.473E-003
Am-243	5.23	5.05	5.31	0.00	0.000E+000	1.473E-003
U-232	5.25	5.06	5.40	0.00	0.000E+000	1.473E-003
Th-228	5.45	5.19	5.51	0.00	0.000E+000	1.473E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	0.00	0.000E+000	1.473E-003
Am-241	5.48	5.30	5.60	1.00	1.042E-003	1.473E-003
Cm-245	5.42	5.40	5.45	0.00	0.000E+000	1.473E-003
Pu-236	5.76	5.61	5.89	1.00	1.042E-003	1.473E-003
Cm-244	5.78	5.64	5.90	1.00	1.042E-003	1.473E-003
Th-227	6.07	5.93	6.18	13.00	1.354E-002	3.898E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:41:13PM 5/15/2014

Sample

Sample Name: ICB;AV44
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

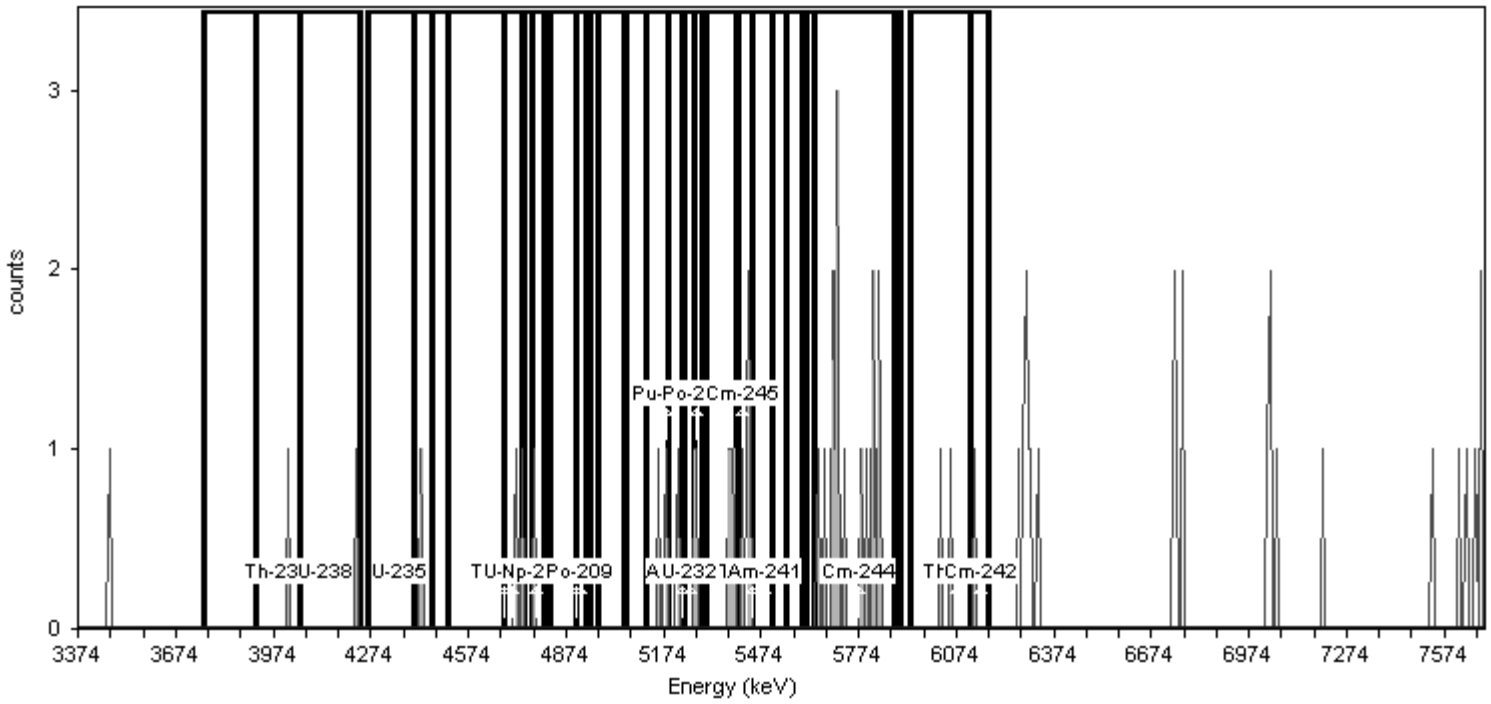
Analyst: 60040

Acquisition

Detector: AV44 , SN: 50-051JJ1
Acquisition Start Date: 5/15/2014 1:18:20AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9795;AV44-20140505
Calibration Date: 5/5/2014 10:09:57PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.32% +/- 0.35% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 61.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	2.00	2.083E-003	1.804E-003
U-235	4.36	4.26	4.46	1.00	1.042E-003	1.473E-003
Th-230	4.68	4.40	4.75	3.00	3.125E-003	2.083E-003
U-234	4.71	4.51	4.82	3.00	3.125E-003	2.083E-003
Pu-242	4.90	4.68	4.95	3.00	3.125E-003	2.083E-003
Th-229	4.86	4.74	5.12	2.00	2.083E-003	1.804E-003
Np-237	4.78	4.77	4.81	1.00	1.042E-003	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	3.00	3.125E-003	2.083E-003
Am-243	5.23	5.05	5.31	5.00	5.208E-003	2.552E-003
U-232	5.25	5.06	5.40	8.00	8.333E-003	3.125E-003
Th-228	5.45	5.19	5.51	10.00	1.042E-002	3.455E-003
Po-210	5.28	5.23	5.29	2.00	2.083E-003	1.804E-003
Pu-238	5.47	5.27	5.55	9.00	9.375E-003	3.294E-003
Am-241	5.48	5.30	5.60	7.00	7.292E-003	2.946E-003
Cm-245	5.42	5.40	5.45	4.00	4.167E-003	2.329E-003
Pu-236	5.76	5.61	5.89	16.00	1.667E-002	4.295E-003
Cm-244	5.78	5.64	5.90	16.00	1.667E-002	4.295E-003
Th-227	6.07	5.93	6.18	3.00	3.125E-003	2.083E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:41:19PM 5/15/2014

Sample

Sample Name: ICB;AV45
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

Analyst: 60040

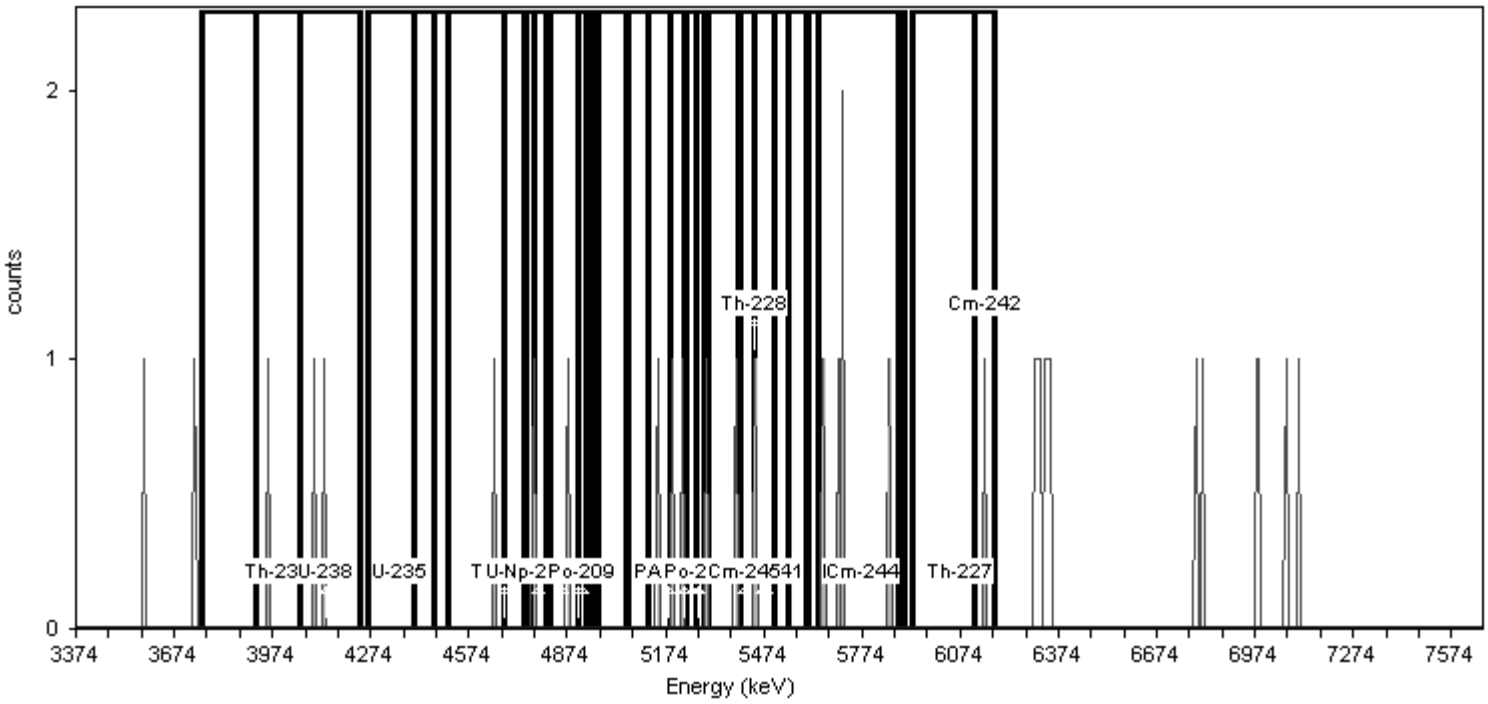
Acquisition

Detector: AV45 , SN: 48-158FF2
Acquisition Start Date: 5/15/2014 1:18:21AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9817;AV45-20140505
Calibration Date: 5/5/2014 10:10:03PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.06% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 32.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	3.00	3.125E-003	2.083E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	1.00	1.042E-003	1.473E-003
U-234	4.71	4.51	4.82	2.00	2.083E-003	1.804E-003
Pu-242	4.90	4.68	4.95	2.00	2.083E-003	1.804E-003
Th-229	4.86	4.74	5.12	2.00	2.083E-003	1.804E-003
Np-237	4.78	4.77	4.81	1.00	1.042E-003	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	3.00	3.125E-003	2.083E-003
Am-243	5.23	5.05	5.31	4.00	4.167E-003	2.329E-003
U-232	5.25	5.06	5.40	5.00	5.208E-003	2.552E-003
Th-228	5.45	5.19	5.51	5.00	5.208E-003	2.552E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	3.00	3.125E-003	2.083E-003
Am-241	5.48	5.30	5.60	3.00	3.125E-003	2.083E-003
Cm-245	5.42	5.40	5.45	1.00	1.042E-003	1.473E-003
Pu-236	5.76	5.61	5.89	5.00	5.208E-003	2.552E-003
Cm-244	5.78	5.64	5.90	5.00	5.208E-003	2.552E-003
Th-227	6.07	5.93	6.18	1.00	1.042E-003	1.473E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:41:25PM 5/15/2014

Sample

Sample Name: ICB;AV46
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

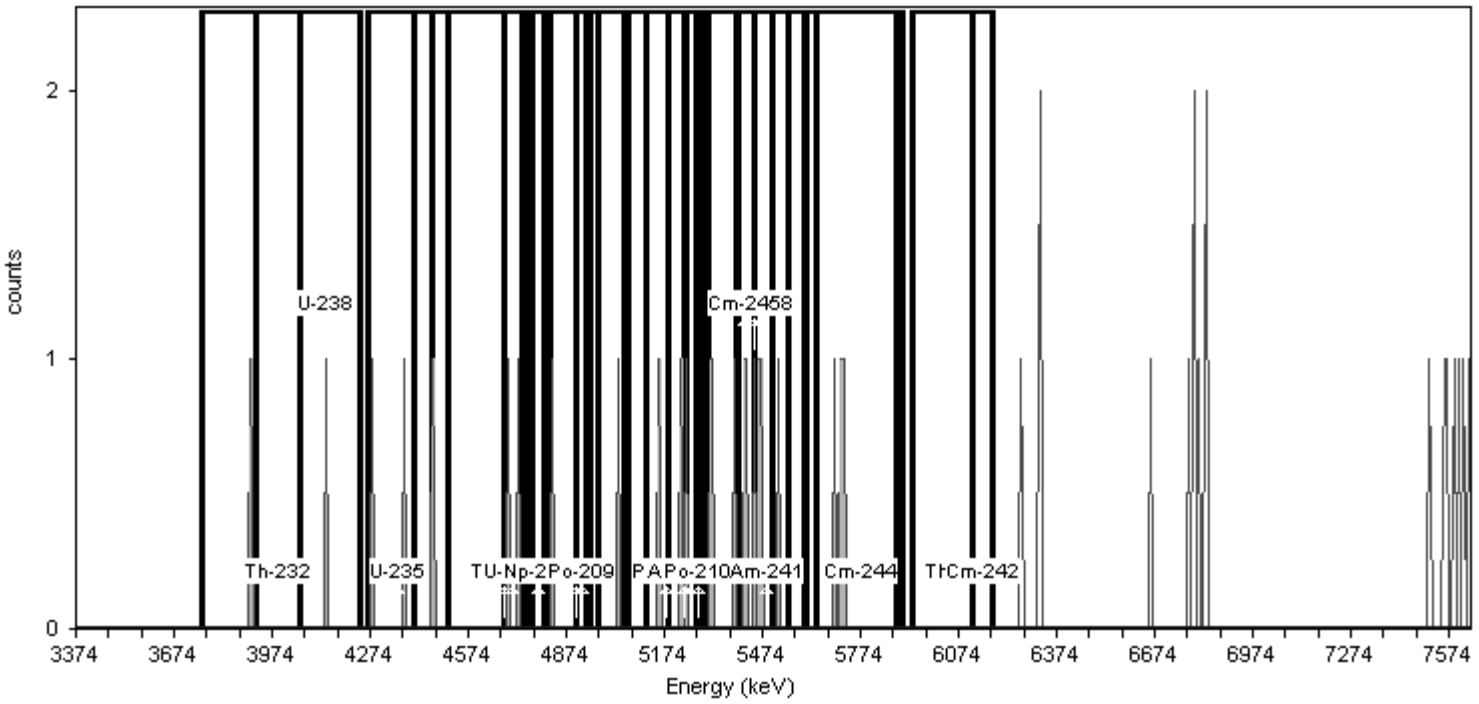
Analyst: 60040

Acquisition

Detector: AV46 , SN: 49-202GG2
Acquisition Start Date: 5/15/2014 1:18:22AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9884;AV46-20140505
Calibration Date: 5/5/2014 10:10:09PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.80% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 42.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	1.00	1.042E-003	1.473E-003
U-235	4.36	4.26	4.46	3.00	3.125E-003	2.083E-003
Th-230	4.68	4.40	4.75	3.00	3.125E-003	2.083E-003
U-234	4.71	4.51	4.82	2.00	2.083E-003	1.804E-003
Pu-242	4.90	4.68	4.95	3.00	3.125E-003	2.083E-003
Th-229	4.86	4.74	5.12	2.00	2.083E-003	1.804E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	4.00	4.167E-003	2.329E-003
Am-243	5.23	5.05	5.31	3.00	3.125E-003	2.083E-003
U-232	5.25	5.06	5.40	6.00	6.250E-003	2.756E-003
Th-228	5.45	5.19	5.51	10.00	1.042E-002	3.455E-003
Po-210	5.28	5.23	5.29	1.00	1.042E-003	1.473E-003
Pu-238	5.47	5.27	5.55	9.00	9.375E-003	3.294E-003
Am-241	5.48	5.30	5.60	9.00	9.375E-003	3.294E-003
Cm-245	5.42	5.40	5.45	3.00	3.125E-003	2.083E-003
Pu-236	5.76	5.61	5.89	3.00	3.125E-003	2.083E-003
Cm-244	5.78	5.64	5.90	3.00	3.125E-003	2.083E-003
Th-227	6.07	5.93	6.18	0.00	0.000E+000	1.473E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:41:36PM 5/15/2014

Sample

Sample Name: ICB;AV48
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

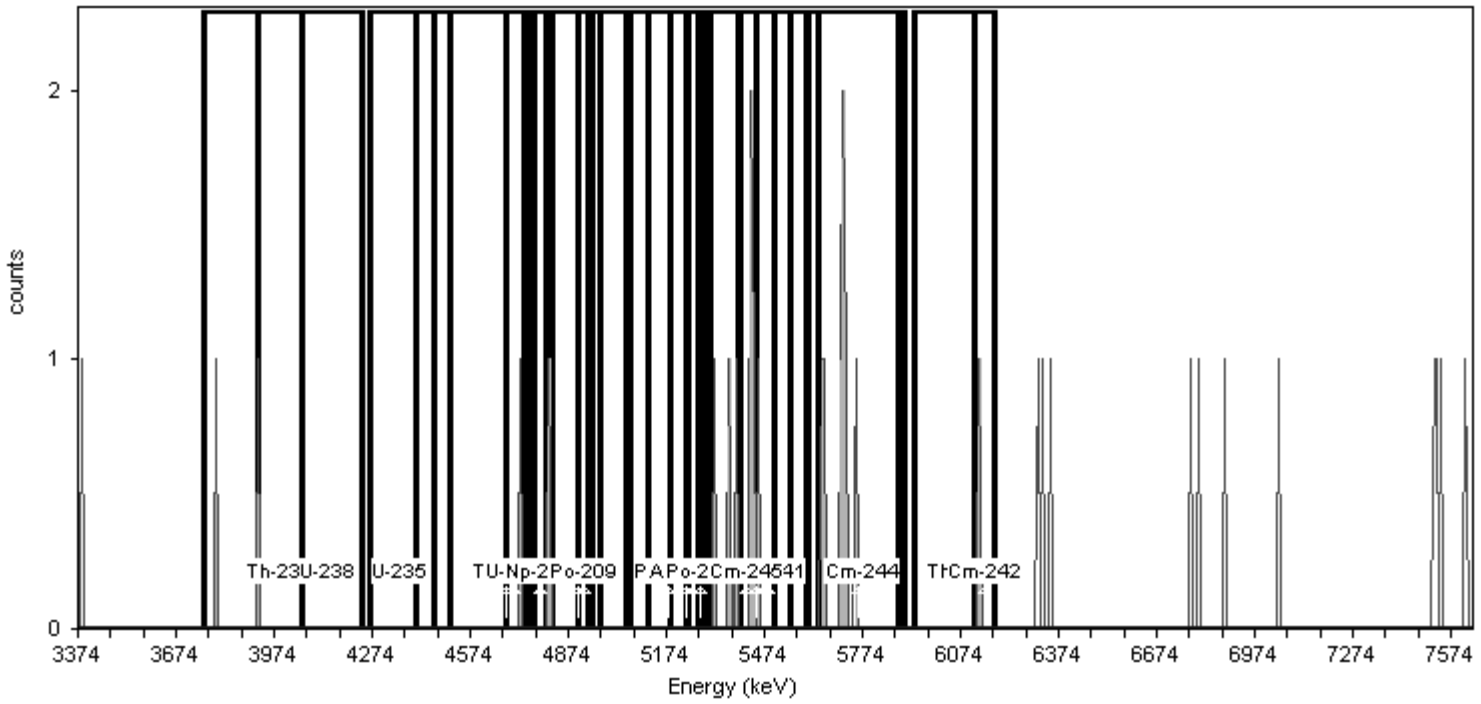
Analyst: 60040

Acquisition

Detector: AV48 , SN: 50-051JJ4
Acquisition Start Date: 5/15/2014 1:18:23AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9886;AV48-20140505
Calibration Date: 5/5/2014 10:10:22PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.78% +/- 0.35% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 31.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	2.00	2.083E-003	1.804E-003
U-238	4.14	3.92	4.24	1.00	1.042E-003	1.473E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	1.00	1.042E-003	1.473E-003
U-234	4.71	4.51	4.82	2.00	2.083E-003	1.804E-003
Pu-242	4.90	4.68	4.95	2.00	2.083E-003	1.804E-003
Th-229	4.86	4.74	5.12	1.00	1.042E-003	1.473E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	0.00	0.000E+000	1.473E-003
Am-243	5.23	5.05	5.31	0.00	0.000E+000	1.473E-003
U-232	5.25	5.06	5.40	3.00	3.125E-003	2.083E-003
Th-228	5.45	5.19	5.51	7.00	7.292E-003	2.946E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	7.00	7.292E-003	2.946E-003
Am-241	5.48	5.30	5.60	7.00	7.292E-003	2.946E-003
Cm-245	5.42	5.40	5.45	3.00	3.125E-003	2.083E-003
Pu-236	5.76	5.61	5.89	7.00	7.292E-003	2.946E-003
Cm-244	5.78	5.64	5.90	7.00	7.292E-003	2.946E-003
Th-227	6.07	5.93	6.18	1.00	1.042E-003	1.473E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:42:22PM 5/15/2014

Sample

Sample Name: ICB;AV57
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

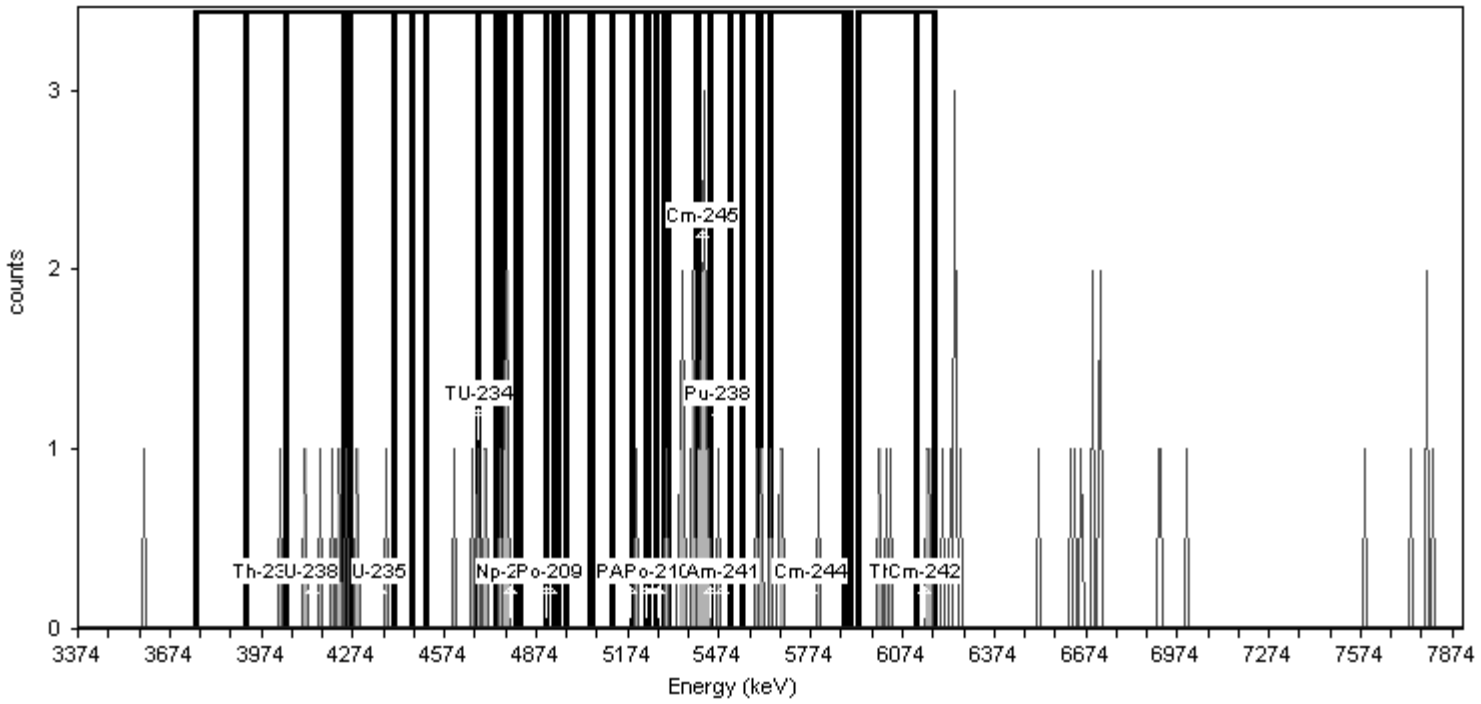
Analyst: 60040

Acquisition

Detector: AV57 , SN: 48-158EE3
Acquisition Start Date: 5/15/2014 1:18:35AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-9793;AV57-20140504
Calibration Date: 5/5/2014 6:53:40PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.74% +/- 0.33% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 70.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	5.00	5.208E-003	2.552E-003
U-235	4.36	4.26	4.46	2.00	2.083E-003	1.804E-003
Th-230	4.68	4.40	4.75	5.00	5.208E-003	2.552E-003
U-234	4.71	4.51	4.82	9.00	9.375E-003	3.294E-003
Pu-242	4.90	4.68	4.95	7.00	7.292E-003	2.946E-003
Th-229	4.86	4.74	5.12	4.00	4.167E-003	2.329E-003
Np-237	4.78	4.77	4.81	3.00	3.125E-003	2.083E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	1.00	1.042E-003	1.473E-003
Am-243	5.23	5.05	5.31	2.00	2.083E-003	1.804E-003
U-232	5.25	5.06	5.40	9.00	9.375E-003	3.294E-003
Th-228	5.45	5.19	5.51	18.00	1.875E-002	4.541E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	17.00	1.771E-002	4.419E-003
Am-241	5.48	5.30	5.60	18.00	1.875E-002	4.541E-003
Cm-245	5.42	5.40	5.45	9.00	9.375E-003	3.294E-003
Pu-236	5.76	5.61	5.89	5.00	5.208E-003	2.552E-003
Cm-244	5.78	5.64	5.90	4.00	4.167E-003	2.329E-003
Th-227	6.07	5.93	6.18	5.00	5.208E-003	2.552E-003
Cm-242	6.15	6.12	6.18	2.00	2.083E-003	1.804E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:42:33PM 5/15/2014

Sample

Sample Name: ICB;AV58
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

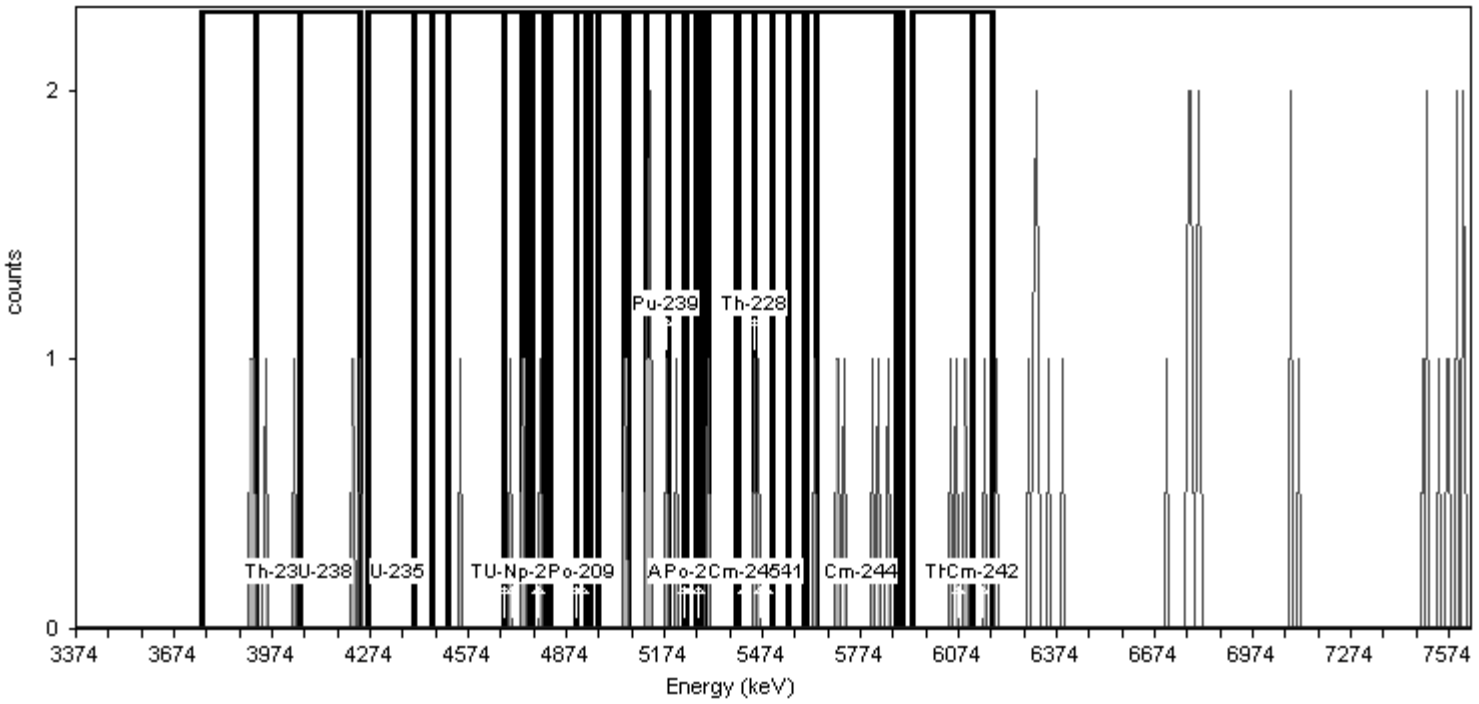
Analyst: 60040

Acquisition

Detector: AV58 , SN: 52-102 C5
Acquisition Start Date: 5/15/2014 1:18:36AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-9794;AV58-20140504
Calibration Date: 5/5/2014 6:53:46PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.56% +/- 0.33% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 61.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	4.00	4.167E-003	2.329E-003
U-238	4.14	3.92	4.24	4.00	4.167E-003	2.329E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	3.00	3.125E-003	2.083E-003
U-234	4.71	4.51	4.82	4.00	4.167E-003	2.329E-003
Pu-242	4.90	4.68	4.95	3.00	3.125E-003	2.083E-003
Th-229	4.86	4.74	5.12	4.00	4.167E-003	2.329E-003
Np-237	4.78	4.77	4.81	1.00	1.042E-003	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	6.00	6.250E-003	2.756E-003
Am-243	5.23	5.05	5.31	7.00	7.292E-003	2.946E-003
U-232	5.25	5.06	5.40	6.00	6.250E-003	2.756E-003
Th-228	5.45	5.19	5.51	4.00	4.167E-003	2.329E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	3.00	3.125E-003	2.083E-003
Am-241	5.48	5.30	5.60	3.00	3.125E-003	2.083E-003
Cm-245	5.42	5.40	5.45	1.00	1.042E-003	1.473E-003
Pu-236	5.76	5.61	5.89	7.00	7.292E-003	2.946E-003
Cm-244	5.78	5.64	5.90	6.00	6.250E-003	2.756E-003
Th-227	6.07	5.93	6.18	4.00	4.167E-003	2.329E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:42:40PM 5/15/2014

Sample

Sample Name: ICB;AV59
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

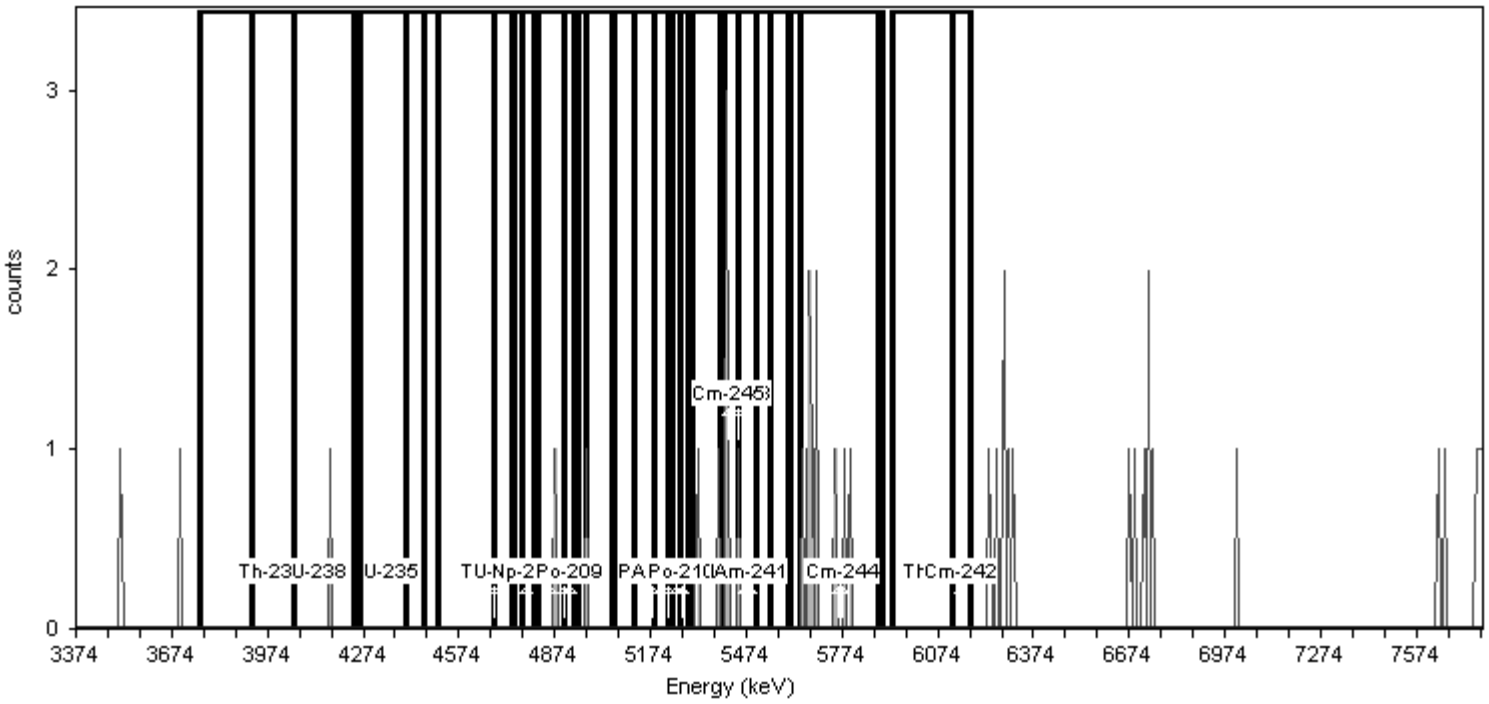
Analyst: 60040

Acquisition

Detector: AV59 , SN: 49-155M7
Acquisition Start Date: 5/15/2014 1:18:38AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9795;AV59-20140504
Calibration Date: 5/5/2014 6:53:53PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.44% +/- 0.36% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 39.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	0.00	0.000E+000	1.473E-003
U-238	4.14	3.92	4.24	1.00	1.042E-003	1.473E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	0.00	0.000E+000	1.473E-003
U-234	4.71	4.51	4.82	0.00	0.000E+000	1.473E-003
Pu-242	4.90	4.68	4.95	1.00	1.042E-003	1.473E-003
Th-229	4.86	4.74	5.12	2.00	2.083E-003	1.804E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	1.00	1.042E-003	1.473E-003
Am-243	5.23	5.05	5.31	0.00	0.000E+000	1.473E-003
U-232	5.25	5.06	5.40	2.00	2.083E-003	1.804E-003
Th-228	5.45	5.19	5.51	7.00	7.292E-003	2.946E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	7.00	7.292E-003	2.946E-003
Am-241	5.48	5.30	5.60	7.00	7.292E-003	2.946E-003
Cm-245	5.42	5.40	5.45	5.00	5.208E-003	2.552E-003
Pu-236	5.76	5.61	5.89	9.00	9.375E-003	3.294E-003
Cm-244	5.78	5.64	5.90	9.00	9.375E-003	3.294E-003
Th-227	6.07	5.93	6.18	0.00	0.000E+000	1.473E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:42:46PM 5/15/2014

Sample

Sample Name: ICB;AV60
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

Analyst: 60040

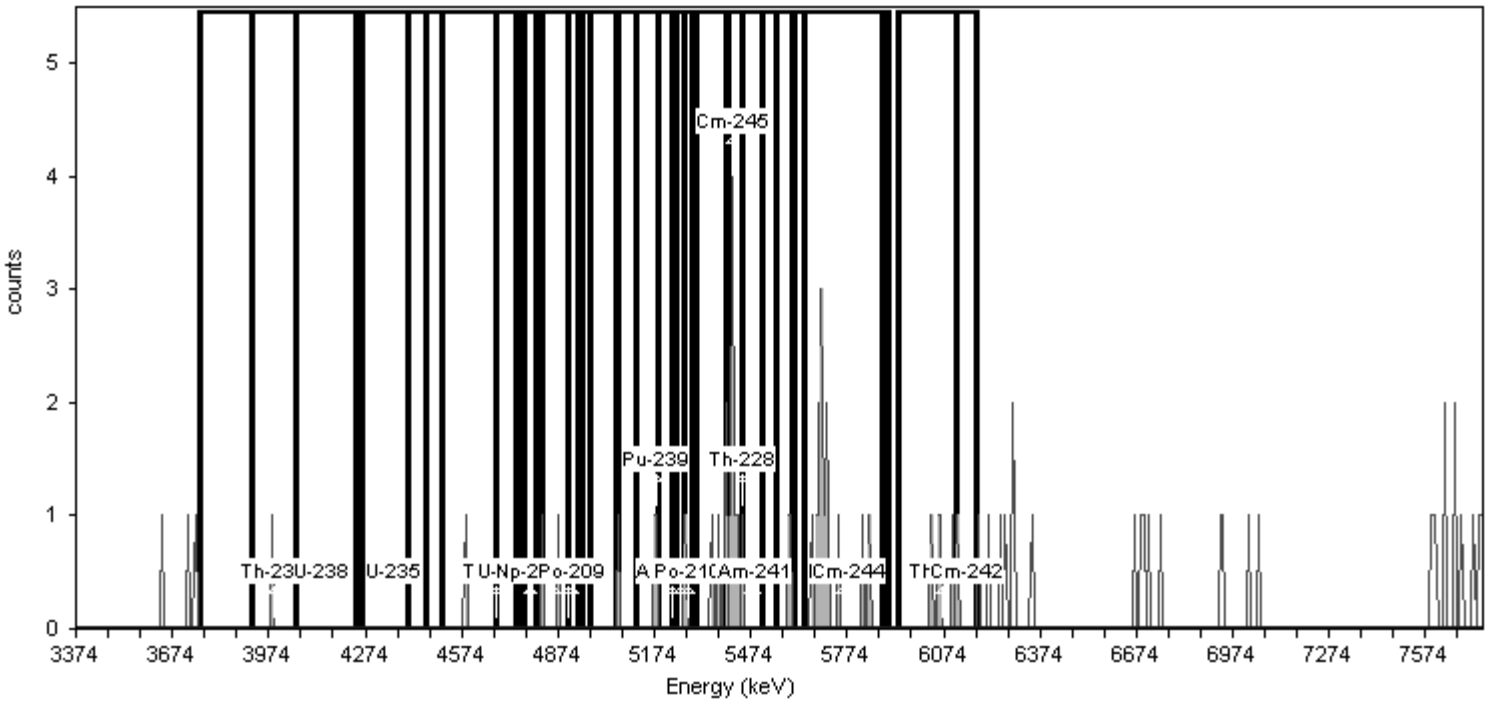
Acquisition

Detector: AV60 , SN: 49-027117
Acquisition Start Date: 5/15/2014 1:18:40AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9817;AV60-20140504
Calibration Date: 5/5/2014 6:53:59PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.33% +/- 0.32% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 71.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	1.00	1.042E-003	1.473E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	1.00	1.042E-003	1.473E-003
U-234	4.71	4.51	4.82	2.00	2.083E-003	1.804E-003
Pu-242	4.90	4.68	4.95	2.00	2.083E-003	1.804E-003
Th-229	4.86	4.74	5.12	3.00	3.125E-003	2.083E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	3.00	3.125E-003	2.083E-003
Am-243	5.23	5.05	5.31	4.00	4.167E-003	2.329E-003
U-232	5.25	5.06	5.40	8.00	8.333E-003	3.125E-003
Th-228	5.45	5.19	5.51	13.00	1.354E-002	3.898E-003
Po-210	5.28	5.23	5.29	1.00	1.042E-003	1.473E-003
Pu-238	5.47	5.27	5.55	13.00	1.354E-002	3.898E-003
Am-241	5.48	5.30	5.60	14.00	1.458E-002	4.034E-003
Cm-245	5.42	5.40	5.45	10.00	1.042E-002	3.455E-003
Pu-236	5.76	5.61	5.89	13.00	1.354E-002	3.898E-003
Cm-244	5.78	5.64	5.90	13.00	1.354E-002	3.898E-003
Th-227	6.07	5.93	6.18	5.00	5.208E-003	2.552E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:42:51PM 5/15/2014

Sample

Sample Name: ICB;AV61
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

Analyst: 60040

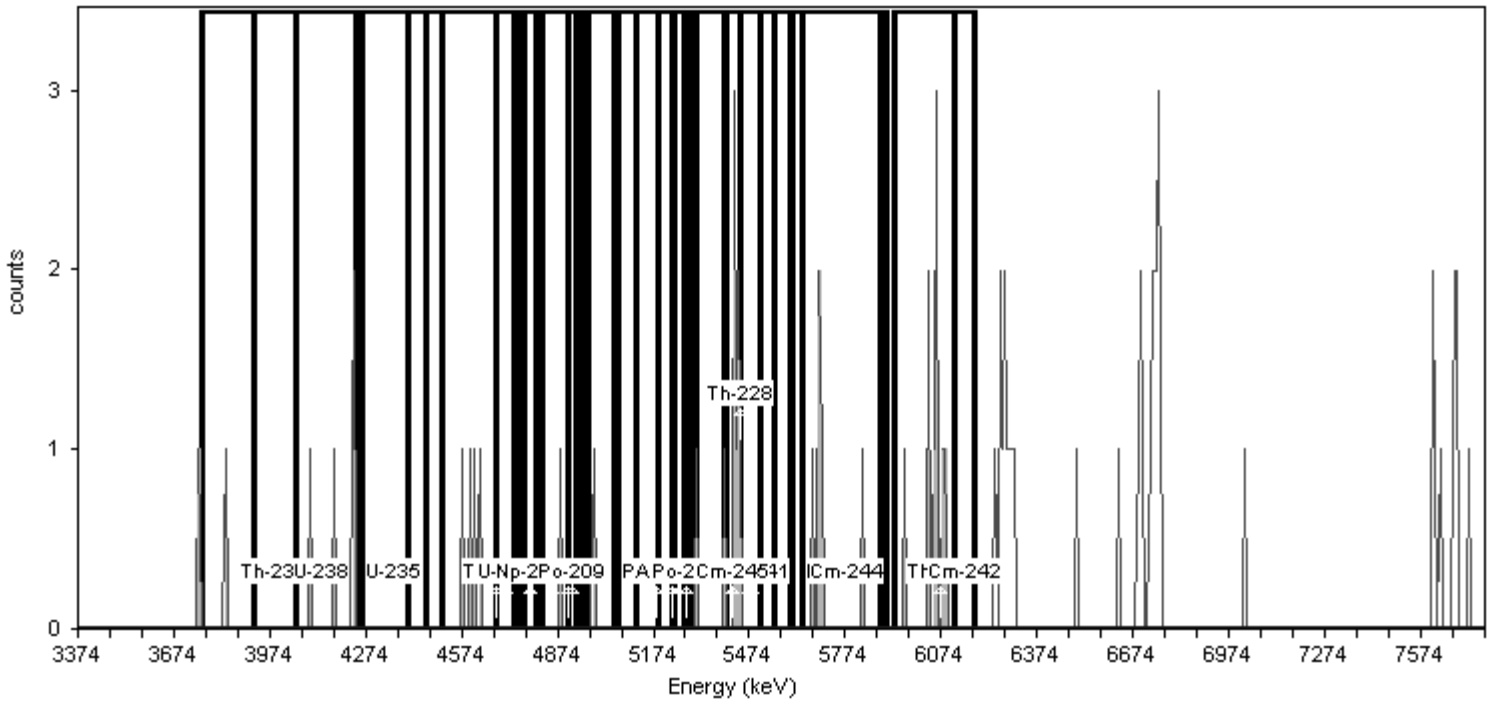
Acquisition

Detector: AV61 , SN: 5-051JJ3
Acquisition Start Date: 5/15/2014 1:18:42AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9884;AV61-20140504
Calibration Date: 5/5/2014 6:54:06PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.46% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 71.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	4.00	4.167E-003	2.329E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	4.00	4.167E-003	2.329E-003
U-234	4.71	4.51	4.82	4.00	4.167E-003	2.329E-003
Pu-242	4.90	4.68	4.95	1.00	1.042E-003	1.473E-003
Th-229	4.86	4.74	5.12	2.00	2.083E-003	1.804E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	1.00	1.042E-003	1.473E-003
Am-243	5.23	5.05	5.31	1.00	1.042E-003	1.473E-003
U-232	5.25	5.06	5.40	2.00	2.083E-003	1.804E-003
Th-228	5.45	5.19	5.51	9.00	9.375E-003	3.294E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	9.00	9.375E-003	3.294E-003
Am-241	5.48	5.30	5.60	9.00	9.375E-003	3.294E-003
Cm-245	5.42	5.40	5.45	8.00	8.333E-003	3.125E-003
Pu-236	5.76	5.61	5.89	5.00	5.208E-003	2.552E-003
Cm-244	5.78	5.64	5.90	5.00	5.208E-003	2.552E-003
Th-227	6.07	5.93	6.18	9.00	9.375E-003	3.294E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:42:57PM 5/15/2014

Sample

Sample Name: ICB;AV62
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

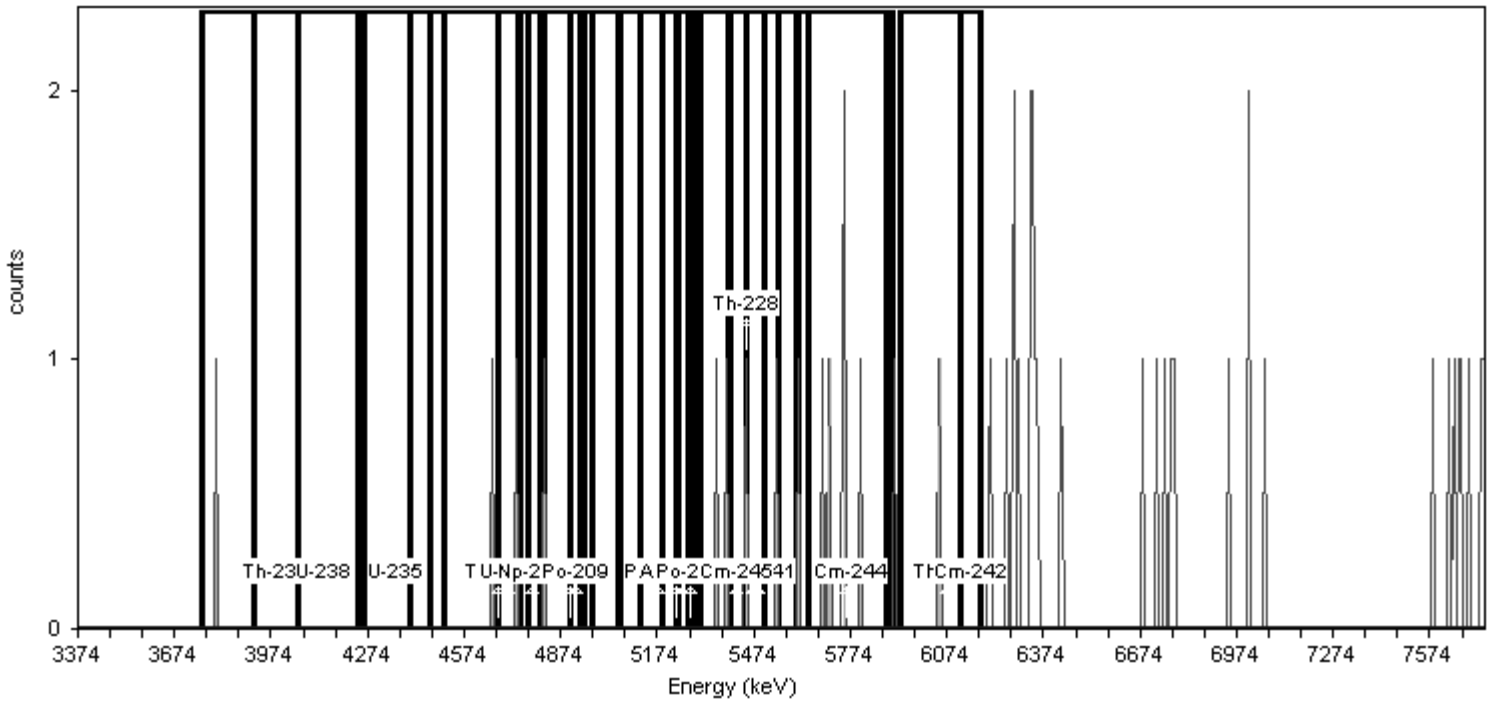
Analyst: 60040

Acquisition

Detector: AV62 , SN: 52-060FF2
Acquisition Start Date: 5/15/2014 1:18:43AM
Live Time: 960.00 min.
Real Time: 960.01 min.
Calibration Name: IC-9885;AV62-20140504
Calibration Date: 5/5/2014 6:54:13PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.34% +/- 0.38% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 45.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	0.00	0.000E+000	1.473E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	2.00	2.083E-003	1.804E-003
U-234	4.71	4.51	4.82	3.00	3.125E-003	2.083E-003
Pu-242	4.90	4.68	4.95	2.00	2.083E-003	1.804E-003
Th-229	4.86	4.74	5.12	1.00	1.042E-003	1.473E-003
Np-237	4.78	4.77	4.81	0.00	0.000E+000	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	0.00	0.000E+000	1.473E-003
Am-243	5.23	5.05	5.31	0.00	0.000E+000	1.473E-003
U-232	5.25	5.06	5.40	2.00	2.083E-003	1.804E-003
Th-228	5.45	5.19	5.51	3.00	3.125E-003	2.083E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	4.00	4.167E-003	2.329E-003
Am-241	5.48	5.30	5.60	4.00	4.167E-003	2.329E-003
Cm-245	5.42	5.40	5.45	1.00	1.042E-003	1.473E-003
Pu-236	5.76	5.61	5.89	6.00	6.250E-003	2.756E-003
Cm-244	5.78	5.64	5.90	5.00	5.208E-003	2.552E-003
Th-227	6.07	5.93	6.18	1.00	1.042E-003	1.473E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:33:03PM 5/15/2014

Sample

Sample Name: ICB;AV78
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

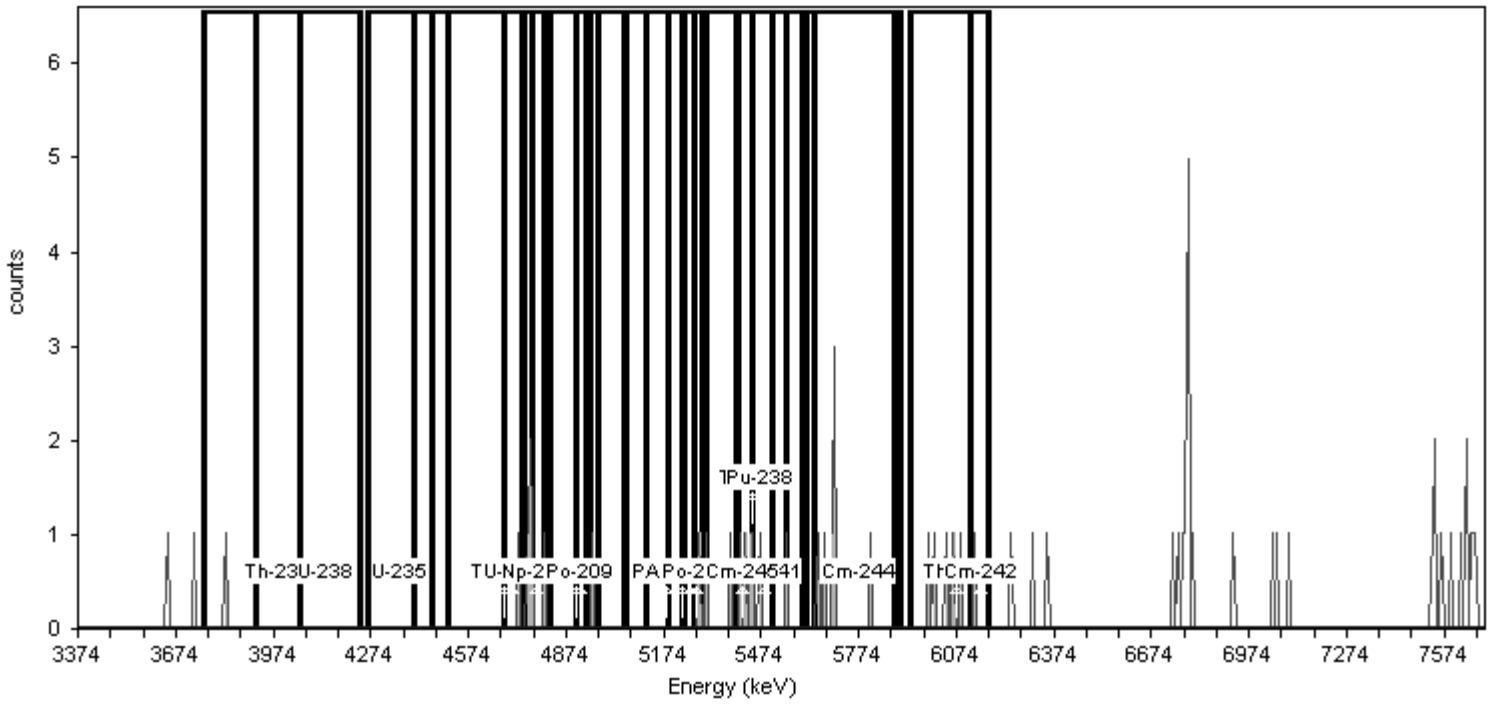
Analyst: 60040

Acquisition

Detector: AV78 , SN: 46-033FF4
Acquisition Start Date: 5/15/2014 1:19:14AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-9886;AV78-20140504
Calibration Date: 5/4/2014 8:45:34PM

Energy Calibration Equation:
Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.71% +/- 0.34% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 60.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	1.00	1.042E-003	1.473E-003
U-238	4.14	3.92	4.24	0.00	0.000E+000	1.473E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	1.00	1.042E-003	1.473E-003
U-234	4.71	4.51	4.82	6.00	6.250E-003	2.756E-003
Pu-242	4.90	4.68	4.95	6.00	6.250E-003	2.756E-003
Th-229	4.86	4.74	5.12	6.00	6.250E-003	2.756E-003
Np-237	4.78	4.77	4.81	2.00	2.083E-003	1.804E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	0.00	0.000E+000	1.473E-003
Am-243	5.23	5.05	5.31	2.00	2.083E-003	1.804E-003
U-232	5.25	5.06	5.40	3.00	3.125E-003	2.083E-003
Th-228	5.45	5.19	5.51	8.00	8.333E-003	3.125E-003
Po-210	5.28	5.23	5.29	1.00	1.042E-003	1.473E-003
Pu-238	5.47	5.27	5.55	9.00	9.375E-003	3.294E-003
Am-241	5.48	5.30	5.60	8.00	8.333E-003	3.125E-003
Cm-245	5.42	5.40	5.45	4.00	4.167E-003	2.329E-003
Pu-236	5.76	5.61	5.89	7.00	7.292E-003	2.946E-003
Cm-244	5.78	5.64	5.90	7.00	7.292E-003	2.946E-003
Th-227	6.07	5.93	6.18	6.00	6.250E-003	2.756E-003
Cm-242	6.15	6.12	6.18	1.00	1.042E-003	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:33:09PM 5/15/2014

Sample

Sample Name: ICB;AV79
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

Analyst: 60040

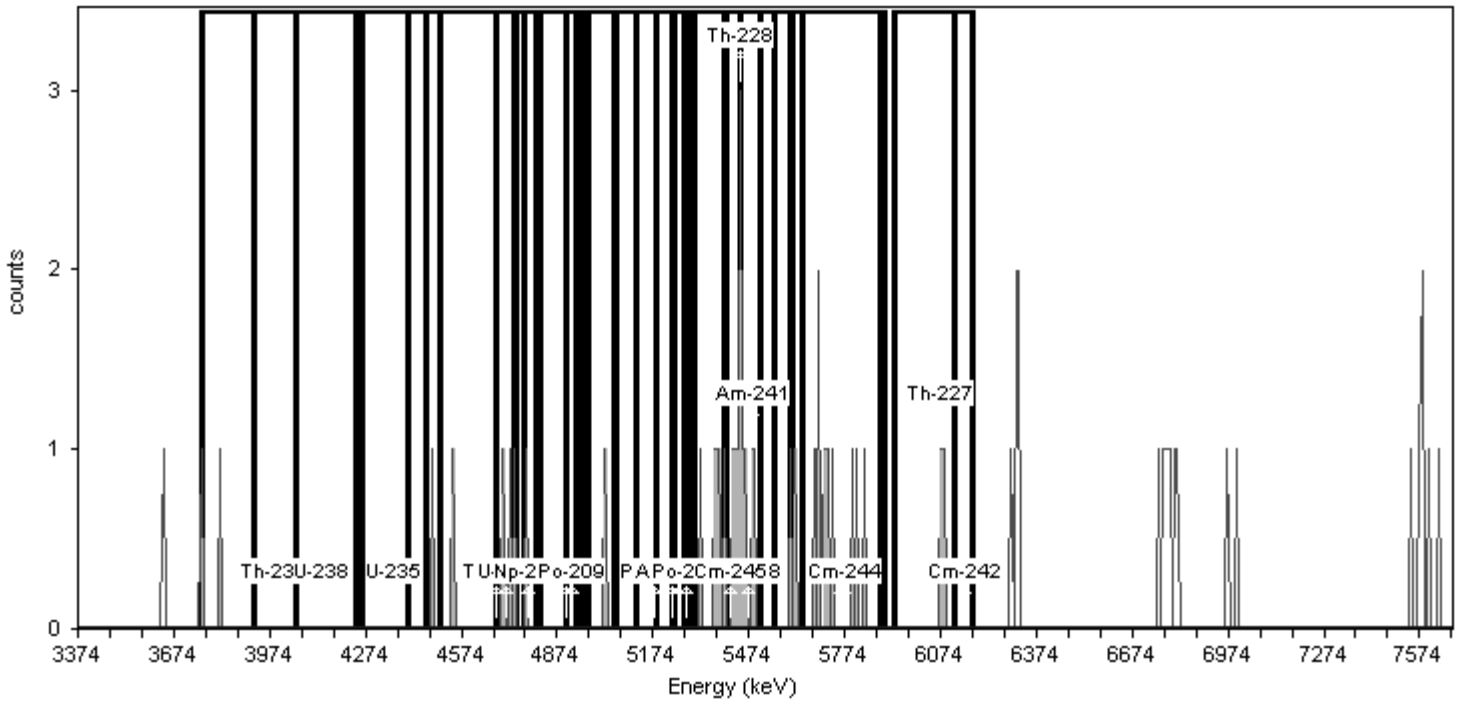
Acquisition

Detector: AV79 , SN: 46-033Q5
Acquisition Start Date: 5/15/2014 1:19:16AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-7107;AV79-20140501
Calibration Date: 5/4/2014 5:31:27PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.05% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 60.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	2.00	2.083E-003	1.804E-003
U-238	4.14	3.92	4.24	0.00	0.000E+000	1.473E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	5.00	5.208E-003	2.552E-003
U-234	4.71	4.51	4.82	5.00	5.208E-003	2.552E-003
Pu-242	4.90	4.68	4.95	4.00	4.167E-003	2.329E-003
Th-229	4.86	4.74	5.12	3.00	3.125E-003	2.083E-003
Np-237	4.78	4.77	4.81	1.00	1.042E-003	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	1.00	1.042E-003	1.473E-003
Am-243	5.23	5.05	5.31	0.00	0.000E+000	1.473E-003
U-232	5.25	5.06	5.40	5.00	5.208E-003	2.552E-003
Th-228	5.45	5.19	5.51	15.00	1.563E-002	4.167E-003
Po-210	5.28	5.23	5.29	0.00	0.000E+000	1.473E-003
Pu-238	5.47	5.27	5.55	15.00	1.563E-002	4.167E-003
Am-241	5.48	5.30	5.60	16.00	1.667E-002	4.295E-003
Cm-245	5.42	5.40	5.45	7.00	7.292E-003	2.946E-003
Pu-236	5.76	5.61	5.89	11.00	1.146E-002	3.608E-003
Cm-244	5.78	5.64	5.90	10.00	1.042E-002	3.455E-003
Th-227	6.07	5.93	6.18	3.00	3.125E-003	2.083E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Alpha-Spectroscopy Background Report

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
5:21:15PM 5/15/2014

Sample

Sample Name: ICB;AV82
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: May2014
Description:

Analyst: 60040

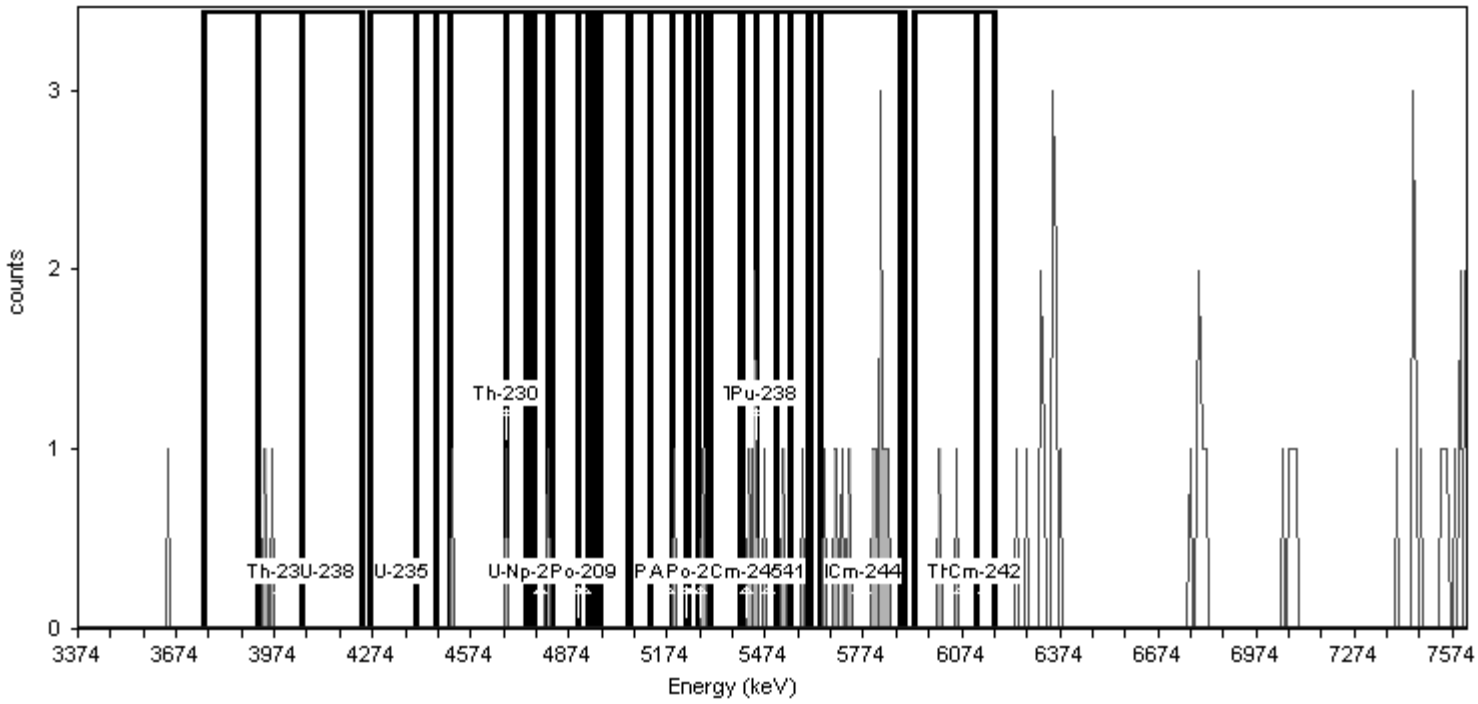
Acquisition

Detector: AV82 , SN: 46-032EE5
Acquisition Start Date: 5/15/2014 1:19:21AM
Live Time: 960.00 min.
Real Time: 960.02 min.
Calibration Name: IC-8876;AV82-20140501
Calibration Date: 5/4/2014 5:31:49PM

Energy Calibration Equation:

Gain = 7.4575 keV / Ch
Offset = 3,366.95 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 25.76% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: Absolute ROI Analysis, Set Name = 11/05_BackgroundROI
Nuclide Library: Background ROI Library
Total Background Counts: 68.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	3.99	3.75	4.05	2.00	2.083E-003	1.804E-003
U-238	4.14	3.92	4.24	2.00	2.083E-003	1.804E-003
U-235	4.36	4.26	4.46	0.00	0.000E+000	1.473E-003
Th-230	4.68	4.40	4.75	2.00	2.083E-003	1.804E-003
U-234	4.71	4.51	4.82	3.00	3.125E-003	2.083E-003
Pu-242	4.90	4.68	4.95	2.00	2.083E-003	1.804E-003
Th-229	4.86	4.74	5.12	1.00	1.042E-003	1.473E-003
Np-237	4.78	4.77	4.81	1.00	1.042E-003	1.473E-003
Po-209	4.92	4.90	4.93	0.00	0.000E+000	1.473E-003
Pu-239	5.18	4.97	5.24	1.00	1.042E-003	1.473E-003
Am-243	5.23	5.05	5.31	2.00	2.083E-003	1.804E-003
U-232	5.25	5.06	5.40	2.00	2.083E-003	1.804E-003
Th-228	5.45	5.19	5.51	7.00	7.292E-003	2.946E-003
Po-210	5.28	5.23	5.29	1.00	1.042E-003	1.473E-003
Pu-238	5.47	5.27	5.55	7.00	7.292E-003	2.946E-003
Am-241	5.48	5.30	5.60	7.00	7.292E-003	2.946E-003
Cm-245	5.42	5.40	5.45	4.00	4.167E-003	2.329E-003
Pu-236	5.76	5.61	5.89	13.00	1.354E-002	3.898E-003
Cm-244	5.78	5.64	5.90	13.00	1.354E-002	3.898E-003
Th-227	6.07	5.93	6.18	2.00	2.083E-003	1.804E-003
Cm-242	6.15	6.12	6.18	0.00	0.000E+000	1.473E-003

Run Logs

Alpha Spectroscopy Run Log

Detector: AV1

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 22:25	140	IC 160-120511/1		120511			PS
05/07/14 23:01	60	ICV 160-120846/1		120846			PS
05/15/14 01:20	960	ICB 160-122292/1		122292			PS
05/18/14 19:19	60	CCV 160-122944/1		122944			PS
05/28/14 09:33	1	PULSER 160-124262/1		124262			MLK
05/28/14 15:45	180	MB 160-123278/1-A		124262	123278	A-01-R	MLK

Detector: AV11

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 22:27	140	IC 160-120513/1		120513			PS
05/07/14 23:04	60	ICV 160-120848/1		120848			PS
05/15/14 01:18	960	ICB 160-122304/1		122304			PS
05/19/14 17:57	60	CCV 160-122963/1		122963			PS
05/23/14 08:54	1	PULSER 160-123762/1		123762			MLK
05/23/14 18:57	180	LCS 160-123278/2-A		123762	123278	A-01-R	MLK

Detector: AV13

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 22:28	140	IC 160-120515/1		120515			PS
05/07/14 23:04	60	ICV 160-120850/1		120850			PS
05/15/14 01:17	960	ICB 160-122325/1		122325			PS
05/18/14 20:51	60	CCV 160-122946/1		122946			PS
05/23/14 08:54	1	PULSER 160-123782/1		123782			MLK
05/23/14 18:57	180	ZZZZZ		123782			

Detector: AV15

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 22:28	140	IC 160-120517/1		120517			PS
05/07/14 23:04	60	ICV 160-120852/1		120852			PS
05/15/14 01:17	960	ICB 160-122336/1		122336			PS
05/18/14 19:22	60	CCV 160-122950/1		122950			PS
05/23/14 08:54	1	PULSER 160-123793/1		123793			MLK
05/23/14 18:57	180	160-6694-1	2222-SD01	123793	123278	A-01-R	MLK

Detector: AV16

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:27	140	IC 160-120398/1		120398			PS
05/08/14 00:14	60	ICV 160-121072/1		121072			PS
05/15/14 01:17	960	ICB 160-122337/1		122337			PS
05/18/14 20:51	60	CCV 160-122951/1		122951			PS
05/23/14 08:54	1	PULSER 160-123794/1		123794			MLK
05/23/14 18:57	180	160-6694-2	2222-SD02	123794	123278	A-01-R	MLK

Detector: AV17

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:28	140	IC 160-120399/1		120399			PS
05/08/14 00:14	60	ICV 160-121073/1		121073			PS

Alpha Spectroscopy Run Log

Detector: AV17 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/15/14 01:17	960	ICB 160-122338/1		122338			PS
05/18/14 19:22	60	CCV 160-122952/1		122952			PS
05/23/14 08:54	1	PULSER 160-123795/1		123795			MLK
05/23/14 18:57	180	160-6694-3	2222-SD03	123795	123278	A-01-R	MLK

Detector: AV18

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:28	140	IC 160-120400/1		120400			PS
05/08/14 00:14	60	ICV 160-121074/1		121074			PS
05/15/14 01:18	960	ICB 160-122339/1		122339			PS
05/18/14 20:51	60	CCV 160-122953/1		122953			PS
05/23/14 08:55	1	PULSER 160-123796/1		123796			MLK
05/23/14 18:57	180	160-6694-4	2222-SD04	123796	123278	A-01-R	MLK

Detector: AV19

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:28	140	IC 160-120401/1		120401			PS
05/08/14 14:33	60	ICV 160-121361/1		121361			PS
05/15/14 01:18	960	ICB 160-122340/1		122340			PS
05/19/14 17:58	60	CCV 160-122965/1		122965			PS
05/23/14 08:55	1	PULSER 160-123797/1		123797			MLK
05/23/14 18:57	180	160-6694-5	2222-SD05	123797	123278	A-01-R	MLK

Detector: AV20

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:28	140	IC 160-120402/1		120402			PS
05/07/14 23:05	60	ICV 160-120854/1		120854			PS
05/15/14 01:18	960	ICB 160-122342/1		122342			PS
05/18/14 20:52	60	CCV 160-122954/1		122954			PS
05/23/14 08:55	1	PULSER 160-123798/1		123798			MLK
05/23/14 18:57	180	160-6694-6	2222-SD06	123798	123278	A-01-R	MLK

Detector: AV43

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:30	140	IC 160-120406/1		120406			PS
05/08/14 00:16	60	ICV 160-121077/1		121077			PS
05/15/14 01:18	960	ICB 160-122348/1		122348			PS
05/15/14 19:01	60	CCV 160-122515/1		122515			PS
05/21/14 16:01	1	PULSER 160-123332/1		123332			RTM
05/21/14 19:04	180	MB 160-123197/1-A		123332	123197	A-01-R	RTM

Detector: AV44

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:30	140	IC 160-120407/1		120407			PS
05/08/14 00:17	60	ICV 160-121078/1		121078			PS
05/15/14 01:18	960	ICB 160-122349/1		122349			PS
05/15/14 19:01	60	CCV 160-122516/1		122516			PS

Alpha Spectroscopy Run Log

Detector: AV44 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/21/14 16:01	1	PULSER 160-123333/1		123333			RTM
05/21/14 19:04	180	LCS 160-123197/2-A		123333	123197	A-01-R	RTM

Detector: AV45

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:30	140	IC 160-120408/1		120408			PS
05/08/14 14:32	60	ICV 160-121363/1		121363			PS
05/15/14 01:18	960	ICB 160-122350/1		122350			PS
05/15/14 19:02	60	CCV 160-122517/1		122517			PS
05/23/14 08:55	1	PULSER 160-123806/1		123806			RTM
05/23/14 19:02	180	MB 160-123276/1-A		123806	123276	A-01-R	RTM

Detector: AV46

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:30	140	IC 160-120409/1		120409			PS
05/08/14 00:18	60	ICV 160-121079/1		121079			PS
05/15/14 01:18	960	ICB 160-122351/1		122351			PS
05/15/14 19:02	60	CCV 160-122518/1		122518			PS
05/23/14 08:55	1	PULSER 160-123807/1		123807			RTM
05/23/14 19:02	180	LCS 160-123276/2-A		123807	123276	A-01-R	RTM

Detector: AV48

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/05/14 19:32	140	IC 160-120411/1		120411			PS
05/08/14 00:18	60	ICV 160-121081/1		121081			PS
05/15/14 01:18	960	ICB 160-122353/1		122353			PS
05/15/14 19:03	60	CCV 160-122520/1		122520			PS
05/21/14 16:02	1	PULSER 160-123337/1		123337			RTM
05/21/14 19:04	180	160-6694-7	2222-RIN-01	123337	123197	A-01-R	RTM
05/23/14 08:55	1	PULSER 160-123809/1		123809			RTM
05/23/14 19:02	180	ZZZZZ		123809			

Detector: AV55

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/07/14 19:51	140	IC 160-120842/1		120842			PS
05/08/14 00:19	60	ICV 160-121083/1		121083			PS
05/15/14 01:18	960	ICB 160-122360/1		122360			PS
05/15/14 20:43	60	CCV 160-122529/1		122529			PS
05/21/14 16:01	1	PULSER 160-123339/1		123339			RTM
05/21/14 19:04	180	ZZZZZ		123339			

Detector: AV57

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/04/14 21:05	140	IC 160-120279/1		120279			PS
05/08/14 14:35	60	ICV 160-121370/1		121370			PS
05/15/14 01:18	960	ICB 160-122362/1		122362			PS
05/15/14 19:05	60	CCV 160-122526/1		122526			PS

Alpha Spectroscopy Run Log

Detector: AV57 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/23/14 08:55	1	PULSER 160-123811/1		123811			RTM
05/23/14 19:02	180	160-6694-1	2222-SD01	123811	123276	A-01-R	RTM

Detector: AV58

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/04/14 21:05	140	IC 160-120280/1		120280			PS
05/08/14 14:35	60	ICV 160-121371/1		121371			PS
05/15/14 01:18	960	ICB 160-122363/1		122363			PS
05/15/14 20:43	60	CCV 160-122530/1		122530			PS
05/23/14 08:55	1	PULSER 160-123812/1		123812			RTM
05/23/14 19:02	180	160-6694-2	2222-SD02	123812	123276	A-01-R	RTM

Detector: AV59

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/04/14 21:05	140	IC 160-120281/1		120281			PS
05/08/14 14:36	60	ICV 160-121372/1		121372			PS
05/15/14 01:18	960	ICB 160-122364/1		122364			PS
05/15/14 20:44	60	CCV 160-122531/1		122531			PS
05/23/14 08:55	1	PULSER 160-123813/1		123813			RTM
05/23/14 19:02	180	160-6694-3	2222-SD03	123813	123276	A-01-R	RTM

Detector: AV60

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/04/14 21:06	140	IC 160-120282/1		120282			PS
05/08/14 17:21	60	ICV 160-121373/1		121373			PS
05/15/14 01:18	960	ICB 160-122366/1		122366			PS
05/15/14 20:44	60	CCV 160-122532/1		122532			PS
05/23/14 08:55	1	PULSER 160-123815/1		123815			RTM
05/23/14 19:02	180	160-6694-4	2222-SD04	123815	123276	A-01-R	RTM

Detector: AV61

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/04/14 21:06	140	IC 160-120283/1		120283			PS
05/08/14 14:36	60	ICV 160-121374/1		121374			PS
05/15/14 01:18	960	ICB 160-122367/1		122367			PS
05/15/14 20:44	60	CCV 160-122533/1		122533			PS
05/23/14 08:55	1	PULSER 160-123816/1		123816			RTM
05/23/14 19:02	180	160-6694-5	2222-SD05	123816	123276	A-01-R	RTM

Detector: AV62

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/04/14 21:06	140	IC 160-120284/1		120284			PS
05/08/14 14:36	60	ICV 160-121375/1		121375			PS
05/15/14 01:18	960	ICB 160-122368/1		122368			PS
05/15/14 20:44	60	CCV 160-122534/1		122534			PS
05/23/14 08:55	1	PULSER 160-123817/1		123817			RTM
05/23/14 19:02	180	160-6694-6	2222-SD06	123817	123276	A-01-R	RTM

Alpha Spectroscopy Run Log

Detector: AV78

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/04/14 17:51	140	IC 160-120055/1		120055			PS
05/08/14 17:20	60	ICV 160-121385/1		121385			PS
05/15/14 01:19	960	ICB 160-122385/1		122385			PS
05/15/14 21:58	60	CCV 160-122550/1		122550			PS
05/21/14 16:01	1	PULSER 160-123362/1		123362			RTM
05/21/14 17:20	180	MB 160-123200/1-A		123362	123200	A-01-R	RTM

Detector: AV79

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/01/14 19:15	140	IC 160-119923/1		119923			PS
05/11/14 20:47	60	ICV 160-121432/1		121432			PS
05/15/14 01:19	960	ICB 160-122386/1		122386			PS
05/15/14 23:08	60	CCV 160-122647/1		122647			PS
05/21/14 16:01	1	PULSER 160-123363/1		123363			RTM
05/21/14 17:20	180	LCS 160-123200/2-A		123363	123200	A-01-R	RTM

Detector: AV82

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/01/14 19:15	140	IC 160-119926/1		119926			PS
05/11/14 20:48	60	ICV 160-121434/1		121434			PS
05/15/14 01:19	960	ICB 160-122390/1		122390			PS
05/16/14 15:28	60	CCV 160-122665/1		122665			PS
05/21/14 16:02	1	PULSER 160-123366/1		123366			RTM
05/21/14 17:20	180	160-6694-7	2222-RIN-01	123366	123200	A-01-R	RTM

Detector: AV84

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/01/14 19:16	140	IC 160-119928/1		119928			PS
05/11/14 19:34	60	ICV 160-121396/1		121396			PS
05/15/14 01:19	960	ICB 160-122392/1		122392			PS
05/15/14 23:08	60	CCV 160-122648/1		122648			PS
05/21/14 16:02	1	PULSER 160-123368/1		123368			RTM
05/21/14 17:20	180	ZZZZZ		123368			

GAMMA SPECTROSCOPY

Method GA-01-R
Cs-137

Cesium-137 & Other Gamma Emitters (GS) by Method GA-01-R

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

Prep Batch: 122895

Fill Geometry, No In-Growth

Gamma Spectroscopy Analysis Detail Report
Prep Batch: 122895

Lab ID: MB 160-122895/1-A | Analyzed: 05/20/14 15:18 | Ts: 60 | Sigma: 2
Client ID: | Detector: GV7 | Decay Corrected: No

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Cesium-137	1.139	6.53	6.53	U	pCi/L	20.0	12.3	123127

Lab ID: LCS 160-122895/2-A | Analyzed: 05/20/14 15:11 | Ts: 60 | Sigma: 2
Client ID: | Detector: GV11 | Decay Corrected: No

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Americium-241	134000	655	15500		pCi/L		489	123145
Cesium-137	50940	366	5060		pCi/L	20.0	167	123145
Cobalt-60	56820	311	5610		pCi/L		89.8	123145

Lab ID: 160-6694-7 | Analyzed: 05/20/14 13:46 | Ts: 60 | Sigma: 2
Client ID: 2222-RIN-01 | Detector: GV18 | Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Cesium-137	-1.19	7.49	7.49	U	pCi/L	20.0	13.4	123230

Lab ID: 160-6694-7 DU | Analyzed: 05/20/14 15:11 | Ts: 60 | Sigma: 2
Client ID: 2222-RIN-01 | Detector: GV12 | Decay Corrected: No

Analyte	DU Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Cesium-137	-0.2213	5.10	5.10	U	pCi/L	20.0	9.54	123147

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 160-122895/1-A	Cesium-137			1.139	U	pCi/L							

Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-122895/2-A	Americium-241		137000	134000		pCi/L	98	90 - 111					
LCS 160-122895/2-A	Cesium-137		50100	50940		pCi/L	102	90 - 111					
LCS 160-122895/2-A	Cobalt-60		57100	56820		pCi/L	100	89 - 110					

Duplicate ID:	Analyte	Parent Result	Spike Added	DU Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
160-6694-7	Cesium-137	-1.19		-0.2213	U	pCi/L			137	0.08	0.21	1	

Glossary:

Ts = Count Duration, Sample

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

Test America St. Louis Spectrum ID: 7_Gamma_20141010

Sample Description: 122895_Gamma_MB 160-122895~1-A
Detector: Ge 7 SN/154
Batch ID: 122895
Work Order Number: Gamma
Lot Number: MB 160-122895~1-A

Decay to Time: 5/20/2014 15:18 Live Time: 3600 sec
Acquisition Time: 5/20/2014 15:18:36 Real Time: 3656 sec
Analysis Time: 5/20/2014 16:19 Dead Time: 1.54 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 7_Liquid_Marinelli 1L.Clb
Efficiency Cal Desc: 7_1Lmarn_90062_032612
Efficiency Cal Date: 3/28/2012 09:18
Energy Cal Date: 2/23/2012 08:40
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 7_2014-05-03_0622.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	-6.164E-01	171.6	1.058E+00	1.058E+00	3.774E+00
K-40	-3.043E+00	2000.0	6.086E+01	6.086E+01	1.113E+01
CO-60	5.588E-02	155.9	8.709E-02	8.713E-02	3.178E-01
I-131	-1.952E-02	590.4	1.152E-01	1.153E-01	4.216E-01
CS-134	3.083E-02	89.5	2.761E-02	2.765E-02	5.324E-01
CS-137	4.216E-02	286.4	1.207E-01	1.208E-01	4.555E-01
EU-152	2.138E-01	94.7	2.024E-01	2.027E-01	1.066E+00
EU-154	1.140E+00	57.1	6.513E-01	6.537E-01	1.929E+00
EU-155	0.000E+00	1000.0	1.589E-01	1.589E-01	1.024E+00
TL-208	1.837E-01	78.9	1.449E-01	1.452E-01	3.630E-01
PB-210	-4.759E-01	399.3	1.900E+00	1.901E+00	6.933E+00
PB-212	-1.078E-01	378.8	4.081E-01	4.082E-01	7.540E-01
PB-214	6.286E-02	341.9	2.149E-01	2.149E-01	9.134E-01
BI-212	8.516E-01	167.8	1.429E+00	1.429E+00	5.270E+00
BI-214	3.683E-01	78.2	2.878E-01	2.884E-01	9.706E-01
AC-228	6.160E-01	68.4	4.213E-01	4.224E-01	1.534E+00
Pa-234	3.883E-01	110.2	4.279E-01	4.284E-01	8.910E-01
TH-234	2.517E+00	45.8	1.152E+00	1.160E+00	6.963E+00
PA-234M	-1.407E+01	2000.0	2.814E+02	2.814E+02	4.560E+01
U-235	3.056E-01	108.6	3.319E-01	3.323E-01	1.546E+00
AM-241	-1.738E-02	704.6	1.224E-01	1.224E-01	4.519E-01
Total	6.776E+00				

Analyst: April Bean

TestAmerica Spectrum name: 7_Gamma_20141010.An1

Sample description
122895_Gamma_MB 160-122895~1-A

Spectrum Filename: C:\User\SPC\Det7\7_Gamma_20141010.An1

Acquisition information
Start time: 5/20/2014 3:18:36 PM
Live time: 3600
Real time: 3656
Dead time: 1.54 %
Detector ID: 7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Liquid_Marinelli 1L.Clb
7_1Lmarn_90062_032612

Energy Calibration
Created: 2/23/2012 8:40:56 AM
Zero offset: 0.117 keV
Gain: 0.250 keV/channel
Quadratic: 3.508E-09 keV/channel^2

Efficiency Calibration
Created: 3/28/2012 9:18:24 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.42 %
Log(Eff): -7.054602E-01 + (-2.848254E-01*Log(E)) +
(-4.423998E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.43 %
Log(Eff): -1.484435E+01 + (5.183775E+00*Log(E)) +
(-5.730519E-01*Log(E)^2)

Library Files
Main analysis library: Client_Routine Short Rev1.lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.61keV)
Stop channel: 8000 (2000.12keV)
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

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	5/20/2014 3:18:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	7_2014-05-03_0622.PBC 5/3/2014 6:22:41 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1201

***** 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
46.58	33.	25.89	0.55	3.379E-02	46.54	4.250	PBC<MDA	PB210
63.13	55.	21.09	0.40	4.063E-02	63.29	3.810	PBC<MDA	TH234
92.42	20.	16.64	0.92	4.410E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	PBC<MDA	U235
					93.35	5.561	PBC<MDA	AC228
122.89	5.	129.69	0.92	4.202E-02	121.78	28.580	PBC<MDA	EU152
					123.10	40.790	8.018E-02	EU154
123.04	6.	94.67	0.92	4.217E-02	121.78	28.580	PBC<MDA	EU152
					123.10	40.790	9.889E-02	EU154
163.25	7.	108.62	0.96	3.653E-02	163.38	5.080	PBC<MDA	U235
					163.38	5.080	9.916E-01	U235
238.81	-5.	102.89	1.04	2.757E-02	238.63	43.300	PBC<MDA	PB212
277.80	5.	138.91	1.08	2.454E-02	277.28	6.310	PBC<MDA	TL208
295.34	2.	428.27	1.10	2.337E-02	295.09	19.300	PBC<MDA	PB214
338.93	4.	147.04	1.14	2.097E-02	338.32	12.010	PBC<MDA	AC228
344.02	6.	96.80	1.15	2.067E-02	344.29	26.500	PBC<MDA	EU152
352.21	1.	533.03	1.16	2.031E-02	351.93	37.600	PBC<MDA	PB214
569.33	4.	130.67	1.37	1.366E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	1.054E+00	Pa234
569.40	5.	110.21	1.37	1.366E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	1.191E+00	Pa234
582.33	6.	78.87	1.38	1.339E-02	583.02	84.500	PBC<MDA	TL208
608.81	8.	78.15	1.41	1.290E-02	609.31	46.090	PBC<MDA	BI214
661.37	2.	286.39	1.46	1.202E-02	661.66	85.210	PBC<MDA	CS137

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
727.61	3.	167.78	1.51	1.108E-02	727.17	7.550	PBC<MDA	BI212
779.52	1.	456.91	1.56	1.043E-02	778.92	12.940	PBC<MDA	EU152
802.78	2.	196.94	1.58	1.017E-02	801.95	8.690	PBC<MDA	CS134
872.77	5.	57.12	1.64	9.435E-03	873.23	12.270	PBC<MDA	EU154
911.55	6.	68.39	1.68	9.087E-03	911.07	29.000	PBC<MDA	AC228
1002.03	2.	182.56	1.75	8.327E-03	1004.77	18.010	PBC<MDA	EU154
1173.61	3.	155.86	1.89	7.239E-03	1173.24	99.900	PBC<MDA	CO60
1410.21	1.	364.37	2.06	6.123E-03	1408.00	21.005	PBC<MDA	EU152

No unknown peaks passed sensitivity test.

This section based on library: Client_Routine Short Rev1.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	185.88	46.58	50.	-2.	-0.001	25.89	0.553s
AM-241	233.28	58.43	19.	-1.	0.000	704.58	0.850
TH-234	252.06	63.13	60.	16.	0.004	21.09	0.402s
EU-155	344.81	86.31	40.	-1.	0.000	800.04	0.880s
TH-234	369.24	92.42	63.	20.	0.006	16.64	0.923s
EU-152	491.74	123.04	14.	6.	0.002	94.67	0.918s
EU-154	491.13	122.89	18.	5.	0.001	129.69	0.919s
U-235	652.59	163.25	23.	7.	0.002	108.62	0.962s
U-235	820.18	205.14	29.	-5.	-0.001	165.24	1.007s
PB-212	954.87	238.81	41.	-5.	-0.001	102.89	1.041s
TL-208	1110.84	277.80	18.	5.	0.001	138.91	1.081s
PB-214	1181.01	295.34	20.	2.	0.000	428.27	1.100s
PB-212	1200.69	300.26	20.	-1.	0.000	720.37	1.105s
AC-228	1355.36	338.93	17.	4.	0.001	147.04	1.144s
EU-152	1375.72	344.02	15.	6.	0.002	96.80	1.150s
PB-214	1408.50	352.21	23.	1.	0.000	533.03	1.157s
I-131	1457.44	364.44	22.	-1.	0.000	590.39	1.170s
BE-7	1909.18	477.37	18.	-4.	-0.001	171.65	1.282s
CS-134	2277.01	569.33	13.	4.	0.001	130.67	1.369s
Pa-234	2277.31	569.40	12.	5.	0.001	110.21	1.370s
TL-208	2329.05	582.33	7.	6.	0.002	78.87	1.382s
CS-134	2420.03	605.08	21.	-5.	-0.002	127.62	1.403s
BI-214	2434.97	608.81	15.	8.	0.002	78.15	1.407s
CS-137	2645.19	661.37	9.	2.	0.000	286.39	1.455s
EU-154	2893.07	723.34	14.	-2.	-0.001	285.99	1.511s
BI-212	2910.17	727.61	8.	3.	0.001	167.78	1.515s
EU-152	3117.81	779.52	9.	1.	0.000	456.91	1.561s
CS-134	3182.55	795.70	12.	-1.	0.000	417.23	1.576s
CS-134	3210.88	802.78	11.	2.	0.001	196.94	1.581s
EU-154	3490.83	872.77	1.	5.	0.001	57.12	1.643s
AC-228	3645.93	911.55	6.	6.	0.002	68.39	1.675s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
EU-154	4007.88	1002.03	9.	2.	0.001	182.56	1.753s
CO-60	4694.17	1173.61	9.	3.	0.001	155.86	1.887s
EU-152	5640.54	1410.21	5.	1.	0.000	364.37	2.059s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	-6.1638E-01				5.31E+01	
			477.60	-6.164E-01	?(	3.774E+00	1.72E+02 1.05E+01 G
K-40	N	-3.0432E+00				4.66E+11	
			1460.83	-3.043E+00	%(P	1.113E+01	1.00E+03 1.07E+01 G
CO-60	F	5.5876E-02				1.93E+03	
			1332.50	0.000E+00	?(	3.178E-01	1.00E+03 1.00E+02 G
			1173.24	1.118E-01	&(	6.361E-01	1.56E+02 9.99E+01 G
I-131	I	-1.9521E-02				8.02E+00	
			364.48	-1.952E-02	?(	4.216E-01	5.90E+02 8.17E+01 G
			284.30	-9.850E-02	%	4.651E+00	1.28E+03 6.14E+00 G
			636.97	1.452E-01	%	6.287E+00	1.15E+03 7.17E+00 G
CS-134	I	3.0832E-02				7.54E+02	
			604.71	-1.194E-01	?(	5.324E-01	1.28E+02 9.76E+01 G
			795.87	-3.769E-02	+	5.915E-01	4.17E+02 8.55E+01 G
			569.32	5.617E-01	?(	2.604E+00	1.31E+02 1.54E+01 G
			801.95	7.790E-01	?(	5.637E+00	1.97E+02 8.69E+00 G
			563.24	1.024E-01	%	4.506E+00	1.15E+03 8.35E+00 G
CS-137	I	4.2160E-02				1.10E+04	
			661.66	4.216E-02	&(	4.555E-01	2.86E+02 8.52E+01 G
EU-152	F	2.1382E-01				4.94E+03	
			344.29	3.196E-01	(	1.066E+00	9.68E+01 2.65E+01 G
			121.78	1.406E-01	?(	4.591E-01	9.47E+01 2.86E+01 G
			778.92	1.988E-01	?(	3.475E+00	4.57E+02 1.29E+01 G
			964.11	-1.057E-01	%	4.281E+00	1.07E+03 1.46E+01 G
			1112.07	0.000E+00	-	1.974E+00	1.00E+03 1.36E+01 G
			1408.00	1.892E-01	?(	2.758E+00	3.64E+02 2.10E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
EU-154	I	1.1402E+00					3.14E+03	
			873.23	1.140E+00	&(	1.929E+00	5.71E+01	1.23E+01 G
			123.10	8.018E-02	&	3.653E-01	1.30E+02	4.08E+01 G
			1274.54	0.000E+00	-	2.337E+00	1.00E+03	3.52E+01 G
			723.36	-2.376E-01	-	2.501E+00	2.86E+02	2.02E+01 G
			1004.77	4.567E-01	-	3.076E+00	1.83E+02	1.80E+01 G
			996.33	0.000E+00	-	5.555E+00	1.00E+03	1.06E+01 G
TL-208	N	1.8373E-01					6.98E+02	
			583.02	1.355E-01	&(	3.630E-01	7.89E+01	8.45E+01 G
			277.28	8.294E-01	&(	4.064E+00	1.39E+02	6.31E+00 G
			860.56	8.087E-02	%	4.095E+00	1.31E+03	1.24E+01 G
PB-210	N	-4.7591E-01					8.14E+03	
			46.54	-4.759E-01	(P	6.933E+00	2.59E+01	4.25E+00 G
PB-212	N	-1.0775E-01					6.98E+02	
			238.63	-1.077E-01	?(P	7.540E-01	1.03E+02	4.33E+01 G
			300.03	-3.250E-01	+	8.626E+00	7.20E+02	3.28E+00 G
PB-214	N	6.2855E-02					5.84E+05	
			351.93	4.704E-02	?(	9.134E-01	5.33E+02	3.76E+01 G
			295.09	9.367E-02	?(	1.465E+00	4.28E+02	1.93E+01 G
			242.00	-6.035E-02	&	3.841E+00	1.75E+03	7.43E+00 G
BI-212	N	8.5161E-01					6.98E+02	
			727.17	8.516E-01	?(	5.270E+00	1.68E+02	7.55E+00 G
			785.42	0.000E+00	-	3.329E+01	1.00E+03	1.28E+00 G
BI-214	N	3.6825E-01					5.84E+05	
			609.31	3.683E-01	(	9.706E-01	7.81E+01	4.61E+01 G
			1120.29	0.000E+00	-	6.169E+00	1.00E+03	1.51E+01 G
			1764.49	0.000E+00	-	2.682E+00	1.00E+03	1.54E+01 G
AC-228	N	6.1596E-01					2.10E+03	
			911.07	6.781E-01	?(	1.534E+00	6.84E+01	2.90E+01 G
			968.97	0.000E+00	-	4.340E+00	1.00E+03	1.75E+01 G
			338.32	4.659E-01	?(	2.429E+00	1.47E+02	1.20E+01 G
								Energy duplication
			93.35	0.000E+00	-	3.977E+00	1.00E+03	5.56E+00 XA
Pa-234	N	3.8827E-01					1.63E+12	
			131.29	2.265E-02	%(	8.910E-01	1.07E+03	1.80E+01 G
			569.47	1.191E+00	?(	4.609E+00	1.10E+02	8.20E+00 G
			946.02	0.000E+00	-	4.001E+00	1.00E+03	1.34E+01 G
			883.24	0.000E+00	-	5.127E+00	1.00E+03	9.60E+00 G
			880.53	-5.075E-02	%	6.189E+00	2.92E+03	6.00E+00 G

```
 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

TH-234   N   2.5165E+00                                      1.63E+12
                          63.29 2.843E+00  (P 6.963E+00 2.11E+01 3.81E+00 G
                          92.59 2.294E+00 *(P 4.467E+00 1.66E+01 5.58E+00 G

PA-234M  N  -1.4068E+01                                      1.63E+12
                        1001.00-1.407E+01 %(P 4.560E+01 1.00E+03 8.37E-01 G
                         766.41-4.415E+01 % P 2.465E+02 1.00E+03 2.94E-01 G

U-235    N   3.0558E-01                                      2.57E+11
                         143.79-1.240E-02 %(  1.546E+00 3.36E+03 1.10E+01 G
                         205.33-8.537E-01 +   4.952E+00 1.65E+02 5.01E+00 G
                         163.38 9.916E-01  (  3.720E+00 1.09E+02 5.08E+00 G
                                                          Energy duplication
                          93.35 0.000E+00 -   3.806E+00 1.00E+03 5.81E+00 X

AM-241   T  -1.7377E-02                                      1.58E+05
                          59.54-1.738E-02  (  4.519E-01 7.05E+02 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.
   + - 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

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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********** 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	46.58	50.	-2.	-0.001	25.89	-4.759E-01	P
AM-241	58.43	19.	-1.	0.000	704.58	-1.738E-02	
EU-155	86.31	40.	-1.	0.000	800.04	-2.306E-02	
EU-152	123.04	14.	6.	0.002	94.67	1.406E-01	
EU-154	122.89	18.	5.	0.001	129.69	8.018E-02	
U-235	163.25	23.	7.	0.002	108.62	9.916E-01	
U-235	205.14	29.	-5.	-0.001	165.24	-8.537E-01	
PB-212	238.81	41.	-5.	-0.001	102.89	-1.077E-01	P
TL-208	277.80	18.	5.	0.001	138.91	8.294E-01	
PB-214	295.34	20.	2.	0.000	428.27	9.367E-02	
PB-212	300.26	20.	-1.	0.000	720.37	-3.250E-01	
AC-228	338.93	17.	4.	0.001	147.04	4.659E-01	
EU-152	344.02	15.	6.	0.002	96.80	3.196E-01	
PB-214	352.21	23.	1.	0.000	533.03	4.704E-02	
I-131	364.44	22.	-1.	0.000	590.39	-1.952E-02	
BE-7	477.37	18.	-4.	-0.001	171.65	-6.164E-01	
CS-134	569.33	13.	4.	0.001	130.67	5.617E-01	
Pa-234	569.40	12.	5.	0.001	110.21	1.191E+00	
TL-208	582.33	7.	6.	0.002	78.87	1.355E-01	
CS-134	605.08	21.	-5.	-0.002	127.62	-1.194E-01	
BI-214	608.81	15.	8.	0.002	78.15	3.683E-01	
CS-137	661.37	9.	2.	0.000	286.39	4.216E-02	
EU-154	723.34	14.	-2.	-0.001	285.99	-2.376E-01	
BI-212	727.61	8.	3.	0.001	167.78	8.516E-01	
EU-152	779.52	9.	1.	0.000	456.91	1.988E-01	
CS-134	795.70	12.	-1.	0.000	417.23	-3.769E-02	
CS-134	802.78	11.	2.	0.001	196.94	7.790E-01	
EU-154	872.77	1.	5.	0.001	57.12	1.140E+00	
AC-228	911.55	6.	6.	0.002	68.39	6.781E-01	
EU-154	1002.03	9.	2.	0.001	182.56	4.567E-01	
CO-60	1173.61	9.	3.	0.001	155.86	1.118E-01	
EU-152	1410.21	5.	1.	0.000	364.37	1.892E-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 *****

Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	-6.1638E-01	-6.1638E-01	1.716E+02%	3.77E+00
K-40	#A	-3.0432E+00	-3.0432E+00	2.000E+03%	1.11E+01
CO-60	#A	5.5876E-02	5.5876E-02	1.559E+02%	3.18E-01
I-131	#A	-1.9520E-02	-1.9521E-02	5.904E+02%	4.22E-01

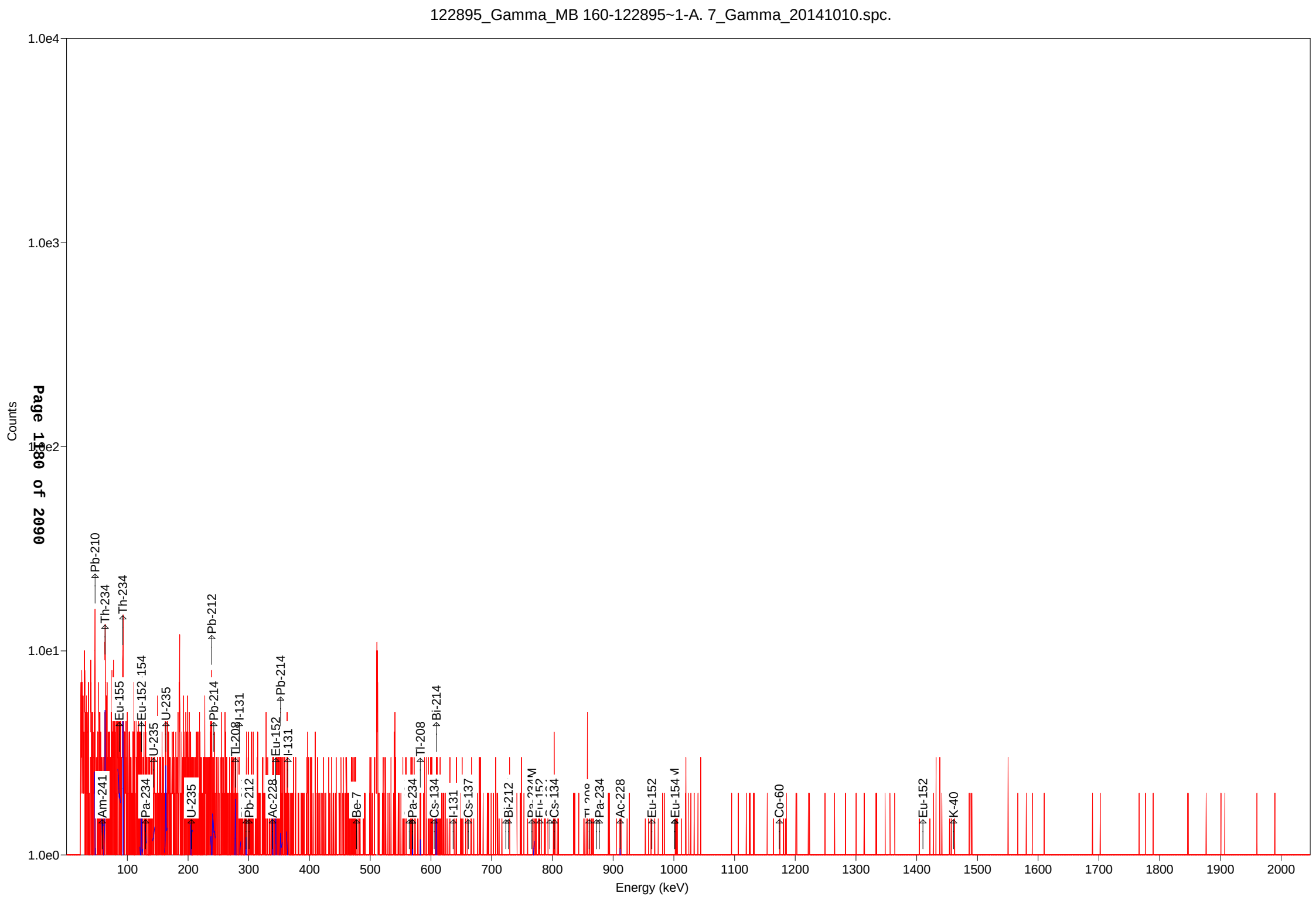
CS-134 #A	3.0832E-02	3.0832E-02	8.953E+01%	5.32E-01
CS-137 #A	4.2160E-02	4.2160E-02	2.864E+02%	4.55E-01
EU-152 #A	2.1382E-01	2.1382E-01	9.467E+01%	1.07E+00
EU-154 #A	1.1402E+00	1.1402E+00	5.712E+01%	1.93E+00
EU-155 #A	0.0000E+00	0.0000E+00	1.000E+03%	1.02E+00
TL-208 #A	1.8373E-01	1.8373E-01	7.887E+01%	3.63E-01
PB-210 #A	-4.7591E-01	-4.7591E-01	3.993E+02%	6.93E+00
PB-212 #A	-1.0775E-01	-1.0775E-01	3.788E+02%	7.54E-01
PB-214 #A	6.2855E-02	6.2855E-02	3.419E+02%	9.13E-01
BI-212 #A	8.5161E-01	8.5161E-01	1.678E+02%	5.27E+00
BI-214 #A	3.6825E-01	3.6825E-01	7.815E+01%	9.71E-01
AC-228 #A	6.1596E-01	6.1596E-01	6.839E+01%	1.53E+00
Pa-234 #A	3.8827E-01	3.8827E-01	1.102E+02%	8.91E-01
TH-234 A	2.5165E+00	2.5165E+00	4.577E+01%	6.96E+00
PA-234M#A	-1.4068E+01	-1.4068E+01	2.000E+03%	4.56E+01
U-235 #A	3.0558E-01	3.0558E-01	1.086E+02%	1.55E+00
AM-241 #A	-1.7377E-02	-1.7377E-02	7.046E+02%	4.52E-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 2000.1 keV) 0.000E+00 Bq/Sample
Total Decayed Activity (37.6 to 2000.1 keV) 0.0000000E+00 Bq/Sample

The library has energies which are not separable.


122895_Gamma_MB 160-122895~1-A. 7_Gamma_20141010.spc.
Counts
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Energy (keV)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Pb-210
Th-234
Th-234
Eu-155
Eu-152 154
U-235
U-235
Pb-212
Pb-214
I-131
Tl-208
Pb-212
Ac-228
Eu-152
Pb-214
I-131
Be-7
Pa-234
Tl-208
Cs-134
Bi-214
I-131
Cs-137
Bi-212
Cs-134
Tl-208
Pa-234
Ac-228
Eu-152
Eu-154 M
Co-60
Eu-152
K-40

Test America St. Louis Spectrum ID: 11_Gamma_20140997

Sample Description: 122895_Gamma_LCS 160-122895~2-A
Detector: Ge11 S/N09363993
Batch ID: 122895
Work Order Number: Gamma
Lot Number: LCS 160-122895~2-A

Decay to Time: 5/20/2014 15:11 Live Time: 3600 sec
Acquisition Time: 5/20/2014 15:11:44 Real Time: 3829 sec
Analysis Time: 5/20/2014 16:15 Dead Time: 5.99 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 11_Liquid_Marinelli 1L.Clb
Efficiency Cal Desc: Ge11_1Lmarn_83924_334_101210
Efficiency Cal Date: 11/1/2011 11:27
Energy Cal Date: 2/28/2012 13:09
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 11_2014-05-03_0719.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	5.506E+00	265.7	1.463E+01	1.463E+01	4.844E+01
K-40	-5.791E+00	3200.0	1.853E+02	1.853E+02	2.506E+01
CO-60	2.102E+03	0.3	5.748E+00	1.038E+02	3.322E+00
I-131	2.348E+00	108.5	2.548E+00	2.551E+00	4.380E+00
CS-134	7.252E-02	2123.0	1.539E+00	1.539E+00	5.112E+00
CS-137	1.885E+03	0.4	6.765E+00	9.362E+01	6.166E+00
EU-152	1.221E+02	2.2	2.655E+00	6.733E+00	1.520E+01
EU-154	1.181E+02	1.5	1.791E+00	6.065E+00	5.916E+01
EU-155	2.106E+00	103.5	2.179E+00	2.183E+00	1.187E+01
TL-208	2.228E+00	56.6	1.260E+00	1.265E+00	4.155E+00
PB-210	-2.972E+02	20.9	6.219E+01	6.777E+01	1.934E+02
PB-212	2.600E+00	98.9	2.572E+00	2.577E+00	8.499E+00
PB-214	2.314E-01	1312.0	3.036E+00	3.036E+00	1.008E+01
BI-212	-1.439E+01	151.3	2.178E+01	2.179E+01	7.213E+01
BI-214	-3.645E-01	297.2	1.084E+00	1.084E+00	9.339E+00
AC-228	-3.205E-01	2555.0	8.187E+00	8.187E+00	2.716E+01
Pa-234	5.716E+00	108.6	6.208E+00	6.215E+00	8.999E+00
TH-234	-7.940E+01	40.5	3.218E+01	3.248E+01	9.070E+01
PA-234M	8.820E+01	326.7	2.882E+02	2.882E+02	9.553E+02
U-235	3.221E+00	233.1	7.506E+00	7.508E+00	2.458E+01
AM-241	4.960E+03	0.2	1.212E+01	2.866E+02	1.808E+01
Total	9.299E+03				

Analyst: April Bean

TestAmerica, Inc Spectrum name: 11_Gamma_20140997.An1

Sample description
122895_Gamma_LCS 160-122895~2-A

Spectrum Filename: C:\User\SPC\Det11\11_Gamma_20140997.An1

Acquisition information
Start time: 5/20/2014 3:11:44 PM
Live time: 3600
Real time: 3829
Dead time: 5.99 %
Detector ID: 11

Detector system
Ge11 S/N09363993

Calibration
Filename: 11_Liquid_Marinelli 1L.Clb
Ge11_1Lmarn_83924_334_101210

Energy Calibration
Created: 2/28/2012 1:09:34 PM
Zero offset: 0.055 keV
Gain: 0.250 keV/channel
Quadratic: -2.946E-08 keV/channel^2

Efficiency Calibration
Created: 11/1/2011 11:27:06 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.69 %
Log(Eff): -1.728738E+00 + (5.998209E-02*Log(E)) + (-6.399241E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.15 %
Log(Eff): -1.340909E+01 + (4.619770E+00*Log(E)) + (-5.089701E-01*Log(E)^2)

Library Files
Main analysis library: Client_Routine Short Rev1.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 (1999.47keV)
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

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	5/20/2014 3:11:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	11_2014-05-03_0719.PBC 5/3/2014 7:19:01 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 25 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1226

***** 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
36.61	2682.	9.73	1.01	3.426E-02				
42.81	381.	58.91	0.71	3.929E-02				
49.53	12992.	3.90	1.65	4.364E-02				
59.49	309731.	0.24	0.88	4.830E-02	59.54	35.900	4.960E+03	AM241
74.98	386.	36.00	0.59	5.229E-02				
86.54	204.	103.47	0.94	5.345E-02	86.54	30.700	PBC<MDA	EU155
87.99	77861.	0.47	0.93	5.351E-02				
92.92	54.	124.17	0.94	5.361E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.561	PBC<MDA	AC228
					93.35	5.810	PBC<MDA	U235
					92.59	5.584	PBC<MDA	TH234
					93.35	5.810	PBC<MDA	U235
					93.35	5.561	PBC<MDA	AC228
98.81	194.	61.06	0.45	5.353E-02				
122.09	12122.	2.18	0.95	5.171E-02	121.78	28.580	2.277E+02	EU152
					123.10	40.790	1.600E+02	EU154
131.44	82.	108.60	0.98	5.056E-02	131.29	18.000	PBC<MDA	Pa234
133.65	190.	50.56	0.98	5.025E-02				
136.45	1277.	9.04	0.98	4.987E-02				
143.92	54.	264.97	0.99	4.880E-02	143.79	10.960	PBC<MDA	U235
					143.79	10.960	2.803E+00	U235
162.53	35.	383.49	1.01	4.576E-02	163.38	5.080	PBC<MDA	U235
					163.38	5.080	4.123E+00	U235
165.82	689.	19.11	1.14	4.537E-02				
238.25	147.	83.24	1.08	3.621E-02	238.63	43.300	PBC<MDA	PB212
285.45	115.	108.52	1.12	3.230E-02	284.30	6.140	PBC<MDA	I131
294.55	280.	35.68	0.46	3.155E-02				
344.90	304.	30.87	1.17	2.835E-02	344.29	26.500	1.123E+01	EU152
347.95	157.	55.82	1.18	2.818E-02				
353.57	9.	358.49	1.18	2.796E-02	351.93	37.600	PBC<MDA	PB214

					351.93	37.600	PBC<MDA	PB214
354.59	118.	72.50	0.32	2.781E-02				
359.82	130.	75.17	0.47	2.753E-02				
362.63	76.	139.81	1.19	2.729E-02	364.48	81.700	PBC<MDA	I131
453.26	214.	47.57	0.62	2.338E-02				
470.34	261.	56.91	0.37	2.276E-02				
477.80	47.	265.66	1.29	2.251E-02	477.60	10.520	PBC<MDA	BE7
545.96	387.	31.20	0.76	2.039E-02				
582.72	132.	51.04	1.38	1.941E-02	583.02	84.500	PBC<MDA	TL208
583.76	99.	70.61	1.38	1.938E-02				
584.06	287.	33.47	0.33	1.938E-02				
638.41	31.	318.41	1.43	1.815E-02	636.97	7.170	PBC<MDA	I131
661.79	101885.	0.36	1.40	1.762E-02	661.66	85.210	1.885E+03	CS137
723.31	250.	46.17	0.59	1.645E-02	723.36	20.220	2.088E+01	EU154
					723.36	20.220	2.088E+01	EU154
751.11	316.	29.99	0.38	1.597E-02				
779.80	56.	175.22	1.55	1.551E-02	778.92	12.940	PBC<MDA	EU152
834.99	10822.	1.50	1.58	1.468E-02				

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
872.96	116.	96.18	1.63	1.416E-02	873.23	12.270	PBC<MDA	EU154
					873.23	12.270	1.862E+01	EU154
883.35	57.	197.62	1.64	1.403E-02	883.24	9.600	PBC<MDA	Pa234
964.08	91.	133.41	1.71	1.306E-02	964.11	14.605	PBC<MDA	EU152
996.62	121.	91.17	1.73	1.272E-02	996.33	10.600	PBC<MDA	EU154
					996.33	10.600	2.488E+01	EU154
1000.97	34.	326.72	1.74	1.267E-02	1001.00	0.837	PBC<MDA	PA234M
1005.13	86.	127.30	1.74	1.263E-02	1004.77	18.010	PBC<MDA	EU154
					1004.77	18.010	1.049E+01	EU154
1092.14	315.	43.31	0.56	1.178E-02				
1108.74	19.	509.26	1.83	1.161E-02	1112.07	13.644	PBC<MDA	EU152
1115.67	4751.	4.34	1.71	1.158E-02				
1173.44	83157.	0.40	1.76	1.109E-02	1173.24	99.900	2.084E+03	CO60
1274.92	193.	21.50	1.96	1.034E-02	1274.54	35.190	1.472E+01	EU154
					1274.54	35.190	1.472E+01	EU154
1283.82	45.	55.91	0.51	1.028E-02				
1332.74	75985.	0.37	1.88	9.953E-03	1332.50	99.980	2.121E+03	CO60
1408.09	140.	22.82	0.33	9.491E-03	1408.00	21.005	1.953E+01	EU152
1420.97	138.	23.68	0.74	9.416E-03				
1540.38	28.	38.72	0.70	8.774E-03				
1764.82	7.	122.10	2.34	7.777E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV		Suspected Nuclide
146.13	36.61	18668.	2682.	7.827E+04	9.73	1.008	-	sM
170.93	42.81	19995.	381.	9.698E+03	58.91	0.712	-	sM
197.77	49.53	70173.	13502.	3.094E+05	2.91	1.654	-	sM
299.49	74.98	8112.	386.	7.382E+03	36.00	0.590	-	s
351.54	87.99	14510.	77658.	1.451E+06	0.42	0.934	-	
394.78	98.81	5207.	194.	3.631E+03	61.06	0.453	-	s
534.36	133.58	5511.	161.	3.195E+03	65.87	0.981	-	sc
544.98	136.38	7565.	1245.	2.497E+04	13.37	0.844	-	
662.67	165.82	5550.	689.	1.519E+04	15.76	1.143	-	
1177.36	294.55	3646.	281.	8.897E+03	31.00	0.460	-	s
1390.92	347.95	2452.	89.	3.159E+03	85.65	0.685	-	sc
1417.45	354.59	2889.	109.	3.912E+03	70.51	0.321	-	sc
1438.37	359.82	3309.	128.	4.658E+03	64.05	0.467	-	sc
1812.04	453.26	3571.	214.	9.139E+03	47.57	0.616	-	s
1880.33	470.34	5672.	261.	1.145E+04	56.91	0.370	-	s
2182.75	545.96	3404.	387.	1.897E+04	31.20	0.762	-	s
2333.96	584.06	2396.	99.	5.109E+03	70.61	1.383	-	sc
2892.14	723.31	3045.	110.	6.675E+03	71.73	0.587	-	sc
3003.33	751.11	2252.	316.	1.976E+04	29.99	0.382	-	sM
3338.88	834.99	3468.	10822.	7.372E+05	1.50	1.583	-	M
4367.76	1092.14	3533.	315.	2.670E+04	43.31	0.563	-	sM
4461.90	1115.67	4087.	5819.	5.027E+05	2.03	1.709	-	M
5134.84	1283.82	196.	45.	4.379E+03	55.91	0.510	-	s
5683.79	1420.97	143.	138.	1.466E+04	23.68	0.742	-	s
6161.76	1540.38	37.	28.	3.153E+03	38.72	0.705	-	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: Client_Routine Short Rev1.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	189.60	47.49	70237.	-1902.	-0.528	20.38	0.901
AM-241	237.59	59.49	58450.	309731.	86.036	0.24	0.879
TH-234	252.55	63.23	17383.	-540.	-0.150	37.63	0.916s
EU-155	345.74	86.54	22068.	204.	0.057	103.47	0.938s
TH-234	371.24	92.92	10205.	54.	0.015	124.17	0.943s
EU-152	487.85	122.09	11880.	12122.	3.367	2.18	0.954
EU-154	487.76	122.07	8847.	11212.	3.114	1.52	0.971s
Pa-234	524.63	131.29	3930.	82.	0.023	108.60	0.979D
U-235	575.11	143.92	10194.	54.	0.015	264.97	0.990s
U-235	649.55	162.53	8735.	35.	0.010	383.49	1.008s
U-235	820.55	205.31	10667.	-135.	-0.037	108.84	1.047s
PB-212	952.27	238.25	10477.	147.	0.041	83.24	1.077s
PB-214	966.51	241.81	10300.	-106.	-0.029	142.84	1.080s
TL-208	1111.59	278.10	9068.	-82.	-0.023	165.15	1.112s
I-131	1141.01	285.45	7752.	115.	0.032	108.52	1.118
PB-214	1186.41	296.81	7627.	-88.	-0.025	164.73	1.128s
AC-228	1350.34	337.81	7911.	-35.	-0.010	359.38	1.167s
EU-152	1376.59	344.37	7697.	219.	0.061	56.94	1.172s
I-131	1449.61	362.63	5602.	76.	0.021	139.81	1.190s
BE-7	1910.18	477.80	7749.	47.	0.013	265.66	1.290
CS-134	2256.33	564.35	4979.	-126.	-0.035	79.64	1.365s
CS-134	2276.79	569.47	5105.	-21.	-0.006	475.17	1.371s
Pa-234	2276.48	569.39	5095.	-13.	-0.004	784.87	1.371s
TL-208	2330.99	583.02	2710.	132.	0.037	51.04	1.382D
I-131	2552.52	638.41	4704.	31.	0.008	318.41	1.429s
CS-137	2646.04	661.79	5035.	101885.	28.301	0.36	1.398
EU-154	2891.78	723.22	4475.	140.	0.039	67.99	1.503s
BI-212	2908.20	727.33	4668.	-64.	-0.018	151.35	1.507s
PA-234M	3065.84	766.73	4815.	-79.	-0.022	125.04	1.540s
EU-152	3118.10	779.80	4845.	56.	0.016	175.22	1.551
BI-212	3140.32	785.36	4871.	-66.	-0.018	151.18	1.556s
CS-134	3185.87	796.74	5154.	-114.	-0.032	89.83	1.565s
CS-134	3207.86	802.24	5096.	-59.	-0.016	170.87	1.570s
EU-154	3490.80	872.96	6214.	116.	0.032	96.18	1.630s
Pa-234	3521.45	880.62	6430.	-50.	-0.014	228.47	1.637s
Pa-234	3532.36	883.35	6296.	57.	0.016	197.62	1.639
EU-152	3855.34	964.08	7376.	91.	0.025	133.41	1.706
AC-228	3875.10	969.02	6893.	-118.	-0.033	100.09	1.710s
EU-154	3985.55	996.62	5996.	121.	0.034	91.17	1.733s
PA-234M	4002.94	1000.97	6032.	34.	0.009	326.72	1.737s
EU-154	4019.58	1005.13	5934.	86.	0.024	127.30	1.740s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
EU-152	4434.19	1108.74	4492.	19.	0.005	509.26	1.828
BI-214	4472.59	1118.34	8240.	-1083.	-0.301	12.33	1.834s
CO-60	4693.10	1173.44	3135.	83157.	23.099	0.40	1.762
EU-154	5099.22	1274.92	763.	193.	0.054	21.50	1.958
CO-60	5330.62	1332.74	623.	75985.	21.107	0.37	1.882
EU-152	5632.22	1408.09	171.	140.	0.039	22.82	0.334s
BI-214	7060.37	1764.82	207.	7.	0.002	122.10	2.336s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	Peak MDA Value Bq/Sample	Peak COMMENTS
BE-7	C	5.5059E+00				5.31E+01	
			477.60	5.506E+00 ?(		4.844E+01 2.66E+02	1.05E+01 G
K-40	N	-5.7906E+00				4.66E+11	
			1460.83	-5.791E+00 %(P		2.506E+01 1.54E+03	1.07E+01 G
CO-60	F	2.1024E+03				1.93E+03	
			1332.50	2.121E+03 (		3.322E+00 3.74E-01	1.00E+02 G
			1173.24	2.084E+03 (		6.607E+00 3.98E-01	9.99E+01 G
I-131	I	2.3480E+00				8.02E+00	
			364.48	9.466E-01 &(		4.380E+00 1.40E+02	8.17E+01 G
			284.30	1.613E+01 (		5.785E+01 1.09E+02	6.14E+00 G
			636.97	6.514E+00 &(		6.881E+01 3.18E+02	7.17E+00 G
CS-134	I	7.2518E-02				7.54E+02	
			604.71	7.252E-02 %(		5.112E+00 2.12E+03	9.76E+01 G
			795.87	-2.420E+00 &		7.182E+00 8.98E+01	8.55E+01 G
			569.32	-1.945E+00 +		3.068E+01 4.75E+02	1.54E+01 G
			801.95	-1.249E+01 &		7.072E+01 1.71E+02	8.69E+00 G
			563.24	-2.106E+01 +		5.536E+01 7.96E+01	8.35E+00 G
CS-137	I	1.8846E+03				1.10E+04	
			661.66	1.885E+03 (		6.166E+00 3.59E-01	8.52E+01 G
EU-152	F	1.2205E+02				4.94E+03	
			344.29	8.105E+00 &(		1.520E+01 5.69E+01	2.65E+01 G
			121.78	2.277E+02 (		9.591E+00 2.18E+00	2.86E+01 G
			778.92	7.796E+00 -		4.526E+01 1.75E+02	1.29E+01 G
			964.11	1.330E+01 -		5.866E+01 1.33E+02	1.46E+01 G
			1112.07	3.268E+00 -		5.526E+01 5.09E+02	1.36E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
			1408.00	1.953E+01 -		8.864E+00	2.28E+01	2.10E+01 G
EU-154	I	1.1808E+02					3.14E+03	
			873.23	1.862E+01 ?(		5.916E+01	9.62E+01	1.23E+01 G
			123.10	1.480E+02 ?(		5.821E+00	1.52E+00	4.08E+01 G
			1274.54	1.472E+01 -		1.003E+01	2.15E+01	3.52E+01 G
			723.36	1.172E+01 -		2.627E+01	6.80E+01	2.02E+01 G
			1004.77	1.049E+01 -		4.418E+01	1.27E+02	1.80E+01 G
			996.33	2.488E+01 -		7.492E+01	9.12E+01	1.06E+01 G
EU-155	I	2.1061E+00					1.81E+03	
			105.31	1.667E-01 %(		1.187E+01	2.15E+03	2.12E+01 G
			86.54	3.445E+00 ?(		1.177E+01	1.03E+02	3.07E+01 G
TL-208	N	2.2275E+00					6.98E+02	
			583.02	2.228E+00 (P		4.155E+00	5.10E+01	8.45E+01 G
			277.28	-1.096E+01 -		5.985E+01	1.65E+02	6.31E+00 G
			860.56	8.980E-01 %		4.579E+01	1.53E+03	1.24E+01 G
PB-210	N	-2.9718E+02					8.14E+03	
			46.54	-2.972E+02 (P		1.934E+02	2.04E+01	4.25E+00 G
PB-212	N	2.5999E+00					6.98E+02	
			238.63	2.600E+00 @(P		8.499E+00	8.32E+01	4.33E+01 G
			300.03	2.762E-02 &		1.170E+02	1.28E+05	3.28E+00 G
PB-214	N	2.3138E-01					5.84E+05	
			351.93	2.314E-01 &(P		1.008E+01	3.58E+02	3.76E+01 G
			295.09	-4.033E+00 + P		1.871E+01	1.65E+02	1.93E+01 G
			242.00	-1.100E+01 + P		4.956E+01	1.43E+02	7.43E+00 G
BI-212	N	-1.4390E+01					6.98E+02	
			727.17	-1.439E+01 ?(		7.213E+01	1.51E+02	7.55E+00 G
			785.42	-9.224E+01 +		4.618E+02	1.51E+02	1.28E+00 G
BI-214	N	-3.6453E-01					5.84E+05	
			609.31	-1.015E+00 &(P		9.339E+00	2.13E+03	4.61E+01 G
			1120.29	-1.727E+02 + P		6.789E+01	1.23E+01	1.51E+01 G
			1764.49	1.581E+00 (P		1.617E+01	1.22E+02	1.54E+01 G
AC-228	N	-3.2050E-01					2.10E+03	
			911.07	-3.205E-01 &(		2.716E+01	2.55E+03	2.90E+01 G
			968.97	-1.441E+01 +		4.764E+01	1.00E+02	1.75E+01 G
			338.32	-2.821E+00 +		3.359E+01	3.59E+02	1.20E+01 G
							Energy duplication	
			93.35	9.981E-01 %		4.337E+01	1.31E+03	5.56E+00 XA

Nuclide		Ave activity	Energy		Activity	Code	Peak	MDA	Comments
Pa-234	N	5.7161E+00						1.63E+12	
			131.29	2.505E+00	(8.999E+00		1.09E+02	1.80E+01	G
			569.47	-2.206E+00	& 5.749E+01		7.85E+02	8.20E+00	G
			946.02	-1.798E+00	% 6.308E+01		1.06E+03	1.34E+01	G
			883.24	1.174E+01	(7.682E+01		1.98E+02	9.60E+00	G
			880.53	-1.637E+01	+ 1.239E+02		2.28E+02	6.00E+00	G
TH-234	N	-7.9399E+01						1.63E+12	
			63.29	-7.940E+01	?(P 9.070E+01		3.76E+01	3.81E+00	G
			92.59	4.991E+00	+ P 4.394E+01		1.24E+02	5.58E+00	G
PA-234M	N	8.8197E+01						1.63E+12	
			1001.00	8.820E+01	(9.553E+02		3.27E+02	8.37E-01	G
			766.41	-4.738E+02	+ 1.961E+03		1.25E+02	2.94E-01	G
U-235	N	3.2207E+00						2.57E+11	
			143.79	2.803E+00	(2.458E+01		2.65E+02	1.10E+01	G
			205.33	-1.875E+01	+ 6.741E+01		1.09E+02	5.01E+00	G
			163.38	4.123E+00	?(5.237E+01		3.83E+02	5.08E+00	G
								Energy	duplication
			93.35	9.554E-01	% 4.151E+01		1.31E+03	5.81E+00	X
AM-241	T	4.9597E+03						1.58E+05	
			59.54	4.960E+03	(1.808E+01		2.44E-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.
+ - 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
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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	47.49	70237.	-1902.	-0.528	20.38	-2.972E+02	P
TH-234	63.23	17383.	-540.	-0.150	37.63	-7.940E+01	P
EU-155	86.54	22068.	204.	0.057	103.47	3.445E+00	
TH-234	92.92	10205.	54.	0.015	124.17	4.991E+00	P
EU-154	122.07	8847.	11212.	3.114	1.52	1.480E+02	
U-235	143.92	10194.	54.	0.015	264.97	2.803E+00	
U-235	162.53	8735.	35.	0.010	383.49	4.123E+00	
U-235	205.31	10667.	-135.	-0.037	108.84	-1.875E+01	
PB-212	238.25	10477.	147.	0.041	83.24	2.600E+00	P
PB-214	241.81	10300.	-106.	-0.029	142.84	-1.100E+01	P
PB-214	296.81	7627.	-88.	-0.025	164.73	-4.033E+00	P
AC-228	337.81	7911.	-35.	-0.010	359.38	-2.821E+00	
BE-7	477.80	7749.	47.	0.013	265.66	5.506E+00	
CS-134	564.35	4979.	-126.	-0.035	79.64	-2.106E+01	
CS-134	569.47	5105.	-21.	-0.006	475.17	-1.945E+00	
EU-154	723.22	4475.	140.	0.039	67.99	1.172E+01	
BI-212	727.33	4668.	-64.	-0.018	151.35	-1.439E+01	
PA-234M	766.73	4815.	-79.	-0.022	125.04	-4.738E+02	
BI-212	785.36	4871.	-66.	-0.018	151.18	-9.224E+01	
CS-134	796.74	5154.	-114.	-0.032	89.83	-2.420E+00	
CS-134	802.24	5096.	-59.	-0.016	170.87	-1.249E+01	
EU-154	872.96	6214.	116.	0.032	96.18	1.862E+01	
AC-228	969.02	6893.	-118.	-0.033	100.09	-1.441E+01	
EU-154	996.62	5996.	121.	0.034	91.17	2.488E+01	
PA-234M	1000.97	6032.	34.	0.009	326.72	8.820E+01	
EU-154	1005.13	5934.	86.	0.024	127.30	1.049E+01	
BI-214	1118.34	8240.	-1083.	-0.301	12.33	-1.727E+02	P
EU-154	1274.92	763.	193.	0.054	21.50	1.472E+01	
BI-214	1764.82	207.	7.	0.002	122.10	1.581E+00	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 *****

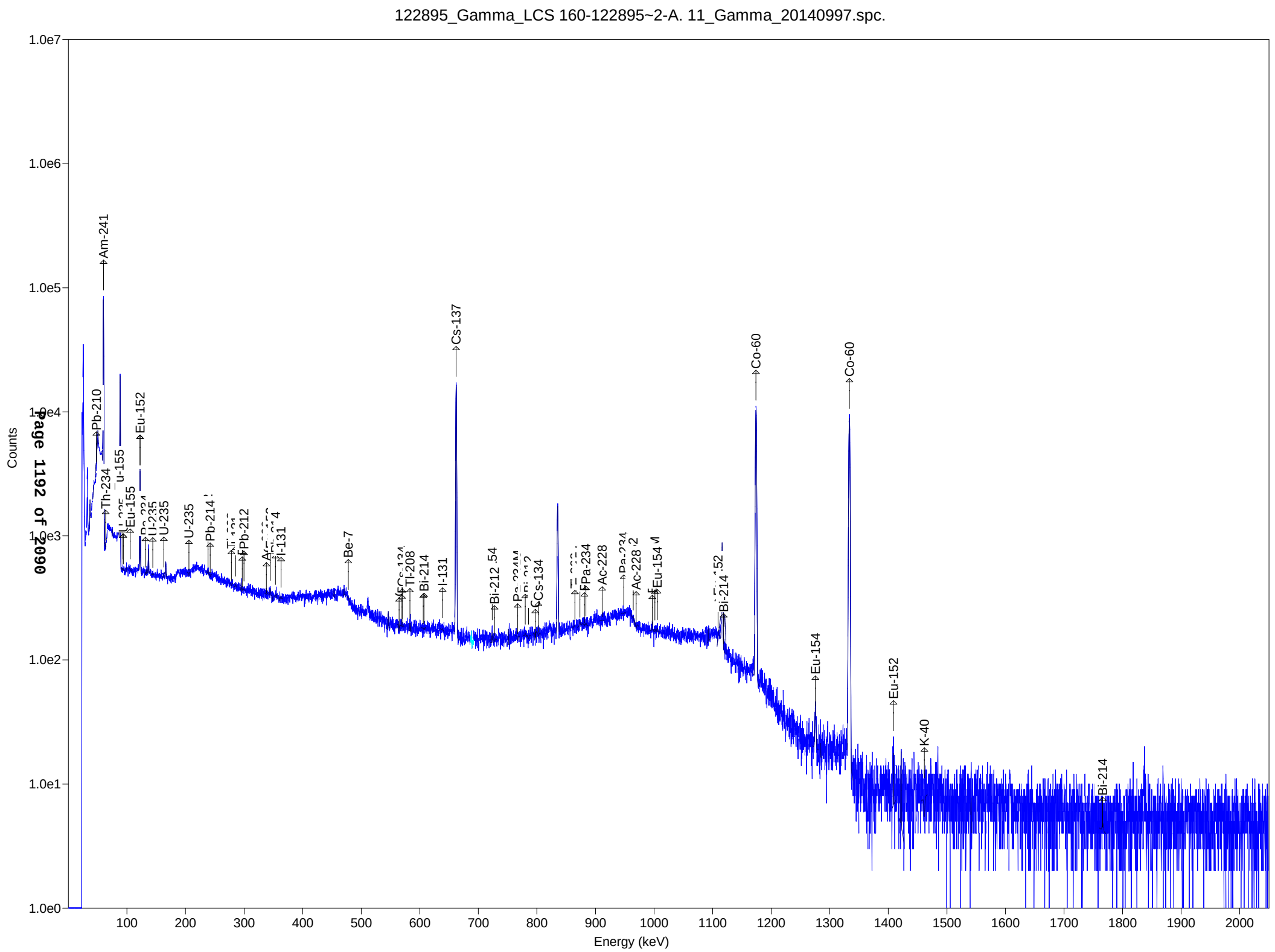
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	5.5058E+00	5.5059E+00	2.657E+02%	4.84E+01
K-40	#A	-5.7906E+00	-5.7906E+00	3.200E+03%	2.51E+01
CO-60		2.1024E+03	2.1024E+03	2.734E-01%	3.32E+00
I-131	A	2.3479E+00	2.3480E+00	1.085E+02%	4.38E+00
CS-134	#A	7.2518E-02	7.2518E-02	2.123E+03%	5.11E+00
CS-137		1.8846E+03	1.8846E+03	3.590E-01%	6.17E+00
EU-152		1.2205E+02	1.2205E+02	2.175E+00%	1.52E+01
EU-154	#C	1.1808E+02	1.1808E+02	1.516E+00%	5.92E+01
EU-155	#A	2.1061E+00	2.1061E+00	1.035E+02%	1.19E+01
TL-208	A	2.2275E+00	2.2275E+00	5.658E+01%	4.15E+00
PB-210	#A	-2.9718E+02	-2.9718E+02	2.093E+01%	1.93E+02
PB-212	#A	2.5999E+00	2.5999E+00	9.893E+01%	8.50E+00
PB-214	#A	2.3138E-01	2.3138E-01	1.312E+03%	1.01E+01
BI-212	#A	-1.4390E+01	-1.4390E+01	1.513E+02%	7.21E+01
BI-214	#A	-3.6453E-01	-3.6453E-01	2.972E+02%	9.34E+00
AC-228	#A	-3.2050E-01	-3.2050E-01	2.555E+03%	2.72E+01
Pa-234	A	5.7161E+00	5.7161E+00	1.086E+02%	9.00E+00
TH-234	#A	-7.9399E+01	-7.9399E+01	4.053E+01%	9.07E+01
PA-234M	#A	8.8197E+01	8.8197E+01	3.267E+02%	9.55E+02
U-235	#A	3.2207E+00	3.2207E+00	2.331E+02%	2.46E+01
AM-241		4.9597E+03	4.9597E+03	2.443E-01%	1.81E+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 (636.8 to 1999.5 keV) 9.071E+03 Bq/Sample
Total Decayed Activity (636.8 to 1999.5 keV) 9.0709473E+03 Bq/Sample

The library has energies which are not separable.


122895_Gamma_LCS 160-122895~2-A. 11_Gamma_20140997.spc.
Counts
Energy (keV)
1.0e7
1.0e6
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Am-241
Pb-210
Th-234
Eu-155
Eu-152
U-235
Pb-214
Pb-212
I-131
Be-7
Tl-208
Bi-214
Cs-137
Bi-212
Cs-134
Pa-234
Ac-228
Ac-228
Eu-154
Co-60
Co-60
Eu-154
Eu-152
K-40
Bi-214

Test America St. Louis Spectrum ID: 18_Gamma_20140439

Sample Description: 122895_Gamma_160-6694-A-7-A
Detector: Ge18 SN/11164036
Batch ID: 122895
Work Order Number: Gamma
Lot Number: 160-6694-A-7-A

Decay to Time: 5/20/2014 13:46 Live Time: 3600 sec
Acquisition Time: 5/20/2014 13:46:18 Real Time: 3614 sec
Analysis Time: 5/20/2014 14:46 Dead Time: 0.38 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 18_1LMarinelli.Clb
Efficiency Cal Desc: 18_1Lmarn_83924-334_120711
Efficiency Cal Date: 12/8/2011 10:14
Energy Cal Date: 3/1/2012 13:27
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 18_2014-05-03_0602.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	-7.696E-03	10580.0	8.142E-01	8.142E-01	3.001E+00
K-40	-2.624E-01	726.9	1.908E+00	1.908E+00	7.360E+00
CO-60	3.671E-02	377.5	1.386E-01	1.386E-01	5.204E-01
I-131	5.858E-02	168.9	9.896E-02	9.901E-02	3.476E-01
CS-134	2.101E-02	328.4	6.901E-02	6.902E-02	4.775E-01
CS-137	-4.394E-02	315.3	1.386E-01	1.386E-01	4.973E-01
EU-152	4.911E-01	72.4	3.556E-01	3.566E-01	1.004E+00
EU-154	1.704E-01	144.8	2.468E-01	2.470E-01	3.483E+00
EU-155	-2.352E-01	160.1	3.767E-01	3.769E-01	1.282E+00
TL-208	-1.802E-01	480.5	8.657E-01	8.658E-01	5.632E-01
PB-210	1.732E+00	162.9	2.823E+00	2.827E+00	8.303E+00
PB-212	1.924E-01	143.4	2.760E-01	2.765E-01	8.409E-01
PB-214	3.560E-01	63.4	2.258E-01	2.266E-01	8.336E-01
BI-212	7.512E-01	175.4	1.318E+00	1.318E+00	4.737E+00
BI-214	-1.777E-01	276.2	4.909E-01	4.910E-01	1.081E+00
AC-228	3.753E-01	82.3	3.090E-01	3.095E-01	1.538E+00
Pa-234	9.292E-02	361.5	3.359E-01	3.359E-01	1.175E+00
TH-234	2.863E+00	113.8	3.258E+00	3.262E+00	9.069E+00
PA-234M	5.142E+00	150.0	7.711E+00	7.715E+00	6.218E+01
U-235	1.279E+00	51.8	6.619E-01	6.651E-01	1.958E+00
AM-241	1.395E-02	1656.0	2.310E-01	2.310E-01	8.022E-01
Total	1.358E+01				

Analyst: April Bean

Test America Spectrum name: 18_Gamma_20140439.An1

Sample description
122895_Gamma_160-6694-A-7-A

Spectrum Filename: C:\User\SPC\Det18\18_Gamma_20140439.An1

Acquisition information
Start time: 5/20/2014 1:46:18 PM
Live time: 3600
Real time: 3614
Dead time: 0.38 %
Detector ID: 18

Detector system
Ge18 SN/11164036

Calibration
Filename: 18_1LMarinelli.Clb
18_1Lmarn_83924-334_120711

Energy Calibration
Created: 3/1/2012 1:27:55 PM
Zero offset: 0.007 keV
Gain: 0.250 keV/channel
Quadratic: -3.202E-08 keV/channel^2

Efficiency Calibration
Created: 12/8/2011 10:14:04 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.55 %
Log(Eff): -1.645931E+00 + (3.227669E-02*Log(E)) + (-6.187585E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.90 %
Log(Eff): -1.318185E+01 + (4.538566E+00*Log(E)) + (-5.017483E-01*Log(E)^2)

Library Files
Main analysis library: Client_Routine Short Rev1.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 (1999.55keV)
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

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	5/20/2014 1:46:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	18_2014-05-03_0602.PBC 5/3/2014 6:02:08 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 9 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0388

***** 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

No unknown peaks passed sensitivity test.

This section based on library: Client_Routine Short Rev1.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	185.70	46.47	123.	11.	0.003	28.41	1.014
TH-234	254.68	63.73	165.	20.	0.005	31.39	0.658s
EU-155	342.17	85.62	148.	-23.	-0.006	78.18	0.989s
TH-234	370.05	92.59	171.	-19.	-0.005	29.82	0.996D
U-235	373.09	93.35	132.	24.	0.007	70.91	0.996D
AC-228	373.09	93.35	123.	58.	0.016	29.92	0.997D
EU-155	420.80	105.29	114.	-10.	-0.003	160.13	1.009s
EU-152	486.33	121.68	110.	-10.	-0.003	156.17	1.026s
EU-154	491.39	122.95	99.	-3.	-0.001	444.56	1.028s
Pa-234	536.39	134.20	59.	3.	0.001	361.48	1.036s
U-235	579.17	144.90	57.	23.	0.006	51.77	1.049s
U-235	652.29	163.20	97.	13.	0.004	113.10	1.070s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
U-235	821.03	205.41	68.	2.	0.000	673.64	1.112
PB-212	954.17	238.71	91.	9.	0.002	33.30	1.146
PB-214	967.89	242.14	82.	-3.	-0.001	373.14	1.149s
I-131	1135.29	284.01	40.	-4.	-0.001	231.65	1.191s
PB-214	1184.73	296.38	46.	6.	0.002	166.51	1.202s
PB-212	1199.03	299.96	44.	2.	0.001	400.72	1.207s
AC-228	1353.21	338.52	24.	6.	0.002	127.66	1.244s
EU-152	1377.45	344.58	27.	11.	0.003	75.21	1.249s
PB-214	1408.38	352.32	38.	15.	0.004	63.42	1.257s
I-131	1457.21	364.53	29.	5.	0.001	168.94	1.269s
CS-134	2250.77	562.98	29.	-2.	0.000	430.22	1.451s
TL-208	2331.93	583.28	42.	-14.	-0.004	409.05	1.468s
BI-214	2438.06	609.82	43.	-5.	-0.002	65.51	1.491s
CS-137	2643.50	661.18	26.	-2.	-0.001	315.31	1.535s
BI-212	2908.91	727.54	15.	3.	0.001	175.40	1.590s
PA-234M	3069.55	767.70	10.	3.	0.001	149.95	1.621s
EU-152	3115.17	779.11	16.	5.	0.001	123.74	1.631s
BI-212	3146.24	786.87	21.	-3.	-0.001	210.00	1.637s
CS-134	3209.45	802.68	19.	2.	0.001	328.40	1.650s
TL-208	3439.33	860.15	22.	1.	0.000	480.53	1.695s
Pa-234	3531.27	883.13	21.	-2.	-0.001	338.50	1.713s
AC-228	3645.22	911.61	17.	4.	0.001	166.02	1.734s
Pa-234	3786.00	946.80	18.	-4.	-0.001	151.41	1.759s
EU-152	3854.95	964.03	18.	1.	0.000	523.17	1.773s
AC-228	3875.21	969.10	12.	4.	0.001	130.87	1.776s
EU-154	3983.12	996.07	17.	-1.	0.000	477.94	1.796s
EU-154	4011.72	1003.22	21.	-4.	-0.001	179.74	1.802s
CO-60	4695.84	1174.19	17.	-4.	-0.001	160.65	1.916s
EU-154	5096.95	1274.43	8.	3.	0.001	144.84	1.980s
CO-60	5332.17	1333.20	12.	1.	0.000	377.55	2.015s
EU-152	5630.22	1407.67	7.	1.	0.000	346.49	2.059s
K-40	5847.10	1461.85	25.	-1.	0.000	45.14	2.088s

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	Peak Energy keV	Peak Activity Bq/Sample	Peak Code	Peak MDA Value Bq/Sample	COMMENTS
BE-7	C	-7.6956E-03				5.31E+01	
			477.60	-7.696E-03	%(	3.001E+00 1.06E+04	1.05E+01 G
K-40	N	-2.6244E-01				4.66E+11	
			1460.83	-2.624E-01	&(P	7.360E+00 4.51E+01	1.07E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CO-60	F	3.6707E-02					1.93E+03	
			1332.50	3.671E-02	?(	5.204E-01	3.78E+02	1.00E+02 G
			1173.24	-9.628E-02	+	5.515E-01	1.61E+02	9.99E+01 G
I-131	I	5.8578E-02					8.02E+00	
			364.48	5.858E-02	?(	3.476E-01	1.69E+02	8.17E+01 G
			284.30	-5.580E-01	+	4.540E+00	2.32E+02	6.14E+00 G
			636.97	3.018E-02	%	5.444E+00	4.90E+03	7.17E+00 G
CS-134	I	2.1014E-02					7.54E+02	
			604.71	-1.309E-02	%(	4.775E-01	1.02E+03	9.76E+01 G
			795.87	1.426E-03	%	5.125E-01	9.68E+03	8.55E+01 G
			569.32	0.000E+00	+	2.290E+00	1.00E+03	1.54E+01 G
			801.95	4.041E-01	?(	4.841E+00	3.28E+02	8.69E+00 G
			563.24	-3.016E-01	+	4.666E+00	4.30E+02	8.35E+00 G
CS-137	I	-4.3944E-02					1.10E+04	
			661.66	-4.394E-02	?(	4.973E-01	3.15E+02	8.52E+01 G
EU-152	F	4.9110E-01					4.94E+03	
			344.29	3.988E-01	?(	1.004E+00	7.52E+01	2.65E+01 G
			121.78	-1.818E-01	-	9.662E-01	1.56E+02	2.86E+01 G
			778.92	6.802E-01	&(	2.959E+00	1.24E+02	1.29E+01 G
			964.11	1.698E-01	&	3.278E+00	5.23E+02	1.46E+01 G
			1112.07	0.000E+00	-	5.360E+00	1.00E+03	1.36E+01 G
			1408.00	1.543E-01	-	2.074E+00	3.46E+02	2.10E+01 G
EU-154	I	1.7043E-01					3.14E+03	
			873.23	0.000E+00	?(	3.483E+00	1.00E+03	1.23E+01 G
			123.10	-4.189E-02	+	6.444E-01	4.45E+02	4.08E+01 G
			1274.54	2.299E-01	&(	1.214E+00	1.45E+02	3.52E+01 G
			723.36	0.000E+00	-	2.413E+00	1.00E+03	2.02E+01 G
			1004.77	-4.612E-01	+	2.950E+00	1.80E+02	1.80E+01 G
			996.33	-2.605E-01	+	4.593E+00	4.78E+02	1.06E+01 G
EU-155	I	-2.3523E-01					1.81E+03	
			105.31	-2.352E-01	?(	1.282E+00	1.60E+02	2.12E+01 G
			86.54	-3.831E-01	&	9.963E-01	7.82E+01	3.07E+01 G
TL-208	N	-1.8016E-01					6.98E+02	
			583.02	-2.389E-01	?(P	5.632E-01	4.09E+02	8.45E+01 G
			277.28	-1.705E-01	% P	4.211E+00	5.00E+02	6.31E+00 G
			860.56	2.196E-01	?(	3.849E+00	4.81E+02	1.24E+01 G
PB-210	N	1.7323E+00					8.14E+03	
			46.54	1.732E+00	(P	8.303E+00	2.84E+01	4.25E+00 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-212	N	1.9244E-01					6.98E+02	
			238.63	1.580E-01	(P	8.409E-01	3.33E+01	4.33E+01 G
			300.03	6.470E-01	?(	9.171E+00	4.01E+02	3.28E+00 G
PB-214	N	3.5604E-01					5.84E+05	
			351.93	3.990E-01	(	8.336E-01	6.34E+01	3.76E+01 G
			295.09	2.724E-01	&(	1.573E+00	1.67E+02	1.93E+01 G
			242.00	-3.641E-01	-	4.714E+00	3.73E+02	7.43E+00 G
BI-212	N	7.5121E-01					6.98E+02	
			727.17	7.512E-01	&(	4.737E+00	1.75E+02	7.55E+00 G
			785.42	-4.565E+00	+	3.430E+01	2.10E+02	1.28E+00 G
BI-214	N	-1.7773E-01					5.84E+05	
			609.31	-1.777E-01	(P	1.081E+00	6.55E+01	4.61E+01 G
			1120.29	-1.251E+00	% P	4.111E+00	2.86E+03	1.51E+01 G
			1764.49	-1.614E+00	% P	3.492E+00	1.00E+03	1.54E+01 G
AC-228	N	3.7532E-01					2.10E+03	
			911.07	2.594E-01	?(	1.538E+00	1.66E+02	2.90E+01 G
			968.97	5.054E-01	?(	2.352E+00	1.31E+02	1.75E+01 G
			338.32	4.661E-01	?(	2.073E+00	1.28E+02	1.20E+01 G
							Energy duplication	
			93.35	5.385E+00	&	5.024E+00	2.99E+01	5.56E+00 XA
Pa-234	N	9.2921E-02					1.63E+12	
			131.29	9.292E-02	?(	1.175E+00	3.61E+02	1.80E+01 G
			569.47	7.649E-02	%	4.655E+00	1.67E+03	8.20E+00 G
			946.02	-6.543E-01	+	3.515E+00	1.51E+02	1.34E+01 G
			883.24	-4.085E-01	+	5.018E+00	3.38E+02	9.60E+00 G
			880.53	0.000E+00	-	1.004E+01	1.00E+03	6.00E+00 G
TH-234	N	2.8626E+00					1.63E+12	
			63.29	2.863E+00	@(P	9.069E+00	3.14E+01	3.81E+00 G
			92.59	-1.791E+00	- P	5.869E+00	2.98E+01	5.58E+00 G
PA-234M	N	5.1422E+00					1.63E+12	
			1001.00	0.000E+00	?(	6.218E+01	1.00E+03	8.37E-01 G
			766.41	1.978E+01	?(	1.073E+02	1.50E+02	2.94E-01 G
U-235	N	1.2785E+00					2.57E+11	
			143.79	1.167E+00	?(	1.958E+00	5.18E+01	1.10E+01 G
			205.33	2.445E-01	-	5.772E+00	6.74E+02	5.01E+00 G
			163.38	1.520E+00	&(	5.810E+00	1.13E+02	5.08E+00 G
							Energy duplication	
			93.35	2.119E+00		4.980E+00	7.09E+01	5.81E+00 X

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
AM-241	T 1.3951E-02					1.58E+05	
		59.54	1.395E-02	&(	8.022E-01	1.66E+03	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.
+ - 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	
EU-155	85.62	148.	-23.	-0.006	78.18	-3.831E-01	
AC-228	93.35	123.	58.	0.016	29.92	5.385E+00	
EU-155	105.29	114.	-10.	-0.003	160.13	-2.352E-01	
EU-152	121.68	110.	-10.	-0.003	156.17	-1.818E-01	
EU-154	122.95	99.	-3.	-0.001	444.56	-4.189E-02	
Pa-234	134.20	59.	3.	0.001	361.48	9.292E-02	
PB-212	238.71	91.	9.	0.002	33.30	1.580E-01	P
PB-214	242.14	82.	-3.	-0.001	373.14	-3.641E-01	
I-131	284.01	40.	-4.	-0.001	231.65	-5.580E-01	
PB-214	296.38	46.	6.	0.002	166.51	2.724E-01	
PB-212	299.96	44.	2.	0.001	400.72	6.470E-01	
AC-228	338.52	24.	6.	0.002	127.66	4.661E-01	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
EU-152	344.58	27.	11.	0.003	75.21	3.988E-01		
PB-214	352.32	38.	15.	0.004	63.42	3.990E-01		
I-131	364.53	29.	5.	0.001	168.94	5.858E-02		
CS-134	562.98	29.	-2.	0.000	430.22	-3.016E-01		
TL-208	583.28	42.	-14.	-0.004	409.05	-2.389E-01		P
BI-214	609.82	43.	-5.	-0.002	65.51	-1.777E-01		P
CS-137	661.18	26.	-2.	-0.001	315.31	-4.394E-02		
BI-212	727.54	15.	3.	0.001	175.40	7.512E-01		
PA-234M	767.70	10.	3.	0.001	149.95	1.978E+01		
EU-152	779.11	16.	5.	0.001	123.74	6.802E-01		
BI-212	786.87	21.	-3.	-0.001	210.00	-4.565E+00		
CS-134	802.68	19.	2.	0.001	328.40	4.041E-01		
TL-208	860.15	22.	1.	0.000	480.53	2.196E-01		
Pa-234	883.13	21.	-2.	-0.001	338.50	-4.085E-01		
AC-228	911.61	17.	4.	0.001	166.02	2.594E-01		
Pa-234	946.80	18.	-4.	-0.001	151.41	-6.543E-01		
EU-152	964.03	18.	1.	0.000	523.17	1.698E-01		
AC-228	969.10	12.	4.	0.001	130.87	5.054E-01		
EU-154	996.07	17.	-1.	0.000	477.94	-2.605E-01		
EU-154	1003.22	21.	-4.	-0.001	179.74	-4.612E-01		
CO-60	1174.19	17.	-4.	-0.001	160.65	-9.628E-02		
EU-154	1274.43	8.	3.	0.001	144.84	2.299E-01		
CO-60	1333.20	12.	1.	0.000	377.55	3.671E-02		
EU-152	1407.67	7.	1.	0.000	346.49	1.543E-01		
K-40	1461.85	25.	-1.	0.000	45.14	-2.624E-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 *****

Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	-7.6956E-03	-7.6956E-03	1.058E+04%	3.00E+00
K-40	#A	-2.6244E-01	-2.6244E-01	7.269E+02%	7.36E+00
CO-60	#A	3.6707E-02	3.6707E-02	3.775E+02%	5.20E-01
I-131	#A	5.8577E-02	5.8578E-02	1.689E+02%	3.48E-01
CS-134	#A	2.1014E-02	2.1014E-02	3.284E+02%	4.77E-01
CS-137	#A	-4.3944E-02	-4.3944E-02	3.153E+02%	4.97E-01
EU-152	#A	4.9110E-01	4.9110E-01	7.240E+01%	1.00E+00
EU-154	#A	1.7043E-01	1.7043E-01	1.448E+02%	3.48E+00
EU-155	#A	-2.3523E-01	-2.3523E-01	1.601E+02%	1.28E+00
TL-208	#A	-1.8016E-01	-1.8016E-01	4.805E+02%	5.63E-01
PB-210	A	1.7323E+00	1.7323E+00	1.629E+02%	8.30E+00
PB-212	#A	1.9244E-01	1.9244E-01	1.434E+02%	8.41E-01
PB-214	#A	3.5604E-01	3.5604E-01	6.342E+01%	8.34E-01
BI-212	#A	7.5121E-01	7.5121E-01	1.754E+02%	4.74E+00
BI-214	#A	-1.7773E-01	-1.7773E-01	2.762E+02%	1.08E+00

AC-228 #A	3.7532E-01	3.7532E-01	8.232E+01%	1.54E+00
Pa-234 #A	9.2921E-02	9.2921E-02	3.615E+02%	1.18E+00
TH-234 #A	2.8626E+00	2.8626E+00	1.138E+02%	9.07E+00
PA-234M#A	5.1422E+00	5.1422E+00	1.500E+02%	6.22E+01
U-235 A	1.2785E+00	1.2785E+00	5.177E+01%	1.96E+00
AM-241 #A	1.3951E-02	1.3951E-02	1.656E+03%	8.02E-01

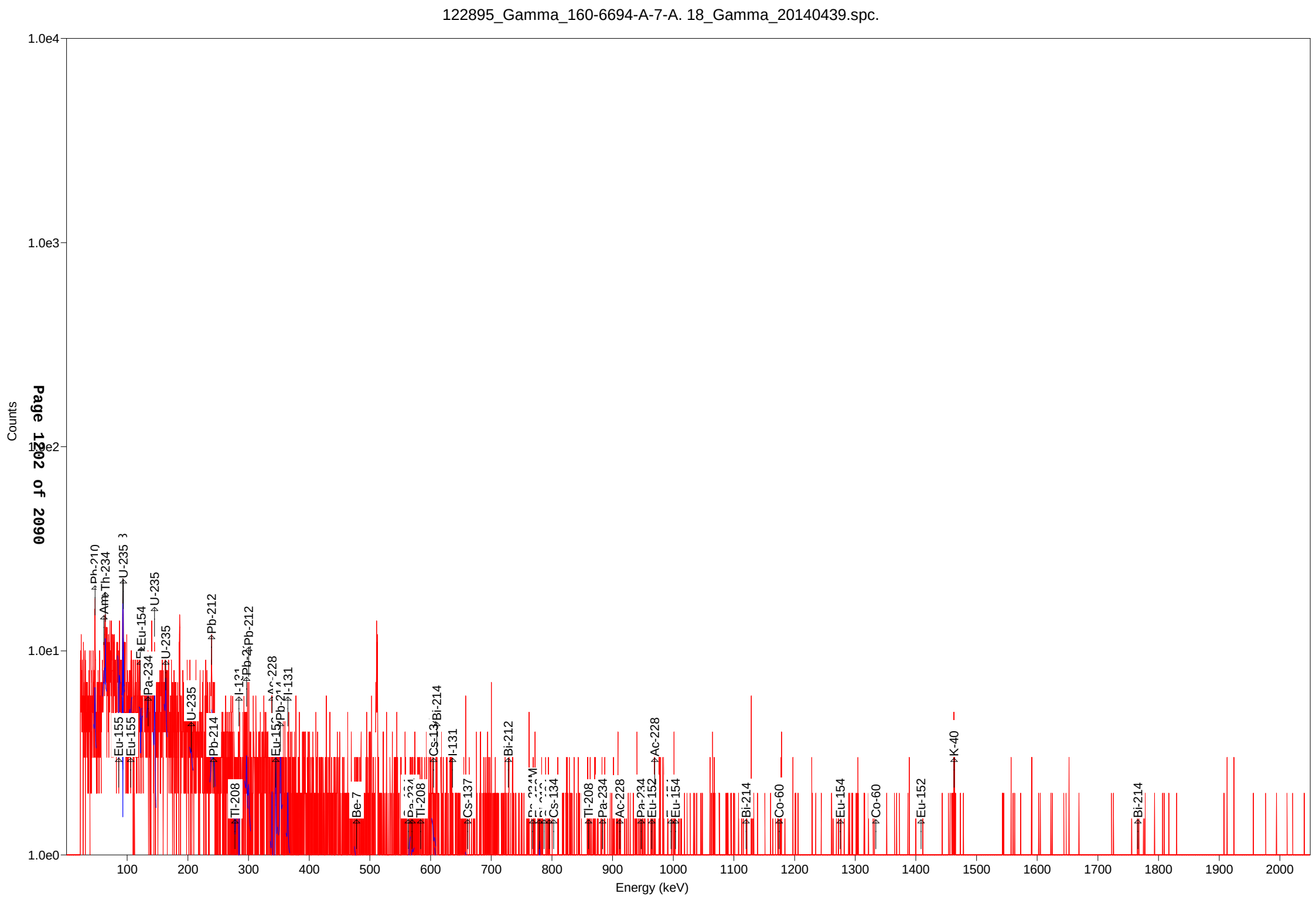
  # - All peaks for activity calculation had bad shape.
  * - Activity omitted from total
  & - Activity omitted from total and all peaks had bad shape.
  < - MDA value printed.
  A - Activity printed, but activity < MDA.
  B - Activity < MDA and failed test.
  C - Area < Critical level.
  F - Failed fraction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

---------- S U M M A R Y ----------

Total Activity (143.6 to 1999.5 keV) 0.000E+00 Bq/Sample
Total Decayed Activity (143.6 to 1999.5 keV) 0.0000000E+00 Bq/Sample

The library has energies which are not separable.

122895_Gamma_160-6694-A-7-A. 18_Gamma_20140439.spc.



Test America St. Louis Spectrum ID: 12_Gamma_20141003

Sample Description: 122895_Gamma_160-6694-A-7-B DU
Detector: Ge12 S/N10034336
Batch ID: 122895
Work Order Number: Gamma
Lot Number: 160-6694-A-7-B DU

Decay to Time: 5/20/2014 15:10 Live Time: 3600 sec
Acquisition Time: 5/20/2014 15:11:10 Real Time: 3611 sec
Analysis Time: 5/20/2014 16:11 Dead Time: 0.30 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 12_Liquid_Marinelli 1L.Clb
Efficiency Cal Desc: Ge12_Marn1LCal_90062_032612
Efficiency Cal Date: 4/2/2012 17:17
Energy Cal Date: 2/28/2012 13:26
Library: Client_Routine Short Rev1.lib
Bkgd Correction File: 12_2014-05-03_0618.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	8.707E-02	620.4	5.402E-01	5.402E-01	2.038E+00
K-40	-2.527E+00	2000.0	5.054E+01	5.054E+01	4.423E+00
CO-60	6.548E-02	152.0	9.951E-02	9.956E-02	3.673E-01
I-131	-8.778E-03	821.9	7.215E-02	7.215E-02	2.662E-01
CS-134	1.014E-01	56.5	5.729E-02	5.751E-02	4.028E-01
CS-137	-8.189E-03	1151.0	9.427E-02	9.427E-02	3.530E-01
EU-152	1.634E-01	149.7	2.445E-01	2.447E-01	8.823E-01
EU-154	6.429E-01	129.5	8.324E-01	8.330E-01	2.941E+00
EU-155	7.980E-02	332.7	2.655E-01	2.655E-01	9.268E-01
TL-208	-4.302E-02	335.8	1.445E-01	1.445E-01	4.094E-01
PB-210	5.717E+00	45.6	2.604E+00	2.655E+00	7.848E+00
PB-212	3.148E-01	78.2	2.462E-01	2.470E-01	6.828E-01
PB-214	3.750E-01	72.9	2.734E-01	2.741E-01	7.950E-01
BI-212	2.254E+00	61.6	1.388E+00	1.393E+00	3.805E+00
BI-214	-7.849E-02	386.5	3.033E-01	3.034E-01	9.264E-01
AC-228	-1.519E-01	289.9	4.403E-01	4.403E-01	1.347E+00
Pa-234	4.422E-01	56.5	2.500E-01	2.511E-01	1.082E+00
TH-234	3.493E+00	39.3	1.372E+00	1.385E+00	7.412E+00
PA-234M	3.639E-02	26750.0	9.737E+00	9.737E+00	4.296E+01
U-235	3.425E-01	73.1	2.505E-01	2.511E-01	1.832E+00
AM-241	1.826E-01	77.5	1.416E-01	1.420E-01	4.742E-01
Total	1.430E+01				

Analyst: April Bean

TestAmerica, Inc Spectrum name: 12_Gamma_20141003.An1

Sample description
122895_Gamma_160-6694-A-7-B DU

Spectrum Filename: C:\User\SPC\Det12\12_Gamma_20141003.An1

Acquisition information
Start time: 5/20/2014 3:11:10 PM
Live time: 3600
Real time: 3611
Dead time: 0.30 %
Detector ID: 12

Detector system
Ge12 S/N10034336

Calibration
Filename: 12_Liquid_Marinelli 1L.Clb
Ge12_Marn1LCal_90062_032612

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: 4/2/2012 5:17:10 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.18 %
Log(Eff): -2.771167E+00 + (4.009767E-01*Log(E)) + (-8.911171E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.25 %
Log(Eff): -1.324587E+01 + (4.570937E+00*Log(E)) + (-5.039442E-01*Log(E)^2)

Library Files
Main analysis library: Client_Routine Short Rev1.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: 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

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	5/20/2014 3:10:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	12_2014-05-03_0618.PBC 5/3/2014 6:18:35 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 10 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.2768

***** 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
46.84	38.	17.01	1.12	4.397E-02	46.54	4.250	PBC<MDA	PB210
61.84	12.	77.54	0.90	5.068E-02	59.54	35.900	PBC<MDA	AM241
63.18	18.	34.65	0.89	5.200E-02	63.29	3.810	PBC<MDA	TH234
92.89	90.	20.29	0.61	5.608E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	7.701E+00	U235
					93.35	5.561	6.999E+00	AC228
					93.35	5.810	7.701E+00	U235
					93.35	5.561	6.999E+00	AC228
105.52	3.	332.68	0.95	5.567E-02	105.31	21.200	PBC<MDA	EU155
					105.31	21.200	7.980E-02	EU155
124.24	13.	76.00	0.96	5.394E-02	123.10	40.790	PBC<MDA	EU154
163.91	15.	73.13	1.00	4.786E-02	163.38	5.080	PBC<MDA	U235
					163.38	5.080	1.663E+00	U235
238.17	19.	30.15	0.62	3.889E-02	238.63	43.300	PBC<MDA	PB212
241.91	13.	66.84	1.07	3.858E-02	242.00	7.430	PBC<MDA	PB214
294.57	-4.	56.24	0.33	3.429E-02	295.09	19.300	PBC<MDA	PB214
352.22	9.	28.60	0.73	3.069E-02	351.93	37.600	PBC<MDA	PB214
476.45	1.	620.40	1.29	2.501E-02	477.60	10.520	PBC<MDA	BE7
570.31	11.	56.54	1.37	2.205E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	1.713E+00	Pa234
570.31	11.	56.47	1.37	2.206E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	1.714E+00	Pa234
583.75	-3.	59.01	1.38	2.168E-02	583.02	84.500	PBC<MDA	TL208
609.33	-3.	51.59	1.41	2.098E-02	609.31	46.090	PBC<MDA	BI214
727.32	6.	89.06	1.51	1.835E-02	727.17	7.550	PBC<MDA	BI212

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
767.56	-4.	292.38	1.54	1.762E-02	766.41	0.294	PBC<MDA	PA234M
786.62	7.	85.13	1.56	1.728E-02	785.42	1.280	PBC<MDA	BI212
796.72	5.	102.53	1.56	1.710E-02	795.87	85.530	PBC<MDA	CS134
801.79	4.	124.91	1.57	1.700E-02	801.95	8.690	PBC<MDA	CS134
874.34	5.	129.49	1.63	1.588E-02	873.23	12.270	PBC<MDA	EU154
911.59	-5.	108.06	1.66	1.535E-02	911.07	29.000	PBC<MDA	AC228
969.13	1.	93.49	1.71	1.459E-02	968.97	17.460	PBC<MDA	AC228
1002.03	0.	78.72	1.73	1.420E-02	1001.00	0.837	PBC<MDA	PA234M
1120.32	-5.	415.32	1.83	1.292E-02	1120.29	15.100	PBC<MDA	BI214
1332.68	3.	151.97	1.99	1.112E-02	1332.50	99.980	PBC<MDA	CO60
1408.04	3.	149.67	2.05	1.059E-02	1408.00	21.005	PBC<MDA	EU152

No unknown peaks passed sensitivity test.

This section based on library: Client_Routine Short Rev1.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	187.00	46.84	116.	38.	0.011	17.01	1.123s
AM-241	246.97	61.84	37.	12.	0.003	77.54	0.902s
TH-234	252.29	63.18	116.	18.	0.005	34.65	0.892
EU-155	345.41	86.48	82.	-9.	-0.002	147.09	0.928s
TH-234	371.03	92.89	100.	47.	0.013	20.29	0.607s
U-235	372.89	93.35	53.	64.	0.018	20.37	0.934D
AC-228	372.89	93.35	65.	52.	0.015	20.37	0.934D
EU-155	421.52	105.52	62.	3.	0.001	332.68	0.946s
EU-154	496.33	124.24	45.	13.	0.004	76.00	0.963s
Pa-234	525.51	131.54	54.	-5.	-0.001	227.66	0.970s
U-235	575.03	143.92	54.	-5.	-0.002	195.92	0.982s
U-235	654.92	163.91	49.	15.	0.004	73.13	1.001s
U-235	820.39	205.31	43.	-1.	0.000	876.01	1.040s
PB-212	951.73	238.17	69.	19.	0.005	30.15	0.619s
PB-214	966.69	241.91	57.	13.	0.003	66.84	1.075
PB-214	1177.22	294.57	34.	-4.	-0.001	56.24	0.327s
PB-212	1200.35	300.35	40.	-6.	-0.002	156.92	1.128s
PB-214	1407.70	352.22	42.	9.	0.002	28.60	0.734s
I-131	1467.81	367.25	20.	-1.	0.000	821.91	1.187s
BE-7	1904.45	476.45	13.	1.	0.000	620.40	1.289s
CS-134	2279.77	570.31	14.	11.	0.003	56.47	1.370s
Pa-234	2279.76	570.31	14.	11.	0.003	56.54	1.370s
TL-208	2333.52	583.75	27.	-3.	-0.001	59.01	1.382s
CS-134	2420.03	605.38	34.	-6.	-0.002	155.31	1.401s
BI-214	2435.81	609.33	40.	-3.	-0.001	51.59	1.405
EU-154	2902.00	725.88	22.	-4.	-0.001	174.14	1.503s
BI-212	2907.75	727.32	12.	6.	0.002	89.06	1.507s
PA-234M	3068.72	767.56	26.	-4.	-0.001	292.38	1.540s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
BI-212	3144.94	786.62	12.	7.	0.002	85.13	1.556s
CS-134	3185.35	796.72	10.	5.	0.001	102.53	1.565s
CS-134	3205.63	801.79	9.	4.	0.001	124.91	1.570s
EU-154	3495.89	874.34	15.	5.	0.001	129.49	1.629s
Pa-234	3522.26	880.93	11.	-1.	0.000	750.25	1.635s
Pa-234	3530.10	882.89	15.	-3.	-0.001	214.66	1.637s
AC-228	3644.89	911.59	16.	-5.	-0.001	108.06	1.660s
EU-152	3854.80	964.05	22.	-4.	-0.001	186.32	1.703s
AC-228	3875.13	969.13	21.	1.	0.000	93.49	1.707s
EU-154	3969.30	992.66	10.	-3.	-0.001	154.05	1.729s
EU-154	4018.81	1005.04	15.	-3.	-0.001	174.55	1.736s
BI-214	4480.12	1120.32	20.	-5.	-0.001	415.32	1.828s
CO-60	4694.62	1173.91	15.	-2.	-0.001	246.95	1.869s
CO-60	5330.11	1332.68	7.	3.	0.001	151.97	1.990s
EU-152	5631.80	1408.04	8.	3.	0.001	149.67	2.046s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	8.7069E-02				5.31E+01	
			477.60	8.707E-02	?(	2.038E+00 6.20E+02 1.05E+01	G
K-40	N	-2.5268E+00				4.66E+11	
			1460.83	-2.527E+00	%(P	4.423E+00 1.00E+03 1.07E+01	G
CO-60	F	6.5477E-02				1.93E+03	
			1332.50	6.548E-02	?(	3.673E-01 1.52E+02 1.00E+02	G
			1173.24	-5.234E-02	+	4.713E-01 2.47E+02 9.99E+01	G
I-131	I	-8.7783E-03				8.02E+00	
			364.48	-8.778E-03	&(	2.662E-01 8.22E+02 8.17E+01	G
			284.30	0.000E+00	&	3.817E+00 1.00E+03 6.14E+00	G
			636.97	1.051E-01	%	4.676E+00 1.21E+03 7.17E+00	G
CS-134	I	1.0144E-01				7.54E+02	
			604.71	-7.443E-02	?(	4.028E-01 1.55E+02 9.76E+01	G
			795.87	9.421E-02	&(	3.376E-01 1.03E+02 8.55E+01	G
			569.32	9.138E-01	&(	1.664E+00 5.65E+01 1.54E+01	G
			801.95	7.106E-01	&(	3.175E+00 1.25E+02 8.69E+00	G
			563.24	2.504E-02	%	3.270E+00 3.48E+03 8.35E+00	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CS-137	I	-8.1885E-03					1.10E+04	
			661.66	-8.188E-03	%(	3.530E-01	1.15E+03	8.52E+01 G
EU-152	F	1.6336E-01					4.94E+03	
			344.29	1.078E-02	&(	8.823E-01	2.23E+03	2.65E+01 G
			121.78	-8.473E-03	%	7.172E-01	2.40E+03	2.86E+01 G
			778.92	-2.930E-02	%	2.471E+00	2.22E+03	1.29E+01 G
			964.11	-4.834E-01	+	3.202E+00	1.86E+02	1.46E+01 G
			1112.07	-4.160E-02	%	2.740E+00	1.70E+03	1.36E+01 G
			1408.00	3.558E-01	?(	1.950E+00	1.50E+02	2.10E+01 G
EU-154	I	6.4287E-01					3.14E+03	
			873.23	6.429E-01	&(	2.941E+00	1.29E+02	1.23E+01 G
			123.10	1.695E-01	&	4.305E-01	7.60E+01	4.08E+01 G
			1274.54	-2.794E-03	%	1.234E+00	1.14E+04	3.52E+01 G
			723.36	-2.982E-01	-	1.841E+00	1.74E+02	2.02E+01 G
			1004.77	-3.580E-01	-	2.249E+00	1.75E+02	1.80E+01 G
			996.33	-5.848E-01	+	3.263E+00	1.54E+02	1.06E+01 G
EU-155	I	7.9795E-02					1.81E+03	
			105.31	7.980E-02	?(	9.268E-01	3.33E+02	2.12E+01 G
			86.54	-1.449E-01	+	7.278E-01	1.47E+02	3.07E+01 G
TL-208	N	-4.3018E-02					6.98E+02	
			583.02	-4.302E-02	?(P	4.094E-01	5.90E+01	8.45E+01 G
			277.28	8.591E-02	%	3.910E+00	1.27E+03	6.31E+00 G
			860.56	0.000E+00	+	2.921E+00	1.00E+03	1.24E+01 G
PB-210	N	5.7165E+00					8.14E+03	
			46.54	5.717E+00	@(P	7.848E+00	1.70E+01	4.25E+00 G
PB-212	N	3.1477E-01					6.98E+02	
			238.63	3.148E-01	@(P	6.828E-01	3.02E+01	4.33E+01 G
			300.03	-1.482E+00	+	8.074E+00	1.57E+02	3.28E+00 G
PB-214	N	3.7504E-01					5.84E+05	
			351.93	2.086E-01	(P	7.950E-01	2.86E+01	3.76E+01 G
			295.09	-1.557E-01	- P	1.250E+00	5.62E+01	1.93E+01 G
			242.00	1.217E+00	(P	3.678E+00	6.68E+01	7.43E+00 G
BI-212	N	2.2536E+00					6.98E+02	
			727.17	1.245E+00	?(	3.805E+00	8.91E+01	7.55E+00 G
			785.42	8.202E+00	?(	2.384E+01	8.51E+01	1.28E+00 G
BI-214	N	-7.8489E-02					5.84E+05	
			609.31	-7.849E-02	(P	9.264E-01	5.16E+01	4.61E+01 G
			1120.29	-7.080E-01	+ P	3.352E+00	4.15E+02	1.51E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
		1764.49	-1.308E+00	% P	3.005E+00	1.00E+03	1.54E+01 G
AC-228	N -1.5187E-01					2.10E+03	
		911.07	-3.240E-01	&(P	1.347E+00	1.08E+02	2.90E+01 G
		968.97	1.341E-01	&(P	2.608E+00	9.35E+01	1.75E+01 G
		338.32	-7.766E-01	% P	2.308E+00	1.00E+03	1.20E+01 G
						Energy duplication	
		93.35	4.670E+00	* P	3.592E+00	2.04E+01	5.56E+00 XA
Pa-234	N 4.4221E-01					1.63E+12	
		131.29	-1.365E-01	&(	1.082E+00	2.28E+02	1.80E+01 G
		569.47	1.713E+00	(	3.122E+00	5.65E+01	8.20E+00 G
		946.02	0.000E+00	-	1.027E+00	1.00E+03	1.34E+01 G
		883.24	-4.941E-01	+	3.849E+00	2.15E+02	9.60E+00 G
		880.53	-1.890E-01	+	5.404E+00	7.50E+02	6.00E+00 G
TH-234	N 3.4932E+00					1.63E+12	
		63.29	2.547E+00	(P	7.412E+00	3.46E+01	3.81E+00 G
		92.59	4.139E+00	*(P	4.381E+00	2.03E+01	5.58E+00 G
PA-234M	N 3.6394E-02					1.63E+12	
		1001.00	3.639E-02	&(P	4.296E+01	7.87E+01	8.37E-01 G
		766.41	-2.289E+01	+ P	1.417E+02	2.92E+02	2.94E-01 G
U-235	N 3.4254E-01					2.57E+11	
		143.79	-2.694E-01	?(	1.832E+00	1.96E+02	1.10E+01 G
		205.33	-1.394E-01	+	4.354E+00	8.76E+02	5.01E+00 G
		163.38	1.663E+00	&(	4.050E+00	7.31E+01	5.08E+00 G
						Energy duplication	
		93.35	5.471E+00	*	3.134E+00	2.04E+01	5.81E+00 X
AM-241	T 1.8258E-01					1.58E+05	
		59.54	1.826E-01	(	4.742E-01	7.75E+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.
+ - 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	
AM-241	61.84	37.	12.	0.003	77.54	1.826E-01	
EU-155	86.48	82.	-9.	-0.002	147.09	-1.449E-01	
U-235	93.35	53.	64.	0.018	20.37	5.471E+00	
AC-228	93.35	65.	52.	0.015	20.37	4.670E+00	P
EU-155	105.52	62.	3.	0.001	332.68	7.980E-02	
EU-154	124.24	45.	13.	0.004	76.00	1.695E-01	
Pa-234	131.54	54.	-5.	-0.001	227.66	-1.365E-01	
U-235	143.92	54.	-5.	-0.002	195.92	-2.694E-01	
U-235	163.91	49.	15.	0.004	73.13	1.663E+00	
U-235	205.31	43.	-1.	0.000	876.01	-1.394E-01	
I-131	367.25	20.	-1.	0.000	821.91	-8.778E-03	
BE-7	476.45	13.	1.	0.000	620.40	8.707E-02	
CS-134	570.31	14.	11.	0.003	56.47	9.138E-01	
Pa-234	570.31	14.	11.	0.003	56.54	1.713E+00	
TL-208	583.75	27.	-3.	-0.001	59.01	-4.302E-02	P
CS-134	605.38	34.	-6.	-0.002	155.31	-7.443E-02	
BI-214	609.33	40.	-3.	-0.001	51.59	-7.849E-02	P
EU-154	725.88	22.	-4.	-0.001	174.14	-2.982E-01	
BI-212	727.32	12.	6.	0.002	89.06	1.245E+00	
PA-234M	767.56	26.	-4.	-0.001	292.38	-2.289E+01	P
BI-212	786.62	12.	7.	0.002	85.13	8.202E+00	
CS-134	796.72	10.	5.	0.001	102.53	9.421E-02	
CS-134	801.79	9.	4.	0.001	124.91	7.106E-01	
EU-154	874.34	15.	5.	0.001	129.49	6.429E-01	
Pa-234	880.93	11.	-1.	0.000	750.25	-1.890E-01	
Pa-234	882.89	15.	-3.	-0.001	214.66	-4.941E-01	
AC-228	911.59	16.	-5.	-0.001	108.06	-3.240E-01	P
EU-152	964.05	22.	-4.	-0.001	186.32	-4.834E-01	
AC-228	969.13	21.	1.	0.000	93.49	1.341E-01	P
EU-154	992.66	10.	-3.	-0.001	154.05	-5.848E-01	
EU-154	1005.04	15.	-3.	-0.001	174.55	-3.580E-01	
BI-214	1120.32	20.	-5.	-0.001	415.32	-7.080E-01	P
CO-60	1173.91	15.	-2.	-0.001	246.95	-5.234E-02	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
CO-60	1332.68	7.	3.	0.001	151.97	6.548E-02	
EU-152	1408.04	8.	3.	0.001	149.67	3.558E-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 *****

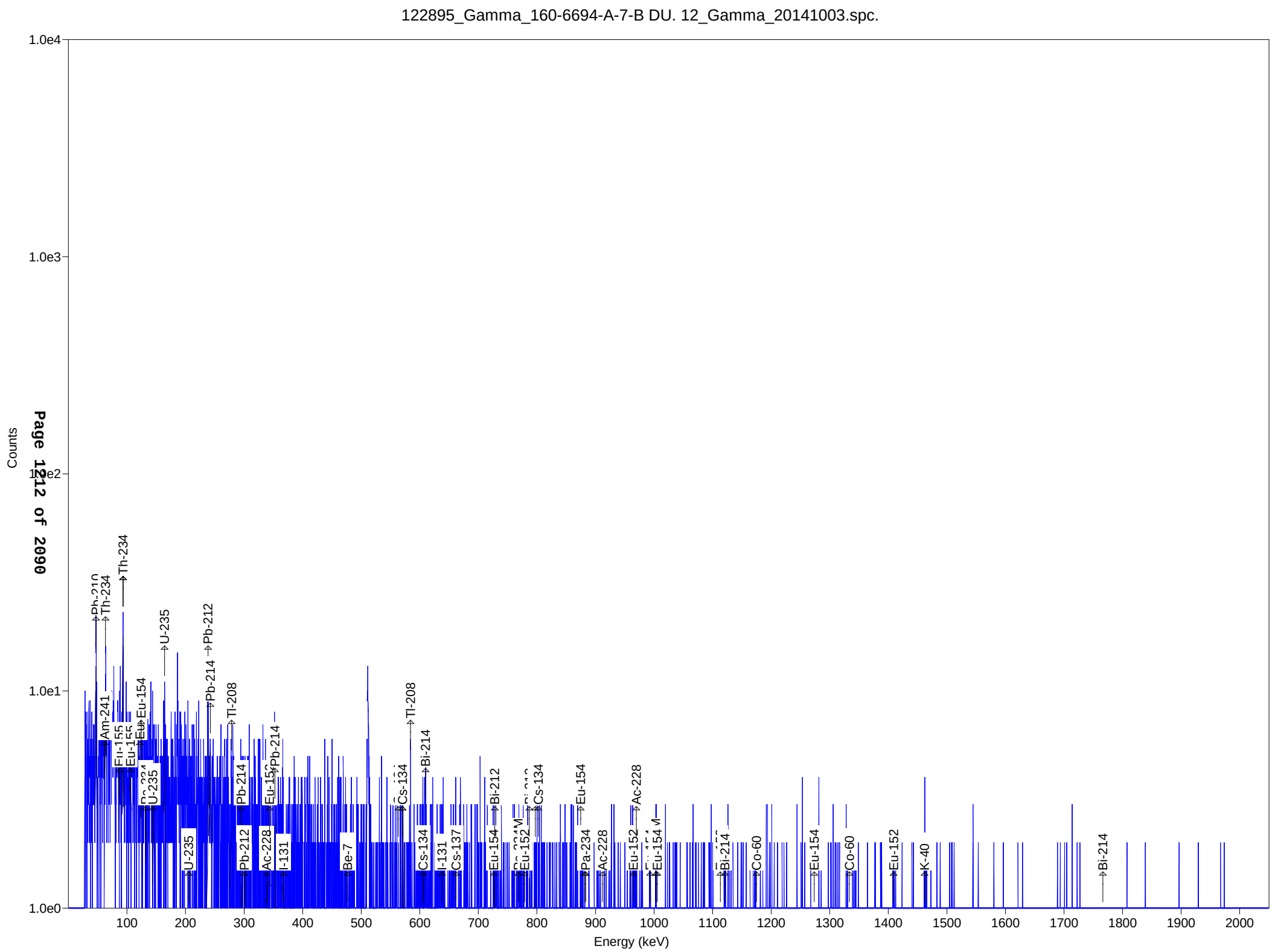
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	8.7068E-02	8.7069E-02	6.204E+02%	2.04E+00
K-40	#A	-2.5268E+00	-2.5268E+00	2.000E+03%	4.42E+00
CO-60	#A	6.5477E-02	6.5477E-02	1.520E+02%	3.67E-01
I-131	#A	-8.7777E-03	-8.7783E-03	8.219E+02%	2.66E-01
CS-134	#A	1.0144E-01	1.0144E-01	5.647E+01%	4.03E-01
CS-137	#A	-8.1885E-03	-8.1885E-03	1.151E+03%	3.53E-01
EU-152	#A	1.6336E-01	1.6336E-01	1.497E+02%	8.82E-01
EU-154	#A	6.4287E-01	6.4287E-01	1.295E+02%	2.94E+00
EU-155	#A	7.9795E-02	7.9795E-02	3.327E+02%	9.27E-01
TL-208	#A	-4.3018E-02	-4.3018E-02	3.358E+02%	4.09E-01
PB-210	#A	5.7165E+00	5.7165E+00	4.556E+01%	7.85E+00
PB-212	#A	3.1477E-01	3.1477E-01	7.821E+01%	6.83E-01
PB-214	A	3.7504E-01	3.7504E-01	7.290E+01%	7.95E-01
BI-212	#A	2.2536E+00	2.2536E+00	6.160E+01%	3.81E+00
BI-214	#A	-7.8489E-02	-7.8489E-02	3.865E+02%	9.26E-01
AC-228	#A	-1.5187E-01	-1.5187E-01	2.899E+02%	1.35E+00
Pa-234	#A	4.4221E-01	4.4221E-01	5.654E+01%	1.08E+00
TH-234	A	3.4932E+00	3.4932E+00	3.928E+01%	7.41E+00
PA-234M	#A	3.6394E-02	3.6394E-02	2.675E+04%	4.30E+01
U-235	#A	3.4254E-01	3.4254E-01	7.313E+01%	1.83E+00
AM-241	#A	1.8258E-01	1.8258E-01	7.754E+01%	4.74E-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 1999.4 keV) 5.717E+00 Bq/Sample
Total Decayed Activity (37.6 to 1999.4 keV) 5.7165465E+00 Bq/Sample

The library has energies which are not separable.


122895_Gamma_160-6694-A-7-B DU. 12_Gamma_20141003.spc.
Counts
Energy (keV)
Page 1212 of 2090
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Pb-210
Th-234
Am-241
Th-234
Eu-154
U-235
Pb-212
Pb-214
Tl-208
Pb-214
Eu-152
U-235
Pb-212
Ac-228
I-131
Be-7
Cs-134
Tl-208
Bi-214
Cs-134
I-131
Cs-137
Eu-154
Bi-212
Cs-134
Eu-154
Pa-234
Ac-228
Ac-228
Eu-152
Eu-154
Bi-214
Co-60
Eu-154
Co-60
Eu-152
K-40
Bi-214

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

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SDG No.:

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Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122895 Batch Start Date: 05/19/14 12:24 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/19/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	GrossWeight	Geometry	1L Marn 00008		
MB 160-122895/1		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn			
LCS 160-122895/2		Fill_Geo-0, GA-01-R		1000 mL	1000 mL	1L Marn	# mL		
160-6694-A-7	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			
160-6694-A-7 DU	2222-RIN-01	Fill_Geo-0, GA-01-R	T	1000 mL	1000 mL	1L Marn			

Batch Notes	
SOP Number	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.

Method GA-01-R
Ra-226

Radium-226 & Other Gamma Emitters (GS) by Method GA-01-R

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

Prep Batch: 123290

Fill Geometry, No In-Growth

Gamma Spectroscopy Analysis Detail Report
Prep Batch: 123290

Lab ID: MB 160-123290/1-A | Analyzed: 05/21/14 12:20 | Ts: 30 | Sigma: 2
Client ID: | Detector: GV5 | Decay Corrected: No

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Radium-226	0.3399	0.705	0.707	U	pCi/g	1.00	1.23	123298
Radium-228	0.0000	0.0468	0.0468	U	pCi/g		0.173	123298
Lead-210	0.8642	0.905	0.911	U	pCi/g		1.57	123298
Lead-212	-0.007971	0.0561	0.0561	U	pCi/g		0.110	123298
Lead-214	-0.04299	1.29	1.29	U	pCi/g		0.192	123298

Lab ID: LCS 160-123290/2-A | Analyzed: 05/21/14 12:20 | Ts: 30 | Sigma: 2
Client ID: | Detector: GV4 | Decay Corrected: No

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Americium-241	103.6	2.05	11.0		pCi/g		1.44	123327
Cesium-137	30.03	1.02	3.29		pCi/g		0.382	123327
Cobalt-60	22.05	0.728	2.33		pCi/g		0.0869	123327

Lab ID: 160-6694-1 | Analyzed: 05/21/14 12:22 | Ts: 30 | Sigma: 2
Client ID: 2222-SD01 | Detector: GV15 | Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Radium-226	0.780	1.07	1.08	U	pCi/g	1.00	1.87	123296
Radium-228	0.628	0.189	0.199		pCi/g		0.322	123296
Lead-210	0.877	1.34	1.35	U	pCi/g		2.40	123296
Lead-212	0.586	0.159	0.176		pCi/g		0.161	123296
Lead-214	0.451	0.143	0.150		pCi/g		0.174	123296

Lab ID: 160-6694-1 DU | Analyzed: 05/21/14 14:28 | Ts: 30 | Sigma: 2
Client ID: 2222-SD01 | Detector: GV9 | Decay Corrected: No

Analyte	DU Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Radium-226	1.162	0.827	0.852	U	pCi/g	1.00	1.29	123245
Radium-228	0.7152	0.177	0.192		pCi/g		0.0811	123245
Lead-210	0.4692	0.966	0.968	U	pCi/g		1.64	123245
Lead-212	0.5914	0.107	0.131		pCi/g		0.0950	123245
Lead-214	0.5125	0.125	0.135		pCi/g		0.121	123245

Gamma Spectroscopy Analysis Detail Report
Prep Batch: 123290

Lab ID: 160-6694-2 Analyzed: 05/21/14 14:32 Ts: 30 Sigma: 2
Client ID: 2222-SD02 Detector: GV12 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Radium-226	0.231	0.799	0.800	U	pCi/g	1.00	1.44	123247
Radium-228	0.647	0.160	0.173		pCi/g		0.208	123247
Lead-210	-0.270	1.54	1.54	U	pCi/g		1.95	123247
Lead-212	0.472	0.110	0.126		pCi/g		0.119	123247
Lead-214	0.450	0.116	0.125		pCi/g		0.119	123247

Lab ID: 160-6694-3 Analyzed: 05/21/14 14:26 Ts: 30 Sigma: 2
Client ID: 2222-SD03 Detector: GV15 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Radium-226	2.86	2.01	2.07		pCi/g	1.00	2.56	123296
Radium-228	0.913	0.302	0.316		pCi/g		0.507	123296
Lead-210	4.29	2.24	2.29		pCi/g		3.09	123296
Lead-212	0.619	0.197	0.213		pCi/g		0.219	123296
Lead-214	0.754	0.184	0.200		pCi/g		0.163	123296

Lab ID: 160-6694-4 Analyzed: 05/21/14 14:27 Ts: 30 Sigma: 2
Client ID: 2222-SD04 Detector: GV17 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Radium-226	4.76	1.85	2.02		pCi/g	1.00	1.96	123294
Radium-228	0.763	0.243	0.255		pCi/g		0.369	123294
Lead-210	4.05	2.62	2.67		pCi/g		3.95	123294
Lead-212	0.767	0.169	0.196		pCi/g		0.195	123294
Lead-214	0.690	0.186	0.200		pCi/g		0.213	123294

Lab ID: 160-6694-5 Analyzed: 05/21/14 15:46 Ts: 30 Sigma: 2
Client ID: 2222-SD05 Detector: GV4 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Radium-226	0.109	1.08	1.09	U	pCi/g	1.00	2.00	123327
Radium-228	0.554	0.221	0.229		pCi/g		0.176	123327
Lead-210	1.53	1.41	1.43	U	pCi/g		2.16	123327
Lead-212	0.450	0.121	0.134		pCi/g		0.121	123327
Lead-214	0.353	0.107	0.113		pCi/g		0.166	123327

Gamma Spectroscopy Analysis Detail Report
Prep Batch: 123290

Lab ID: 160-6694-6 Analyzed: 05/21/14 15:45 Ts: 30 Sigma: 2
Client ID: 2222-SD06 Detector: GV7 Decay Corrected: No

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Anly Batch
Radium-226	2.93	1.63	1.71		pCi/g	1.00	1.92	123299
Radium-228	0.608	0.220	0.229		pCi/g		0.434	123299
Lead-210	3.67	1.60	1.66		pCi/g		2.17	123299
Lead-212	0.811	0.204	0.229		pCi/g		0.194	123299
Lead-214	0.664	0.159	0.174		pCi/g		0.155	123299

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 160-123290/1-A	Radium-226			0.3399	U	pCi/g							
MB 160-123290/1-A	Radium-228			0.0000	U	pCi/g							
MB 160-123290/1-A	Lead-210			0.8642	U	pCi/g							
MB 160-123290/1-A	Lead-212			-0.007971	U	pCi/g							
MB 160-123290/1-A	Lead-214			-0.04299	U	pCi/g							

Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-123290/2-A	Americium-241		97.4	103.6		pCi/g	106	87 - 116					
LCS 160-123290/2-A	Cesium-137		31.1	30.03		pCi/g	97	87 - 120					
LCS 160-123290/2-A	Cobalt-60		22.4	22.05		pCi/g	98	87 - 115					

Duplicate ID:	Analyte	Parent Result	Spike Added	DU Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
160-6694-1	Radium-226	0.780		1.162	U	pCi/g			39	0.20	0.56	1	
160-6694-1	Radium-228	0.628		0.7152		pCi/g			13	0.22	0.63	1	
160-6694-1	Lead-210	0.877		0.4692	U	pCi/g			61	0.18	0.49	1	
160-6694-1	Lead-212	0.586		0.5914		pCi/g			0.8	0.02	0.04	1	
160-6694-1	Lead-214	0.451		0.5125		pCi/g			13	0.22	0.61	1	

Glossary:

Ts = Count Duration, Sample

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

Test America St. Louis Spectrum ID: 5_Gamma_20141021

Sample Description: 123290_Gamma_MB 160-123290~1-A
Detector: Ge 5 SN/157
Batch ID: 123290
Work Order Number: Gamma
Lot Number: MB 160-123290~1-A

Decay to Time: 5/21/2014 12:20 Live Time: 1800 sec
Acquisition Time: 5/21/2014 12:20:54 Real Time: 1805 sec
Analysis Time: 5/21/2014 18:51 Dead Time: 0.27 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 5_Soil_TunaCan.Clb
Efficiency Cal Desc: 5_Soil_TunaCan_90099_032612
Efficiency Cal Date: 3/27/2012 17:20
Energy Cal Date: 2/28/2012 19:35
Library: Client_Short_no ingrowth Rev2.li
Bkgd Correction File: 5_2014-05-03_0559.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	-2.038E-02	7459.0	1.520E+00	1.520E+00	6.099E+00
K-40	-3.146E+00	2000.0	6.292E+01	6.292E+01	1.111E+01
CO-60	2.878E-01	95.6	2.752E-01	2.756E-01	9.854E-01
I-131	-3.229E-02	543.0	1.754E-01	1.754E-01	6.779E-01
CS-134	2.447E-01	97.7	2.392E-01	2.395E-01	8.368E-01
CS-137	-2.135E-01	2000.0	4.270E+00	4.270E+00	1.139E+00
EU-152	2.669E-02	2018.0	5.386E-01	5.386E-01	2.097E+00
EU-154	1.952E-01	160.6	3.134E-01	3.136E-01	4.242E+00
EU-155	2.171E-01	146.8	3.187E-01	3.189E-01	1.162E+00
TL-208	0.000E+00	1000.0	8.428E-02	8.428E-02	8.322E-01
PB-210	9.311E+00	52.4	4.877E+00	4.907E+00	1.693E+01
PB-212	-8.588E-02	352.0	3.023E-01	3.023E-01	1.185E+00
PB-214	-4.632E-01	1504.0	6.966E+00	6.966E+00	2.066E+00
BI-212	2.103E+00	136.2	2.863E+00	2.866E+00	1.058E+01
BI-214	-3.441E-01	364.3	1.254E+00	1.254E+00	2.191E+00
AC-228	0.000E+00	1000.0	2.524E-01	2.524E-01	1.860E+00
Pa-234	3.763E-01	81.9	3.080E-01	3.086E-01	1.993E+00
TH-234	-1.368E-01	2240.0	3.066E+00	3.066E+00	1.345E+01
PA-234M	5.525E+00	422.2	2.333E+01	2.333E+01	9.873E+01
Ra-226	3.662E+00	103.6	3.795E+00	3.809E+00	1.321E+01
U-235	-2.289E-01	234.8	5.373E-01	5.375E-01	3.245E+00
AM-241	2.259E-01	146.0	3.298E-01	3.300E-01	1.272E+00
Total	2.218E+01				

Analyst: Siobhan Perry

TestAmerica Spectrum name: 5_Gamma_20141021.An1

Sample description
123290_Gamma_MB 160-123290~1-A

Spectrum Filename: C:\User\SPC\Det5\5_Gamma_20141021.An1

Acquisition information
Start time: 5/21/2014 12:20:54 PM
Live time: 1800
Real time: 1805
Dead time: 0.27 %
Detector ID: 5

Detector system
Ge 5 SN/157

Calibration
Filename: 5_Soil_TunaCan.Clb
5_Soil_TunaCan_90099_032612

Energy Calibration
Created: 2/28/2012 7:35:48 PM
Zero offset: 0.158 keV
Gain: 0.250 keV/channel
Quadratic: 3.911E-08 keV/channel^2

Efficiency Calibration
Created: 3/27/2012 5:20:37 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.87 %
Log(Eff): 6.466115E-01 + (-7.830454E-01*Log(E)) +
(-4.117504E-03*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.43 %
Log(Eff): -2.462251E+01 + (9.075211E+00*Log(E)) +
(-9.664422E-01*Log(E)^2)

Library Files
Main analysis library: Client_Short_no ingrowth Rev2.li
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.62keV)
Stop channel: 8000 (2000.81keV)
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

```
       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       5/21/2014 12:20:00 PM
       Decay during acquisition:      YES
       Decay during collection:       NO
       True coincidence correction:   NO
       Peaked background correction:  YES       5_2014-05-03_0559.PBC
                                                 5/3/2014 5:59:07 AM

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


total peaks alloc.    2 cutoff: 5.00E+01%
       Energy Calibration
            Normalized diff:       1.0000

*****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
 Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
 Energy                             Factor    Energy   Ratio    Bq/Sampl
```

No unknown peaks passed sensitivity test.

This section based on library: Client_Short_no ingrowth Rev2.li

********** 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	186.78	46.81	19.	13.	0.007	24.71	0.749s
AM-241	238.63	59.76	15.	4.	0.002	63.75	0.797s
TH-234	369.61	92.48	41.	-6.	-0.003	50.92	0.831s
U-235	373.09	93.35	17.	14.	0.008	48.06	0.832D
AC-228	373.09	93.35	17.	14.	0.008	48.06	0.832D
EU-155	422.26	105.63	8.	3.	0.002	146.82	0.844s
EU-152	486.72	121.73	22.	-4.	-0.002	158.69	0.861s
EU-154	492.28	123.12	12.	3.	0.002	160.61	0.862s
Pa-234	522.28	130.62	18.	-3.	-0.002	206.46	0.871s
U-235	652.87	163.24	12.	2.	0.001	234.75	0.903s
Ra-226	742.79	185.71	18.	6.	0.003	96.40	0.926s
PB-212	957.28	239.29	16.	-3.	-0.002	171.14	0.978s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
TL-208	1112.43	278.06	14.	-1.	-0.001	420.72	1.016s
I-131	1135.26	283.76	12.	-3.	-0.002	160.73	1.022s
PB-214	1180.62	295.09	20.	-8.	-0.004	204.79	1.033s
PB-212	1202.13	300.47	14.	1.	0.001	490.45	1.038s
AC-228	1351.86	337.88	12.	-4.	-0.002	140.38	1.074s
I-131	1453.97	363.40	8.	-1.	0.000	543.01	1.099s
Pa-234	2280.77	570.03	1.	3.	0.002	81.85	1.286s
CS-134	2420.48	604.95	8.	5.	0.003	97.74	1.317s
BI-214	2438.11	609.35	13.	-3.	-0.002	116.40	1.321s
I-131	2550.53	637.46	6.	-1.	-0.001	261.63	1.345s
BI-212	2903.81	725.77	5.	3.	0.001	136.15	1.421s
TL-208	3445.02	861.08	8.	-1.	-0.001	294.82	1.529s
AC-228	3881.93	970.33	8.	-2.	-0.001	261.23	1.612s
PA-234M	4004.85	1001.07	3.	1.	0.000	422.23	1.636s
EU-152	4445.52	1111.28	6.	-2.	-0.001	210.59	1.717s
BI-214	4478.30	1119.48	5.	-1.	-0.001	118.56	1.723s
EU-154	5100.04	1275.01	1.	1.	0.001	161.08	1.828s
CO-60	5329.15	1332.32	2.	3.	0.002	95.62	1.866s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	-2.0382E-02				5.31E+01	
			477.60	-2.038E-02	%(	6.099E+00 7.46E+03 1.05E+01	G
K-40	N	-3.1458E+00				4.66E+11	
			1460.83	-3.146E+00	%(P	1.111E+01 1.00E+03 1.07E+01	G
CO-60	F	2.8779E-01				1.93E+03	
			1332.50	2.878E-01	?(	9.854E-01 9.56E+01 1.00E+02	G
			1173.24	0.000E+00	-	1.724E+00 1.00E+03 9.99E+01	G
I-131	I	-3.2292E-02				8.02E+00	
			364.48	-3.229E-02	?(	6.779E-01 5.43E+02 8.17E+01	G
			284.30	-1.451E+00	+	8.431E+00 1.61E+02 6.14E+00	G
			636.97	-1.049E+00	+	1.060E+01 2.62E+02 7.17E+00	G
CS-134	I	2.4470E-01				7.54E+02	
			604.71	2.447E-01	&(	8.368E-01 9.77E+01 9.76E+01	G
			795.87	0.000E+00	-	5.630E-01 1.00E+03 8.55E+01	G
			569.32	0.000E+00	-	2.366E+00 1.00E+03 1.54E+01	G
			801.95	0.000E+00	-	5.577E+00 1.00E+03 8.69E+00	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
			563.24	-4.219E-02	%	6.836E+00	3.79E+03	8.35E+00 G
CS-137	I	-2.1351E-01					1.10E+04	
			661.66	-2.135E-01	%(P	1.139E+00	1.00E+03	8.52E+01 G
EU-152	F	2.6685E-02					4.94E+03	
			344.29	2.669E-02	&(	2.097E+00	2.02E+03	2.65E+01 G
			121.78	-2.390E-01	+	1.339E+00	1.59E+02	2.86E+01 G
			778.92	-1.723E-01	%	7.539E+00	1.10E+03	1.29E+01 G
			964.11	-4.381E-02	%	7.823E+00	4.45E+03	1.46E+01 G
			1112.07	-1.113E+00	+	8.928E+00	2.11E+02	1.36E+01 G
			1408.00	0.000E+00	-	3.703E+00	1.00E+03	2.10E+01 G
EU-154	I	1.9516E-01					3.14E+03	
			873.23	0.000E+00	?(	4.242E+00	1.00E+03	1.23E+01 G
			123.10	1.224E-01	?(	7.106E-01	1.61E+02	4.08E+01 G
			1274.54	3.476E-01	?(	2.284E+00	1.61E+02	3.52E+01 G
			723.36	0.000E+00	-	6.143E+00	1.00E+03	2.02E+01 G
			1004.77	0.000E+00	-	3.251E+00	1.00E+03	1.80E+01 G
			996.33	0.000E+00	-	1.288E+01	1.00E+03	1.06E+01 G
EU-155	I	2.1706E-01					1.81E+03	
			105.31	2.171E-01	?(	1.162E+00	1.47E+02	2.12E+01 G
			86.54	1.445E-02	%	1.120E+00	2.06E+03	3.07E+01 G
PB-210	N	9.3105E+00					8.14E+03	
			46.54	9.311E+00	@(P	1.693E+01	2.47E+01	4.25E+00 G
PB-212	N	-8.5880E-02					6.98E+02	
			238.63	-1.647E-01	&(P	1.185E+00	1.71E+02	4.33E+01 G
			300.03	9.542E-01	&(	1.751E+01	4.90E+02	3.28E+00 G
PB-214	N	-4.6316E-01					5.84E+05	
			351.93	-4.632E-01	%(P	2.066E+00	7.01E+02	3.76E+01 G
			295.09	-1.194E+00	+ P	3.514E+00	2.05E+02	1.93E+01 G
			242.00	1.278E-02	% P	6.180E+00	3.34E+02	7.43E+00 G
BI-212	N	2.1031E+00					6.98E+02	
			727.17	2.103E+00	?(	1.058E+01	1.36E+02	7.55E+00 G
			785.42	0.000E+00	&	1.263E+02	1.00E+03	1.28E+00 G
BI-214	N	-3.4410E-01					5.84E+05	
			609.31	-3.441E-01	?(P	2.191E+00	1.16E+02	4.61E+01 G
			1120.29	-5.736E-01	+ P	7.520E+00	1.19E+02	1.51E+01 G
			1764.49	-1.364E+00	% P	7.203E+00	1.00E+03	1.54E+01 G

Nuclide		Ave activity	Energy		Activity	Code	Peak	MDA	Comments
Pa-234	N	3.7630E-01						1.63E+12	
			131.29	-2.684E-01	?(	1.993E+00	2.06E+02	1.80E+01	G
			569.47	1.792E+00	&(	5.043E+00	8.19E+01	8.20E+00	G
			946.02	0.000E+00	-	4.154E+00	1.00E+03	1.34E+01	G
			883.24	0.000E+00	-	1.208E+01	1.00E+03	9.60E+00	G
			880.53	0.000E+00	-	2.591E+01	1.00E+03	6.00E+00	G
TH-234	N	-1.3683E-01						1.63E+12	
			63.29	-1.368E-01	%(P	1.345E+01	3.70E+01	3.81E+00	G
			92.59	-1.654E+00	+ P	9.222E+00	5.09E+01	5.58E+00	G
PA-234M	N	5.5254E+00						1.63E+12	
			1001.00	5.525E+00	?(	9.873E+01	4.22E+02	8.37E-01	G
			766.41	8.085E-01	%	3.961E+02	1.27E+04	2.94E-01	G
Ra-226	N	3.6624E+00						5.84E+05	
			185.99	3.662E+00	(P	1.321E+01	9.64E+01	3.28E+00	G
U-235	N	-2.2889E-01						2.57E+11	
			143.79	-6.969E-01	%(P	3.245E+00	4.75E+04	1.10E+01	G
			205.33	-1.849E-02	%	7.679E+00	1.07E+04	5.01E+00	G
			163.38	7.808E-01	?(	6.743E+00	2.35E+02	5.08E+00	G
								Energy duplication	
			93.35	3.912E+00	&	5.920E+00	4.81E+01	5.81E+00	X
AM-241	T	2.2591E-01						1.58E+05	
			59.54	2.259E-01	(P	1.272E+00	6.37E+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.
+ - 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

Peak Codes:
G - Gamma Ray

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

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	
AM-241	59.76	15.	4.	0.002	63.75	2.259E-01	P
TH-234	92.48	41.	-6.	-0.003	50.92	-1.654E+00	P
U-235	93.35	17.	14.	0.008	48.06	3.912E+00	
AC-228	93.35	17.	14.	0.008	48.06	4.087E+00	
EU-155	105.63	8.	3.	0.002	146.82	2.171E-01	
EU-152	121.73	22.	-4.	-0.002	158.69	-2.390E-01	
EU-154	123.12	12.	3.	0.002	160.61	1.224E-01	
Pa-234	130.62	18.	-3.	-0.002	206.46	-2.684E-01	
U-235	163.24	12.	2.	0.001	234.75	7.808E-01	
Ra-226	185.71	18.	6.	0.003	96.40	3.662E+00	P
PB-212	239.29	16.	-3.	-0.002	171.14	-1.647E-01	P
TL-208	278.06	14.	-1.	-0.001	420.72	-5.583E-01	
I-131	283.76	12.	-3.	-0.002	160.73	-1.451E+00	
PB-214	295.09	20.	-8.	-0.004	204.79	-1.194E+00	P
PB-212	300.47	14.	1.	0.001	490.45	9.542E-01	
AC-228	337.88	12.	-4.	-0.002	140.38	-9.874E-01	
I-131	363.40	8.	-1.	0.000	543.01	-3.229E-02	
Pa-234	570.03	1.	3.	0.002	81.85	1.792E+00	
CS-134	604.95	8.	5.	0.003	97.74	2.447E-01	
BI-214	609.35	13.	-3.	-0.002	116.40	-3.441E-01	P
I-131	637.46	6.	-1.	-0.001	261.63	-1.049E+00	
BI-212	725.77	5.	3.	0.001	136.15	2.103E+00	
TL-208	861.08	8.	-1.	-0.001	294.82	-7.959E-01	
AC-228	970.33	8.	-2.	-0.001	261.23	-6.910E-01	
PA-234M	1001.07	3.	1.	0.000	422.23	5.525E+00	
EU-152	1111.28	6.	-2.	-0.001	210.59	-1.113E+00	
BI-214	1119.48	5.	-1.	-0.001	118.56	-5.736E-01	P
EU-154	1275.01	1.	1.	0.001	161.08	3.476E-01	
CO-60	1332.32	2.	3.	0.002	95.62	2.878E-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 *****

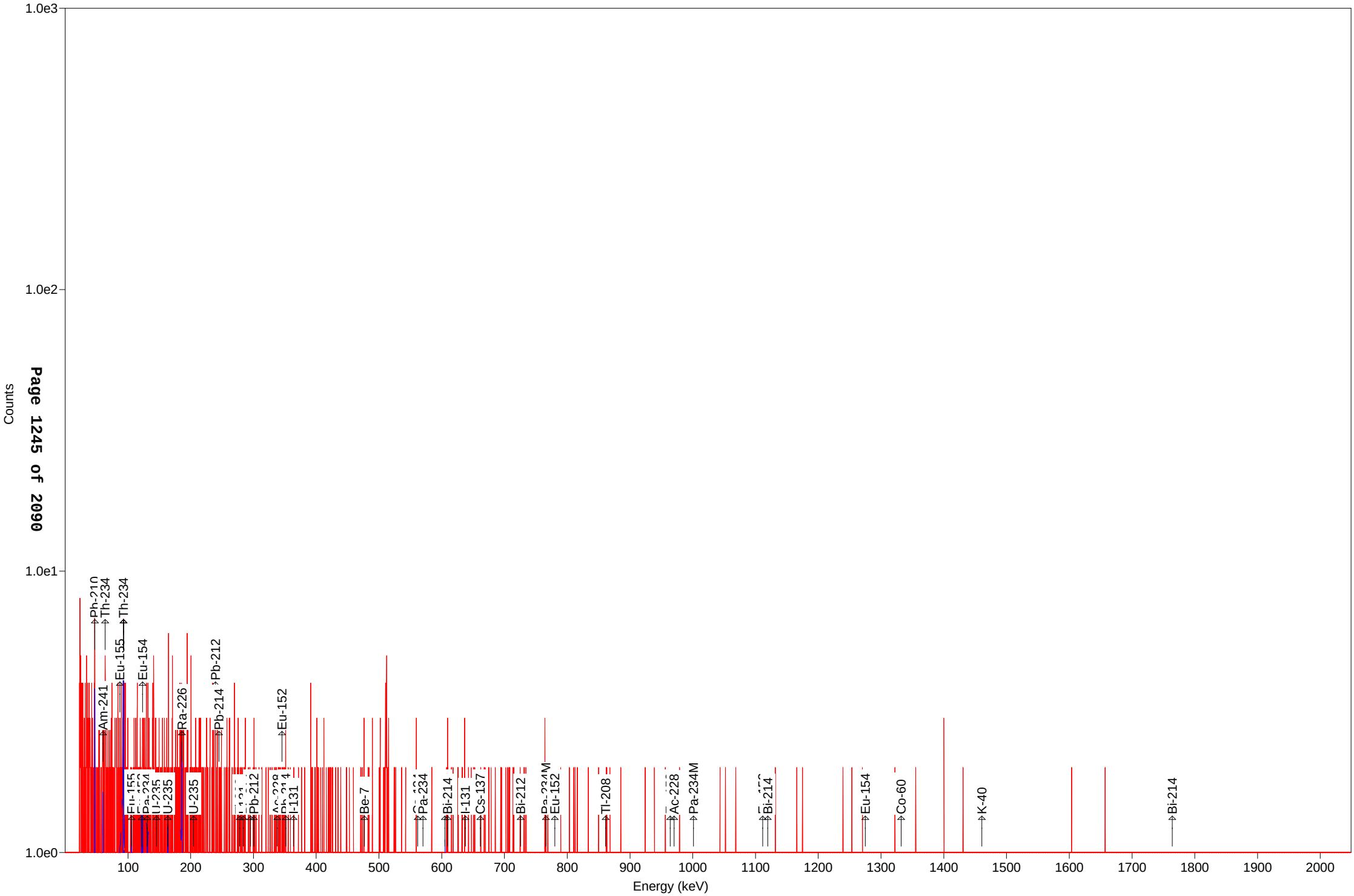
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty Counting 1 Sigma	MDA Bq/Sample
BE-7	#A	-2.0382E-02	-2.0382E-02	7.459E+03%	6.10E+00
K-40	#A	-3.1458E+00	-3.1458E+00	2.000E+03%	1.11E+01
CO-60	#A	2.8779E-01	2.8779E-01	9.562E+01%	9.85E-01
I-131	#A	-3.2291E-02	-3.2292E-02	5.430E+02%	6.78E-01
CS-134	#A	2.4470E-01	2.4470E-01	9.774E+01%	8.37E-01
CS-137	#A	-2.1351E-01	-2.1351E-01	2.000E+03%	1.14E+00
EU-152	#A	2.6685E-02	2.6685E-02	2.018E+03%	2.10E+00
EU-154	#A	1.9516E-01	1.9516E-01	1.606E+02%	4.24E+00
EU-155	#A	2.1706E-01	2.1706E-01	1.468E+02%	1.16E+00
TL-208	#A	0.0000E+00	0.0000E+00	1.000E+03%	8.32E-01
PB-210	#A	9.3105E+00	9.3105E+00	5.238E+01%	1.69E+01
PB-212	#A	-8.5880E-02	-8.5880E-02	3.520E+02%	1.18E+00
PB-214	#A	-4.6316E-01	-4.6316E-01	1.504E+03%	2.07E+00
BI-212	#A	2.1031E+00	2.1031E+00	1.362E+02%	1.06E+01
BI-214	#A	-3.4410E-01	-3.4410E-01	3.643E+02%	2.19E+00
AC-228	#A	0.0000E+00	0.0000E+00	1.000E+03%	1.86E+00
Pa-234	#A	3.7630E-01	3.7630E-01	8.185E+01%	1.99E+00
TH-234	#A	-1.3683E-01	-1.3683E-01	2.240E+03%	1.34E+01
PA-234M	#A	5.5254E+00	5.5254E+00	4.222E+02%	9.87E+01
Ra-226	#A	3.6624E+00	3.6624E+00	1.036E+02%	1.32E+01
U-235	#A	-2.2889E-01	-2.2889E-01	2.348E+02%	3.24E+00
AM-241	#A	2.2591E-01	2.2591E-01	1.460E+02%	1.27E+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 2000.8 keV) 9.311E+00 Bq/Sample
Total Decayed Activity (37.6 to 2000.8 keV) 9.3105164E+00 Bq/Sample

The library has energies which are not separable.


123290_Gamma_MB 160-123290~1-A. 5_Gamma_20141021.spc.
Counts
1.0e3
1.0e2
1.0e1
1.0e0
Energy (keV)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Pb-210
Th-234
Th-234
Eu-155
Eu-154
Am-241
Ra-226
U-235
Pb-214
Pb-212
Eu-152
Be-7
Pa-234
Bi-214
I-131
Cs-137
Bi-212
Eu-152
Tl-208
Ac-228
Pa-234M
Bi-214
Eu-154
Co-60
K-40
Bi-214

Test America St. Louis Spectrum ID: 4_Gamma_20140888

Sample Description: 123290_Gamma_LCS 160-123290~2-A
Detector: Ge 4 SN/181
Batch ID: 123290
Work Order Number: Gamma
Lot Number: LCS 160-123290~2-A

Decay to Time: 5/21/2014 12:20 Live Time: 1800 sec
Acquisition Time: 5/21/2014 12:20:36 Real Time: 1812 sec
Analysis Time: 5/21/2014 12:51 Dead Time: 0.67 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 4_Soil_TunaCan.Clb
Efficiency Cal Desc: 4_Soil_TunaCan_90099_033012
Efficiency Cal Date: 4/2/2012 13:19
Energy Cal Date: 2/28/2012 14:55
Library: Client_Short_no ingrowth Rev2.li
Bkgd Correction File: 4_2014-05-03_0556.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	-3.760E+00	326.2	1.226E+01	1.227E+01	4.172E+01
K-40	-2.901E+00	2000.0	5.801E+01	5.801E+01	3.408E+01
CO-60	2.789E+02	1.7	4.603E+00	1.474E+01	1.099E+00
I-131	-3.254E-01	462.6	1.505E+00	1.505E+00	5.103E+00
CS-134	1.314E+00	107.2	1.409E+00	1.411E+00	2.820E+00
CS-137	3.799E+02	1.7	6.454E+00	2.079E+01	4.830E+00
EU-152	2.596E+00	104.6	2.715E+00	2.719E+00	1.372E+01
EU-154	1.664E+01	74.0	1.231E+01	1.234E+01	4.092E+01
EU-155	1.712E+00	75.4	1.291E+00	1.294E+00	9.080E+00
TL-208	2.871E+00	52.6	1.510E+00	1.518E+00	4.815E+00
PB-210	1.252E+04	1.3	1.574E+02	7.520E+02	2.672E+02
PB-212	1.360E+01	22.6	3.069E+00	3.193E+00	7.137E+00
PB-214	7.170E+00	45.2	3.239E+00	3.260E+00	1.023E+01
BI-212	2.746E+01	66.2	1.817E+01	1.823E+01	5.575E+01
BI-214	4.655E+00	57.7	2.687E+00	2.698E+00	9.896E+00
AC-228	3.296E+00	206.6	6.810E+00	6.813E+00	2.346E+01
Pa-234	1.871E+00	131.9	2.467E+00	2.469E+00	1.399E+01
TH-234	-2.791E+00	176.8	4.936E+00	4.938E+00	1.013E+02
PA-234M	3.439E+02	53.8	1.848E+02	1.857E+02	7.807E+02
Ra-226	-2.386E+01	197.6	4.715E+01	4.719E+01	9.072E+01
U-235	7.978E+00	89.6	7.151E+00	7.163E+00	2.276E+01
AM-241	1.311E+03	1.0	1.295E+01	6.926E+01	1.823E+01
Total	1.493E+04				

Analyst: April Bean

TestAmerica Spectrum name: 4_Gamma_20140888.An1

Sample description
123290_Gamma_LCS 160-123290~2-A

Spectrum Filename: C:\User\SPC\Det4\4_Gamma_20140888.An1

Acquisition information
Start time: 5/21/2014 12:20:36 PM
Live time: 1800
Real time: 1812
Dead time: 0.67 %
Detector ID: 4

Detector system
Ge 4 SN/181

Calibration
Filename: 4_Soil_TunaCan.Clb
4_Soil_TunaCan_90099_033012

Energy Calibration
Created: 2/28/2012 2:55:17 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.917E-08 keV/channel^2

Efficiency Calibration
Created: 4/2/2012 1:19:41 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.78 %
Log(Eff): -3.983609E-01 + (-5.746278E-01*Log(E)) +
(-2.046438E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.80 %
Log(Eff): -2.546791E+01 + (9.285295E+00*Log(E)) +
(-9.904428E-01*Log(E)^2)

Library Files
Main analysis library: Client_Short_no ingrowth Rev2.li
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.61keV)
Stop channel: 8000 (1999.44keV)
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

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	5/21/2014 12:20:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	4_2014-05-03_0556.PBC 5/3/2014 5:56:46 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 19 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1817

***** 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
46.53	11584.	1.26	0.75	1.207E-02	46.54	4.250	1.252E+04	PB210
59.58	14565.	0.99	0.76	1.721E-02	59.54	35.900	1.311E+03	AM241
83.22	46.	53.87	0.43	2.292E-02				
86.58	38.	75.39	0.84	2.336E-02	86.54	30.700	PBC<MDA	EU155
88.06	463.	12.33	0.97	2.354E-02				
92.67	15.	80.57	0.84	2.397E-02	92.59	5.584	PBC<MDA	TH234
93.04	41.	82.40	0.84	2.403E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	1.629E+01	U235
					93.35	5.561	1.701E+01	AC228
93.43	36.	78.36	0.84	2.403E-02	93.35	5.810	PBC<MDA	U235
					93.35	5.561	1.508E+01	AC228
122.56	23.	132.75	0.87	2.426E-02	121.78	28.580	PBC<MDA	EU152
					121.78	28.580	1.854E+00	EU152
143.26	14.	221.58	0.89	2.273E-02	143.79	10.960	PBC<MDA	U235
204.61	30.	89.64	0.95	1.763E-02	205.33	5.010	PBC<MDA	U235
238.30	166.	21.65	0.99	1.564E-02	238.63	43.300	1.360E+01	PB212
242.31	36.	77.25	0.98	1.547E-02	242.00	7.430	PBC<MDA	PB214
					242.00	7.430	1.727E+01	PB214
277.40	6.	425.77	1.01	1.387E-02	277.28	6.310	PBC<MDA	TL208
					277.28	6.310	3.770E+00	TL208
295.44	17.	154.04	1.03	1.319E-02	295.09	19.300	PBC<MDA	PB214
					295.09	19.300	3.683E+00	PB214
344.21	12.	187.34	1.07	1.164E-02	344.29	26.500	PBC<MDA	EU152
					344.29	26.500	2.169E+00	EU152
351.94	54.	45.17	1.08	1.143E-02	351.93	37.600	PBC<MDA	PB214
					351.93	37.600	6.964E+00	PB214
567.52	10.	131.89	1.27	7.689E-03	569.47	8.200	PBC<MDA	Pa234
					569.47	8.200	8.718E+00	Pa234
569.26	8.	201.52	1.27	7.690E-03				
583.23	32.	52.60	1.28	7.539E-03	583.02	84.500	PBC<MDA	TL208
					583.02	84.500	2.804E+00	TL208
600.94	6.	163.84	1.30	7.312E-03	604.71	97.620	PBC<MDA	CS134

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
608.98	26.	69.06	1.30	7.266E-03	609.31	46.090	PBC<MDA	BI214
661.38	3951.	1.70	1.29	6.783E-03	661.66	85.210	3.799E+02	CS137
717.47	22.	38.83	0.60	6.334E-03				
727.17	2.	684.93	1.40	6.262E-03	727.17	7.550	PBC<MDA	BI212
768.92	17.	64.79	1.44	5.990E-03	766.41	0.294	PBC<MDA	PA234M
778.64	7.	213.93	1.45	5.909E-03	778.92	12.940	PBC<MDA	EU152
					778.92	12.940	5.107E+00	EU152
785.45	24.	66.19	1.45	5.867E-03	785.42	1.280	PBC<MDA	BI212
795.94	15.	107.21	1.46	5.802E-03	795.87	85.530	PBC<MDA	CS134
797.81	2.	531.63	1.47	5.765E-03	801.95	8.690	PBC<MDA	CS134
871.55	20.	73.97	1.53	5.362E-03	873.23	12.270	PBC<MDA	EU154
910.15	9.	206.61	1.56	5.172E-03	911.07	29.000	PBC<MDA	AC228
967.03	5.	358.66	1.60	4.906E-03	968.97	17.460	PBC<MDA	AC228
1001.11	20.	85.79	1.63	4.771E-03	1001.00	0.837	PBC<MDA	PA234M
1120.06	2.	768.00	1.73	4.331E-03	1120.29	15.100	PBC<MDA	BI214
1173.03	2128.	2.33	1.78	4.163E-03	1173.24	99.900	2.843E+02	CO60
1332.27	1835.	2.33	1.78	3.728E-03	1332.50	99.980	2.736E+02	CO60
1763.77	5.	92.52	2.21	2.916E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
332.34	83.22	260.	46.	2.000E+03	53.87	0.429	-	sM
351.81	88.06	471.	396.	1.685E+04	9.22	0.839	-	D
2868.75	717.47	23.	22.	3.526E+03	38.83	0.604	-	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: Client_Short_no ingrowth Rev2.li

********** 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	185.65	46.53	2745.	11569.	6.427	1.26	0.753
AM-241	237.81	59.58	1839.	14565.	8.092	0.99	0.763
TH-234	256.25	64.19	723.	-20.	-0.011	522.96	0.816
EU-155	345.61	86.54	385.	38.	0.021	75.39	0.837D
TH-234	369.79	92.59	370.	15.	0.009	80.57	0.843D
U-235	372.83	93.35	386.	36.	0.020	78.36	0.844D
AC-228	372.83	93.35	548.	41.	0.023	82.40	0.843D
EU-152	489.62	122.56	460.	23.	0.013	132.75	0.870s
EU-154	495.00	123.91	492.	-18.	-0.010	171.50	0.871s

TestAmerica Spectrum name: 4_Gamma_20140888.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Pa-234	528.50	132.29	506.	-10.	-0.005	333.13	0.878s
U-235	572.36	143.26	455.	14.	0.008	221.58	0.890s
U-235	654.00	163.68	446.	-27.	-0.015	111.13	0.908s
Ra-226	746.79	186.89	455.	-27.	-0.015	155.14	0.928s
U-235	817.66	204.61	342.	30.	0.017	89.64	0.946
PB-212	952.36	238.30	327.	166.	0.092	21.65	0.993s
PB-214	968.39	242.31	363.	36.	0.020	77.25	0.979s
TL-208	1108.71	277.40	317.	6.	0.003	425.77	1.011s
PB-214	1180.82	295.44	329.	17.	0.009	154.04	1.027s
PB-212	1199.37	300.07	291.	-17.	-0.009	149.37	1.032s
AC-228	1354.25	338.81	298.	-7.	-0.004	363.49	1.066s
EU-152	1375.86	344.21	249.	12.	0.007	187.34	1.071s
PB-214	1406.76	351.94	269.	54.	0.030	45.17	1.078s
I-131	1460.01	365.25	300.	-5.	-0.003	462.56	1.089s
BE-7	1899.38	475.12	210.	-6.	-0.004	326.16	1.189s
CS-134	2275.88	569.26	116.	8.	0.004	201.52	1.269s
Pa-234	2268.94	567.52	80.	10.	0.005	131.89	1.269s
TL-208	2331.76	583.23	127.	32.	0.018	52.60	1.281s
CS-134	2402.60	600.94	52.	6.	0.004	163.84	1.300s
BI-214	2434.78	608.98	149.	26.	0.014	69.06	1.304s
I-131	2550.09	637.81	128.	-18.	-0.010	92.99	1.327s
CS-137	2644.34	661.38	104.	3951.	2.195	1.70	1.293
EU-154	2892.15	723.32	140.	-9.	-0.005	180.76	1.401s
BI-212	2907.53	727.17	92.	2.	0.001	684.93	1.404s
PA-234M	3074.54	768.92	54.	17.	0.010	64.79	1.437s
EU-152	3113.41	778.64	110.	7.	0.004	213.93	1.448s
BI-212	3140.67	785.45	112.	24.	0.013	66.19	1.453
CS-134	3182.62	795.94	127.	15.	0.009	107.21	1.462s
CS-134	3190.12	797.81	70.	2.	0.001	531.63	1.467s
TL-208	3452.83	863.48	144.	-6.	-0.003	279.73	1.516s
EU-154	3485.13	871.55	96.	20.	0.011	73.97	1.526s
Pa-234	3524.08	881.29	148.	-7.	-0.004	246.70	1.532s
AC-228	3639.56	910.15	169.	9.	0.005	206.61	1.557s
Pa-234	3774.01	943.75	196.	-20.	-0.011	103.26	1.586s
AC-228	3867.15	967.03	156.	5.	0.003	358.66	1.605s
EU-154	3978.62	994.89	141.	-8.	-0.004	217.89	1.627s
PA-234M	4003.52	1001.11	131.	20.	0.011	85.79	1.631s
EU-152	4448.13	1112.22	135.	-11.	-0.006	152.52	1.720s
BI-214	4479.50	1120.06	125.	2.	0.001	768.00	1.727s
CO-60	4691.45	1173.03	48.	2128.	1.182	2.33	1.779
CO-60	5328.76	1332.27	0.	1835.	1.019	2.33	1.783
BI-214	7056.22	1763.77	7.	5.	0.003	92.52	2.214s

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	Peak Energy keV		Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	-3.7600E+00					5.31E+01	
			477.60	-3.760E+00	&(	4.172E+01	3.26E+02	1.05E+01 G
K-40	N	-2.9006E+00					4.66E+11	
			1460.83	-2.901E+00	%(P	3.408E+01	1.00E+03	1.07E+01 G
CO-60	F	2.7894E+02					1.93E+03	
			1332.50	2.736E+02	(	1.099E+00	2.33E+00	1.00E+02 G
			1173.24	2.843E+02	(	4.676E+00	2.33E+00	9.99E+01 G
I-131	I	-3.2536E-01					8.02E+00	
			364.48	-3.254E-01	&(	5.103E+00	4.63E+02	8.17E+01 G
			284.30	3.808E-01	&	5.833E+01	4.51E+03	6.14E+00 G
			636.97	-1.968E+01	+	6.130E+01	9.30E+01	7.17E+00 G
CS-134	I	1.3141E+00					7.54E+02	
			604.71	4.980E-01	&(	2.820E+00	1.64E+02	9.76E+01 G
			795.87	1.715E+00	&(	6.186E+00	1.07E+02	8.55E+01 G
			569.32	3.601E+00	?(	2.480E+01	2.02E+02	1.54E+01 G
			801.95	2.493E+00	&(	4.633E+01	5.32E+02	8.69E+00 G
			563.24	7.683E-01	%	4.576E+01	1.72E+03	8.35E+00 G
CS-137	I	3.7989E+02					1.10E+04	
			661.66	3.799E+02	(	4.830E+00	1.70E+00	8.52E+01 G
EU-152	F	2.5957E+00					4.94E+03	
			344.29	2.169E+00	?(	1.372E+01	1.87E+02	2.65E+01 G
			121.78	1.854E+00	?(	8.226E+00	1.33E+02	2.86E+01 G
			778.92	5.107E+00	&(	3.741E+01	2.14E+02	1.29E+01 G
			964.11	9.740E-01	%	5.453E+01	1.64E+03	1.46E+01 G
			1112.07	-1.026E+01	+	5.308E+01	1.53E+02	1.36E+01 G
			1408.00	0.000E+00	-	5.487E+00	1.00E+03	2.10E+01 G
EU-154	I	1.6639E+01					3.14E+03	
			873.23	1.664E+01	?(	4.092E+01	7.40E+01	1.23E+01 G
			123.10	-1.039E+00	-	5.971E+00	1.72E+02	4.08E+01 G
			1274.54	0.000E+00	-	1.671E+01	1.00E+03	3.52E+01 G
			723.36	-4.110E+00	-	2.526E+01	1.81E+02	2.02E+01 G
			1004.77	-2.803E-01	%	3.963E+01	4.10E+03	1.80E+01 G
			996.33	-8.557E+00	&	6.357E+01	2.18E+02	1.06E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
EU-155	I	1.7121E+00					1.81E+03	
			105.31	-3.878E-02	&(	9.080E+00	6.88E+03	2.12E+01 G
			86.54	2.921E+00	(	7.296E+00	7.54E+01	3.07E+01 G
TL-208	N	2.8712E+00					6.98E+02	
			583.02	2.804E+00	(	4.815E+00	5.26E+01	8.45E+01 G
			277.28	3.770E+00	?(	5.436E+01	4.26E+02	6.31E+00 G
			860.56	-5.058E+00	-	4.837E+01	2.80E+02	1.24E+01 G
PB-210	N	1.2523E+04					8.14E+03	
			46.54	1.252E+04	(P	2.672E+02	1.26E+00	4.25E+00 G
PB-212	N	1.3596E+01					6.98E+02	
			238.63	1.360E+01	*(P	7.137E+00	2.17E+01	4.33E+01 G
			300.03	-2.170E+01	- P	1.071E+02	1.49E+02	3.28E+00 G
PB-214	N	7.1700E+00					5.84E+05	
			351.93	6.964E+00	(	1.023E+01	4.52E+01	3.76E+01 G
			295.09	3.683E+00	?(	1.905E+01	1.54E+02	1.93E+01 G
			242.00	1.727E+01	&(	4.423E+01	7.73E+01	7.43E+00 G
BI-212	N	2.7456E+01					6.98E+02	
			727.17	2.342E+00	?(	5.575E+01	6.85E+02	7.55E+00 G
			785.42	1.756E+02	(	3.841E+02	6.62E+01	1.28E+00 G
BI-214	N	4.6553E+00					5.84E+05	
			609.31	4.329E+00	?(	9.896E+00	6.91E+01	4.61E+01 G
			1120.29	1.758E+00	-	4.660E+01	7.68E+02	1.51E+01 G
			1764.49	5.633E+00	&(	1.816E+01	9.25E+01	1.54E+01 G
AC-228	N	3.2963E+00					2.10E+03	
			911.07	3.341E+00	?(	2.346E+01	2.07E+02	2.90E+01 G
			968.97	3.221E+00	(	3.953E+01	3.59E+02	1.75E+01 G
			338.32	-2.645E+00	+	3.257E+01	3.63E+02	1.20E+01 G
							Energy duplication	
			93.35	1.701E+01		4.649E+01	8.24E+01	5.56E+00 XA
Pa-234	N	1.8707E+00					1.63E+12	
			131.29	-1.248E+00	?(	1.399E+01	3.33E+02	1.80E+01 G
			569.47	8.718E+00	?(	3.916E+01	1.32E+02	8.20E+00 G
			946.02	-1.628E+01	&	5.631E+01	1.03E+02	1.34E+01 G
			883.24	9.202E-01	%	6.632E+01	2.09E+03	9.60E+00 G
			880.53	-1.227E+01	+	1.033E+02	2.47E+02	6.00E+00 G
TH-234	N	-2.7912E+00					1.63E+12	
			63.29	-1.622E+01	?(P	1.013E+02	5.23E+02	3.81E+00 G
			92.59	6.369E+00	(P	3.831E+01	8.06E+01	5.58E+00 G

```
 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

PA-234M  N   3.4385E+02                                      1.63E+12
                         1001.00 2.724E+02 ?(  7.807E+02 8.58E+01 8.37E-01 G
                          766.41 5.472E+02 &(  1.171E+03 6.48E+01 2.94E-01 G

Ra-226   N  -2.3856E+01                                      5.84E+05
                          185.99-2.386E+01 &(P 9.072E+01 1.55E+02 3.28E+00 G

U-235    N   7.9779E+00                                      2.57E+11
                          143.79 3.057E+00 &(  2.276E+01 2.22E+02 1.10E+01 G
                          205.33 1.874E+01  (  5.590E+01 8.96E+01 5.01E+00 G
                          163.38-1.432E+01 +   5.306E+01 1.11E+02 5.08E+00 G
                                                          Energy duplication
                           93.35 1.443E+01     3.749E+01 7.84E+01 5.81E+00 X

AM-241   T   1.3111E+03                                      1.58E+05
                           59.54 1.311E+03  (  1.823E+01 9.88E-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.
   + - 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

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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********** 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	
AC-228	93.35	548.	41.	0.023	82.40	1.701E+01	
EU-152	122.56	460.	23.	0.013	132.75	1.854E+00	
EU-154	123.91	492.	-18.	-0.010	171.50	-1.039E+00	
Pa-234	132.29	506.	-10.	-0.005	333.13	-1.248E+00	
Ra-226	186.89	455.	-27.	-0.015	155.14	-2.386E+01	P
PB-214	242.31	363.	36.	0.020	77.25	1.727E+01	
TL-208	277.40	317.	6.	0.003	425.77	3.770E+00	
PB-214	295.44	329.	17.	0.009	154.04	3.683E+00	
AC-228	338.81	298.	-7.	-0.004	363.49	-2.645E+00	
EU-152	344.21	249.	12.	0.007	187.34	2.169E+00	
PB-214	351.94	269.	54.	0.030	45.17	6.964E+00	
I-131	365.25	300.	-5.	-0.003	462.56	-3.254E-01	
BE-7	475.12	210.	-6.	-0.004	326.16	-3.760E+00	
CS-134	569.26	116.	8.	0.004	201.52	3.601E+00	
Pa-234	567.52	80.	10.	0.005	131.89	8.718E+00	
TL-208	583.23	127.	32.	0.018	52.60	2.804E+00	
CS-134	600.94	52.	6.	0.004	163.84	4.980E-01	
BI-214	608.98	149.	26.	0.014	69.06	4.329E+00	
I-131	637.81	128.	-18.	-0.010	92.99	-1.968E+01	
EU-154	723.32	140.	-9.	-0.005	180.76	-4.110E+00	
EU-152	778.64	110.	7.	0.004	213.93	5.107E+00	
CS-134	795.94	127.	15.	0.009	107.21	1.715E+00	
CS-134	797.81	70.	2.	0.001	531.63	2.493E+00	
TL-208	863.48	144.	-6.	-0.003	279.73	-5.058E+00	
EU-154	871.55	96.	20.	0.011	73.97	1.664E+01	
Pa-234	881.29	148.	-7.	-0.004	246.70	-1.227E+01	
AC-228	910.15	169.	9.	0.005	206.61	3.341E+00	
Pa-234	943.75	196.	-20.	-0.011	103.26	-1.628E+01	
AC-228	967.03	156.	5.	0.003	358.66	3.221E+00	
EU-154	994.89	141.	-8.	-0.004	217.89	-8.557E+00	
EU-152	1112.22	135.	-11.	-0.006	152.52	-1.026E+01	
BI-214	1120.06	125.	2.	0.001	768.00	1.758E+00	
BI-214	1763.77	7.	5.	0.003	92.52	5.633E+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 *****

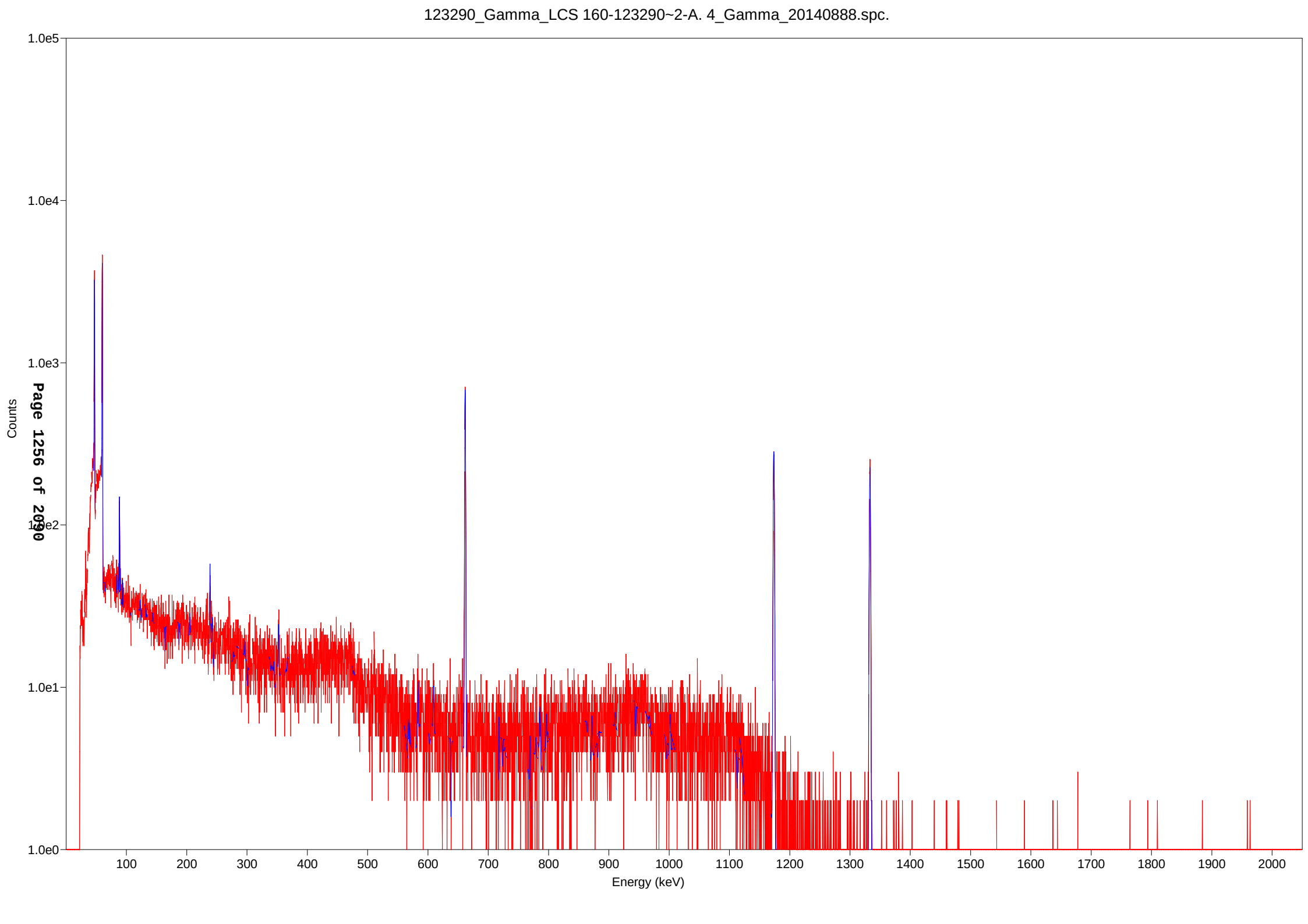
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	-3.7599E+00	-3.7600E+00	3.262E+02%	4.17E+01
K-40	#A	-2.9006E+00	-2.9006E+00	2.000E+03%	3.41E+01
CO-60		2.7894E+02	2.7894E+02	1.650E+00%	1.10E+00
I-131	#A	-3.2535E-01	-3.2536E-01	4.626E+02%	5.10E+00
CS-134	#A	1.3141E+00	1.3141E+00	1.072E+02%	2.82E+00
CS-137		3.7989E+02	3.7989E+02	1.699E+00%	4.83E+00
EU-152	#A	2.5957E+00	2.5957E+00	1.046E+02%	1.37E+01
EU-154	#A	1.6639E+01	1.6639E+01	7.397E+01%	4.09E+01
EU-155	A	1.7121E+00	1.7121E+00	7.539E+01%	9.08E+00
TL-208	#A	2.8712E+00	2.8712E+00	5.260E+01%	4.82E+00
PB-210		1.2523E+04	1.2523E+04	1.257E+00%	2.67E+02
PB-212	#	1.3596E+01	1.3596E+01	2.258E+01%	7.14E+00
PB-214	#A	7.1700E+00	7.1700E+00	4.517E+01%	1.02E+01
BI-212	A	2.7456E+01	2.7456E+01	6.619E+01%	5.58E+01
BI-214	#A	4.6553E+00	4.6553E+00	5.773E+01%	9.90E+00
AC-228	#A	3.2963E+00	3.2963E+00	2.066E+02%	2.35E+01
Pa-234	#A	1.8707E+00	1.8707E+00	1.319E+02%	1.40E+01
TH-234	A	-2.7912E+00	-2.7912E+00	1.768E+02%	1.01E+02
PA-234M	#A	3.4385E+02	3.4385E+02	5.375E+01%	7.81E+02
Ra-226	#A	-2.3856E+01	-2.3856E+01	1.976E+02%	9.07E+01
U-235	A	7.9779E+00	7.9779E+00	8.964E+01%	2.28E+01
AM-241		1.3111E+03	1.3111E+03	9.877E-01%	1.82E+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 (105.1 to 1999.4 keV) 1.451E+04 Bq/Sample
Total Decayed Activity (105.1 to 1999.4 keV) 1.4506853E+04 Bq/Sample

The library has energies which are not separable.


123290_Gamma_LCS 160-123290~2-A. 4_Gamma_20140888.spc.
1.0e5
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Counts
Page 1256 of 2000
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Energy (keV)

Test America St. Louis Spectrum ID: 15_Gamma_20140929

Sample Description: 123290_Gamma_160-6694-A-1-D
Detector: Ge15 SN/11012216
Batch ID: 123290
Work Order Number: Gamma
Lot Number: 160-6694-A-1-D

Decay to Time: 5/21/2014 12:21 Live Time: 1800 sec
Acquisition Time: 5/21/2014 12:22:50 Real Time: 1801 sec
Analysis Time: 5/21/2014 12:53 Dead Time: 0.07 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 15_Soil_TunaCan.Clb
Efficiency Cal Desc: 15_TunaCan_90099_032212
Efficiency Cal Date: 3/22/2012 13:03
Energy Cal Date: 2/28/2012 16:29
Library: Client_Short_no ingrowth Rev2.li
Bkgd Correction File: 15_2014-05-03_0613.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	1.888E+00	103.8	1.961E+00	1.963E+00	6.828E+00
K-40	1.473E+02	7.9	1.158E+01	1.382E+01	9.781E+00
CO-60	5.325E-02	298.5	1.589E-01	1.589E-01	1.401E+00
I-131	1.472E-01	151.2	2.225E-01	2.226E-01	7.909E-01
CS-134	2.253E-01	95.7	2.156E-01	2.159E-01	1.042E+00
CS-137	3.407E-01	117.6	4.006E-01	4.010E-01	1.391E+00
EU-152	2.444E-01	54.5	1.332E-01	1.338E-01	2.479E+00
EU-154	-3.022E-01	864.9	2.614E+00	2.614E+00	9.860E+00
EU-155	-7.133E-01	133.9	9.555E-01	9.563E-01	3.247E+00
TL-208	2.406E+00	16.9	4.071E-01	4.258E-01	8.459E-01
PB-210	1.077E+01	76.5	8.241E+00	8.265E+00	2.949E+01
PB-212	7.200E+00	13.5	9.735E-01	1.079E+00	1.973E+00
PB-214	5.536E+00	15.8	8.770E-01	9.229E-01	2.140E+00
BI-212	4.744E+00	86.1	4.086E+00	4.093E+00	1.394E+01
BI-214	5.862E+00	13.3	7.784E-01	8.359E-01	1.513E+00
AC-228	7.712E+00	15.0	1.158E+00	1.223E+00	3.947E+00
Pa-234	1.060E+00	78.0	8.270E-01	8.288E-01	3.390E+00
TH-234	1.018E+01	73.9	7.524E+00	7.543E+00	2.610E+01
PA-234M	6.744E+01	58.9	3.971E+01	3.986E+01	1.464E+02
Ra-226	9.571E+00	68.8	6.581E+00	6.634E+00	2.300E+01
U-235	1.962E+00	87.8	1.722E+00	1.724E+00	5.366E+00
AM-241	7.200E-01	97.3	7.001E-01	7.011E-01	2.362E+00
Total	2.854E+02				

Analyst: April Bean

TestAmerica, Inc. Spectrum name: 15_Gamma_20140929.An1

Sample description
123290_Gamma_160-6694-A-1-D

Spectrum Filename: C:\User\SPC\Det15\15_Gamma_20140929.An1

Acquisition information
Start time:	5/21/2014 12:22:50 PM
Live time:	1800
Real time:	1801
Dead time:	0.07 %
Detector ID:	15

Detector system
Ge15 SN/11012216

Calibration
Filename: 15_Soil_TunaCan.Clb
15_TunaCan_90099_032212

Energy Calibration
Created:	2/28/2012 4:29:17 PM
Zero offset:	0.044 keV
Gain:	0.250 keV/channel
Quadratic:	-3.267E-08 keV/channel^2

Efficiency Calibration
Created:	3/22/2012 1:03:01 PM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 1.00 %
Log(Eff):	-6.894897E-01 + (-3.290613E-01*Log(E)) + (-3.875629E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 1.13 %
Log(Eff):	-2.362677E+01 + (8.666669E+00*Log(E)) + (-9.214638E-01*Log(E)^2)

Library Files
Main analysis library:	Client_Short_no ingrowth Rev2.li
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.57keV)
Stop channel:	8000 (1999.52keV)
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

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	5/21/2014 12:21:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	15_2014-05-03_0613.PBC 5/3/2014 6:13:31 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 10 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0727

***** 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	16.	32.32	0.95	1.957E-02	46.54	4.250	PBC<MDA	PB210
59.69	13.	97.25	0.96	2.737E-02	59.54	35.900	PBC<MDA	AM241
63.64	20.	37.69	0.96	2.924E-02	63.29	3.810	PBC<MDA	TH234
					63.29	3.810	PBC<MDA	TH234
74.73	66.	32.18	0.63	3.378E-02				
90.17	24.	36.74	0.34	3.741E-02				
92.75	42.	32.13	0.99	3.785E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	1.065E+01	U235
					93.35	5.561	1.113E+01	AC228
					92.59	5.584	3.872E+00	TH234
92.75	42.	32.13	0.99	3.785E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	1.065E+01	U235
					93.35	5.561	1.113E+01	AC228
92.76	11.	38.47	0.99	3.776E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	PBC<MDA	U235
					93.35	5.561	PBC<MDA	AC228
119.88	16.	54.51	1.02	3.848E-02	121.78	28.580	PBC<MDA	EU152
131.42	16.	78.03	1.02	3.775E-02	131.29	18.000	PBC<MDA	Pa234
143.18	13.	90.10	1.04	3.639E-02	143.79	10.960	PBC<MDA	U235
163.27	7.	150.62	1.05	3.367E-02	163.38	5.080	PBC<MDA	U235
185.77	18.	36.64	1.07	3.120E-02	185.99	3.280	PBC<MDA	Ra226
238.60	156.	12.63	1.29	2.592E-02	238.63	43.300	7.200E+00	PB212
					242.00	7.430	4.538E+01	PB214
276.99	8.	82.12	1.15	2.313E-02	277.28	6.310	PBC<MDA	TL208
295.02	30.	33.54	1.17	2.205E-02	295.09	19.300	PBC<MDA	PB214
					295.09	19.300	3.981E+00	PB214

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
338.74	51.	19.84	0.96	1.983E-02	338.32	12.010	1.190E+01	AC228
351.92	72.	15.84	1.22	1.923E-02	351.93	37.600	5.536E+00	PB214
					351.93	37.600	5.536E+00	PB214
364.47	4.	151.16	1.23	1.871E-02	364.48	81.700	PBC<MDA	I131
477.70	5.	103.84	1.32	1.508E-02	477.60	10.520	PBC<MDA	BE7
562.39	4.	122.48	1.39	1.319E-02	563.24	8.350	PBC<MDA	CS134
583.17	46.	14.91	1.20	1.282E-02	583.02	84.500	2.372E+00	TL208
609.35	63.	11.87	0.50	1.236E-02	609.31	46.090	6.187E+00	BI214
662.03	6.	117.57	1.47	1.155E-02	661.66	85.210	PBC<MDA	CS137
727.49	7.	86.12	1.52	1.067E-02	727.17	7.550	PBC<MDA	BI212
768.27	7.	68.39	1.55	1.021E-02	766.41	0.294	PBC<MDA	PA234M
794.90	5.	95.70	1.57	9.887E-03	795.87	85.530	PBC<MDA	CS134
861.56	3.	182.19	1.62	9.252E-03	860.56	12.420	PBC<MDA	TL208
884.55	1.	512.00	1.64	9.048E-03	883.24	9.600	PBC<MDA	Pa234
911.06	26.	26.56	1.66	8.811E-03	911.07	29.000	5.674E+00	AC228
969.02	22.	30.52	1.70	8.357E-03	968.97	17.460	8.217E+00	AC228
1001.04	5.	95.87	1.72	8.125E-03	1001.00	0.837	PBC<MDA	PA234M
1120.94	6.	66.40	1.80	7.368E-03	1120.29	15.100	PBC<MDA	BI214
1173.31	2.	298.47	1.84	7.076E-03	1173.24	99.900	PBC<MDA	CO60
1461.01	165.	7.72	1.27	5.828E-03	1460.83	10.670	1.473E+02	K40
1765.09	7.	39.59	2.18	4.916E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide
298.51	74.73	110.	66.	1.954E+03	32.18	0.633	- s
360.22	90.17	26.	24.	6.495E+02	35.81	0.340	- 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_Short_no ingrowth Rev2.li

********** 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	186.30	46.66	79.	16.	0.009	32.32	0.946s
AM-241	238.39	59.69	70.	13.	0.007	97.25	0.958s
TH-234	254.20	63.64	113.	20.	0.011	37.69	0.962s
TH-234	370.60	92.76	119.	11.	0.006	38.47	0.989s
U-235	372.95	93.35	71.	42.	0.023	32.13	0.989D
AC-228	372.95	93.35	71.	42.	0.023	32.13	0.989D

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
EU-155	420.79	105.32	95.	-11.	-0.006	133.94	1.000s
EU-152	479.00	119.88	28.	16.	0.009	54.51	1.015s
Pa-234	525.13	131.42	69.	16.	0.009	78.03	1.024
U-235	572.15	143.18	59.	13.	0.007	90.10	1.036s
U-235	652.46	163.27	57.	7.	0.004	150.62	1.053s
Ra-226	742.40	185.77	72.	18.	0.010	36.64	1.074s
PB-212	953.60	238.60	64.	145.	0.081	12.63	1.292s
PB-214	954.20	238.75	67.	47.	0.026	28.64	1.123
TL-208	1107.09	276.99	23.	8.	0.004	82.12	1.154s
PB-214	1179.18	295.02	37.	30.	0.017	33.54	1.170s
AC-228	1353.97	338.74	11.	51.	0.028	19.84	0.961s
EU-152	1376.18	344.30	19.	-3.	-0.002	201.37	1.212s
PB-214	1406.64	351.92	29.	72.	0.040	15.84	1.219
I-131	1456.85	364.47	17.	4.	0.002	151.16	1.229s
BE-7	1909.61	477.70	13.	5.	0.003	103.84	1.324s
CS-134	2248.28	562.39	12.	4.	0.002	122.48	1.394s
CS-134	2274.18	568.87	24.	-1.	0.000	869.98	1.399s
TL-208	2331.38	583.17	9.	46.	0.026	14.91	1.202
CS-134	2416.26	604.39	19.	-1.	-0.001	568.38	1.427s
BI-214	2436.08	609.35	8.	63.	0.035	11.87	0.495s
I-131	2547.41	637.18	16.	-1.	-0.001	432.46	1.452s
CS-137	2646.80	662.03	22.	6.	0.003	117.57	1.472s
EU-154	2892.31	723.41	26.	-3.	-0.002	226.39	1.519s
BI-212	2908.62	727.49	14.	7.	0.004	86.12	1.522s
PA-234M	3071.73	768.27	9.	7.	0.004	68.39	1.552s
CS-134	3178.26	794.90	10.	5.	0.003	95.70	1.574s
TL-208	3444.92	861.56	18.	3.	0.002	182.19	1.622s
EU-154	3488.09	872.35	14.	-1.	0.000	864.87	1.631s
Pa-234	3536.90	884.55	11.	1.	0.001	512.00	1.638s
AC-228	3642.95	911.06	11.	26.	0.014	26.56	1.658s
Pa-234	3781.51	945.69	17.	-3.	-0.002	216.42	1.683s
EU-152	3866.23	966.87	28.	-7.	-0.004	116.31	1.696s
AC-228	3874.83	969.02	11.	22.	0.012	30.52	1.699s
EU-154	3990.98	998.05	23.	-1.	-0.001	565.14	1.718s
PA-234M	4002.93	1001.04	11.	5.	0.003	95.87	1.722s
EU-154	4019.94	1005.29	17.	-4.	-0.002	171.97	1.724s
BI-214	4482.68	1120.94	15.	6.	0.003	66.40	1.803s
CO-60	4692.26	1173.31	14.	2.	0.001	298.47	1.838s
EU-154	5097.27	1274.51	9.	-1.	-0.001	330.48	1.903s
CO-60	5330.43	1332.77	8.	0.	0.000	930.42	1.938s
K-40	5843.74	1461.01	3.	165.	0.092	7.72	1.270s
BI-214	7061.18	1765.09	5.	7.	0.004	39.59	2.180s

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	Peak Energy keV	Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	1.8882E+00				5.31E+01	
			477.60	1.888E+00 ?(		6.828E+00 1.04E+02	1.05E+01 G
K-40	N	1.4730E+02				4.66E+11	
			1460.83	1.473E+02 (P		9.781E+00 7.72E+00	1.07E+01 G
CO-60	F	5.3245E-02				1.93E+03	
			1332.50	-3.843E-02 &(		1.401E+00 9.30E+02	1.00E+02 G
			1173.24	1.450E-01 ?(		1.595E+00 2.98E+02	9.99E+01 G
I-131	I	1.4719E-01				8.02E+00	
			364.48	1.472E-01 ?(		7.909E-01 1.51E+02	8.17E+01 G
			284.30	-9.553E-02 &		1.234E+01 3.58E+03	6.14E+00 G
			636.97	-8.684E-01 +		1.389E+01 4.32E+02	7.17E+00 G
CS-134	I	2.2525E-01				7.54E+02	
			604.71	-4.972E-02 ?(		1.042E+00 5.68E+02	9.76E+01 G
			795.87	3.434E-01 ?(		1.141E+00 9.57E+01	8.55E+01 G
			569.32	-2.205E-01 +		7.017E+00 8.70E+02	1.54E+01 G
			801.95	0.000E+00 -		1.040E+01 1.00E+03	8.69E+00 G
			563.24	2.230E+00 ?(		9.662E+00 1.22E+02	8.35E+00 G
CS-137	I	3.4072E-01				1.10E+04	
			661.66	3.407E-01 ?(		1.391E+00 1.18E+02	8.52E+01 G
EU-152	F	2.4441E-01				4.94E+03	
			344.29	-3.433E-01 ?(		2.479E+00 2.01E+02	2.65E+01 G
			121.78	7.894E-01 ?(		1.393E+00 5.45E+01	2.86E+01 G
			778.92	3.029E-02 %		8.575E+00 7.44E+03	1.29E+01 G
			964.11	-3.073E+00 +		1.235E+01 1.16E+02	1.46E+01 G
			1112.07	0.000E+00 -		1.010E+01 1.00E+03	1.36E+01 G
			1408.00	0.000E+00 -		1.247E+01 1.00E+03	2.10E+01 G
EU-154	I	-3.0220E-01				3.14E+03	
			873.23	-3.022E-01 ?(		9.860E+00 8.65E+02	1.23E+01 G
			123.10	-4.313E-03 %		1.316E+00 8.59E+03	4.08E+01 G
			1274.54	-3.232E-01 +		4.048E+00 3.30E+02	3.52E+01 G
			723.36	-8.471E-01 +		6.825E+00 2.26E+02	2.02E+01 G
			1004.77	-1.363E+00 +		8.381E+00 1.72E+02	1.80E+01 G
			996.33	-7.827E-01 +		1.613E+01 5.65E+02	1.06E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak MDA	Comments
EU-155	I	-7.1334E-01				1.81E+03	
			105.31	-7.133E-01	?(	3.247E+00 1.34E+02 2.12E+01	G
			86.54	1.462E-02	&	2.143E+00 4.18E+03 3.07E+01	G
TL-208	N	2.4055E+00				6.98E+02	
			583.02	2.372E+00	(P	8.459E-01 1.49E+01 8.45E+01	G
			277.28	2.856E+00	&(P	9.615E+00 8.21E+01 6.31E+00	G
			860.56	1.653E+00	-	1.079E+01 1.82E+02 1.24E+01	G
PB-210	N	1.0768E+01				8.14E+03	
			46.54	1.077E+01	(P	2.949E+01 3.23E+01 4.25E+00	G
PB-212	N	7.2002E+00				6.98E+02	
			238.63	7.200E+00	@(P	1.973E+00 1.26E+01 4.33E+01	G
			300.03	0.000E+00	-	2.888E+01 1.00E+03 3.28E+00	G
PB-214	N	5.5364E+00				5.84E+05	
			351.93	5.536E+00	(	2.140E+00 1.58E+01 3.76E+01	G
			295.09	3.981E+00	-	4.057E+00 3.35E+01 1.93E+01	G
			242.00	1.373E+01	+	1.194E+01 2.86E+01 7.43E+00	G
BI-212	N	4.7444E+00				6.98E+02	
			727.17	4.744E+00	&(	1.394E+01 8.61E+01 7.55E+00	G
			785.42	0.000E+00	-	1.504E+02 1.00E+03 1.28E+00	G
BI-214	N	5.8617E+00				5.84E+05	
			609.31	6.187E+00	(P	1.513E+00 1.19E+01 4.61E+01	G
			1120.29	3.045E+00	- P	1.032E+01 6.64E+01 1.51E+01	G
			1764.49	4.889E+00	?(P	9.813E+00 3.96E+01 1.54E+01	G
AC-228	N	7.7116E+00				2.10E+03	
			911.07	5.674E+00	?(	3.947E+00 2.66E+01 2.90E+01	G
			968.97	8.217E+00	?(	6.892E+00 3.05E+01 1.75E+01	G
			338.32	1.190E+01	@(	4.237E+00 1.98E+01 1.20E+01	G
						Energy duplication	
			93.35	1.113E+01	&	1.106E+01 3.21E+01 5.56E+00	XA
Pa-234	N	1.0599E+00				1.63E+12	
			131.29	1.301E+00	(	3.390E+00 7.80E+01 1.80E+01	G
			569.47	-3.391E-02	%	1.301E+01 1.04E+04 8.20E+00	G
			946.02	-1.350E+00	-	1.057E+01 2.16E+02 1.34E+01	G
			883.24	6.076E-01	?(	1.178E+01 5.12E+02 9.60E+00	G
			880.53	-3.994E-01	%	2.099E+01 1.39E+03 6.00E+00	G
TH-234	N	1.0176E+01				1.63E+12	
			63.29	1.018E+01	(P	2.610E+01 3.77E+01 3.81E+00	G
			92.59	2.945E+00	- P	1.409E+01 3.85E+01 5.58E+00	G

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

PA-234M  N   6.7443E+01                                      1.63E+12
                         1001.00 4.402E+01 ?(  1.464E+02 9.59E+01 8.37E-01 G
                          766.41 1.341E+02 ?(  3.040E+02 6.84E+01 2.94E-01 G

Ra-226   N   9.5709E+00                                      5.84E+05
                          185.99 9.571E+00  (P 2.300E+01 3.66E+01 3.28E+00 G

U-235    N   1.9618E+00                                      2.57E+11
                          143.79 1.768E+00 ?(  5.366E+00 9.01E+01 1.10E+01 G
                          205.33 8.158E-02 %   1.418E+01 4.89E+03 5.01E+00 G
                          163.38 2.379E+00 ?(  1.233E+01 1.51E+02 5.08E+00 G
                                                          Energy duplication
                           93.35 1.065E+01 &   1.058E+01 3.21E+01 5.81E+00 X

AM-241   T   7.1995E-01                                      1.58E+05
                           59.54 7.199E-01  (  2.362E+00 9.72E+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.
   + - 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

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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********** 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	46.66	79.	16.	0.009	32.32	1.077E+01	P
AM-241	59.69	70.	13.	0.007	97.25	7.199E-01	
TH-234	63.64	113.	20.	0.011	37.69	1.018E+01	P
TH-234	92.76	119.	11.	0.006	38.47	2.945E+00	P
U-235	93.35	71.	42.	0.023	32.13	1.065E+01	
EU-155	105.32	95.	-11.	-0.006	133.94	-7.133E-01	
Pa-234	131.42	69.	16.	0.009	78.03	1.301E+00	
U-235	143.18	59.	13.	0.007	90.10	1.768E+00	
U-235	163.27	57.	7.	0.004	150.62	2.379E+00	
Ra-226	185.77	72.	18.	0.010	36.64	9.571E+00	P
PB-214	238.75	67.	47.	0.026	28.64	1.373E+01	
PB-214	295.02	37.	30.	0.017	33.54	3.981E+00	
PB-214	351.92	29.	72.	0.040	15.84	5.536E+00	
I-131	364.47	17.	4.	0.002	151.16	1.472E-01	
BE-7	477.70	13.	5.	0.003	103.84	1.888E+00	
CS-134	562.39	12.	4.	0.002	122.48	2.230E+00	
CS-134	568.87	24.	-1.	0.000	869.98	-2.205E-01	
CS-134	604.39	19.	-1.	-0.001	568.38	-4.972E-02	
I-131	637.18	16.	-1.	-0.001	432.46	-8.684E-01	
CS-137	662.03	22.	6.	0.003	117.57	3.407E-01	
EU-154	723.41	26.	-3.	-0.002	226.39	-8.471E-01	
BI-212	727.49	14.	7.	0.004	86.12	4.744E+00	
PA-234M	768.27	9.	7.	0.004	68.39	1.341E+02	
CS-134	794.90	10.	5.	0.003	95.70	3.434E-01	
EU-154	872.35	14.	-1.	0.000	864.87	-3.022E-01	
Pa-234	884.55	11.	1.	0.001	512.00	6.076E-01	
Pa-234	945.69	17.	-3.	-0.002	216.42	-1.350E+00	
EU-154	998.05	23.	-1.	-0.001	565.14	-7.827E-01	
PA-234M	1001.04	11.	5.	0.003	95.87	4.402E+01	
EU-154	1005.29	17.	-4.	-0.002	171.97	-1.363E+00	
CO-60	1173.31	14.	2.	0.001	298.47	1.450E-01	
EU-154	1274.51	9.	-1.	-0.001	330.48	-3.232E-01	
CO-60	1332.77	8.	0.	0.000	930.42	-3.843E-02	

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 *****

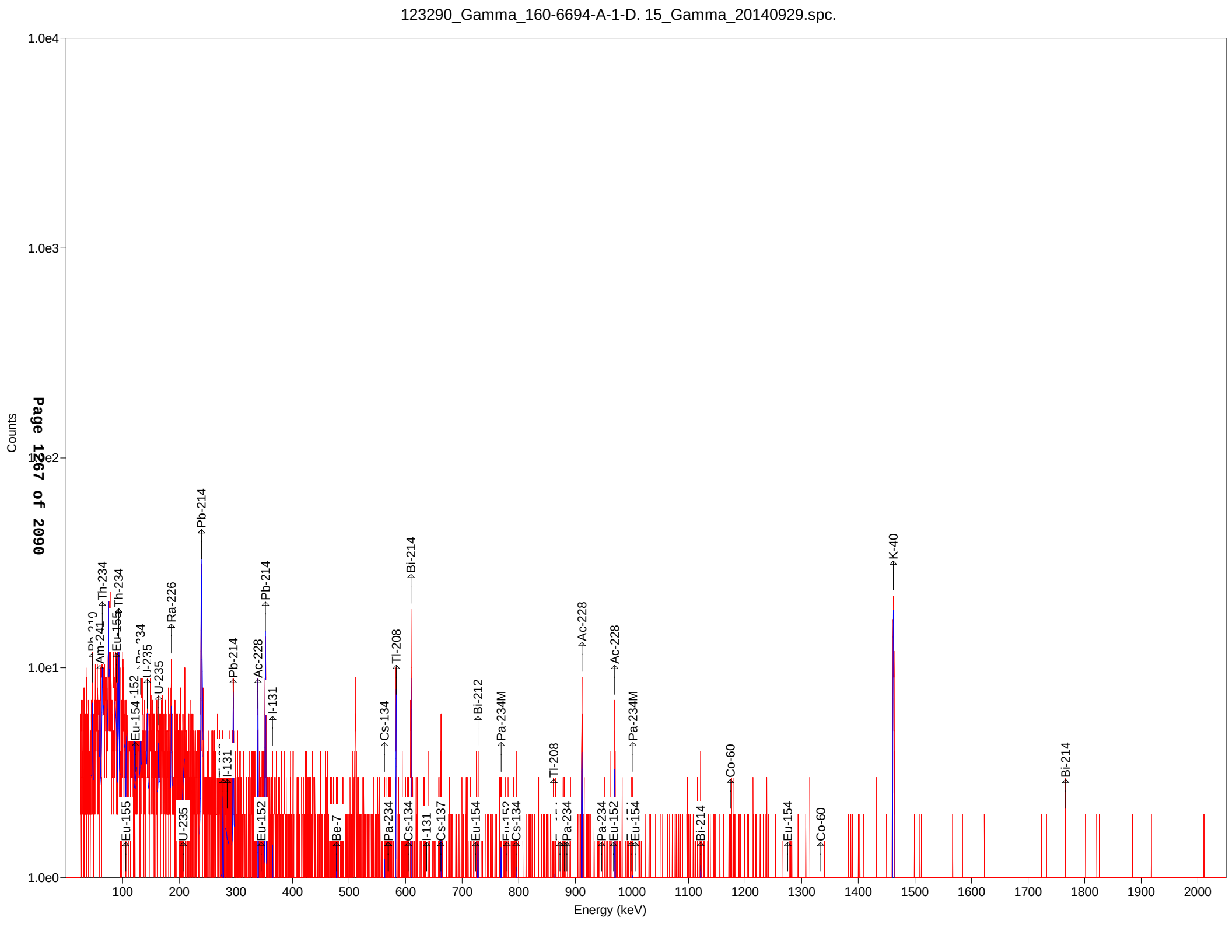
Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	1.8882E+00	1.8882E+00	1.038E+02%	6.83E+00
K-40		1.4730E+02	1.4730E+02	7.861E+00%	9.78E+00
CO-60	#A	5.3245E-02	5.3245E-02	2.985E+02%	1.40E+00
I-131	#A	1.4717E-01	1.4719E-01	1.512E+02%	7.91E-01
CS-134	#A	2.2525E-01	2.2525E-01	9.570E+01%	1.04E+00
CS-137	#A	3.4072E-01	3.4072E-01	1.176E+02%	1.39E+00
EU-152	#A	2.4441E-01	2.4441E-01	5.451E+01%	2.48E+00
EU-154	#A	-3.0220E-01	-3.0220E-01	8.649E+02%	9.86E+00
EU-155	#A	-7.1334E-01	-7.1334E-01	1.339E+02%	3.25E+00
TL-208		2.4055E+00	2.4055E+00	1.692E+01%	8.46E-01
PB-210	#A	1.0768E+01	1.0768E+01	7.653E+01%	2.95E+01
PB-212	#	7.2002E+00	7.2002E+00	1.352E+01%	1.97E+00
PB-214	#	5.5364E+00	5.5364E+00	1.584E+01%	2.14E+00
BI-212	#A	4.7444E+00	4.7444E+00	8.612E+01%	1.39E+01
BI-214		5.8617E+00	5.8617E+00	1.328E+01%	1.51E+00
AC-228	#	7.7116E+00	7.7116E+00	1.502E+01%	3.95E+00
Pa-234	#A	1.0599E+00	1.0599E+00	7.803E+01%	3.39E+00
TH-234	#A	1.0176E+01	1.0176E+01	7.394E+01%	2.61E+01
PA-234M	#A	6.7443E+01	6.7443E+01	5.888E+01%	1.46E+02
Ra-226	#A	9.5709E+00	9.5709E+00	6.876E+01%	2.30E+01
U-235	#A	1.9618E+00	1.9618E+00	8.775E+01%	5.37E+00
AM-241	#A	7.1995E-01	7.1995E-01	9.725E+01%	2.36E+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) 1.705E+02 Bq/Sample
Total Decayed Activity (37.6 to 1999.5 keV) 1.7048320E+02 Bq/Sample

The library has energies which are not separable.


123290_Gamma_160-6694-A-1-D. 15_Gamma_20140929.spc.
Counts
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Energy (keV)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Pb-210
Am-241
Th-234
Eu-155
Th-234
Eu-154
U-235
U-235
Ra-226
Pb-214
Pb-214
Ac-228
I-131
Eu-155
U-235
Eu-152
Be-7
Cs-134
Pa-234
Cs-134
Tl-208
Bi-214
I-131
Cs-137
Eu-154
Bi-212
Pa-234M
Eu-152
Cs-134
Tl-208
Pa-234
Ac-228
Pa-234
Eu-152
Ac-228
Eu-154
Pa-234M
Bi-214
Co-60
Eu-154
Co-60
K-40
Bi-214

Test America St. Louis Spectrum ID: 9_Gamma_20140914

Sample Description: 123290_Gamma_160-6694-A-1-E DU
Detector: Ge9 S/N100228730
Batch ID: 123290
Work Order Number: Gamma
Lot Number: 160-6694-A-1-E DU

Decay to Time: 5/21/2014 14:28 Live Time: 1800 sec
Acquisition Time: 5/21/2014 14:28:25 Real Time: 1803 sec
Analysis Time: 5/21/2014 14:58 Dead Time: 0.15 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 9_Soil_TunaCan.Clb
Efficiency Cal Desc: 9_Soil_TunaCan_90099_050312
Efficiency Cal Date: 6/14/2012 10:19
Energy Cal Date: 3/1/2012 13:57
Library: Client_Short_no ingrowth Rev2.li
Bkgd Correction File: 9_2014-05-03_0559.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	1.786E+00	94.5	1.688E+00	1.691E+00	5.770E+00
K-40	1.441E+02	6.2	8.905E+00	1.156E+01	8.590E+00
CO-60	0.000E+00	1000.0	1.058E-01	1.058E-01	3.900E-01
I-131	2.612E-01	72.8	1.902E-01	1.907E-01	6.125E-01
CS-134	-2.957E-01	90.3	2.669E-01	2.674E-01	1.116E+00
CS-137	6.682E-01	40.1	2.676E-01	2.699E-01	8.163E-01
EU-152	6.537E-01	72.0	4.705E-01	4.718E-01	1.870E+00
EU-154	0.000E+00	707.1	3.090E-01	3.090E-01	9.661E+00
EU-155	7.780E-01	88.1	6.854E-01	6.867E-01	2.298E+00
TL-208	2.744E+00	12.9	3.537E-01	3.813E-01	4.972E-01
PB-210	5.760E+00	103.0	5.930E+00	5.940E+00	2.009E+01
PB-212	7.260E+00	9.0	6.547E-01	8.058E-01	1.166E+00
PB-214	6.292E+00	12.2	7.646E-01	8.315E-01	1.484E+00
BI-212	1.615E+01	16.4	2.655E+00	2.785E+00	3.217E+00
BI-214	5.566E+00	13.2	7.340E-01	7.890E-01	1.446E+00
AC-228	8.781E+00	12.4	1.089E+00	1.178E+00	9.956E-01
Pa-234	8.992E-01	68.2	6.132E-01	6.150E-01	2.499E+00
TH-234	1.779E+01	48.4	8.609E+00	8.659E+00	1.976E+01
PA-234M	1.152E+01	295.5	3.404E+01	3.405E+01	1.230E+02
Ra-226	1.426E+01	35.6	5.077E+00	5.227E+00	1.588E+01
U-235	7.360E-01	90.4	6.655E-01	6.665E-01	5.406E+00
AM-241	4.700E-01	140.5	6.604E-01	6.608E-01	2.241E+00
Total	2.465E+02				

Analyst: April Bean

TestAmerica, Inc Spectrum name: 9_Gamma_20140914.An1

Sample description
123290_Gamma_160-6694-A-1-E DU

Spectrum Filename: C:\User\SPC\Det9\9_Gamma_20140914.An1

Acquisition information
Start time: 5/21/2014 2:28:25 PM
Live time: 1800
Real time: 1803
Dead time: 0.15 %
Detector ID: 9

Detector system
Ge9 S/N100228730

Calibration
Filename: 9_Soil_TunaCan.Clb
9_Soil_TunaCan_90099_050312

Energy Calibration
Created: 3/1/2012 1:57:17 PM
Zero offset: 0.074 keV
Gain: 0.250 keV/channel
Quadratic: -2.269E-08 keV/channel^2

Efficiency Calibration
Created: 6/14/2012 10:19:51 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.30 %
Log(Eff): -8.079856E-01 + (-2.367265E-01*Log(E)) + (-3.950640E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.42 %
Log(Eff): -2.387916E+01 + (8.875647E+00*Log(E)) + (-9.401100E-01*Log(E)^2)

Library Files
Main analysis library: Client_Short_no ingrowth Rev2.li
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.59keV)
Stop channel: 8000 (1999.34keV)
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

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	5/21/2014 2:28:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	9_2014-05-03_0559.PBC 5/3/2014 5:59:24 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 17 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0918

***** 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
46.34	11.	102.95	1.00	2.577E-02	46.54	4.250	PBC<MDA	PB210
60.12	11.	140.52	1.01	3.659E-02	59.54	35.900	PBC<MDA	AM241
63.27	48.	48.40	0.49	3.921E-02	63.29	3.810	PBC<MDA	TH234
74.99	94.	17.26	1.03	4.581E-02				
77.28	137.	13.50	1.03	4.683E-02				
92.53	15.	85.54	1.04	5.156E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	2.809E+00	U235
					93.35	5.810	2.809E+00	U235
92.92	36.	42.47	1.04	5.171E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	6.743E+00	U235
					93.35	5.561	7.044E+00	AC228
93.29	41.	29.28	1.04	5.171E-02	93.35	5.810	7.556E+00	U235
					93.35	5.561	7.894E+00	AC228
105.49	16.	88.10	1.05	5.318E-02	105.31	21.200	PBC<MDA	EU155
					105.31	21.200	7.779E-01	EU155
121.93	17.	71.97	1.07	5.305E-02	121.78	28.580	PBC<MDA	EU152
160.57	10.	90.42	1.11	4.676E-02	163.38	5.080	PBC<MDA	U235
					163.38	5.080	2.324E+00	U235
186.17	37.	35.60	1.13	4.399E-02	185.99	3.280	PBC<MDA	Ra226
238.51	216.	8.82	1.17	3.733E-02	238.63	43.300	7.260E+00	PB212
242.10	70.	24.12	1.37	3.697E-02	242.00	7.430	1.415E+01	PB214
276.67	5.	219.53	1.21	3.372E-02	277.28	6.310	PBC<MDA	TL208
285.39	1.	620.40	1.22	3.315E-02	284.30	6.140	PBC<MDA	I131
295.05	73.	18.91	0.80	3.232E-02	295.09	19.300	6.489E+00	PB214
301.72	6.	151.57	1.24	3.195E-02	300.03	3.280	PBC<MDA	PB212
338.49	76.	15.34	0.54	2.940E-02	338.32	12.010	1.196E+01	AC228

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
344.37	5.	136.18	1.27	2.905E-02	344.29	26.500	PBC<MDA	EU152
351.62	128.	12.36	1.27	2.862E-02	351.93	37.600	6.191E+00	PB214
365.01	10.	72.82	1.29	2.791E-02	364.48	81.700	PBC<MDA	I131
478.21	8.	94.54	1.39	2.301E-02	477.60	10.520	PBC<MDA	BE7
583.28	83.	12.89	0.95	1.989E-02	583.02	84.500	2.744E+00	TL208
608.98	89.	11.68	1.48	1.925E-02	609.31	46.090	5.566E+00	BI214
661.59	19.	40.06	1.55	1.810E-02	661.66	85.210	PBC<MDA	CS137
727.42	37.	16.44	0.36	1.686E-02	727.17	7.550	1.615E+01	BI212
778.35	4.	109.85	1.64	1.600E-02	778.92	12.940	PBC<MDA	EU152
785.27	1.	673.04	1.65	1.590E-02	785.42	1.280	PBC<MDA	BI212
794.93	9.	48.96	1.66	1.574E-02	795.87	85.530	PBC<MDA	CS134
802.62	1.	441.76	1.66	1.565E-02	801.95	8.690	PBC<MDA	CS134
860.62	5.	115.61	1.71	1.482E-02	860.56	12.420	PBC<MDA	TL208
911.05	65.	12.40	0.65	1.418E-02	911.07	29.000	8.781E+00	AC228
947.03	7.	68.20	1.77	1.377E-02	946.02	13.400	PBC<MDA	Pa234
963.94	3.	238.79	1.79	1.357E-02	964.11	14.605	PBC<MDA	EU152
999.90	2.	295.51	1.81	1.318E-02	1001.00	0.837	PBC<MDA	PA234M
1120.56	4.	92.58	1.90	1.206E-02	1120.29	15.100	PBC<MDA	BI214
1460.53	270.	6.00	2.02	9.749E-03	1460.83	10.670	1.441E+02	K40

********** 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	
299.57	74.97	86.	94.	2.061E+03	17.26	1.025	-	D
308.71	77.26	102.	137.	2.923E+03	13.50	1.027	-	D

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_Short_no ingrowth Rev2.li

********** 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	184.99	46.34	63.	11.	0.006	102.95	0.998s
AM-241	240.11	60.12	116.	11.	0.006	140.52	1.010s
TH-234	252.68	63.27	117.	48.	0.027	48.40	0.493s
TH-234	369.94	92.59	77.	15.	0.008	85.54	1.042D
U-235	372.98	93.35	102.	36.	0.020	42.47	1.043D
AC-228	372.98	93.35	51.	41.	0.023	29.28	1.043D
EU-155	421.53	105.49	89.	16.	0.009	88.10	1.054s
EU-152	487.27	121.93	63.	17.	0.009	71.97	1.070s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
EU-154	492.25	123.17	82.	-10.	-0.005	135.16	1.071s
U-235	641.77	160.57	35.	10.	0.006	90.42	1.109s
Ra-226	744.17	186.17	68.	37.	0.021	35.60	1.130s
U-235	820.09	205.15	83.	-13.	-0.007	99.42	1.148s
PB-212	953.50	238.51	45.	211.	0.117	8.82	1.166
PB-214	967.85	242.10	47.	70.	0.039	24.12	1.365s
TL-208	1106.11	276.67	50.	5.	0.003	219.53	1.214
I-131	1140.96	285.39	38.	1.	0.001	620.40	1.221s
PB-214	1179.59	295.05	37.	73.	0.040	18.91	0.798s
PB-212	1206.30	301.72	40.	6.	0.003	151.57	1.235s
AC-228	1353.36	338.49	12.	76.	0.042	15.34	0.538s
EU-152	1376.86	344.37	25.	5.	0.003	136.18	1.275s
PB-214	1405.87	351.62	31.	120.	0.067	12.36	1.271s
I-131	1459.43	365.01	23.	10.	0.006	72.82	1.293s
BE-7	1912.19	478.21	23.	8.	0.004	94.54	1.392s
CS-134	2257.81	564.61	29.	-6.	-0.003	132.65	1.466s
TL-208	2332.47	583.28	7.	83.	0.046	12.89	0.950s
CS-134	2422.44	605.77	57.	-12.	-0.007	90.25	1.500s
BI-214	2435.28	608.98	19.	89.	0.049	11.68	1.475s
CS-137	2645.75	661.59	18.	19.	0.010	40.06	1.548s
EU-154	2898.20	724.69	35.	-7.	-0.004	118.18	1.598s
BI-212	2909.12	727.42	0.	37.	0.021	16.44	0.365s
EU-152	3112.88	778.35	9.	4.	0.002	109.85	1.643s
BI-212	3140.55	785.27	15.	1.	0.000	673.04	1.648s
CS-134	3179.22	794.93	6.	9.	0.005	48.96	1.656s
CS-134	3209.95	802.62	14.	1.	0.001	441.76	1.661s
TL-208	3442.03	860.62	15.	5.	0.003	115.61	1.707s
Pa-234	3515.84	879.07	11.	-2.	-0.001	257.72	1.724s
AC-228	3643.78	911.05	0.	65.	0.036	12.40	0.650s
Pa-234	3787.76	947.03	8.	7.	0.004	68.20	1.772s
EU-152	3855.45	963.94	19.	3.	0.002	238.79	1.786s
PA-234M	3999.31	999.90	22.	2.	0.001	295.51	1.814s
BI-214	4482.17	1120.56	20.	4.	0.002	92.58	1.901s
EU-154	5096.70	1274.12	19.	-1.	0.000	798.96	2.008s
EU-152	5632.39	1407.96	14.	-3.	-0.001	218.68	2.097s
K-40	5842.83	1460.53	8.	270.	0.150	6.00	2.016

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	1.7860E+00				5.31E+01	
			477.60	1.786E+00 &(		5.770E+00	9.45E+01 1.05E+01 G
K-40	N	1.4408E+02				4.66E+11	
			1460.83	1.441E+02 (P		8.590E+00	6.00E+00 1.07E+01 G
I-131	I	2.6122E-01				8.02E+00	
			364.48	2.519E-01 &(		6.125E-01	7.28E+01 8.17E+01 G
			284.30	3.856E-01 ?(		8.550E+00	6.20E+02 6.14E+00 G
			636.97	9.626E-02 %		1.051E+01	2.96E+03 7.17E+00 G
CS-134	I	-2.9573E-01				7.54E+02	
			604.71	-3.671E-01 ?(		1.116E+00	9.03E+01 9.76E+01 G
			795.87	3.915E-01 +		5.847E-01	4.90E+01 8.55E+01 G
			569.32	0.000E+00 +		2.524E+00	1.00E+03 1.54E+01 G
			801.95	5.055E-01 ?(		8.312E+00	4.42E+02 8.69E+00 G
			563.24	-1.982E+00 +		9.133E+00	1.33E+02 8.35E+00 G
CS-137	I	6.6820E-01				1.10E+04	
			661.66	6.682E-01 ?(		8.163E-01	4.01E+01 8.52E+01 G
EU-152	F	6.5374E-01				4.94E+03	
			344.29	3.930E-01 ?(		1.870E+00	1.36E+02 2.65E+01 G
			121.78	6.087E-01 (		1.456E+00	7.20E+01 2.86E+01 G
			778.92	1.171E+00 ?(		4.541E+00	1.10E+02 1.29E+01 G
			964.11	7.570E-01 ?(		6.519E+00	2.39E+02 1.46E+01 G
			1112.07	0.000E+00 -		6.672E+00	1.00E+03 1.36E+01 G
			1408.00	-6.586E-01 +		5.257E+00	2.19E+02 2.10E+01 G
EU-155	I	7.7795E-01				1.81E+03	
			105.31	7.779E-01 (		2.298E+00	8.81E+01 2.12E+01 G
			86.54	1.535E-02 %		2.016E+00	3.80E+03 3.07E+01 G
TL-208	N	2.7439E+00				6.98E+02	
			583.02	2.744E+00 (		4.972E-01	1.29E+01 8.45E+01 G
			277.28	1.216E+00 -		9.308E+00	2.20E+02 6.31E+00 G
			860.56	1.538E+00 -		6.230E+00	1.16E+02 1.24E+01 G
PB-210	N	5.7603E+00				8.14E+03	
			46.54	5.760E+00 ?(		2.009E+01	1.03E+02 4.25E+00 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-212	N	7.2601E+00					6.98E+02	
			238.63	7.260E+00	(P	1.166E+00	8.82E+00	4.33E+01 G
			300.03	3.261E+00	-	1.714E+01	1.52E+02	3.28E+00 G
PB-214	N	6.2917E+00					5.84E+05	
			351.93	6.191E+00	@(P	1.484E+00	1.24E+01	3.76E+01 G
			295.09	6.489E+00	(P	2.771E+00	1.89E+01	1.93E+01 G
			242.00	1.415E+01	+ P	7.013E+00	2.41E+01	7.43E+00 G
BI-212	N	1.6152E+01					6.98E+02	
			727.17	1.615E+01	(	3.217E+00	1.64E+01	7.55E+00 G
			785.42	2.289E+00	-	5.748E+01	6.73E+02	1.28E+00 G
BI-214	N	5.5662E+00					5.84E+05	
			609.31	5.566E+00	@(P	1.446E+00	1.17E+01	4.61E+01 G
			1120.29	1.343E+00	- P	7.214E+00	9.26E+01	1.51E+01 G
			1764.49	-1.134E+00	% P	4.433E+00	1.00E+03	1.54E+01 G
AC-228	N	8.7806E+00					2.10E+03	
			911.07	8.781E+00	(	9.956E-01	1.24E+01	2.90E+01 G
			968.97	0.000E+00	-	4.188E+00	1.00E+03	1.75E+01 G
			338.32	1.196E+01	+	2.966E+00	1.53E+01	1.20E+01 G
							Energy duplication	
			93.35	7.894E+00		6.962E+00	2.93E+01	5.56E+00 XA
Pa-234	N	8.9918E-01					1.63E+12	
			131.29	1.532E-02	%(	2.499E+00	4.64E+03	1.80E+01 G
			569.47	0.000E+00	-	4.826E+00	1.00E+03	8.20E+00 G
			946.02	2.086E+00	?(	4.710E+00	6.82E+01	1.34E+01 G
			883.24	-7.524E-01	+	7.209E+00	2.58E+02	9.60E+00 G
			880.53	2.030E-01	%	1.197E+01	1.54E+03	6.00E+00 G
TH-234	N	1.7787E+01					1.63E+12	
			63.29	1.779E+01	(	1.976E+01	4.84E+01	3.81E+00 G
			92.59	2.931E+00	-	8.404E+00	8.55E+01	5.58E+00 G
PA-234M	N	1.1520E+01					1.63E+12	
			1001.00	1.152E+01	?(	1.230E+02	2.96E+02	8.37E-01 G
			766.41	0.000E+00	-	3.439E+02	1.00E+03	2.94E-01 G
Ra-226	N	1.4261E+01					5.84E+05	
			185.99	1.426E+01	(	1.588E+01	3.56E+01	3.28E+00 G
U-235	N	7.3597E-01					2.57E+11	
			143.79	0.000E+00	(	5.406E+00	1.00E+03	1.10E+01 G
			205.33	-3.627E+00	+	1.216E+01	9.94E+01	5.01E+00 G
			163.38	2.324E+00	(	7.117E+00	9.04E+01	5.08E+00 G
							Energy duplication	
			93.35	6.743E+00	?	9.189E+00	4.25E+01	5.81E+00 X

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
AM-241	T 4.6997E-01					1.58E+05	
		59.54	4.700E-01	(	2.241E+00	1.41E+02	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.
+ - 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	46.34	63.	11.	0.006	102.95	5.760E+00
AM-241	60.12	116.	11.	0.006	140.52	4.700E-01
U-235	93.35	102.	36.	0.020	42.47	6.743E+00
EU-155	105.49	89.	16.	0.009	88.10	7.779E-01
EU-152	121.93	63.	17.	0.009	71.97	6.087E-01
EU-154	123.17	82.	-10.	-0.005	135.16	-2.511E-01
U-235	160.57	35.	10.	0.006	90.42	2.324E+00
Ra-226	186.17	68.	37.	0.021	35.60	1.426E+01
U-235	205.15	83.	-13.	-0.007	99.42	-3.627E+00
I-131	285.39	38.	1.	0.001	620.40	3.856E-01
EU-152	344.37	25.	5.	0.003	136.18	3.930E-01
I-131	365.01	23.	10.	0.006	72.82	2.519E-01

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
BE-7	478.21	23.	8.	0.004	94.54	1.786E+00	
CS-134	564.61	29.	-6.	-0.003	132.65	-1.982E+00	
CS-134	605.77	57.	-12.	-0.007	90.25	-3.671E-01	
CS-137	661.59	18.	19.	0.010	40.06	6.682E-01	
EU-154	724.69	35.	-7.	-0.004	118.18	-1.211E+00	
EU-152	778.35	9.	4.	0.002	109.85	1.171E+00	
CS-134	794.93	6.	9.	0.005	48.96	3.915E-01	
CS-134	802.62	14.	1.	0.001	441.76	5.055E-01	
EU-152	963.94	19.	3.	0.002	238.79	7.570E-01	
PA-234M	999.90	22.	2.	0.001	295.51	1.152E+01	
EU-154	1274.12	19.	-1.	0.000	798.96	-1.140E-01	
EU-152	1407.96	14.	-3.	-0.001	218.68	-6.586E-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 *****

Nuclide	Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7 #A	1.7860E+00	1.7860E+00	9.454E+01%	5.77E+00
K-40	1.4408E+02	1.4408E+02	6.181E+00%	8.59E+00
CO-60 #A	0.0000E+00	0.0000E+00	1.000E+03%	3.90E-01
I-131 #A	2.6121E-01	2.6122E-01	7.282E+01%	6.13E-01
CS-134 #A	-2.9573E-01	-2.9573E-01	9.025E+01%	1.12E+00
CS-137 #A	6.6820E-01	6.6820E-01	4.006E+01%	8.16E-01
EU-152 #A	6.5374E-01	6.5374E-01	7.197E+01%	1.87E+00
EU-154 #A	0.0000E+00	0.0000E+00	7.071E+02%	9.66E+00
EU-155 #A	7.7795E-01	7.7795E-01	8.810E+01%	2.30E+00
TL-208	2.7439E+00	2.7439E+00	1.289E+01%	4.97E-01
PB-210 #A	5.7603E+00	5.7603E+00	1.030E+02%	2.01E+01
PB-212	7.2601E+00	7.2601E+00	9.018E+00%	1.17E+00
PB-214	6.2917E+00	6.2917E+00	1.215E+01%	1.48E+00
BI-212	1.6152E+01	1.6152E+01	1.644E+01%	3.22E+00
BI-214 #	5.5662E+00	5.5662E+00	1.319E+01%	1.45E+00
AC-228	8.7806E+00	8.7806E+00	1.240E+01%	9.96E-01
Pa-234 #A	8.9918E-01	8.9918E-01	6.820E+01%	2.50E+00
TH-234 A	1.7787E+01	1.7787E+01	4.840E+01%	1.98E+01
PA-234M#A	1.1520E+01	1.1520E+01	2.955E+02%	1.23E+02
Ra-226 #A	1.4261E+01	1.4261E+01	3.560E+01%	1.59E+01
U-235 #A	7.3597E-01	7.3597E-01	9.042E+01%	5.41E+00
AM-241 #A	4.6997E-01	4.6997E-01	1.405E+02%	2.24E+00

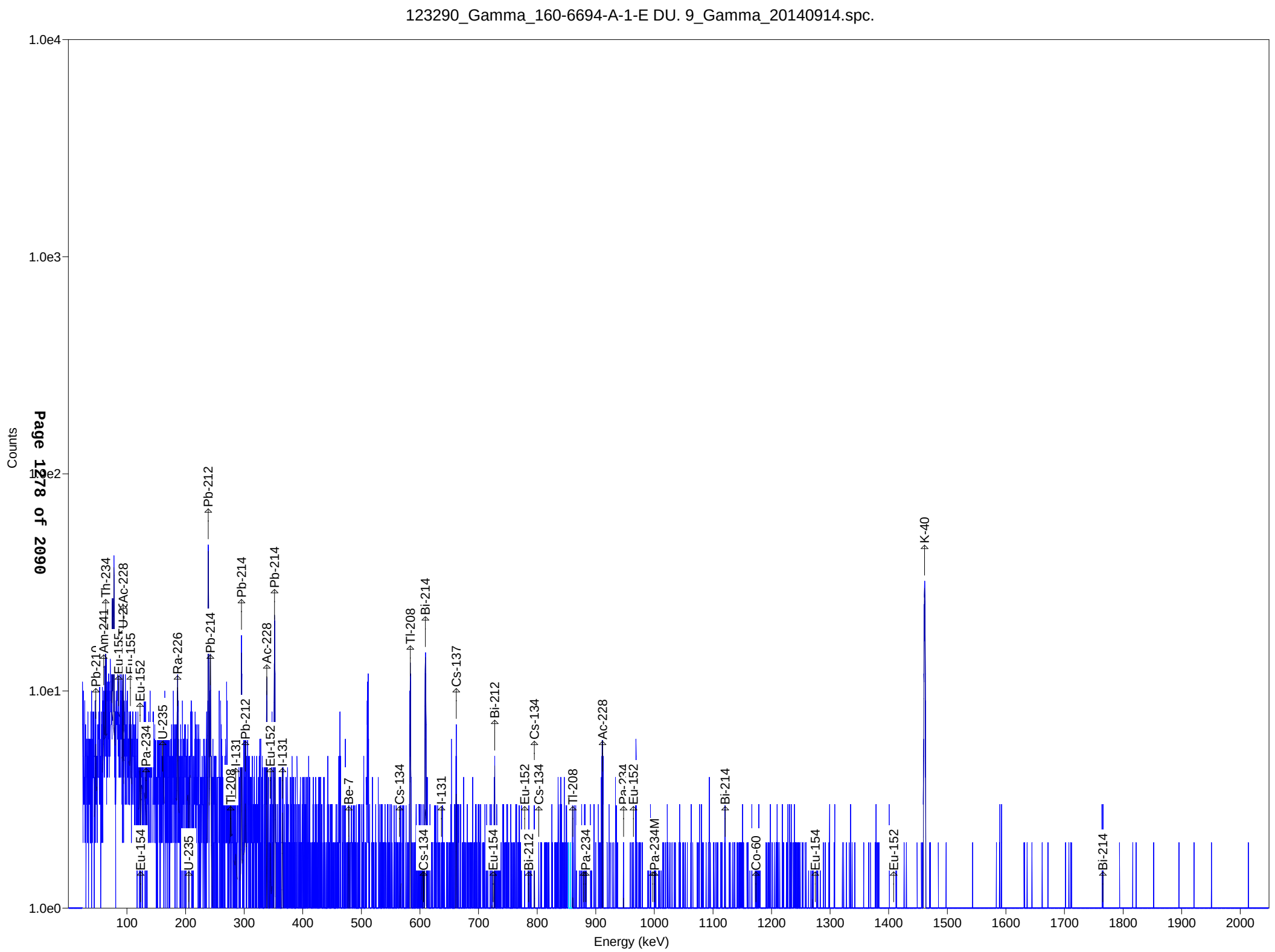
- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.

  < - 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 (131.1 to 1999.3 keV) 2.087E+02 Bq/Sample
Total Decayed Activity (131.1 to 1999.3 keV) 2.0866092E+02 Bq/Sample

The library has energies which are not separable.


123290_Gamma_160-6694-A-1-E DU. 9_Gamma_20140914.spc.
Counts
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Energy (keV)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Pb-210
Am-241
Th-234
Eu-155
U-235
Ac-228
Eu-155
Eu-152
Pa-234
U-235
Ra-226
Pb-212
Pb-214
Tl-208
I-131
Pb-212
Pb-214
Ac-228
Eu-152
I-131
Be-7
Cs-134
Tl-208
Bi-214
Cs-137
I-131
Bi-212
Eu-154
Eu-152
Cs-134
Bi-212
Tl-208
Pa-234
Ac-228
Pa-234
Eu-152
Pa-234M
Bi-214
Co-60
Eu-154
Eu-152
K-40
Bi-214

Test America St. Louis Spectrum ID: 12_Gamma_20141015

Sample Description: 123290_Gamma_160-6694-A-2-D
Detector: Ge12 S/N10034336
Batch ID: 123290
Work Order Number: Gamma
Lot Number: 160-6694-A-2-D

Decay to Time: 5/21/2014 14:31 Live Time: 1800 sec
Acquisition Time: 5/21/2014 14:32:00 Real Time: 1805 sec
Analysis Time: 5/21/2014 15:02 Dead Time: 0.28 %
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_Short_no ingrowth Rev2.li
Bkgd Correction File: 12_2014-05-03_0618.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	-3.551E-01	521.2	1.851E+00	1.851E+00	6.733E+00
K-40	1.465E+02	6.9	1.009E+01	1.257E+01	1.426E+01
CO-60	-6.553E-02	512.0	3.356E-01	3.356E-01	1.249E+00
I-131	3.985E-01	86.1	3.429E-01	3.435E-01	7.147E-01
CS-134	2.036E-01	131.1	2.669E-01	2.671E-01	8.633E-01
CS-137	2.608E-01	92.8	2.421E-01	2.425E-01	8.328E-01
EU-152	3.371E-01	127.6	4.303E-01	4.306E-01	3.303E+00
EU-154	3.708E-01	101.8	3.777E-01	3.781E-01	8.319E+00
EU-155	7.685E-01	68.6	5.268E-01	5.285E-01	2.502E+00
TL-208	2.599E+00	15.4	4.006E-01	4.227E-01	8.064E-01
PB-210	-4.014E+00	285.5	1.146E+01	1.146E+01	2.895E+01
PB-212	7.006E+00	11.6	8.153E-01	9.328E-01	1.771E+00
PB-214	6.676E+00	12.9	8.621E-01	9.293E-01	1.770E+00
BI-212	6.555E+00	62.0	4.063E+00	4.077E+00	1.126E+01
BI-214	4.703E+00	13.2	6.212E-01	6.675E-01	1.198E+00
AC-228	9.598E+00	12.4	1.188E+00	1.285E+00	3.080E+00
Pa-234	8.621E-01	106.9	9.212E-01	9.223E-01	3.137E+00
TH-234	-3.609E+00	546.9	1.973E+01	1.973E+01	2.678E+01
PA-234M	-1.416E+01	7411.0	1.049E+03	1.049E+03	1.473E+02
Ra-226	3.422E+00	173.2	5.926E+00	5.934E+00	2.133E+01
U-235	2.963E+00	50.9	1.507E+00	1.515E+00	4.420E+00
AM-241	-6.340E-02	1213.0	7.688E-01	7.688E-01	2.661E+00
Total	1.932E+02				

Analyst: April Bean

TestAmerica, Inc Spectrum name: 12_Gamma_20141015.An1

Sample description
123290_Gamma_160-6694-A-2-D

Spectrum Filename: C:\User\SPC\Det12\12_Gamma_20141015.An1

Acquisition information
Start time: 5/21/2014 2:32:00 PM
Live time: 1800
Real time: 1805
Dead time: 0.28 %
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*Log(E)) + (-3.369562E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.96 %
Log(Eff): -2.288409E+01 + (8.352717E+00*Log(E)) + (-8.812368E-01*Log(E)^2)

Library Files
Main analysis library: Client_Short_no ingrowth Rev2.li
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: 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

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	5/21/2014 2:31:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	12_2014-05-03_0618.PBC 5/3/2014 6:18:35 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1090

***** 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
46.63	-7.	49.96	0.89	2.229E-02	46.54	4.250	PBC<MDA	PB210
63.37	-8.	170.40	0.91	3.338E-02	63.29	3.810	PBC<MDA	TH234
77.02	108.	18.88	1.06	3.959E-02				
87.88	13.	125.59	0.93	4.243E-02	86.54	30.700	PBC<MDA	EU155
92.68	38.	41.94	0.93	4.382E-02	93.35	5.561	PBC<MDA	AC228
					93.35	5.810	8.372E+00	U235
93.13	84.	21.86	1.03	4.382E-02	93.35	5.561	1.907E+01	AC228
					93.35	5.810	1.825E+01	U235
105.09	19.	68.55	0.95	4.516E-02	105.31	21.200	PBC<MDA	EU155
121.45	3.	411.88	0.96	4.528E-02	121.78	28.580	PBC<MDA	EU152
					121.78	28.580	1.360E-01	EU152
123.75	8.	161.50	0.96	4.522E-02	123.10	40.790	PBC<MDA	EU154
131.48	3.	438.68	0.97	4.468E-02	131.29	18.000	PBC<MDA	Pa234
144.47	23.	50.87	0.98	4.338E-02	143.79	10.960	PBC<MDA	U235
164.06	13.	101.40	1.00	4.061E-02	163.38	5.080	PBC<MDA	U235
185.45	8.	50.73	1.02	3.796E-02	185.99	3.280	PBC<MDA	Ra226
238.44	191.	10.71	1.21	3.221E-02	238.63	43.300	7.006E+00	PB212
295.03	70.	19.57	0.88	2.789E-02	295.09	19.300	7.240E+00	PB214
299.94	24.	34.90	0.91	2.757E-02	300.03	3.280	1.444E+01	PB212
338.24	58.	15.63	1.22	2.538E-02	338.32	12.010	1.055E+01	AC228
351.79	107.	11.98	1.36	2.470E-02	351.93	37.600	6.386E+00	PB214
364.59	4.	166.69	1.19	2.410E-02	364.48	81.700	PBC<MDA	I131
583.15	68.	14.05	0.61	1.724E-02	583.02	84.500	2.606E+00	TL208

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
604.07	6.	131.13	1.40	1.679E-02	604.71	97.620	PBC<MDA	CS134
609.18	65.	11.62	1.20	1.669E-02	609.31	46.090	4.703E+00	BI214
637.11	7.	86.05	1.43	1.616E-02	636.97	7.170	PBC<MDA	I131
661.21	6.	92.84	1.45	1.571E-02	661.66	85.210	PBC<MDA	CS137
727.70	8.	81.30	1.51	1.465E-02	727.17	7.550	PBC<MDA	BI212
786.33	7.	93.60	1.56	1.383E-02	785.42	1.280	PBC<MDA	BI212
802.93	1.	784.65	1.57	1.362E-02	801.95	8.690	PBC<MDA	CS134
861.35	7.	73.50	1.62	1.291E-02	860.56	12.420	PBC<MDA	TL208
880.53	2.	180.22	1.63	1.269E-02	880.53	6.000	PBC<MDA	Pa234
883.24	4.	106.86	1.64	1.266E-02	883.24	9.600	PBC<MDA	Pa234
911.19	59.	16.65	0.55	1.237E-02	911.07	29.000	9.205E+00	AC228
968.63	13.	46.01	1.71	1.180E-02	968.97	17.460	PBC<MDA	AC228
995.68	5.	119.78	1.73	1.155E-02	996.33	10.600	PBC<MDA	EU154
1004.79	2.	255.49	1.74	1.148E-02	1004.77	18.010	PBC<MDA	EU154
1120.54	23.	26.64	0.65	1.055E-02	1120.29	15.100	7.913E+00	BI214
1407.06	3.	127.63	2.05	8.829E-03	1408.00	21.005	PBC<MDA	EU152
					1408.00	21.005	1.036E+00	EU152
1460.76	241.	6.75	2.08	8.576E-03	1460.83	10.670	1.465E+02	K40

********** 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
307.63	77.02	108.	108.	2.723E+03	18.88	1.061	-

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_Short_no ingrowth Rev2.li

********** 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	186.16	46.63	100.	-7.	-0.004	49.96	0.889s
TH-234	253.05	63.37	158.	-8.	-0.005	170.40	0.905s
EU-155	351.04	87.88	119.	13.	0.007	125.59	0.928s
TH-234	377.23	94.44	106.	-8.	-0.004	95.84	0.934s
AC-228	372.89	93.35	82.	84.	0.046	21.86	1.028D
U-235	372.89	93.35	110.	38.	0.021	41.94	0.934D
EU-155	419.80	105.09	75.	19.	0.011	68.55	0.946s
EU-152	485.20	121.45	84.	3.	0.002	411.88	0.961s
EU-154	494.39	123.75	73.	8.	0.004	161.50	0.963s
Pa-234	525.28	131.48	84.	3.	0.002	438.68	0.970s
U-235	577.20	144.47	57.	23.	0.013	50.87	0.982s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
U-235	655.50	164.06	83.	13.	0.007	101.40	1.001
Ra-226	741.02	185.45	94.	8.	0.004	50.73	1.022s
PB-212	952.82	238.44	80.	176.	0.098	10.71	1.208
PB-214	971.26	243.05	103.	-5.	-0.003	456.59	1.075s
PB-214	1179.05	295.03	41.	70.	0.039	19.57	0.882s
PB-212	1198.70	299.94	12.	24.	0.013	34.90	0.907s
AC-228	1351.81	338.24	16.	58.	0.032	15.63	1.221
PB-214	1405.97	351.79	33.	107.	0.059	11.98	1.358s
I-131	1457.16	364.59	24.	4.	0.002	166.69	1.187s
BE-7	1909.92	477.82	24.	-1.	-0.001	521.20	1.289s
CS-134	2254.22	563.92	32.	-3.	-0.002	281.64	1.365s
CS-134	2273.53	568.75	23.	-1.	0.000	979.08	1.370s
Pa-234	2273.51	568.74	23.	-1.	0.000	958.59	1.370
TL-208	2331.13	583.15	16.	68.	0.038	14.05	0.608s
CS-134	2414.79	604.07	24.	6.	0.003	131.13	1.401s
BI-214	2435.22	609.18	9.	65.	0.036	11.62	1.199
I-131	2546.93	637.11	17.	7.	0.004	86.05	1.429s
CS-137	2643.33	661.21	14.	6.	0.003	92.84	1.451s
EU-154	2894.01	723.89	26.	-4.	-0.002	189.20	1.503s
BI-212	2909.25	727.70	18.	8.	0.005	81.30	1.507s
EU-152	3114.82	779.09	21.	-2.	-0.001	394.59	1.550s
BI-212	3143.80	786.33	16.	7.	0.004	93.60	1.556s
CS-134	3210.21	802.93	19.	1.	0.000	784.65	1.570s
TL-208	3443.93	861.35	11.	7.	0.004	73.50	1.618s
EU-154	3489.29	872.69	20.	-4.	-0.002	164.76	1.629s
Pa-234	3520.65	880.53	7.	2.	0.001	180.22	1.635D
Pa-234	3531.49	883.24	5.	4.	0.002	106.86	1.637D
AC-228	3643.32	911.19	14.	59.	0.033	16.65	0.547s
AC-228	3873.11	968.63	21.	13.	0.007	46.01	1.707s
EU-154	3981.35	995.68	18.	5.	0.003	119.78	1.729s
EU-154	4017.82	1004.79	15.	2.	0.001	255.49	1.736s
EU-152	4439.89	1110.26	15.	-1.	0.000	760.97	1.821s
BI-214	4481.03	1120.54	7.	23.	0.013	26.64	0.649s
CO-60	4690.35	1172.85	24.	-3.	-0.002	219.63	1.869s
EU-154	5094.82	1273.90	19.	-4.	-0.002	181.14	1.946s
CO-60	5332.87	1333.37	15.	-1.	-0.001	512.02	1.990s
EU-152	5627.88	1407.06	8.	3.	0.002	127.63	2.046s
K-40	5842.87	1460.76	20.	241.	0.134	6.75	2.085s

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	Peak Energy keV	Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	-3.5510E-01				5.31E+01	
			477.60	-3.551E-01	?(	6.733E+00 5.21E+02 1.05E+01	G
K-40	N	1.4652E+02				4.66E+11	
			1460.83	1.465E+02	(P	1.426E+01 6.75E+00 1.07E+01	G
CO-60	F	-6.5534E-02				1.93E+03	
			1332.50	-6.553E-02	?(	1.249E+00 5.12E+02 1.00E+02	G
			1173.24	-1.763E-01	+	1.383E+00 2.20E+02 9.99E+01	G
I-131	I	3.9845E-01				8.02E+00	
			364.48	1.214E-01	@(	7.147E-01 1.67E+02 8.17E+01	G
			284.30	3.896E-02	&	8.092E+00 5.64E+03 6.14E+00	G
			636.97	3.556E+00	(	1.042E+01 8.60E+01 7.17E+00	G
CS-134	I	2.0357E-01				7.54E+02	
			604.71	1.887E-01	(	8.633E-01 1.31E+02 9.76E+01	G
			795.87	-4.698E-04	%	1.129E+00 6.46E+04 8.55E+01	G
			569.32	-1.422E-01	&	5.112E+00 9.79E+02 1.54E+01	G
			801.95	3.709E-01	?(	1.076E+01 7.85E+02 8.69E+00	G
			563.24	-1.089E+00	+	1.091E+01 2.82E+02 8.35E+00	G
CS-137	I	2.6076E-01				1.10E+04	
			661.66	2.608E-01	?(	8.328E-01 9.28E+01 8.52E+01	G
EU-152	F	3.3713E-01				4.94E+03	
			344.29	0.000E+00	&(	3.303E+00 1.00E+03 2.65E+01	G
			121.78	1.360E-01	?(	1.945E+00 4.12E+02 2.86E+01	G
			778.92	-5.133E-01	&	7.380E+00 3.95E+02 1.29E+01	G
			964.11	0.000E+00	-	1.924E+01 1.00E+03 1.46E+01	G
			1112.07	-2.820E-01	+	8.028E+00 7.61E+02 1.36E+01	G
			1408.00	1.036E+00	?(	4.763E+00 1.28E+02 2.10E+01	G
EU-154	I	3.7082E-01				3.14E+03	
			873.23	-1.422E+00	?(	8.319E+00 1.65E+02 1.23E+01	G
			123.10	2.318E-01	+	1.284E+00 1.62E+02 4.08E+01	G
			1274.54	-5.928E-01	+	3.833E+00 1.81E+02 3.52E+01	G
			723.36	-7.417E-01	&	4.964E+00 1.89E+02 2.02E+01	G
			1004.77	5.898E-01	&	5.517E+00 2.55E+02 1.80E+01	G
			996.33	2.446E+00	?(	1.024E+01 1.20E+02 1.06E+01	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
EU-155	I	7.6854E-01					1.81E+03	
			105.31	1.102E+00	&(	2.502E+00	6.85E+01	2.12E+01 G
			86.54	5.384E-01	&(	2.287E+00	1.26E+02	3.07E+01 G
TL-208	N	2.5989E+00					6.98E+02	
			583.02	2.606E+00	(P	8.064E-01	1.40E+01	8.45E+01 G
			277.28	0.000E+00	-	1.179E+01	1.00E+03	6.31E+00 G
			860.56	2.547E+00	?(	6.275E+00	7.35E+01	1.24E+01 G
PB-210	N	-4.0139E+00					8.14E+03	
			46.54	-4.014E+00	?(P	2.895E+01	5.00E+01	4.25E+00 G
PB-212	N	7.0056E+00					6.98E+02	
			238.63	7.006E+00	(P	1.771E+00	1.07E+01	4.33E+01 G
			300.03	1.444E+01	+	1.179E+01	3.49E+01	3.28E+00 G
PB-214	N	6.6756E+00					5.84E+05	
			351.93	6.386E+00	*(P	1.770E+00	1.20E+01	3.76E+01 G
			295.09	7.240E+00	*(P	3.354E+00	1.96E+01	1.93E+01 G
			242.00	-1.209E+00	& P	1.174E+01	4.57E+02	7.43E+00 G
BI-212	N	6.5546E+00					6.98E+02	
			727.17	4.093E+00	&(	1.126E+01	8.13E+01	7.55E+00 G
			785.42	2.107E+01	?(	6.772E+01	9.36E+01	1.28E+00 G
BI-214	N	4.7030E+00					5.84E+05	
			609.31	4.703E+00	(P	1.198E+00	1.16E+01	4.61E+01 G
			1120.29	7.913E+00	+ P	5.333E+00	2.66E+01	1.51E+01 G
			1764.49	-1.528E+00	% P	5.354E+00	1.00E+03	1.54E+01 G
AC-228	N	9.5979E+00					2.10E+03	
			911.07	9.205E+00	(P	3.080E+00	1.66E+01	2.90E+01 G
			968.97	3.495E+00	- P	6.441E+00	4.60E+01	1.75E+01 G
			338.32	1.055E+01	(P	3.903E+00	1.56E+01	1.20E+01 G
								Energy duplication
			93.35	1.907E+01	+ P	1.026E+01	2.19E+01	5.56E+00 XA
Pa-234	N	8.6209E-01					1.63E+12	
			131.29	2.059E-01	?(	3.137E+00	4.39E+02	1.80E+01 G
			569.47	-2.727E-01	+	9.593E+00	9.59E+02	8.20E+00 G
			946.02	0.000E+00	-	7.888E+00	1.00E+03	1.34E+01 G
			883.24	1.626E+00	(	6.208E+00	1.07E+02	9.60E+00 G
			880.53	1.609E+00	(	1.084E+01	1.80E+02	6.00E+00 G
TH-234	N	-3.6086E+00					1.63E+12	
			63.29	-3.609E+00	?(P	2.678E+01	1.70E+02	3.81E+00 G
			92.59	-1.766E+00	+ P	1.154E+01	9.58E+01	5.58E+00 G

```
 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

PA-234M  N  -1.4161E+01                                      1.63E+12
                        1001.00-1.416E+01 %(P 1.473E+02 3.57E+03 8.37E-01 G
                         766.41-5.149E+01 & P 3.128E+02 9.47E+02 2.94E-01 G

Ra-226   N   3.4216E+00                                      5.84E+05
                         185.99 3.422E+00  (P 2.133E+01 5.07E+01 3.28E+00 G

U-235    N   2.9625E+00                                      2.57E+11
                         143.79 2.684E+00 ?(  4.420E+00 5.09E+01 1.10E+01 G
                         205.33 6.972E-03 %   9.967E+00 3.97E+04 5.01E+00 G
                         163.38 3.563E+00 ?(  1.219E+01 1.01E+02 5.08E+00 G
                                                          Energy duplication
                          93.35 8.372E+00 *   1.127E+01 4.19E+01 5.81E+00 X

AM-241   T  -6.3396E-02                                      1.58E+05
                          59.54-6.340E-02 %(  2.661E+00 1.21E+03 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.
   + - 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	
PB-210	46.63	100.	-7.	-0.004	49.96	-4.014E+00	P
TH-234	63.37	158.	-8.	-0.005	170.40	-3.609E+00	P
EU-155	87.88	119.	13.	0.007	125.59	5.384E-01	
TH-234	94.44	106.	-8.	-0.004	95.84	-1.766E+00	P
U-235	93.35	110.	38.	0.021	41.94	8.372E+00	
EU-155	105.09	75.	19.	0.011	68.55	1.102E+00	
EU-152	121.45	84.	3.	0.002	411.88	1.360E-01	
EU-154	123.75	73.	8.	0.004	161.50	2.318E-01	
U-235	144.47	57.	23.	0.013	50.87	2.684E+00	
U-235	164.06	83.	13.	0.007	101.40	3.563E+00	
Ra-226	185.45	94.	8.	0.004	50.73	3.422E+00	P
I-131	364.59	24.	4.	0.002	166.69	1.214E-01	
BE-7	477.82	24.	-1.	-0.001	521.20	-3.551E-01	
CS-134	563.92	32.	-3.	-0.002	281.64	-1.089E+00	
CS-134	568.75	23.	-1.	0.000	979.08	-1.422E-01	
CS-134	604.07	24.	6.	0.003	131.13	1.887E-01	
I-131	637.11	17.	7.	0.004	86.05	3.556E+00	
CS-137	661.21	14.	6.	0.003	92.84	2.608E-01	
EU-154	723.89	26.	-4.	-0.002	189.20	-7.417E-01	
BI-212	727.70	18.	8.	0.005	81.30	4.093E+00	
EU-152	779.09	21.	-2.	-0.001	394.59	-5.133E-01	
BI-212	786.33	16.	7.	0.004	93.60	2.107E+01	
CS-134	802.93	19.	1.	0.000	784.65	3.709E-01	
EU-154	872.69	20.	-4.	-0.002	164.76	-1.422E+00	
EU-154	995.68	18.	5.	0.003	119.78	2.446E+00	
EU-154	1004.79	15.	2.	0.001	255.49	5.898E-01	
EU-152	1110.26	15.	-1.	0.000	760.97	-2.820E-01	
CO-60	1172.85	24.	-3.	-0.002	219.63	-1.763E-01	
EU-154	1273.90	19.	-4.	-0.002	181.14	-5.928E-01	
CO-60	1333.37	15.	-1.	-0.001	512.02	-6.553E-02	
EU-152	1407.06	8.	3.	0.002	127.63	1.036E+00	
K-40	1460.76	20.	241.	0.134	6.75	1.465E+02	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 *****

Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	-3.5509E-01	-3.5510E-01	5.212E+02%	6.73E+00
K-40	#	1.4652E+02	1.4652E+02	6.885E+00%	1.43E+01
CO-60	#A	-6.5534E-02	-6.5534E-02	5.120E+02%	1.25E+00
I-131	#A	3.9843E-01	3.9845E-01	8.605E+01%	7.15E-01

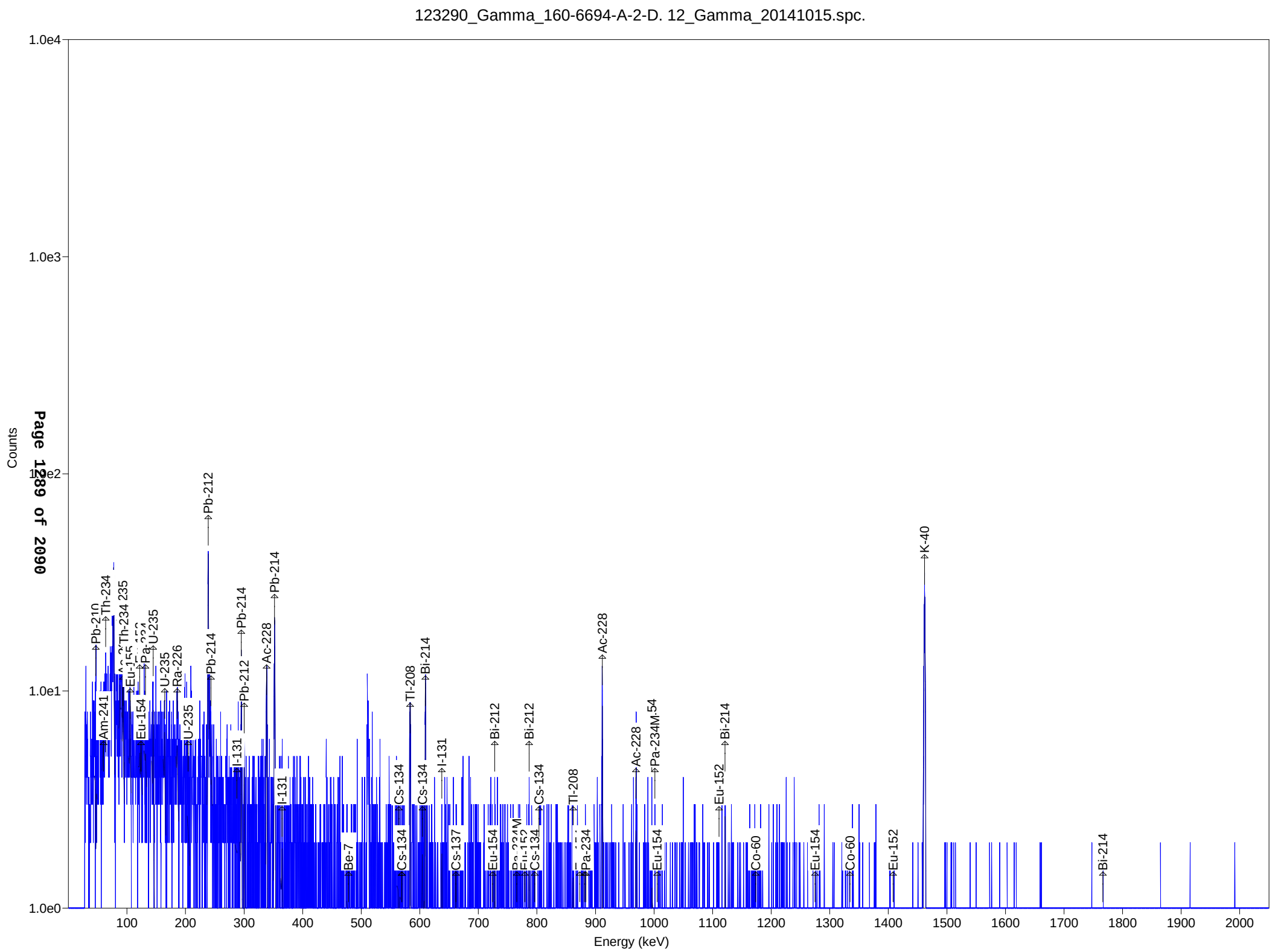
CS-134 #A	2.0357E-01	2.0357E-01	1.311E+02%	8.63E-01
CS-137 #A	2.6076E-01	2.6076E-01	9.284E+01%	8.33E-01
EU-152 #A	3.3713E-01	3.3713E-01	1.276E+02%	3.30E+00
EU-154 #A	3.7082E-01	3.7082E-01	1.018E+02%	8.32E+00
EU-155 #A	7.6854E-01	7.6854E-01	6.855E+01%	2.50E+00
TL-208	2.5989E+00	2.5989E+00	1.541E+01%	8.06E-01
PB-210 #A	-4.0139E+00	-4.0139E+00	2.855E+02%	2.90E+01
PB-212	7.0056E+00	7.0056E+00	1.164E+01%	1.77E+00
PB-214 #	6.6756E+00	6.6756E+00	1.291E+01%	1.77E+00
BI-212 #A	6.5546E+00	6.5546E+00	6.199E+01%	1.13E+01
BI-214	4.7030E+00	4.7030E+00	1.321E+01%	1.20E+00
AC-228	9.5979E+00	9.5979E+00	1.237E+01%	3.08E+00
Pa-234 A	8.6209E-01	8.6209E-01	1.069E+02%	3.14E+00
TH-234 #A	-3.6086E+00	-3.6086E+00	5.469E+02%	2.68E+01
PA-234M#A	-1.4161E+01	-1.4161E+01	7.411E+03%	1.47E+02
Ra-226 #A	3.4216E+00	3.4216E+00	1.732E+02%	2.13E+01
U-235 #A	2.9625E+00	2.9625E+00	5.087E+01%	4.42E+00
AM-241 #A	-6.3396E-02	-6.3396E-02	1.213E+03%	2.66E+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 (910.9 to 1999.4 keV) 3.058E+01 Bq/Sample
Total Decayed Activity (910.9 to 1999.4 keV) 3.0581013E+01 Bq/Sample

The library has energies which are not separable.


123290_Gamma_160-6694-A-2-D. 12_Gamma_20141015.spc.
Counts
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Energy (keV)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Pb-210
Th-234
Th-234
235
Eu-154
Pa-234
U-235
U-235
Ra-226
Am-241
U-235
Pb-212
Pb-214
Pb-212
I-131
Ac-228
Pb-214
I-131
Be-7
Cs-134
Cs-134
Tl-208
Bi-214
Cs-134
I-131
Cs-137
Eu-154
Bi-212
Pa-234M
Eu-152
Bi-212
Cs-134
Tl-208
Pa-234
Ac-228
Ac-228
Pa-234M
Eu-154
Eu-152
Bi-214
Co-60
Eu-154
Co-60
Eu-152
K-40
Bi-214

Test America St. Louis Spectrum ID: 15_Gamma_20140931

Sample Description: 123290_Gamma_160-6694-A-3-D
Detector: Ge15 SN/11012216
Batch ID: 123290
Work Order Number: Gamma
Lot Number: 160-6694-A-3-D

Decay to Time: 5/21/2014 14:25 Live Time: 1800 sec
Acquisition Time: 5/21/2014 14:26:18 Real Time: 1801 sec
Analysis Time: 5/21/2014 14:56 Dead Time: 0.06 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 15_Soil_TunaCan.Clb
Efficiency Cal Desc: 15_TunaCan_90099_032212
Efficiency Cal Date: 3/22/2012 13:03
Energy Cal Date: 2/28/2012 16:29
Library: Client_Short_no ingrowth Rev2.li
Bkgd Correction File: 15_2014-05-03_0613.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	-5.045E-01	438.9	2.214E+00	2.214E+00	8.112E+00
K-40	9.907E+01	9.7	9.582E+00	1.084E+01	1.035E+01
CO-60	2.699E-01	69.2	1.867E-01	1.872E-01	6.475E-01
I-131	-7.549E-02	286.4	2.162E-01	2.162E-01	7.897E-01
CS-134	-9.726E-02	190.9	1.857E-01	1.857E-01	1.118E+00
CS-137	9.938E-01	38.1	3.785E-01	3.820E-01	1.126E+00
EU-152	-1.889E-02	214.4	4.051E-02	4.052E-02	2.465E+00
EU-154	7.988E-01	297.3	2.375E+00	2.375E+00	8.888E+00
EU-155	1.148E+00	39.7	4.556E-01	4.599E-01	3.153E+00
TL-208	2.183E+00	16.4	3.575E-01	3.750E-01	7.364E-01
PB-210	3.381E+01	26.1	8.806E+00	9.027E+00	2.434E+01
PB-212	4.874E+00	15.9	7.757E-01	8.373E-01	1.725E+00
PB-214	5.939E+00	12.2	7.252E-01	7.881E-01	1.282E+00
BI-212	4.530E+00	78.3	3.548E+00	3.555E+00	1.200E+01
BI-214	4.933E+00	17.0	8.402E-01	8.785E-01	1.819E+00
AC-228	7.189E+00	16.5	1.188E+00	1.244E+00	3.991E+00
Pa-234	5.669E-01	113.9	6.459E-01	6.465E-01	3.010E+00
TH-234	8.859E+00	46.5	4.122E+00	4.148E+00	2.468E+01
PA-234M	1.665E+00	1869.0	3.112E+01	3.112E+01	1.240E+02
Ra-226	2.255E+01	35.1	7.924E+00	8.165E+00	2.014E+01
U-235	2.445E+00	63.9	1.563E+00	1.568E+00	4.626E+00
AM-241	1.168E+00	46.2	5.395E-01	5.429E-01	1.716E+00
Total	2.030E+02				

Analyst: April Bean

TestAmerica, Inc. Spectrum name: 15_Gamma_20140931.An1

Sample description
123290_Gamma_160-6694-A-3-D

Spectrum Filename: C:\User\SPC\Det15\15_Gamma_20140931.An1

Acquisition information
Start time:	5/21/2014 2:26:18 PM
Live time:	1800
Real time:	1801
Dead time:	0.06 %
Detector ID:	15

Detector system
Ge15 SN/11012216

Calibration
Filename: 15_Soil_TunaCan.Clb
15_TunaCan_90099_032212

Energy Calibration
Created:	2/28/2012 4:29:17 PM
Zero offset:	0.044 keV
Gain:	0.250 keV/channel
Quadratic:	-3.267E-08 keV/channel^2

Efficiency Calibration
Created:	3/22/2012 1:03:01 PM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 1.00 %
Log(Eff):	-6.894897E-01 + (-3.290613E-01*Log(E)) + (-3.875629E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 1.13 %
Log(Eff):	-2.362677E+01 + (8.666669E+00*Log(E)) + (-9.214638E-01*Log(E)^2)

Library Files
Main analysis library:	Client_Short_no ingrowth Rev2.li
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.57keV)
Stop channel:	8000 (1999.52keV)
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

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	5/21/2014 2:25:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	15_2014-05-03_0613.PBC 5/3/2014 6:13:31 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 18 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0648

***** 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
46.44	73.	18.14	0.91	1.950E-02	46.54	4.250	3.381E+01	PB210
58.78	21.	46.20	0.96	2.737E-02	59.54	35.900	PBC<MDA	AM241
63.08	18.	37.88	0.96	2.924E-02	63.29	3.810	PBC<MDA	TH234
					63.29	3.810	PBC<MDA	TH234
74.74	68.	23.57	0.97	3.378E-02				
77.23	99.	16.71	0.97	3.455E-02				
87.12	39.	39.67	0.98	3.679E-02	86.54	30.700	PBC<MDA	EU155
					86.54	30.700	1.941E+00	EU155
92.58	63.	23.42	0.99	3.785E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	1.586E+01	U235
					93.35	5.561	1.657E+01	AC228
					92.59	5.584	9.301E+00	TH234
					93.35	5.810	1.586E+01	U235
92.58	63.	23.42	0.99	3.785E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	1.586E+01	U235
					93.35	5.561	1.657E+01	AC228
92.60	34.	26.26	0.99	3.776E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	PBC<MDA	U235
					93.35	5.561	PBC<MDA	AC228
121.78	4.	320.46	1.02	3.848E-02	121.78	28.580	PBC<MDA	EU152
123.57	1.	887.11	1.02	3.840E-02	123.10	40.790	PBC<MDA	EU154
143.76	16.	63.93	1.04	3.639E-02	143.79	10.960	PBC<MDA	U235
					143.79	10.960	2.194E+00	U235
185.83	42.	25.60	0.80	3.120E-02	185.99	3.280	2.255E+01	Ra226
205.01	8.	129.67	1.09	2.900E-02	205.33	5.010	PBC<MDA	U235
					205.33	5.010	2.992E+00	U235
238.66	109.	14.42	1.04	2.592E-02	238.63	43.300	4.874E+00	PB212
277.27	5.	109.31	1.15	2.313E-02	277.28	6.310	PBC<MDA	TL208
295.29	55.	19.38	1.32	2.220E-02	295.09	19.300	7.181E+00	PB214

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
338.25	39.	22.21	0.88	1.983E-02	338.32	12.010	9.097E+00	AC228
351.91	69.	14.85	1.47	1.923E-02	351.93	37.600	5.302E+00	PB214
563.66	1.	411.46	1.39	1.319E-02	563.24	8.350	PBC<MDA	CS134
583.19	43.	14.29	0.81	1.282E-02	583.02	84.500	2.192E+00	TL208
609.37	53.	14.92	1.07	1.236E-02	609.31	46.090	5.196E+00	BI214
662.12	18.	38.09	1.47	1.155E-02	661.66	85.210	PBC<MDA	CS137
727.30	7.	78.32	1.52	1.067E-02	727.17	7.550	PBC<MDA	BI212
860.81	3.	139.13	1.62	9.252E-03	860.56	12.420	PBC<MDA	TL208
873.58	2.	297.27	1.63	9.137E-03	873.23	12.270	PBC<MDA	EU154
881.19	4.	135.78	1.64	9.072E-03	880.53	6.000	PBC<MDA	Pa234
911.68	29.	24.50	1.66	8.811E-03	911.07	29.000	6.398E+00	AC228
968.90	11.	56.48	1.70	8.357E-03	968.97	17.460	PBC<MDA	AC228
1119.93	5.	71.22	1.80	7.368E-03	1120.29	15.100	PBC<MDA	BI214
1331.70	3.	69.19	1.94	6.325E-03	1332.50	99.980	PBC<MDA	CO60
1461.03	111.	9.41	2.02	5.828E-03	1460.83	10.670	9.907E+01	K40
1764.76	6.	44.19	2.18	4.916E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide
298.54	74.74	100.	63.	1.875E+03	30.74	0.359	- s
308.50	77.23	81.	85.	2.470E+03	20.76	0.492	- 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_Short_no ingrowth Rev2.li

********** 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	185.44	46.44	52.	51.	0.028	18.14	0.907s
AM-241	234.76	58.78	35.	21.	0.011	46.20	0.958s
TH-234	251.96	63.08	101.	18.	0.010	37.88	0.962s
EU-155	348.05	87.12	103.	39.	0.022	39.67	0.983
TH-234	369.94	92.60	126.	34.	0.019	26.26	0.989s
U-235	372.95	93.35	77.	63.	0.035	23.42	0.989D
AC-228	372.95	93.35	77.	63.	0.035	23.42	0.989D
EU-152	486.59	121.78	67.	4.	0.002	320.46	1.015s
EU-154	493.74	123.57	66.	1.	0.001	887.11	1.017s
Pa-234	521.92	130.62	54.	-6.	-0.003	182.98	1.024s
U-235	574.44	143.76	43.	16.	0.009	63.93	1.036

TestAmerica, Inc. Spectrum name: 15_Gamma_20140931.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Ra-226	742.63	185.83	54.	42.	0.023	25.60	0.798s
U-235	819.31	205.01	48.	8.	0.004	129.67	1.091s
PB-212	953.84	238.66	48.	98.	0.055	14.42	1.039
PB-214	959.04	239.96	114.	-37.	-0.021	44.05	1.123s
TL-208	1108.18	277.27	25.	5.	0.003	109.31	1.154
PB-214	1180.24	295.29	16.	55.	0.031	19.38	1.324s
PB-212	1202.00	300.73	24.	-2.	-0.001	321.35	1.174
AC-228	1352.01	338.25	9.	39.	0.022	22.21	0.884s
EU-152	1383.10	346.03	19.	-2.	-0.001	284.90	1.212s
PB-214	1406.61	351.91	9.	69.	0.038	14.85	1.472s
I-131	1445.29	361.58	17.	-2.	-0.001	286.37	1.229s
BE-7	1908.43	477.41	19.	-1.	-0.001	438.87	1.324s
CS-134	2253.36	563.66	15.	1.	0.001	411.46	1.394s
CS-134	2277.65	569.73	15.	-2.	-0.001	302.11	1.399s
Pa-234	2277.17	569.61	15.	-2.	-0.001	302.20	1.399s
TL-208	2331.47	583.19	6.	43.	0.024	14.29	0.813s
CS-134	2419.74	605.26	22.	-4.	-0.002	190.89	1.427s
BI-214	2436.18	609.37	12.	53.	0.030	14.92	1.072s
CS-137	2647.14	662.12	14.	18.	0.010	38.09	1.472s
EU-154	2890.59	722.99	15.	-4.	-0.002	146.45	1.519s
BI-212	2907.84	727.30	10.	7.	0.004	78.32	1.522s
PA-234M	3063.01	766.09	20.	-4.	-0.002	151.88	1.552s
BI-212	3138.84	785.05	13.	-4.	-0.002	150.46	1.566s
CS-134	3181.89	795.81	16.	-1.	-0.001	436.93	1.574s
CS-134	3204.91	801.56	18.	-2.	-0.001	310.10	1.578s
TL-208	3441.92	860.81	9.	3.	0.002	139.13	1.621s
EU-154	3492.99	873.58	11.	2.	0.001	297.27	1.631s
Pa-234	3523.45	881.19	10.	4.	0.002	135.78	1.636s
Pa-234	3534.02	883.83	16.	-3.	-0.002	182.85	1.638s
AC-228	3645.44	911.68	11.	29.	0.016	24.50	1.658
EU-152	3865.61	966.71	23.	-4.	-0.002	164.52	1.696s
AC-228	3874.36	968.90	13.	11.	0.006	56.48	1.699s
EU-152	4428.52	1107.40	10.	-1.	-0.001	482.32	1.797s
BI-214	4478.66	1119.93	13.	5.	0.003	71.22	1.803s
CO-60	4692.34	1173.33	10.	-1.	-0.001	325.47	1.838s
CO-60	5326.14	1331.70	1.	3.	0.002	69.19	1.938s
K-40	5843.81	1461.03	4.	111.	0.062	9.41	2.015s
BI-214	7059.87	1764.76	6.	6.	0.003	44.19	2.180s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	-5.0448E-01				5.31E+01	
			477.60	-5.045E-01	?(	8.112E+00	4.39E+02 1.05E+01 G
K-40	N	9.9073E+01				4.66E+11	
			1460.83	9.907E+01	?(P	1.035E+01	9.41E+00 1.07E+01 G
CO-60	F	2.6990E-01				1.93E+03	
			1332.50	2.699E-01	&(	6.475E-01	6.92E+01 1.00E+02 G
			1173.24	-1.095E-01	-	1.347E+00	3.25E+02 9.99E+01 G
I-131	I	-7.5494E-02				8.02E+00	
			364.48	-7.549E-02	?(	7.897E-01	2.86E+02 8.17E+01 G
			284.30	0.000E+00	&	1.309E+01	1.00E+03 6.14E+00 G
			636.97	1.940E-01	%	9.993E+00	1.30E+03 7.17E+00 G
CS-134	I	-9.7255E-02				7.54E+02	
			604.71	-1.644E-01	?(	1.118E+00	1.91E+02 9.76E+01 G
			795.87	-8.619E-02	+	1.394E+00	4.37E+02 8.55E+01 G
			569.32	-5.172E-01	+	5.745E+00	3.02E+02 1.54E+01 G
			801.95	-1.279E+00	+	1.448E+01	3.10E+02 8.69E+00 G
			563.24	6.880E-01	&(	1.049E+01	4.11E+02 8.35E+00 G
CS-137	I	9.9383E-01				1.10E+04	
			661.66	9.938E-01	?(	1.126E+00	3.81E+01 8.52E+01 G
EU-152	F	-1.8894E-02				4.94E+03	
			344.29	-2.383E-01	?(	2.465E+00	2.85E+02 2.65E+01 G
			121.78	1.845E-01	?(	2.059E+00	3.20E+02 2.86E+01 G
			778.92	2.142E-01	&	8.163E+00	1.00E+03 1.29E+01 G
			964.11	-1.960E+00	+	1.139E+01	1.65E+02 1.46E+01 G
			1112.07	-5.333E-01	+	9.773E+00	4.82E+02 1.36E+01 G
			1408.00	0.000E+00	+	3.237E+00	1.00E+03 2.10E+01 G
EU-154	I	7.9878E-01				3.14E+03	
			873.23	7.988E-01	?(	8.888E+00	2.97E+02 1.23E+01 G
			123.10	4.622E-02	&	1.441E+00	8.87E+02 4.08E+01 G
			1274.54	-2.242E-02	%	4.121E+00	4.71E+03 3.52E+01 G
			723.36	-1.014E+00	+	5.289E+00	1.46E+02 2.02E+01 G
			1004.77	0.000E+00	-	9.068E+00	1.00E+03 1.80E+01 G
			996.33	0.000E+00	-	1.142E+01	1.00E+03 1.06E+01 G

Nuclide		Ave activity	Energy		Activity	Code	Peak	MDA	Comments
EU-155	I	1.1484E+00						1.81E+03	
			105.31	0.000E+00	&(3.153E+00		1.00E+03	2.12E+01	G
			86.54	1.941E+00	&(2.458E+00		3.97E+01	3.07E+01	G
TL-208	N	2.1831E+00						6.98E+02	
			583.02	2.192E+00	(P 7.364E-01		1.43E+01	8.45E+01	G
			277.28	2.059E+00	(P 9.964E+00		1.09E+02	6.31E+00	G
			860.56	1.618E+00	- 8.133E+00		1.39E+02	1.24E+01	G
PB-210	N	3.3809E+01						8.14E+03	
			46.54	3.381E+01	*(P 2.434E+01		1.81E+01	4.25E+00	G
PB-212	N	4.8736E+00						6.98E+02	
			238.63	4.874E+00	(P 1.725E+00		1.44E+01	4.33E+01	G
			300.03	-1.730E+00	- 2.003E+01		3.21E+02	3.28E+00	G
PB-214	N	5.9392E+00						5.84E+05	
			351.93	5.302E+00	(1.282E+00		1.49E+01	3.76E+01	G
			295.09	7.181E+00	(2.787E+00		1.94E+01	1.93E+01	G
			242.00	-1.076E+01	- 1.528E+01		4.41E+01	7.43E+00	G
BI-212	N	4.5298E+00						6.98E+02	
			727.17	4.530E+00	&(1.200E+01		7.83E+01	7.55E+00	G
			785.42	-1.557E+01	+ 8.407E+01		1.50E+02	1.28E+00	G
BI-214	N	4.9334E+00						5.84E+05	
			609.31	5.196E+00	(P 1.819E+00		1.49E+01	4.61E+01	G
			1120.29	2.453E+00	- P 9.771E+00		7.12E+01	1.51E+01	G
			1764.49	4.149E+00	?(P 1.016E+01		4.42E+01	1.54E+01	G
AC-228	N	7.1886E+00						2.10E+03	
			911.07	6.398E+00	?(3.991E+00		2.45E+01	2.90E+01	G
			968.97	4.048E+00	- 7.359E+00		5.65E+01	1.75E+01	G
			338.32	9.097E+00	(3.893E+00		2.22E+01	1.20E+01	G
								Energy duplication	
			93.35	1.657E+01	+ 1.149E+01		2.34E+01	5.56E+00	XA
Pa-234	N	5.6690E-01						1.63E+12	
			131.29	-4.748E-01	?(3.010E+00		1.83E+02	1.80E+01	G
			569.47	-9.746E-01	+ 1.082E+01		3.02E+02	8.20E+00	G
			946.02	0.000E+00	+ 8.242E+00		1.00E+03	1.34E+01	G
			883.24	-2.072E+00	+ 1.362E+01		1.83E+02	9.60E+00	G
			880.53	3.692E+00	?(1.800E+01		1.36E+02	6.00E+00	G
TH-234	N	8.8592E+00						1.63E+12	
			63.29	8.815E+00	(P 2.468E+01		3.79E+01	3.81E+00	G
			92.59	8.889E+00	(P 1.450E+01		2.63E+01	5.58E+00	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PA-234M	N	1.6652E+00					1.63E+12	
			1001.00	1.665E+00	%(	1.240E+02	1.87E+03	8.37E-01 G
			766.41	-8.068E+01	+	4.333E+02	1.52E+02	2.94E-01 G
Ra-226	N	2.2554E+01					5.84E+05	
			185.99	2.255E+01	(P	2.014E+01	2.56E+01	3.28E+00 G
U-235	N	2.4445E+00					2.57E+11	
			143.79	2.194E+00	?(	4.626E+00	6.39E+01	1.10E+01 G
			205.33	2.992E+00	?(	1.332E+01	1.30E+02	5.01E+00 G
			163.38	4.593E-02	&	1.238E+01	7.60E+03	5.08E+00 G
								Energy duplication
			93.35	1.586E+01	?	1.100E+01	2.34E+01	5.81E+00 X
AM-241	T	1.1679E+00					1.58E+05	
			59.54	1.168E+00	&(	1.716E+00	4.62E+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.
+ - 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	
AM-241	58.78	35.	21.	0.011	46.20	1.168E+00	
TH-234	63.08	101.	18.	0.010	37.88	8.815E+00	P
EU-155	87.12	103.	39.	0.022	39.67	1.941E+00	
TH-234	92.60	126.	34.	0.019	26.26	8.889E+00	P
U-235	93.35	77.	63.	0.035	23.42	1.586E+01	
EU-152	121.78	67.	4.	0.002	320.46	1.845E-01	
EU-154	123.57	66.	1.	0.001	887.11	4.622E-02	
Pa-234	130.62	54.	-6.	-0.003	182.98	-4.748E-01	
U-235	143.76	43.	16.	0.009	63.93	2.194E+00	
U-235	205.01	48.	8.	0.004	129.67	2.992E+00	
EU-152	346.03	19.	-2.	-0.001	284.90	-2.383E-01	
I-131	361.58	17.	-2.	-0.001	286.37	-7.549E-02	
BE-7	477.41	19.	-1.	-0.001	438.87	-5.045E-01	
CS-134	563.66	15.	1.	0.001	411.46	6.880E-01	
CS-134	569.73	15.	-2.	-0.001	302.11	-5.172E-01	
Pa-234	569.61	15.	-2.	-0.001	302.20	-9.746E-01	
CS-134	605.26	22.	-4.	-0.002	190.89	-1.644E-01	
EU-154	722.99	15.	-4.	-0.002	146.45	-1.014E+00	
BI-212	727.30	10.	7.	0.004	78.32	4.530E+00	
PA-234M	766.09	20.	-4.	-0.002	151.88	-8.068E+01	
BI-212	785.05	13.	-4.	-0.002	150.46	-1.557E+01	
CS-134	795.81	16.	-1.	-0.001	436.93	-8.619E-02	
CS-134	801.56	18.	-2.	-0.001	310.10	-1.279E+00	
EU-154	873.58	11.	2.	0.001	297.27	7.988E-01	
Pa-234	881.19	10.	4.	0.002	135.78	3.692E+00	
Pa-234	883.83	16.	-3.	-0.002	182.85	-2.072E+00	
EU-152	966.71	23.	-4.	-0.002	164.52	-1.960E+00	
EU-152	1107.40	10.	-1.	-0.001	482.32	-5.333E-01	
CO-60	1173.33	10.	-1.	-0.001	325.47	-1.095E-01	
CO-60	1331.70	1.	3.	0.002	69.19	2.699E-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 *****

Nuclide		Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	-5.0447E-01	-5.0448E-01	4.389E+02%	8.11E+00
K-40	#	9.9073E+01	9.9073E+01	9.672E+00%	1.04E+01
CO-60	#A	2.6990E-01	2.6990E-01	6.919E+01%	6.47E-01
I-131	#A	-7.5488E-02	-7.5494E-02	2.864E+02%	7.90E-01
CS-134	#A	-9.7255E-02	-9.7255E-02	1.909E+02%	1.12E+00
CS-137	#A	9.9383E-01	9.9383E-01	3.809E+01%	1.13E+00

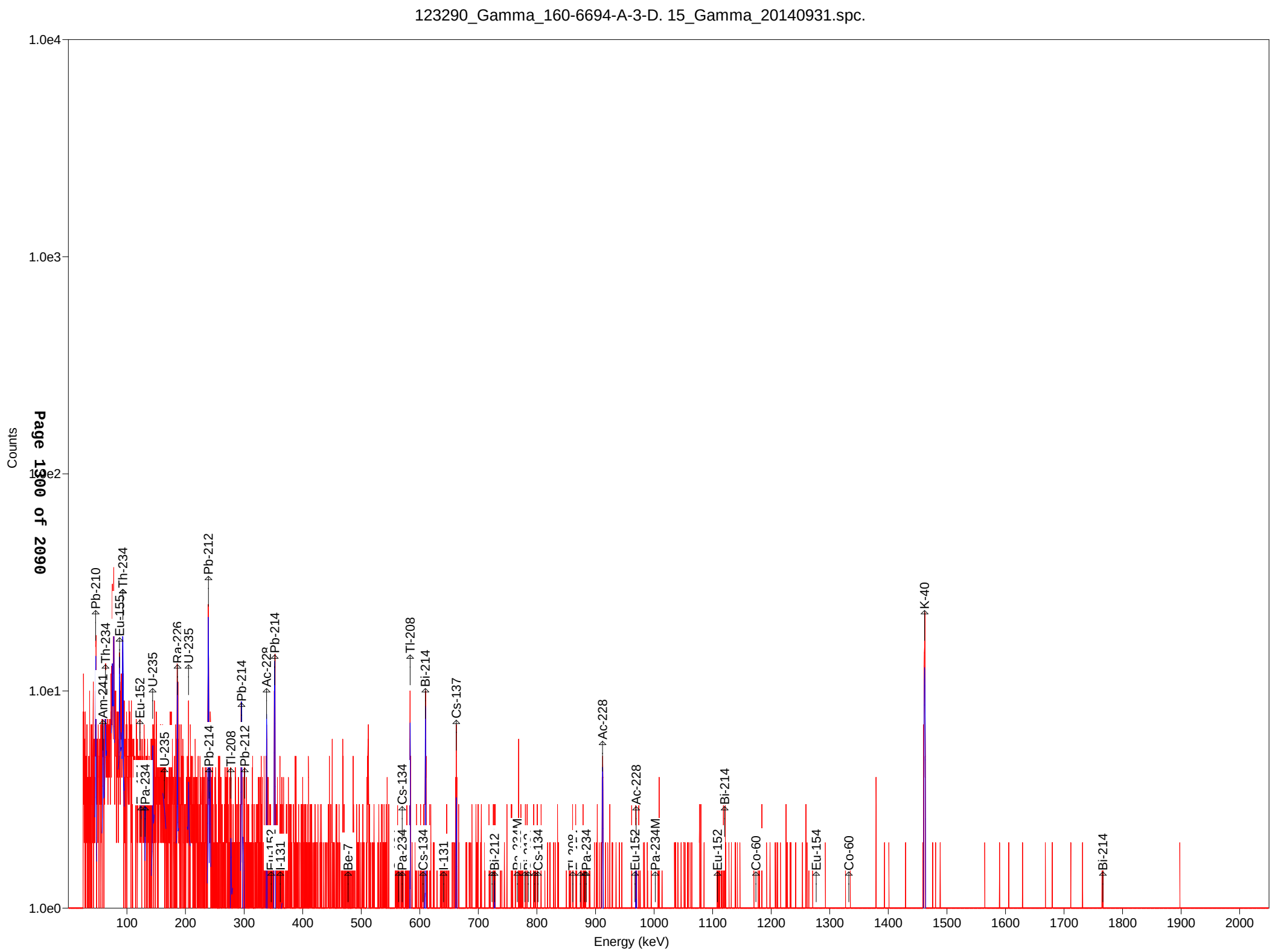
EU-152 #A	-1.8894E-02	-1.8894E-02	2.144E+02%	2.46E+00
EU-154 #A	7.9878E-01	7.9878E-01	2.973E+02%	8.89E+00
EU-155 #A	1.1484E+00	1.1484E+00	3.967E+01%	3.15E+00
TL-208	2.1831E+00	2.1831E+00	1.637E+01%	7.36E-01
PB-210 #	3.3809E+01	3.3809E+01	2.605E+01%	2.43E+01
PB-212	4.8736E+00	4.8736E+00	1.592E+01%	1.72E+00
PB-214	5.9392E+00	5.9392E+00	1.221E+01%	1.28E+00
BI-212 #A	4.5298E+00	4.5298E+00	7.832E+01%	1.20E+01
BI-214	4.9334E+00	4.9334E+00	1.703E+01%	1.82E+00
AC-228	7.1886E+00	7.1886E+00	1.653E+01%	3.99E+00
Pa-234 #A	5.6690E-01	5.6690E-01	1.139E+02%	3.01E+00
TH-234 #A	8.8592E+00	8.8592E+00	4.653E+01%	2.47E+01
PA-234M#A	1.6652E+00	1.6652E+00	1.869E+03%	1.24E+02
Ra-226	2.2554E+01	2.2554E+01	3.513E+01%	2.01E+01
U-235 #A	2.4445E+00	2.4445E+00	6.393E+01%	4.63E+00
AM-241 #A	1.1679E+00	1.1679E+00	4.620E+01%	1.72E+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) 1.815E+02 Bq/Sample
Total Decayed Activity (37.6 to 1999.5 keV) 1.8154678E+02 Bq/Sample

The library has energies which are not separable.


123290_Gamma_160-6694-A-3-D. 15_Gamma_20140931.spc.
Counts
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Energy (keV)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Pb-210
Th-234
Am-241
Eu-155
Th-234
Eu-152
U-235
Pa-234
U-235
Ra-226
U-235
Pb-212
Pb-214
Tl-208
Pb-212
Pb-214
Ac-228
Pb-214
Be-7
Pa-234
Cs-134
Tl-208
Bi-214
I-131
Cs-137
Bi-212
Cs-134
Ac-228
Pa-234
Eu-152
Ac-228
Pa-234M
Eu-152
Bi-214
Co-60
Eu-154
Co-60
K-40
Bi-214

Test America St. Louis Spectrum ID: 17_Gamma_20140807

Sample Description: 123290_Gamma_160-6694-A-4-D
Detector: Ge17 SN/11080671
Batch ID: 123290
Work Order Number: Gamma
Lot Number: 160-6694-A-4-D

Decay to Time: 5/21/2014 14:27 Live Time: 1800 sec
Acquisition Time: 5/21/2014 14:27:45 Real Time: 1805 sec
Analysis Time: 5/21/2014 14:57 Dead Time: 0.29 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 17_Soil_TunaCan.Clb
Efficiency Cal Desc: 17_TunaCan_90099_032612
Efficiency Cal Date: 4/12/2012 09:28
Energy Cal Date: 2/29/2012 10:33
Library: Client_Short_no ingrowth Rev2.li
Bkgd Correction File: 17_2014-05-03_0615.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	0.000E+00	1000.0	4.077E-01	4.077E-01	7.879E+00
K-40	8.219E+01	9.2	7.549E+00	8.641E+00	9.556E+00
CO-60	1.788E-01	154.2	2.757E-01	2.759E-01	1.013E+00
I-131	2.684E-03	7429.0	1.994E-01	1.994E-01	7.392E-01
CS-134	3.805E-01	69.0	2.624E-01	2.631E-01	1.189E+00
CS-137	2.049E+00	20.0	4.102E-01	4.238E-01	7.056E-01
EU-152	7.878E-01	66.7	5.252E-01	5.268E-01	1.905E+00
EU-154	3.919E-01	429.3	1.682E+00	1.682E+00	6.440E+00
EU-155	2.309E-01	292.5	6.754E-01	6.755E-01	2.357E+00
TL-208	3.035E+00	14.5	4.387E-01	4.661E-01	7.797E-01
PB-210	2.878E+01	32.4	9.335E+00	9.487E+00	2.807E+01
PB-212	5.457E+00	11.0	6.003E-01	6.964E-01	1.385E+00
PB-214	4.909E+00	13.5	6.625E-01	7.099E-01	1.518E+00
BI-212	7.511E+00	51.9	3.896E+00	3.915E+00	9.384E+00
BI-214	7.791E+00	12.8	9.966E-01	1.076E+00	1.627E+00
AC-228	5.430E+00	15.9	8.649E-01	9.082E-01	2.626E+00
Pa-234	8.747E-01	63.4	5.545E-01	5.563E-01	3.287E+00
TH-234	7.731E+00	42.7	3.298E+00	3.323E+00	2.277E+01
PA-234M	6.695E+01	56.2	3.761E+01	3.776E+01	1.209E+02
Ra-226	3.382E+01	19.4	6.563E+00	7.197E+00	1.396E+01
U-235	4.791E-01	74.8	3.582E-01	3.590E-01	5.903E+00
AM-241	8.119E-03	9178.0	7.452E-01	7.452E-01	2.596E+00
Total	2.590E+02				

Analyst: April Bean

TestAmerica, Inc. Spectrum name: 17_Gamma_20140807.An1

Sample description
123290_Gamma_160-6694-A-4-D

Spectrum Filename: C:\User\SPC\Det17\17_Gamma_20140807.An1

Acquisition information
Start time:	5/21/2014 2:27:45 PM
Live time:	1800
Real time:	1805
Dead time:	0.29 %
Detector ID:	17

Detector system
Ge17 SN/11080671

Calibration
Filename: 17_Soil_TunaCan.Clb
17_TunaCan_90099_032612

Energy Calibration
Created:	2/29/2012 10:33:23 AM
Zero offset:	0.108 keV
Gain:	0.250 keV/channel
Quadratic:	-2.584E-08 keV/channel^2

Efficiency Calibration
Created:	4/12/2012 9:28:42 AM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 0.91 %
Log(Eff):	-5.264190E-01 + (-4.024164E-01*Log(E)) + (-2.604461E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 1.00 %
Log(Eff):	-2.343889E+01 + (8.582715E+00*Log(E)) + (-9.075430E-01*Log(E)^2)

Library Files
Main analysis library:	Client_Short_no ingrowth Rev2.li
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.63keV)
Stop channel:	8000 (1999.54keV)
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

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	5/21/2014 2:27:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	17_2014-05-03_0615.PBC 5/3/2014 6:15:46 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 21 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0996

***** 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
46.69	81.	18.52	0.51	2.111E-02	46.54	4.250	2.878E+01	PB210
63.55	50.	33.56	0.88	3.178E-02	63.29	3.810	PBC<MDA	TH234
74.84	65.	21.06	0.80	3.681E-02				
77.23	97.	15.08	0.80	3.765E-02				
92.61	26.	22.42	0.82	4.144E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	PBC<MDA	U235
					93.35	5.810	PBC<MDA	U235
92.75	72.	20.14	0.82	4.156E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	1.664E+01	U235
93.37	21.	73.18	0.82	4.156E-02	93.35	5.561	PBC<MDA	AC228
105.66	4.	292.48	0.83	4.278E-02	105.31	21.200	PBC<MDA	EU155
185.67	71.	19.33	1.02	3.546E-02	185.99	3.280	3.382E+01	Ra226
204.76	11.	67.42	0.92	3.312E-02	205.33	5.010	PBC<MDA	U235
					205.33	5.010	PBC<MDA	U235
238.49	151.	9.67	0.77	2.990E-02	238.63	43.300	5.966E+00	PB212
241.86	12.	74.11	0.96	2.960E-02	242.00	7.430	PBC<MDA	PB214
295.24	47.	20.23	1.12	2.580E-02	295.09	19.300	5.218E+00	PB214
300.22	22.	33.90	0.42	2.550E-02	300.03	3.280	1.472E+01	PB212
338.26	32.	26.41	1.05	2.344E-02	338.32	12.010	6.321E+00	AC228
344.70	10.	66.67	1.05	2.315E-02	344.29	26.500	PBC<MDA	EU152
351.79	79.	14.64	0.82	2.280E-02	351.93	37.600	4.750E+00	PB214
561.72	6.	87.45	1.25	1.624E-02	563.24	8.350	PBC<MDA	CS134
569.10	9.	63.39	1.25	1.611E-02	569.32	15.380	PBC<MDA	CS134
					569.47	8.200	3.777E+00	Pa234
569.10	9.	68.96	1.25	1.612E-02	569.32	15.380	PBC<MDA	CS134

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					569.47	8.200	3.592E+00	Pa234
583.19	73.	13.24	1.13	1.584E-02	583.02	84.500	3.035E+00	TL208
609.25	104.	12.15	1.03	1.533E-02	609.31	46.090	7.791E+00	BI214
661.75	45.	20.02	1.02	1.443E-02	661.66	85.210	2.049E+00	CS137
727.33	10.	55.11	1.39	1.345E-02	727.17	7.550	PBC<MDA	BI212
785.15	6.	87.88	1.44	1.270E-02	785.42	1.280	PBC<MDA	BI212
873.09	1.	429.27	1.51	1.172E-02	873.23	12.270	PBC<MDA	EU154
					873.23	12.270	3.919E-01	EU154
880.88	2.	255.43	1.52	1.165E-02	880.53	6.000	PBC<MDA	Pa234
911.58	31.	21.97	1.55	1.135E-02	911.07	29.000	5.216E+00	AC228
946.38	2.	245.73	1.57	1.103E-02	946.02	13.400	PBC<MDA	Pa234
969.11	18.	33.21	1.59	1.083E-02	968.97	17.460	5.172E+00	AC228
1001.03	11.	56.17	1.62	1.057E-02	1001.00	0.837	PBC<MDA	PA234M
1112.56	2.	344.03	1.71	9.752E-03	1112.07	13.644	PBC<MDA	EU152
1120.19	10.	55.31	1.72	9.697E-03	1120.29	15.100	PBC<MDA	BI214
1332.36	3.	154.21	1.89	8.481E-03	1332.50	99.980	PBC<MDA	CO60
1460.81	125.	8.74	0.69	7.894E-03	1460.83	10.670	8.219E+01	K40
1764.75	11.	27.38	2.21	6.804E-03	1764.49	15.400	PBC<MDA	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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
298.74	74.83	63.	60.	1.621E+03	25.34	0.825	-	
308.30	77.22	55.	99.	2.629E+03	16.12	0.980	-	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_Short_no ingrowth Rev2.li

********** 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	186.23	46.69	83.	46.	0.026	18.52	0.507s
TH-234	252.94	63.38	100.	22.	0.012	29.53	0.791
TH-234	369.74	92.59	109.	26.	0.014	22.42	0.818D
U-235	372.78	93.35	70.	72.	0.040	20.14	0.819D
AC-228	372.78	93.35	111.	21.	0.012	73.18	0.819D
EU-155	421.99	105.66	59.	4.	0.002	292.48	0.830s
EU-154	490.26	122.73	62.	-9.	-0.005	128.54	0.847s
Pa-234	523.33	131.00	82.	-7.	-0.004	179.04	0.855s
U-235	652.84	163.39	35.	-2.	-0.001	377.15	0.885s
Ra-226	741.92	185.67	32.	71.	0.039	19.33	1.021s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
U-235	818.21	204.76	27.	11.	0.006	67.42	0.924s
PB-212	953.18	238.51	40.	127.	0.071	10.05	0.954
PB-214	966.58	241.86	42.	12.	0.007	74.11	0.958s
I-131	1137.01	284.48	41.	-3.	-0.002	278.85	0.996s
PB-214	1180.03	295.24	20.	47.	0.026	20.23	1.117
PB-212	1199.96	300.22	11.	22.	0.012	33.90	0.424s
AC-228	1352.05	338.26	20.	32.	0.018	26.41	1.046
EU-152	1377.80	344.70	15.	10.	0.005	66.67	1.051s
PB-214	1406.18	351.79	20.	73.	0.041	14.64	0.819s
CS-134	2245.73	561.72	10.	6.	0.003	87.45	1.247s
CS-134	2275.26	569.10	13.	9.	0.005	68.96	1.252s
Pa-234	2275.26	569.10	12.	9.	0.005	63.39	1.253s
TL-208	2331.63	583.19	12.	73.	0.041	13.24	1.128s
CS-134	2432.32	608.36	40.	-1.	-0.001	908.89	1.283s
BI-214	2435.88	609.25	15.	99.	0.055	12.15	1.027
I-131	2540.94	635.52	17.	-1.	0.000	732.27	1.312s
CS-137	2645.86	661.75	8.	45.	0.025	20.02	1.022
EU-154	2890.71	722.96	18.	-4.	-0.002	171.01	1.386s
BI-212	2908.17	727.33	10.	10.	0.005	55.11	1.390s
PA-234M	3055.88	764.25	15.	-2.	-0.001	269.92	1.423s
BI-212	3139.49	785.15	11.	6.	0.003	87.88	1.439s
EU-154	3491.28	873.09	9.	1.	0.001	429.27	1.514s
Pa-234	3522.45	880.88	8.	2.	0.001	255.43	1.520s
AC-228	3645.30	911.58	8.	31.	0.017	21.97	1.545s
Pa-234	3784.51	946.38	12.	2.	0.001	245.73	1.574s
AC-228	3875.47	969.11	8.	18.	0.010	33.21	1.594
EU-154	3983.63	996.14	24.	-4.	-0.002	163.86	1.616s
PA-234M	4003.17	1001.03	13.	11.	0.006	56.17	1.620s
EU-154	4017.90	1004.71	22.	-6.	-0.003	121.88	1.623s
EU-152	4449.43	1112.56	13.	2.	0.001	344.03	1.710s
BI-214	4479.98	1120.19	11.	10.	0.006	55.31	1.717s
CO-60	4694.63	1173.83	11.	-1.	-0.001	470.84	1.760s
CO-60	5329.04	1332.36	7.	3.	0.002	154.21	1.886s
K-40	5843.17	1460.81	6.	125.	0.069	8.74	0.687s
BI-214	7059.90	1764.75	3.	11.	0.006	27.38	2.211s

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	Peak Energy keV	Peak Activity Bq/Sample	Peak Code	Peak MDA Value Bq/Sample	COMMENTS
K-40	N	8.2188E+01				4.66E+11	
			1460.83	8.219E+01	(P	9.556E+00 8.74E+00 1.07E+01 G	

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CO-60	F 1.7879E-01					1.93E+03	
		1332.50	1.788E-01	?(	1.013E+00	1.54E+02	1.00E+02 G
		1173.24	-5.993E-02	-	1.070E+00	4.71E+02	9.99E+01 G
I-131	I 2.6837E-03					8.02E+00	
		364.48	2.684E-03	&(	7.392E-01	7.43E+03	8.17E+01 G
		284.30	-1.128E+00	+	1.109E+01	2.79E+02	6.14E+00 G
		636.97	-4.206E-01	+	1.145E+01	7.32E+02	7.17E+00 G
CS-134	I 3.8045E-01					7.54E+02	
		604.71	-3.660E-02	&(	1.189E+00	9.09E+02	9.76E+01 G
		795.87	4.431E-03	%	1.008E+00	5.95E+03	8.55E+01 G
		569.32	1.915E+00	(	4.385E+00	6.90E+01	1.54E+01 G
		801.95	1.745E-01	%	1.047E+01	1.59E+03	8.69E+00 G
		563.24	2.430E+00	?(	7.293E+00	8.75E+01	8.35E+00 G
CS-137	I 2.0486E+00					1.10E+04	
		661.66	2.049E+00	(	7.056E-01	2.00E+01	8.52E+01 G
EU-152	F 7.8778E-01					4.94E+03	
		344.29	8.639E-01	&(	1.905E+00	6.67E+01	2.65E+01 G
		121.78	-8.832E-04	&	1.464E+00	4.61E+04	2.86E+01 G
		778.92	2.091E-02	%	6.845E+00	8.62E+03	1.29E+01 G
		964.11	0.000E+00	-	1.620E+01	1.00E+03	1.46E+01 G
		1112.07	6.399E-01	?(	8.182E+00	3.44E+02	1.36E+01 G
		1408.00	0.000E+00	-	2.399E+00	1.00E+03	2.10E+01 G
EU-154	I 3.9191E-01					3.14E+03	
		873.23	3.919E-01	?(	6.440E+00	4.29E+02	1.23E+01 G
		123.10	-2.861E-01	+	1.257E+00	1.29E+02	4.08E+01 G
		1274.54	0.000E+00	-	1.325E+00	1.00E+03	3.52E+01 G
		723.36	-7.574E-01	+	4.619E+00	1.71E+02	2.02E+01 G
		1004.77	-1.711E+00	+	7.255E+00	1.22E+02	1.80E+01 G
		996.33	-2.185E+00	+	1.263E+01	1.64E+02	1.06E+01 G
EU-155	I 2.3093E-01					1.81E+03	
		105.31	2.309E-01	&(	2.357E+00	2.92E+02	2.12E+01 G
		86.54	0.000E+00	-	2.339E+00	1.00E+03	3.07E+01 G
TL-208	N 3.0346E+00					6.98E+02	
		583.02	3.035E+00	*(P	7.797E-01	1.32E+01	8.45E+01 G
		277.28	-3.903E-01	& P	8.664E+00	1.00E+03	6.31E+00 G
		860.56	0.000E+00	-	2.781E+00	1.00E+03	1.24E+01 G
PB-210	N 2.8780E+01					8.14E+03	
		46.54	2.878E+01	@(P	2.807E+01	1.85E+01	4.25E+00 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-212	N	5.4569E+00					6.98E+02	
			238.63	5.457E+00	?(P	1.385E+00	1.01E+01	4.33E+01 G
			300.03	1.472E+01	+	1.199E+01	3.39E+01	3.28E+00 G
PB-214	N	4.9088E+00					5.84E+05	
			351.93	4.750E+00	(P	1.518E+00	1.46E+01	3.76E+01 G
			295.09	5.218E+00	(P	2.641E+00	2.02E+01	1.93E+01 G
			242.00	2.956E+00	& P	8.320E+00	7.41E+01	7.43E+00 G
BI-212	N	7.5114E+00					6.98E+02	
			727.17	5.344E+00	?(	9.384E+00	5.51E+01	7.55E+00 G
			785.42	2.030E+01	?(	6.124E+01	8.79E+01	1.28E+00 G
BI-214	N	7.7909E+00					5.84E+05	
			609.31	7.791E+00	(P	1.627E+00	1.22E+01	4.61E+01 G
			1120.29	3.937E+00	-	6.968E+00	5.53E+01	1.51E+01 G
			1764.49	5.774E+00	- P	5.915E+00	2.74E+01	1.54E+01 G
AC-228	N	5.4299E+00					2.10E+03	
			911.07	5.216E+00	?(	2.626E+00	2.20E+01	2.90E+01 G
			968.97	5.172E+00	(	4.739E+00	3.32E+01	1.75E+01 G
			338.32	6.321E+00	(	4.624E+00	2.64E+01	1.20E+01 G
							Energy duplication	
			93.35	5.117E+00		1.244E+01	7.32E+01	5.56E+00 XA
Pa-234	N	8.7466E-01					1.63E+12	
			131.29	-5.350E-01	?(	3.287E+00	1.79E+02	1.80E+01 G
			569.47	3.777E+00	(	7.848E+00	6.34E+01	8.20E+00 G
			946.02	7.848E-01	&(	7.116E+00	2.46E+02	1.34E+01 G
			883.24	0.000E+00	-	1.232E+01	1.00E+03	9.60E+00 G
			880.53	1.338E+00	?(	1.289E+01	2.55E+02	6.00E+00 G
TH-234	N	7.7310E+00					1.63E+12	
			63.29	1.006E+01	?(P	2.277E+01	2.95E+01	3.81E+00 G
			92.59	6.145E+00	(P	1.235E+01	2.24E+01	5.58E+00 G
PA-234M	N	6.6954E+01					1.63E+12	
			1001.00	6.695E+01	&(	1.209E+02	5.62E+01	8.37E-01 G
			766.41	-3.066E+01	-	3.032E+02	2.70E+02	2.94E-01 G
Ra-226	N	3.3824E+01					5.84E+05	
			185.99	3.382E+01	(P	1.396E+01	1.93E+01	3.28E+00 G
U-235	N	4.7908E-01					2.57E+11	
			143.79	-9.198E-01	%(P	5.903E+00	1.00E+03	1.10E+01 G
			205.33	3.539E+00	&(P	8.943E+00	6.74E+01	5.01E+00 G
			163.38	-6.450E-01	+	8.668E+00	3.77E+02	5.08E+00 G
							Energy duplication	
			93.35	1.664E+01	?	9.587E+00	2.01E+01	5.81E+00 X

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
AM-241	T 8.1188E-03					1.58E+05	
		59.54	8.119E-03	&(	2.596E+00	9.18E+03	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.
+ - 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	
U-235	93.35	70.	72.	0.040	20.14	1.664E+01	
EU-155	105.66	59.	4.	0.002	292.48	2.309E-01	
EU-154	122.73	62.	-9.	-0.005	128.54	-2.861E-01	
Pa-234	131.00	82.	-7.	-0.004	179.04	-5.350E-01	
U-235	163.39	35.	-2.	-0.001	377.15	-6.450E-01	
U-235	204.76	27.	11.	0.006	67.42	3.539E+00	P
I-131	284.48	41.	-3.	-0.002	278.85	-1.128E+00	
EU-152	344.70	15.	10.	0.005	66.67	8.639E-01	
CS-134	561.72	10.	6.	0.003	87.45	2.430E+00	
CS-134	569.10	13.	9.	0.005	68.96	1.915E+00	
Pa-234	569.10	12.	9.	0.005	63.39	3.777E+00	
CS-134	608.36	40.	-1.	-0.001	908.89	-3.660E-02	

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
I-131	635.52	17.	-1.	0.000	732.27	-4.206E-01	
EU-154	722.96	18.	-4.	-0.002	171.01	-7.574E-01	
BI-212	727.33	10.	10.	0.005	55.11	5.344E+00	
PA-234M	764.25	15.	-2.	-0.001	269.92	-3.066E+01	
BI-212	785.15	11.	6.	0.003	87.88	2.030E+01	
EU-154	873.09	9.	1.	0.001	429.27	3.919E-01	
Pa-234	880.88	8.	2.	0.001	255.43	1.338E+00	
Pa-234	946.38	12.	2.	0.001	245.73	7.848E-01	
EU-154	996.14	24.	-4.	-0.002	163.86	-2.185E+00	
PA-234M	1001.03	13.	11.	0.006	56.17	6.695E+01	
EU-154	1004.71	22.	-6.	-0.003	121.88	-1.711E+00	
EU-152	1112.56	13.	2.	0.001	344.03	6.399E-01	
CO-60	1173.83	11.	-1.	-0.001	470.84	-5.993E-02	
CO-60	1332.36	7.	3.	0.002	154.21	1.788E-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 *****

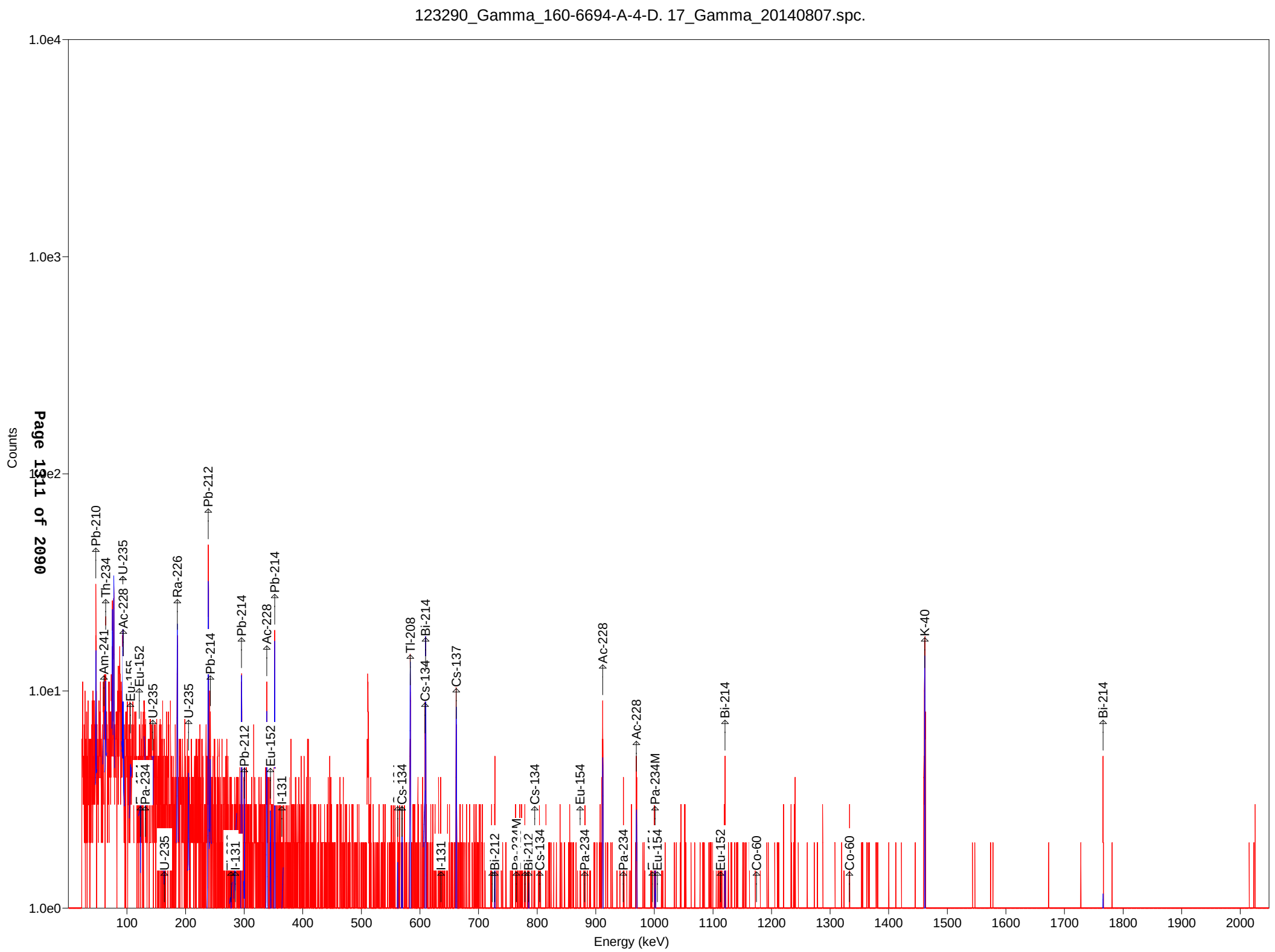
Nuclide	Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7 #A	0.0000E+00	0.0000E+00	1.000E+03%	7.88E+00
K-40	8.2188E+01	8.2188E+01	9.185E+00%	9.56E+00
CO-60 #A	1.7879E-01	1.7879E-01	1.542E+02%	1.01E+00
I-131 #A	2.6836E-03	2.6837E-03	7.429E+03%	7.39E-01
CS-134 #A	3.8045E-01	3.8045E-01	6.896E+01%	1.19E+00
CS-137	2.0486E+00	2.0486E+00	2.002E+01%	7.06E-01
EU-152 #A	7.8778E-01	7.8778E-01	6.667E+01%	1.90E+00
EU-154 #A	3.9191E-01	3.9191E-01	4.293E+02%	6.44E+00
EU-155 #A	2.3093E-01	2.3093E-01	2.925E+02%	2.36E+00
TL-208 #	3.0346E+00	3.0346E+00	1.446E+01%	7.80E-01
PB-210 #	2.8780E+01	2.8780E+01	3.244E+01%	2.81E+01
PB-212 #	5.4569E+00	5.4569E+00	1.100E+01%	1.39E+00
PB-214	4.9088E+00	4.9088E+00	1.350E+01%	1.52E+00
BI-212 #A	7.5114E+00	7.5114E+00	5.187E+01%	9.38E+00
BI-214	7.7909E+00	7.7909E+00	1.279E+01%	1.63E+00
AC-228	5.4299E+00	5.4299E+00	1.593E+01%	2.63E+00
Pa-234 #A	8.7466E-01	8.7466E-01	6.339E+01%	3.29E+00
TH-234 A	7.7310E+00	7.7310E+00	4.266E+01%	2.28E+01
PA-234M#A	6.6954E+01	6.6954E+01	5.617E+01%	1.21E+02
Ra-226 #	3.3824E+01	3.3824E+01	1.940E+01%	1.40E+01
U-235 #A	4.7908E-01	4.7908E-01	7.477E+01%	5.90E+00
AM-241 #A	8.1188E-03	8.1188E-03	9.178E+03%	2.60E+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 (185.9 to 1999.5 keV) 1.680E+02 Bq/Sample
Total Decayed Activity (185.9 to 1999.5 keV) 1.6803157E+02 Bq/Sample

The library has energies which are not separable.


123290_Gamma_160-6694-A-4-D. 17_Gamma_20140807.spc.
Counts
Energy (keV)
Page 1311 of 2090
Pb-210
Am-241
Th-234
U-235
Ac-228
Eu-152
Pa-234
U-235
Ra-226
U-235
Pb-212
Pb-214
Pb-212
Pb-214
Ac-228
Eu-152
I-131
Cs-134
Tl-208
Bi-214
Cs-134
Cs-137
I-131
Bi-212
Cs-134
Bi-212
Cs-134
Eu-154
Ac-228
Pa-234
Ac-228
Pa-234M
Eu-154
Bi-214
Eu-152
Co-60
K-40
Co-60
Bi-214

Test America St. Louis Spectrum ID: 4_Gamma_20140891

Sample Description: 123290_Gamma_160-6694-A-5-D
Detector: Ge 4 SN/181
Batch ID: 123290
Work Order Number: Gamma
Lot Number: 160-6694-A-5-D

Decay to Time: 5/21/2014 15:46 Live Time: 1800 sec
Acquisition Time: 5/21/2014 15:46:31 Real Time: 1802 sec
Analysis Time: 5/21/2014 16:17 Dead Time: 0.13 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 4_Soil_TunaCan.Clb
Efficiency Cal Desc: 4_Soil_TunaCan_90099_033012
Efficiency Cal Date: 4/2/2012 13:19
Energy Cal Date: 2/28/2012 14:55
Library: Client_Short_no ingrowth Rev2.li
Bkgd Correction File: 4_2014-05-03_0556.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	3.177E+00	85.8	2.725E+00	2.730E+00	9.365E+00
K-40	1.560E+02	9.9	1.551E+01	1.744E+01	1.386E+01
CO-60	4.522E-02	494.6	2.237E-01	2.237E-01	2.989E+00
I-131	6.314E-02	385.7	2.435E-01	2.435E-01	1.299E+00
CS-134	1.672E-01	277.7	4.644E-01	4.644E-01	1.481E+00
CS-137	-2.972E-01	192.1	5.710E-01	5.712E-01	2.058E+00
EU-152	8.064E-02	112.3	9.054E-02	9.064E-02	3.435E+00
EU-154	1.552E+00	278.6	4.322E+00	4.323E+00	1.602E+01
EU-155	1.156E+00	61.3	7.083E-01	7.111E-01	2.947E+00
TL-208	2.084E+00	36.6	7.620E-01	7.696E-01	1.704E+00
PB-210	2.377E+01	46.2	1.099E+01	1.107E+01	3.363E+01
PB-212	6.993E+00	13.4	9.396E-01	1.043E+00	1.877E+00
PB-214	5.481E+00	15.1	8.275E-01	8.751E-01	2.584E+00
BI-212	7.975E+00	85.4	6.810E+00	6.822E+00	1.803E+01
BI-214	2.960E+00	41.9	1.241E+00	1.250E+00	3.104E+00
AC-228	8.604E+00	20.0	1.721E+00	1.776E+00	2.730E+00
Pa-234	1.594E+00	57.1	9.102E-01	9.139E-01	2.922E+00
TH-234	1.364E+01	64.1	8.738E+00	8.767E+00	3.046E+01
PA-234M	0.000E+00	1000.0	1.967E+01	1.967E+01	2.441E+02
Ra-226	1.697E+00	496.6	8.429E+00	8.430E+00	3.101E+01
U-235	1.419E+00	127.0	1.802E+00	1.804E+00	5.437E+00
AM-241	3.603E-02	1846.0	6.649E-01	6.650E-01	2.427E+00
Total	2.385E+02				

Analyst: April Bean

TestAmerica Spectrum name: 4_Gamma_20140891.An1

Sample description
123290_Gamma_160-6694-A-5-D

Spectrum Filename: C:\User\SPC\Det4\4_Gamma_20140891.An1

Acquisition information
Start time:	5/21/2014 3:46:31 PM
Live time:	1800
Real time:	1802
Dead time:	0.13 %
Detector ID:	4

Detector system
Ge 4 SN/181

Calibration
Filename: 4_Soil_TunaCan.Clb
4_Soil_TunaCan_90099_033012

Energy Calibration
Created:	2/28/2012 2:55:17 PM
Zero offset:	0.091 keV
Gain:	0.250 keV/channel
Quadratic:	-2.917E-08 keV/channel^2

Efficiency Calibration
Created:	4/2/2012 1:19:41 PM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 0.78 %
Log(Eff):	-3.983609E-01 + (-5.746278E-01*Log(E)) + (-2.046438E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.80 %
Log(Eff):	-2.546791E+01 + (9.285295E+00*Log(E)) + (-9.904428E-01*Log(E)^2)

Library Files
Main analysis library:	Client_Short_no ingrowth Rev2.li
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (1999.44keV)
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

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	5/21/2014 3:46:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	4_2014-05-03_0556.PBC 5/3/2014 5:56:46 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 10 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1719

***** 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
46.75	37.	27.43	0.43	1.217E-02	46.54	4.250	PBC<MDA	PB210
63.44	17.	36.20	0.82	1.842E-02	63.29	3.810	PBC<MDA	TH234
					63.29	3.810	PBC<MDA	TH234
77.20	66.	22.22	0.40	2.191E-02				
87.36	18.	64.45	0.84	2.336E-02	86.54	30.700	PBC<MDA	EU155
92.87	48.	24.25	1.09	2.403E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.561	1.995E+01	AC228
					93.35	5.810	1.910E+01	U235
					92.59	5.584	1.231E+01	TH234
92.93	29.	36.30	0.84	2.403E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.561	1.192E+01	AC228
					93.35	5.810	1.141E+01	U235
92.95	12.	33.60	0.84	2.397E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.561	PBC<MDA	AC228
					93.35	5.810	PBC<MDA	U235
104.93	8.	104.22	0.85	2.456E-02	105.31	21.200	PBC<MDA	EU155
119.55	6.	112.28	0.87	2.426E-02	121.78	28.580	PBC<MDA	EU152
130.37	12.	57.10	0.88	2.372E-02	131.29	18.000	PBC<MDA	Pa234
142.47	3.	200.66	0.89	2.273E-02	143.79	10.960	PBC<MDA	U235
163.40	1.	759.28	0.91	2.083E-02	163.38	5.080	PBC<MDA	U235
186.26	2.	102.40	0.93	1.906E-02	185.99	3.280	PBC<MDA	Ra226
205.19	6.	127.04	0.95	1.763E-02	205.33	5.010	PBC<MDA	U235
238.39	92.	12.41	1.00	1.565E-02	238.63	43.300	6.993E+00	PB212
277.11	4.	178.21	1.01	1.387E-02	277.28	6.310	PBC<MDA	TL208

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
294.91	33.	20.33	1.18	1.319E-02	295.09	19.300	7.202E+00	PB214
299.91	4.	153.56	1.03	1.301E-02	300.03	3.280	PBC<MDA	PB212
338.20	18.	40.90	1.07	1.181E-02	338.32	12.010	PBC<MDA	AC228
351.38	36.	22.33	1.08	1.143E-02	351.93	37.600	4.597E+00	PB214
477.22	5.	85.78	1.19	8.899E-03	477.60	10.520	PBC<MDA	BE7
566.34	1.	452.54	1.26	7.760E-03	563.24	8.350	PBC<MDA	CS134
582.65	18.	36.56	1.28	7.539E-03	583.02	84.500	PBC<MDA	TL208
604.75	2.	321.91	1.30	7.312E-03	604.71	97.620	PBC<MDA	CS134
608.99	15.	41.91	1.30	7.266E-03	609.31	46.090	PBC<MDA	BI214
637.34	1.	385.69	1.33	7.001E-03	636.97	7.170	PBC<MDA	I131
729.67	4.	121.36	1.40	6.262E-03	727.17	7.550	PBC<MDA	BI212
785.55	4.	120.16	1.45	5.867E-03	785.42	1.280	PBC<MDA	BI212
859.54	6.	68.43	1.52	5.429E-03	860.56	12.420	PBC<MDA	TL208
872.95	2.	278.57	1.53	5.362E-03	873.23	12.270	PBC<MDA	EU154
910.81	25.	20.00	0.42	5.172E-03	911.07	29.000	9.261E+00	AC228
945.60	2.	189.91	1.59	5.008E-03	946.02	13.400	PBC<MDA	Pa234
969.25	7.	61.10	1.60	4.906E-03	968.97	17.460	PBC<MDA	AC228
1120.39	5.	80.06	1.73	4.331E-03	1120.29	15.100	PBC<MDA	BI214
1171.17	1.	494.58	1.77	4.162E-03	1173.24	99.900	PBC<MDA	CO60
1460.53	103.	9.76	0.41	3.441E-03	1460.83	10.670	1.560E+02	K40

********** 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
308.25	77.20	48.	66.	3.028E+03	22.22	0.398	- 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_Short_no ingrowth Rev2.li

********** 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	186.52	46.75	37.	22.	0.012	27.43	0.426s
TH-234	253.24	63.44	59.	17.	0.010	36.20	0.816s
EU-155	348.87	87.36	57.	18.	0.010	64.45	0.837s
TH-234	371.22	92.95	55.	12.	0.007	33.60	0.843s
AC-228	372.83	93.35	25.	48.	0.027	24.25	1.086D
U-235	372.83	93.35	40.	29.	0.016	36.30	0.843D
EU-155	419.13	104.93	29.	8.	0.004	104.22	0.855s
EU-152	477.56	119.55	18.	6.	0.003	112.28	0.870s

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Pa-234	520.82	130.37	18.	12.	0.007	57.10	0.878s
U-235	569.20	142.47	22.	3.	0.002	200.66	0.890s
U-235	652.87	163.40	33.	1.	0.001	759.28	0.908s
Ra-226	744.30	186.26	48.	2.	0.001	102.40	0.928s
U-235	819.98	205.19	25.	6.	0.003	127.04	0.946s
PB-212	952.71	238.39	19.	85.	0.047	12.41	1.004
PB-214	968.43	242.32	33.	-3.	-0.002	265.67	0.979s
TL-208	1107.53	277.11	20.	4.	0.002	178.21	1.011
I-131	1135.64	284.14	25.	-3.	-0.001	286.83	1.018s
PB-214	1178.71	294.91	4.	33.	0.018	20.33	1.179
PB-212	1198.72	299.91	19.	4.	0.002	153.56	1.032
AC-228	1351.84	338.20	18.	18.	0.010	40.90	1.066
EU-152	1374.77	343.94	12.	-2.	-0.001	279.23	1.071s
PB-214	1404.53	351.38	14.	36.	0.020	22.33	1.078s
BE-7	1907.77	477.22	8.	5.	0.003	85.78	1.189s
CS-134	2264.23	566.34	6.	1.	0.000	452.54	1.264s
Pa-234	2279.15	570.07	17.	-1.	-0.001	625.95	1.269s
TL-208	2329.45	582.65	13.	18.	0.010	36.56	1.281s
CS-134	2417.86	604.75	12.	2.	0.001	321.91	1.300s
BI-214	2434.82	608.99	12.	15.	0.008	41.91	1.304s
I-131	2548.20	637.34	6.	1.	0.001	385.69	1.327s
CS-137	2645.44	661.65	16.	-3.	-0.002	192.09	1.348s
BI-212	2917.55	729.67	7.	4.	0.002	121.36	1.404s
PA-234M	3059.03	765.04	5.	-2.	-0.001	195.87	1.437s
EU-152	3110.29	777.85	8.	-1.	0.000	617.08	1.448s
BI-212	3141.06	785.55	10.	4.	0.002	120.16	1.453s
CS-134	3216.01	804.28	10.	-3.	-0.002	164.44	1.467s
TL-208	3437.09	859.54	7.	6.	0.004	68.43	1.516s
EU-154	3490.71	872.95	12.	2.	0.001	278.57	1.526s
Pa-234	3517.87	879.73	10.	-3.	-0.002	159.54	1.532s
AC-228	3642.20	910.81	0.	25.	0.014	20.00	0.417s
Pa-234	3781.42	945.60	6.	2.	0.001	189.91	1.586s
AC-228	3876.01	969.25	7.	7.	0.004	61.10	1.605s
EU-152	4441.98	1110.69	7.	-2.	-0.001	222.10	1.720s
BI-214	4480.82	1120.39	6.	5.	0.003	80.06	1.727s
CO-60	4684.02	1171.17	5.	1.	0.000	494.58	1.769s
K-40	5842.18	1460.53	2.	103.	0.057	9.76	0.406s

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	Peak Energy keV	Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	3.1771E+00				5.31E+01	
			477.60	3.177E+00	?(	9.365E+00 8.58E+01	1.05E+01 G
K-40	N	1.5600E+02				4.66E+11	
			1460.83	1.560E+02	(P	1.386E+01 9.76E+00	1.07E+01 G
CO-60	F	4.5222E-02				1.93E+03	
			1332.50	0.000E+00	?(	2.989E+00 1.00E+03	1.00E+02 G
			1173.24	9.048E-02	?(	1.791E+00 4.95E+02	9.99E+01 G
I-131	I	6.3136E-02				8.02E+00	
			364.48	-2.135E-02	%(	1.299E+00 1.62E+03	8.17E+01 G
			284.30	-1.681E+00	+	1.731E+01 2.87E+02	6.14E+00 G
			636.97	1.026E+00	?(	1.555E+01 3.86E+02	7.17E+00 G
CS-134	I	1.6723E-01				7.54E+02	
			604.71	1.235E-01	?(	1.481E+00 3.22E+02	9.76E+01 G
			795.87	0.000E+00	-	1.752E+00 1.00E+03	8.55E+01 G
			569.32	-2.797E-02	%	9.228E+00 8.64E+03	1.54E+01 G
			801.95	-3.248E+00	+	1.946E+01 1.64E+02	8.69E+00 G
			563.24	6.780E-01	?(	1.212E+01 4.53E+02	8.35E+00 G
CS-137	I	-2.9723E-01				1.10E+04	
			661.66	-2.972E-01	?(	2.058E+00 1.92E+02	8.52E+01 G
EU-152	F	8.0637E-02				4.94E+03	
			344.29	-3.320E-01	?(	3.435E+00 2.79E+02	2.65E+01 G
			121.78	4.632E-01	?(	1.809E+00 1.12E+02	2.86E+01 G
			778.92	-4.870E-01	+	1.168E+01 6.17E+02	1.29E+01 G
			964.11	0.000E+00	-	2.489E+01 1.00E+03	1.46E+01 G
			1112.07	-1.681E+00	+	1.412E+01 2.22E+02	1.36E+01 G
			1408.00	0.000E+00	-	1.571E+01 1.00E+03	2.10E+01 G
EU-154	I	1.5517E+00				3.14E+03	
			873.23	1.552E+00	?(	1.602E+01 2.79E+02	1.23E+01 G
			123.10	-3.550E-02	&	1.744E+00 1.37E+03	4.08E+01 G
			1274.54	0.000E+00	-	8.082E+00 1.00E+03	3.52E+01 G
			723.36	0.000E+00	-	6.706E+00 1.00E+03	2.02E+01 G
			1004.77	0.000E+00	-	4.780E+00 1.00E+03	1.80E+01 G
			996.33	0.000E+00	-	1.916E+01 1.00E+03	1.06E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
EU-155	I	1.1560E+00					1.81E+03	
			105.31	8.245E-01	@(	2.947E+00	1.04E+02	2.12E+01 G
			86.54	1.385E+00	&(	2.946E+00	6.45E+01	3.07E+01 G
TL-208	N	2.0843E+00					6.98E+02	
			583.02	1.587E+00	?(	1.704E+00	3.66E+01	8.45E+01 G
			277.28	2.338E+00	(	1.485E+01	1.78E+02	6.31E+00 G
			860.56	5.337E+00	?(	1.209E+01	6.84E+01	1.24E+01 G
PB-210	N	2.3770E+01					8.14E+03	
			46.54	2.377E+01	(P	3.363E+01	2.74E+01	4.25E+00 G
PB-212	N	6.9928E+00					6.98E+02	
			238.63	6.993E+00	(P	1.877E+00	1.24E+01	4.33E+01 G
			300.03	5.118E+00	- P	3.011E+01	1.54E+02	3.28E+00 G
PB-214	N	5.4808E+00					5.84E+05	
			351.93	4.597E+00	&(	2.584E+00	2.23E+01	3.76E+01 G
			295.09	7.202E+00	(	2.626E+00	2.03E+01	1.93E+01 G
			242.00	-1.524E+00	-	1.435E+01	2.66E+02	7.43E+00 G
BI-212	N	7.9745E+00					6.98E+02	
			727.17	4.132E+00	?(	1.803E+01	1.21E+02	7.55E+00 G
			785.42	3.064E+01	&(	1.308E+02	1.20E+02	1.28E+00 G
BI-214	N	2.9603E+00					5.84E+05	
			609.31	2.451E+00	?(	3.104E+00	4.19E+01	4.61E+01 G
			1120.29	4.514E+00	&(	1.231E+01	8.01E+01	1.51E+01 G
			1764.49	0.000E+00	&	9.119E+00	1.00E+03	1.54E+01 G
AC-228	N	8.6036E+00					2.10E+03	
			911.07	9.261E+00	(	2.730E+00	2.00E+01	2.90E+01 G
			968.97	4.828E+00	-	9.535E+00	6.11E+01	1.75E+01 G
			338.32	7.017E+00	?(	8.782E+00	4.09E+01	1.20E+01 G
							Energy duplication	
			93.35	1.995E+01	+	1.081E+01	2.43E+01	5.56E+00 XA
Pa-234	N	1.5940E+00					1.63E+12	
			131.29	1.579E+00	?(	2.922E+00	5.71E+01	1.80E+01 G
			569.47	-8.409E-01	-	1.950E+01	6.26E+02	8.20E+00 G
			946.02	1.614E+00	?(	1.160E+01	1.90E+02	1.34E+01 G
			883.24	0.000E+00	-	1.789E+01	1.00E+03	9.60E+00 G
			880.53	-5.318E+00	-	3.081E+01	1.60E+02	6.00E+00 G
TH-234	N	1.3636E+01					1.63E+12	
			63.29	1.364E+01	(P	3.046E+01	3.62E+01	3.81E+00 G
			92.59	4.980E+00	- P	1.548E+01	3.36E+01	5.58E+00 G

```
 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ra-226   N   1.6972E+00                                        5.84E+05
                          185.99 1.697E+00 ?(P 3.101E+01 1.02E+02 3.28E+00 G

U-235    N   1.4185E+00                                        2.57E+11
                          143.79 7.592E-01 ?(  5.437E+00 2.01E+02 1.10E+01 G
                          205.33 3.728E+00  (  1.647E+01 1.27E+02 5.01E+00 G
                          163.38 5.638E-01 ?(  1.541E+01 7.59E+02 5.08E+00 G
                                                            Energy duplication
                           93.35 1.141E+01 *   1.278E+01 3.63E+01 5.81E+00 X

AM-241   T   3.6029E-02                                        1.58E+05
                           59.54 3.603E-02 %(  2.427E+00 1.85E+03 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.
   + - 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

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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********** 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	
TH-234	63.44	59.	17.	0.010	36.20	1.364E+01	P
EU-155	87.36	57.	18.	0.010	64.45	1.385E+00	
TH-234	92.95	55.	12.	0.007	33.60	4.980E+00	P
U-235	93.35	40.	29.	0.016	36.30	1.141E+01	
EU-155	104.93	29.	8.	0.004	104.22	8.245E-01	
EU-152	119.55	18.	6.	0.003	112.28	4.632E-01	
Pa-234	130.37	18.	12.	0.007	57.10	1.579E+00	
U-235	142.47	22.	3.	0.002	200.66	7.592E-01	
U-235	163.40	33.	1.	0.001	759.28	5.638E-01	
Ra-226	186.26	48.	2.	0.001	102.40	1.697E+00	P
U-235	205.19	25.	6.	0.003	127.04	3.728E+00	
I-131	284.14	25.	-3.	-0.001	286.83	-1.681E+00	
EU-152	343.94	12.	-2.	-0.001	279.23	-3.320E-01	
BE-7	477.22	8.	5.	0.003	85.78	3.177E+00	
CS-134	566.34	6.	1.	0.000	452.54	6.780E-01	
Pa-234	570.07	17.	-1.	-0.001	625.95	-8.409E-01	
CS-134	604.75	12.	2.	0.001	321.91	1.235E-01	
I-131	637.34	6.	1.	0.001	385.69	1.026E+00	
CS-137	661.65	16.	-3.	-0.002	192.09	-2.972E-01	
BI-212	729.67	7.	4.	0.002	121.36	4.132E+00	
PA-234M	765.04	5.	-2.	-0.001	195.87	-5.655E+01	
EU-152	777.85	8.	-1.	0.000	617.08	-4.870E-01	
BI-212	785.55	10.	4.	0.002	120.16	3.064E+01	
CS-134	804.28	10.	-3.	-0.002	164.44	-3.248E+00	
EU-154	872.95	12.	2.	0.001	278.57	1.552E+00	
Pa-234	879.73	10.	-3.	-0.002	159.54	-5.318E+00	
Pa-234	945.60	6.	2.	0.001	189.91	1.614E+00	
EU-152	1110.69	7.	-2.	-0.001	222.10	-1.681E+00	
CO-60	1171.17	5.	1.	0.000	494.58	9.048E-02	

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 1 Sigma Counting	MDA Bq/Sample
BE-7	#A	3.1771E+00	3.1771E+00	8.578E+01%	9.36E+00
K-40		1.5600E+02	1.5600E+02	9.940E+00%	1.39E+01
CO-60	#A	4.5222E-02	4.5222E-02	4.946E+02%	2.99E+00
I-131	#A	6.3134E-02	6.3136E-02	3.857E+02%	1.30E+00
CS-134	#A	1.6723E-01	1.6723E-01	2.777E+02%	1.48E+00
CS-137	#A	-2.9723E-01	-2.9723E-01	1.921E+02%	2.06E+00
EU-152	#A	8.0637E-02	8.0637E-02	1.123E+02%	3.43E+00

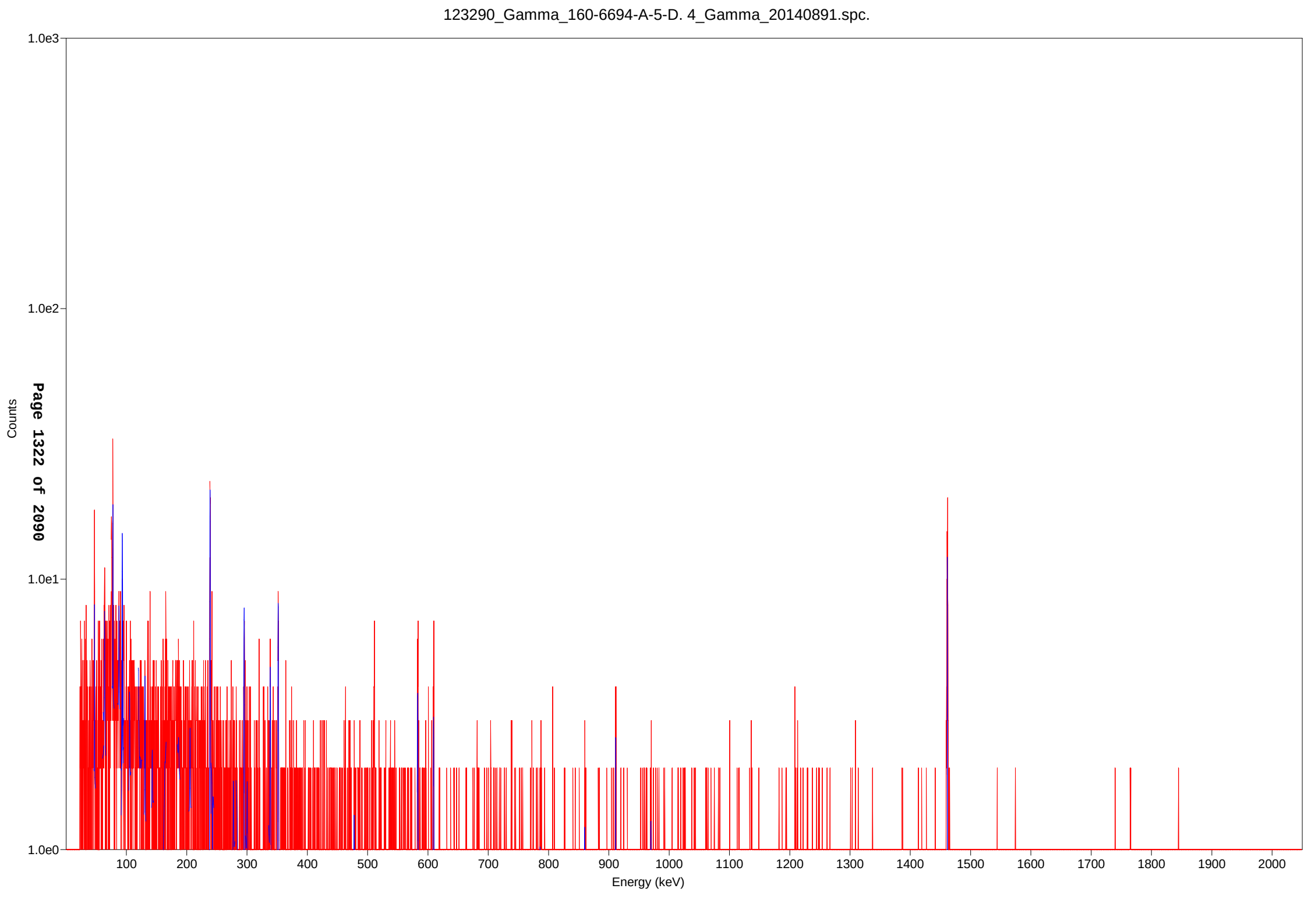
EU-154 #A	1.5517E+00	1.5517E+00	2.786E+02%	1.60E+01
EU-155 #A	1.1560E+00	1.1560E+00	6.127E+01%	2.95E+00
TL-208	2.0843E+00	2.0843E+00	3.656E+01%	1.70E+00
PB-210 A	2.3770E+01	2.3770E+01	4.622E+01%	3.36E+01
PB-212	6.9928E+00	6.9928E+00	1.344E+01%	1.88E+00
PB-214	5.4808E+00	5.4808E+00	1.510E+01%	2.58E+00
BI-212 #A	7.9745E+00	7.9745E+00	8.539E+01%	1.80E+01
BI-214 #A	2.9603E+00	2.9603E+00	4.191E+01%	3.10E+00
AC-228	8.6036E+00	8.6036E+00	2.000E+01%	2.73E+00
Pa-234 #A	1.5940E+00	1.5940E+00	5.710E+01%	2.92E+00
TH-234 #A	1.3636E+01	1.3636E+01	6.408E+01%	3.05E+01
PA-234M#A	0.0000E+00	0.0000E+00	1.000E+03%	2.44E+02
Ra-226 #A	1.6972E+00	1.6972E+00	4.966E+02%	3.10E+01
U-235 #A	1.4185E+00	1.4185E+00	1.270E+02%	5.44E+00
AM-241 #A	3.6029E-02	3.6029E-02	1.846E+03%	2.43E+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)   2.059E+02 Bq/Sample
Total Decayed Activity (37.6 to 1999.4 keV) 2.0589240E+02 Bq/Sample

The library has energies which are not separable.


123290_Gamma_160-6694-A-5-D. 4_Gamma_20140891.spc.
1.0e3
1.0e2
1.0e1
1.0e0
Counts
Page 1322 of 2090
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Energy (keV)

Test America St. Louis Spectrum ID: 7_Gamma_20141023

Sample Description: 123290_Gamma_160-6694-A-6-D
Detector: Ge 7 SN/154
Batch ID: 123290
Work Order Number: Gamma
Lot Number: 160-6694-A-6-D

Decay to Time: 5/21/2014 15:45 Live Time: 1800 sec
Acquisition Time: 5/21/2014 15:45:52 Real Time: 1828 sec
Analysis Time: 5/21/2014 16:16 Dead Time: 1.56 %
Analysis Quantity: 1.000E+00 Sample

Efficiency Cal File: 7_Soil_TunaCan.Clb
Efficiency Cal Desc: 7_TunaCan_90099_032712
Efficiency Cal Date: 3/16/2012 11:45
Energy Cal Date: 2/23/2012 08:40
Library: Client_Short_no ingrowth Rev2.li
Bkgd Correction File: 7_2014-05-03_0622.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	1.038E+00	161.1	1.672E+00	1.673E+00	5.950E+00
K-40	1.194E+02	7.8	9.316E+00	1.114E+01	8.104E+00
CO-60	0.000E+00	707.1	6.989E-02	6.989E-02	1.419E+00
I-131	6.724E-02	140.3	9.431E-02	9.437E-02	6.661E-01
CS-134	0.000E+00	1000.0	1.318E-01	1.318E-01	2.351E+00
CS-137	7.444E-01	40.4	3.006E-01	3.031E-01	9.108E-01
EU-152	5.243E-01	86.6	4.540E-01	4.549E-01	2.493E+00
EU-154	1.540E-01	107.1	1.649E-01	1.651E-01	9.968E+00
EU-155	2.874E-01	88.1	2.533E-01	2.538E-01	1.360E+00
TL-208	1.989E+00	16.1	3.207E-01	3.369E-01	4.420E-01
PB-210	2.778E+01	21.8	6.055E+00	6.271E+00	1.640E+01
PB-212	6.143E+00	12.6	7.719E-01	8.682E-01	1.471E+00
PB-214	5.031E+00	12.0	6.033E-01	6.575E-01	1.174E+00
BI-212	8.109E+00	41.6	3.376E+00	3.402E+00	1.020E+01
BI-214	6.830E+00	12.0	8.185E-01	8.921E-01	9.729E-01
AC-228	4.604E+00	18.1	8.337E-01	8.662E-01	3.286E+00
Pa-234	6.430E-01	176.1	1.132E+00	1.133E+00	1.994E+00
TH-234	7.928E+00	63.0	4.994E+00	5.011E+00	1.734E+01
PA-234M	-1.140E+01	2000.0	2.280E+02	2.280E+02	1.213E+02
Ra-226	2.219E+01	27.8	6.159E+00	6.457E+00	1.456E+01
U-235	2.018E+00	40.7	8.218E-01	8.282E-01	2.489E+00
AM-241	-4.977E-01	109.9	5.471E-01	5.477E-01	1.852E+00
Total	2.154E+02				

Analyst: April Bean

TestAmerica Spectrum name: 7_Gamma_20141023.An1

Sample description
123290_Gamma_160-6694-A-6-D

Spectrum Filename: C:\User\SPC\Det7\7_Gamma_20141023.An1

Acquisition information
Start time: 5/21/2014 3:45:52 PM
Live time: 1800
Real time: 1828
Dead time: 1.56 %
Detector ID: 7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Soil_TunaCan.Clb
7_TunaCan_90099_032712

Energy Calibration
Created: 2/23/2012 8:40:56 AM
Zero offset: 0.117 keV
Gain: 0.250 keV/channel
Quadratic: 3.508E-09 keV/channel^2

Efficiency Calibration
Created: 3/16/2012 11:45:14 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.87 %
Log(Eff): 6.716580E-01 + (-6.166540E-01*Log(E)) + (-2.065917E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.48 %
Log(Eff): -2.689695E+01 + (1.019544E+01*Log(E)) + (-1.081671E+00*Log(E)^2)

Library Files
Main analysis library: Client_Short_no ingrowth Rev2.li
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.61keV)
Stop channel: 8000 (2000.12keV)
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

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	5/21/2014 3:45:00 PM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	7_2014-05-03_0622.PBC 5/3/2014 6:22:41 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 20 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1731

***** 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
46.43	70.	16.31	0.64	2.472E-02	46.54	4.250	2.778E+01	PB210
63.31	43.	34.73	0.73	4.006E-02	63.29	3.810	PBC<MDA	TH234
77.18	138.	14.64	0.89	4.891E-02				
86.54	5.	341.81	0.88	5.281E-02	86.54	30.700	PBC<MDA	EU155
					86.54	30.700	1.712E-01	EU155
87.13	59.	20.71	0.45	5.300E-02				
92.61	32.	46.16	0.89	5.470E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	5.579E+00	U235
					93.35	5.561	5.829E+00	AC228
					93.35	5.810	5.579E+00	U235
92.61	32.	46.16	0.89	5.470E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	5.579E+00	U235
					93.35	5.561	5.829E+00	AC228
92.65	13.	41.88	0.89	5.452E-02	92.59	5.584	PBC<MDA	TH234
					93.35	5.810	PBC<MDA	U235
					93.35	5.561	PBC<MDA	AC228
105.64	10.	88.14	0.90	5.638E-02	105.31	21.200	PBC<MDA	EU155
					105.31	21.200	4.558E-01	EU155
122.65	8.	107.11	0.92	5.596E-02	123.10	40.790	PBC<MDA	EU154
130.99	3.	319.02	0.93	5.494E-02	131.29	18.000	PBC<MDA	Pa234
143.14	21.	40.73	0.94	5.271E-02	143.79	10.960	PBC<MDA	U235
					143.79	10.960	1.975E+00	U235
163.20	8.	101.69	0.96	4.826E-02	163.38	5.080	PBC<MDA	U235
					163.38	5.080	1.776E+00	U235
185.99	73.	22.21	0.54	4.438E-02	185.99	3.280	2.219E+01	Ra226
205.24	9.	93.80	1.01	4.086E-02	205.33	5.010	PBC<MDA	U235
					205.33	5.010	2.355E+00	U235
238.66	179.	12.13	1.12	3.601E-02	238.63	43.300	6.143E+00	PB212
277.56	9.	90.63	1.08	3.172E-02	277.28	6.310	PBC<MDA	TL208

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
295.15	48.	21.67	1.10	3.009E-02	295.09	19.300	4.625E+00	PB214
					295.09	19.300	4.625E+00	PB214
300.34	25.	26.23	0.29	2.966E-02	300.03	3.280	1.427E+01	PB212
338.27	24.	33.83	1.14	2.677E-02	338.32	12.010	PBC<MDA	AC228
352.01	111.	10.88	0.83	2.587E-02	351.93	37.600	6.318E+00	PB214
					351.93	37.600	6.318E+00	PB214
477.70	4.	161.10	1.28	1.987E-02	477.60	10.520	PBC<MDA	BE7
583.19	50.	16.12	0.64	1.669E-02	583.02	84.500	1.957E+00	TL208
609.47	91.	11.98	1.57	1.605E-02	609.31	46.090	6.846E+00	BI214
637.10	3.	140.26	1.43	1.543E-02	636.97	7.170	PBC<MDA	I131
661.81	17.	40.38	1.46	1.492E-02	661.66	85.210	PBC<MDA	CS137
727.80	15.	41.63	1.51	1.373E-02	727.17	7.550	PBC<MDA	BI212
860.22	3.	141.83	1.63	1.181E-02	860.56	12.420	PBC<MDA	TL208
880.48	3.	211.70	1.65	1.157E-02	880.53	6.000	PBC<MDA	Pa234
911.44	23.	30.44	1.68	1.122E-02	911.07	29.000	3.883E+00	AC228
946.15	2.	363.99	1.70	1.085E-02	946.02	13.400	PBC<MDA	Pa234
969.41	20.	29.67	1.72	1.062E-02	968.97	17.460	6.145E+00	AC228
1112.33	5.	86.60	1.84	9.373E-03	1112.07	13.644	PBC<MDA	EU152
1120.67	8.	66.41	1.85	9.311E-03	1120.29	15.100	PBC<MDA	BI214
1408.44	1.	277.48	2.06	7.560E-03	1408.00	21.005	PBC<MDA	EU152
1460.96	168.	7.65	1.57	7.309E-03	1460.83	10.670	1.194E+02	K40
1764.50	12.	32.92	2.29	6.141E-03	1764.49	15.400	6.780E+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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
308.29	77.18	84.	138.	2.811E+03	14.64	0.885	-	s
348.07	87.13	38.	54.	1.019E+03	21.12	0.452	-	s
1407.71	352.01	99.	19.	7.305E+02	77.95	0.832	-	sc

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_Short_no ingrowth Rev2.li

********** 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	185.26	46.43	37.	53.	0.029	16.31	0.644	s
AM-241	236.53	59.24	80.	-12.	-0.007	109.92	0.850	s
TH-234	252.95	63.35	93.	22.	0.012	33.31	0.854	
EU-155	345.74	86.54	143.	5.	0.003	341.81	0.880	s
TH-234	370.15	92.65	123.	13.	0.007	41.88	0.886	s
U-235	372.97	93.35	93.	32.	0.018	46.16	0.887	D

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
AC-228	372.97	93.35	93.	32.	0.018	46.16	0.887D
EU-155	422.12	105.64	32.	10.	0.005	88.14	0.900s
EU-154	490.19	122.65	35.	8.	0.005	107.11	0.919s
Pa-234	523.54	130.99	49.	3.	0.002	319.02	0.928s
U-235	572.17	143.14	25.	21.	0.011	40.73	0.941s
U-235	652.40	163.20	28.	8.	0.004	101.69	0.962
Ra-226	743.58	185.99	58.	58.	0.032	22.21	0.541s
U-235	820.58	205.24	29.	9.	0.005	93.80	1.007s
PB-212	954.28	238.66	69.	172.	0.096	12.13	1.118
TL-208	1109.87	277.56	27.	9.	0.005	90.63	1.081
PB-214	1180.22	295.15	31.	48.	0.027	21.67	1.100s
PB-212	1201.01	300.34	6.	25.	0.014	26.23	0.291s
AC-228	1352.72	338.27	20.	24.	0.013	33.83	1.144
PB-214	1407.48	351.96	15.	92.	0.051	11.99	1.157s
I-131	1456.49	364.21	22.	-2.	-0.001	283.82	1.170s
BE-7	1910.48	477.70	18.	4.	0.002	161.10	1.282s
TL-208	2332.46	583.19	3.	50.	0.028	16.12	0.644s
BI-214	2437.60	609.47	5.	91.	0.051	11.98	1.571s
I-131	2548.11	637.10	8.	3.	0.002	140.26	1.433s
CS-137	2646.98	661.81	15.	17.	0.009	40.38	1.455s
BI-212	2910.93	727.80	12.	15.	0.008	41.63	1.515s
PA-234M	3059.19	764.86	20.	-6.	-0.003	165.11	1.550s
BI-212	3134.81	783.77	18.	-4.	-0.002	162.78	1.567s
CS-134	3182.33	795.65	20.	-3.	-0.002	228.95	1.576s
CS-134	3206.96	801.81	20.	-5.	-0.003	125.67	1.581s
TL-208	3440.63	860.22	10.	3.	0.002	141.83	1.632s
Pa-234	3521.65	880.48	15.	3.	0.002	211.70	1.649s
AC-228	3645.50	911.44	13.	23.	0.013	30.44	1.675
Pa-234	3784.33	946.15	14.	2.	0.001	363.99	1.704s
EU-152	3867.27	966.88	42.	-14.	-0.008	71.01	1.719s
AC-228	3877.40	969.41	8.	20.	0.011	29.67	1.724
EU-154	3983.91	996.04	19.	-2.	-0.001	271.94	1.746s
EU-154	4019.06	1004.83	20.	-4.	-0.002	153.84	1.753s
EU-152	4449.07	1112.33	7.	5.	0.003	86.60	1.839s
BI-214	4482.43	1120.67	10.	8.	0.004	66.41	1.845s
EU-154	5104.73	1276.25	16.	-1.	-0.001	425.12	1.963s
EU-152	5633.46	1408.44	6.	1.	0.001	277.48	2.059s
K-40	5843.53	1460.96	3.	168.	0.093	7.65	1.573s
BI-214	7057.62	1764.50	1.	12.	0.006	32.92	2.290s

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	Peak Energy keV	Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
BE-7	C	1.0378E+00				5.31E+01	
			477.60	1.038E+00	&(	5.950E+00 1.61E+02	1.05E+01 G
K-40	N	1.1936E+02				4.66E+11	
			1460.83	1.194E+02	(P	8.104E+00 7.65E+00	1.07E+01 G
I-131	I	6.7239E-02				8.02E+00	
			364.48	-6.508E-02	?(	6.661E-01 2.84E+02	8.17E+01 G
			284.30	1.568E-02	%	6.876E+00 1.18E+04	6.14E+00 G
			636.97	1.575E+00	?(	8.024E+00 1.40E+02	7.17E+00 G
CS-137	I	7.4435E-01				1.10E+04	
			661.66	7.444E-01	?(	9.108E-01 4.04E+01	8.52E+01 G
EU-152	F	5.2426E-01				4.94E+03	
			344.29	0.000E+00	?(	2.493E+00 1.00E+03	2.65E+01 G
			121.78	6.392E-03	&	1.012E+00 4.37E+03	2.86E+01 G
			778.92	0.000E+00	&(	6.922E+00 1.00E+03	1.29E+01 G
			964.11	-4.976E+00	&	1.175E+01 7.10E+01	1.46E+01 G
			1112.07	2.137E+00	?(	6.384E+00 8.66E+01	1.36E+01 G
			1408.00	4.611E-01	?(	4.951E+00 2.77E+02	2.10E+01 G
EU-154	I	1.5397E-01				3.14E+03	
			873.23	0.000E+00	?(	9.968E+00 1.00E+03	1.23E+01 G
			123.10	2.003E-01	&(	7.344E-01 1.07E+02	4.08E+01 G
			1274.54	-2.551E-01	+	4.016E+00 4.25E+02	3.52E+01 G
			723.36	7.376E-02	&	5.221E+00 1.93E+03	2.02E+01 G
			1004.77	-1.288E+00	+	7.012E+00 1.54E+02	1.80E+01 G
			996.33	-1.169E+00	+	1.153E+01 2.72E+02	1.06E+01 G
EU-155	I	2.8744E-01				1.81E+03	
			105.31	4.558E-01	(	1.360E+00 8.81E+01	2.12E+01 G
			86.54	1.712E-01	?(	2.004E+00 3.42E+02	3.07E+01 G
TL-208	N	1.9893E+00				6.98E+02	
			583.02	1.957E+00	(	4.420E-01 1.61E+01	8.45E+01 G
			277.28	2.423E+00	(	7.465E+00 9.06E+01	6.31E+00 G
			860.56	1.295E+00	-	6.623E+00 1.42E+02	1.24E+01 G
PB-210	N	2.7784E+01				8.14E+03	
			46.54	2.778E+01	(P	1.640E+01 1.63E+01	4.25E+00 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-212	N	6.1433E+00					6.98E+02	
			238.63	6.143E+00	(P	1.471E+00	1.21E+01	4.33E+01 G
			300.03	1.427E+01	+	8.065E+00	2.62E+01	3.28E+00 G
PB-214	N	5.0309E+00					5.84E+05	
			351.93	5.239E+00	(	1.174E+00	1.20E+01	3.76E+01 G
			295.09	4.625E+00	*(	2.729E+00	2.17E+01	1.93E+01 G
			242.00	-2.265E-01	%	1.330E+01	1.71E+03	7.43E+00 G
BI-212	N	8.1086E+00					6.98E+02	
			727.17	8.109E+00	?(	1.020E+01	4.16E+01	7.55E+00 G
			785.42	-1.331E+01	-	7.705E+01	1.63E+02	1.28E+00 G
BI-214	N	6.8297E+00					5.84E+05	
			609.31	6.846E+00	@(	9.729E-01	1.20E+01	4.61E+01 G
			1120.29	3.187E+00	-	6.985E+00	6.64E+01	1.51E+01 G
			1764.49	6.780E+00	?(	4.885E+00	3.29E+01	1.54E+01 G
AC-228	N	4.6040E+00					2.10E+03	
			911.07	3.883E+00	(	3.286E+00	3.04E+01	2.90E+01 G
			968.97	6.145E+00	(	4.824E+00	2.97E+01	1.75E+01 G
			338.32	4.107E+00	(	4.108E+00	3.38E+01	1.20E+01 G
							Energy duplication	
			93.35	5.829E+00		8.683E+00	4.62E+01	5.56E+00 XA
Pa-234	N	6.4296E-01					1.63E+12	
			131.29	1.780E-01	?(	1.994E+00	3.19E+02	1.80E+01 G
			569.47	2.924E-02	&	6.812E+00	5.96E+03	8.20E+00 G
			946.02	5.746E-01	?(	7.752E+00	3.64E+02	1.34E+01 G
			883.24	3.650E-02	%	9.593E+00	6.86E+03	9.60E+00 G
			880.53	2.191E+00	&(	1.681E+01	2.12E+02	6.00E+00 G
TH-234	N	7.9280E+00					1.63E+12	
			63.29	7.928E+00	?(P	1.734E+01	3.33E+01	3.81E+00 G
			92.59	2.315E+00	& P	9.908E+00	4.19E+01	5.58E+00 G
PA-234M	N	-1.1401E+01					1.63E+12	
			1001.00	-1.140E+01	%(P	1.213E+02	1.00E+03	8.37E-01 G
			766.41	-9.077E+01	+ P	3.431E+02	1.65E+02	2.94E-01 G
Ra-226	N	2.2194E+01					5.84E+05	
			185.99	2.219E+01	*(P	1.456E+01	2.22E+01	3.28E+00 G
U-235	N	2.0176E+00					2.57E+11	
			143.79	1.975E+00	?(	2.489E+00	4.07E+01	1.10E+01 G
			205.33	2.355E+00	?(	7.520E+00	9.38E+01	5.01E+00 G
			163.38	1.776E+00	?(	6.187E+00	1.02E+02	5.08E+00 G
							Energy duplication	
			93.35	5.579E+00	*	8.311E+00	4.62E+01	5.81E+00 X

```
 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

AM-241   T  -4.9773E-01                                        1.58E+05
                          59.54-4.977E-01 ?(  1.852E+00 1.10E+02 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.
   + - 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

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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********** 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
AM-241	59.24	80.	-12.	-0.007	109.92	-4.977E-01
EU-155	86.54	143.	5.	0.003	341.81	1.712E-01
U-235	93.35	93.	32.	0.018	46.16	5.579E+00
EU-155	105.64	32.	10.	0.005	88.14	4.558E-01
EU-154	122.65	35.	8.	0.005	107.11	2.003E-01
Pa-234	130.99	49.	3.	0.002	319.02	1.780E-01
U-235	143.14	25.	21.	0.011	40.73	1.975E+00
U-235	163.20	28.	8.	0.004	101.69	1.776E+00
U-235	205.24	29.	9.	0.005	93.80	2.355E+00
PB-214	295.15	31.	48.	0.027	21.67	4.625E+00
PB-214	351.96	15.	92.	0.051	11.99	5.239E+00
I-131	364.21	22.	-2.	-0.001	283.82	-6.508E-02

TestAmerica Spectrum name: 7_Gamma_20141023.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
BE-7	477.70	18.	4.	0.002	161.10	1.038E+00		
I-131	637.10	8.	3.	0.002	140.26	1.575E+00		
PA-234M	764.86	20.	-6.	-0.003	165.11	-9.077E+01		P
CS-134	795.65	20.	-3.	-0.002	228.95	-1.479E-01		
CS-134	801.81	20.	-5.	-0.003	125.67	-2.741E+00		
Pa-234	880.48	15.	3.	0.002	211.70	2.191E+00		
Pa-234	946.15	14.	2.	0.001	363.99	5.746E-01		
EU-152	966.88	42.	-14.	-0.008	71.01	-4.976E+00		
EU-154	996.04	19.	-2.	-0.001	271.94	-1.169E+00		
EU-154	1004.83	20.	-4.	-0.002	153.84	-1.288E+00		
EU-152	1112.33	7.	5.	0.003	86.60	2.137E+00		
EU-154	1276.25	16.	-1.	-0.001	425.12	-2.551E-01		
EU-152	1408.44	6.	1.	0.001	277.48	4.611E-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 *****

Nuclide	Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
BE-7 #A	1.0378E+00	1.0378E+00	1.611E+02%	5.95E+00
K-40	1.1936E+02	1.1936E+02	7.805E+00%	8.10E+00
CO-60 #A	0.0000E+00	0.0000E+00	7.071E+02%	1.42E+00
I-131 #A	6.7235E-02	6.7239E-02	1.403E+02%	6.66E-01
CS-134 #A	0.0000E+00	0.0000E+00	1.000E+03%	2.35E+00
CS-137 #A	7.4435E-01	7.4435E-01	4.038E+01%	9.11E-01
EU-152 #A	5.2426E-01	5.2426E-01	8.660E+01%	2.49E+00
EU-154 #A	1.5397E-01	1.5397E-01	1.071E+02%	9.97E+00
EU-155 #A	2.8744E-01	2.8744E-01	8.814E+01%	1.36E+00
TL-208	1.9893E+00	1.9893E+00	1.612E+01%	4.42E-01
PB-210 #	2.7784E+01	2.7784E+01	2.179E+01%	1.64E+01
PB-212	6.1433E+00	6.1433E+00	1.256E+01%	1.47E+00
PB-214 #	5.0309E+00	5.0309E+00	1.199E+01%	1.17E+00
BI-212 #A	8.1086E+00	8.1086E+00	4.163E+01%	1.02E+01
BI-214 #	6.8297E+00	6.8297E+00	1.198E+01%	9.73E-01
AC-228	4.6040E+00	4.6040E+00	1.811E+01%	3.29E+00
Pa-234 #A	6.4296E-01	6.4296E-01	1.761E+02%	1.99E+00
TH-234 #A	7.9280E+00	7.9280E+00	6.299E+01%	1.73E+01
PA-234M#A	-1.1401E+01	-1.1401E+01	2.000E+03%	1.21E+02
Ra-226 #	2.2194E+01	2.2194E+01	2.775E+01%	1.46E+01
U-235 #A	2.0176E+00	2.0176E+00	4.073E+01%	2.49E+00
AM-241 #A	-4.9773E-01	-4.9773E-01	1.099E+02%	1.85E+00

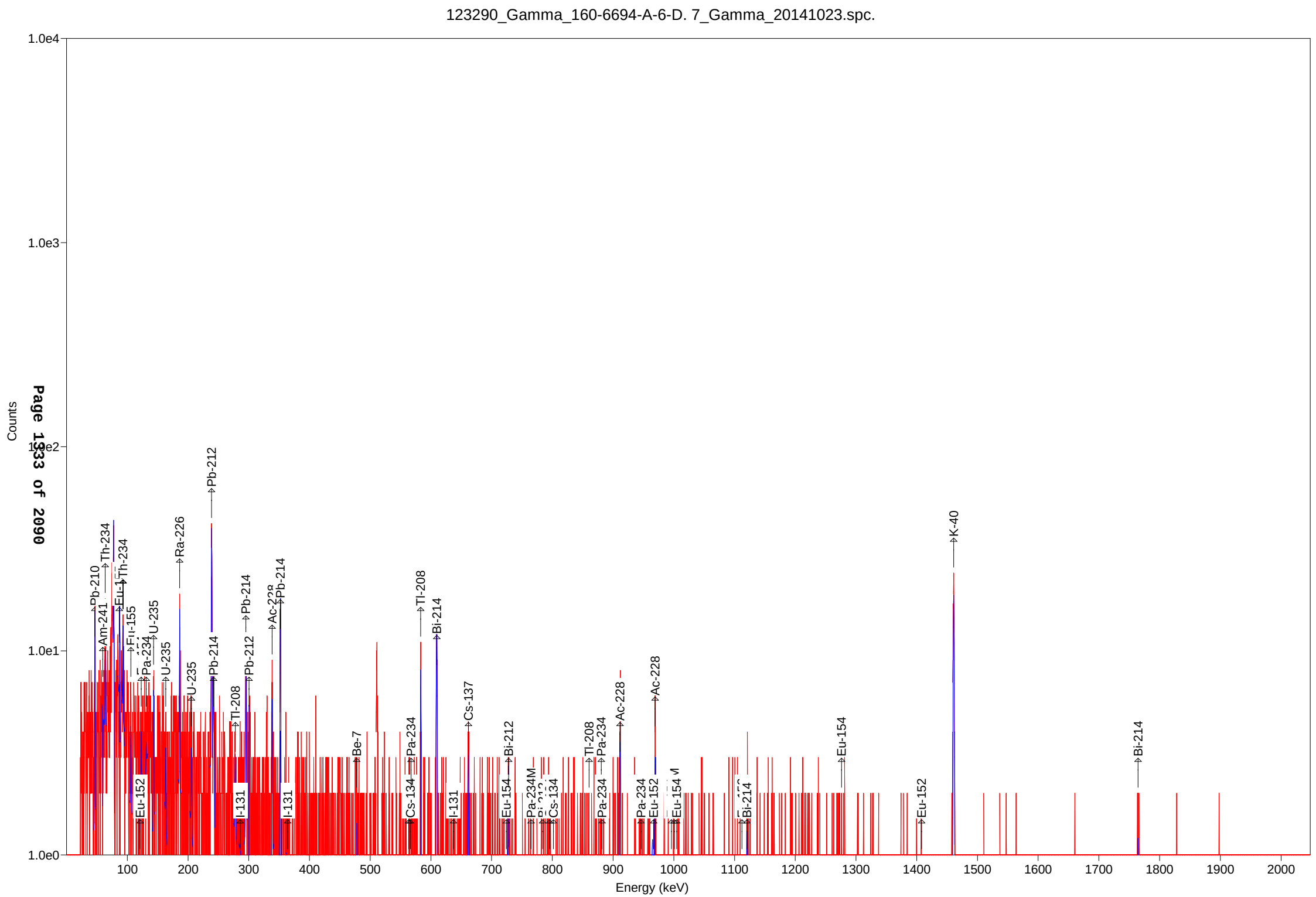
- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.

  < - 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 2000.1 keV) 1.931E+02 Bq/Sample
Total Decayed Activity (37.6 to 2000.1 keV) 1.9314903E+02 Bq/Sample

The library has energies which are not separable.


123290_Gamma_160-6694-A-6-D. 7_Gamma_20141023.spc.
Counts
1.0e4
1.0e3
1.0e2
1.0e1
1.0e0
Energy (keV)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Pb-210
Am-241
Th-234
Eu-152
Th-234
Eu-155
Pa-234
U-235
U-235
Ra-226
U-235
Pb-212
Pb-214
Tl-208
Pb-212
Pb-214
Ac-228
Pb-214
I-131
I-131
Be-7
Cs-134
Pa-234
Tl-208
Bi-214
I-131
Cs-137
Eu-154
Bi-212
Pa-234M
Cs-134
Tl-208
Pa-234
Ac-228
Pa-234
Eu-152
Ac-228
Eu-154
Bi-214
Eu-152
K-40
Eu-152
Bi-214

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

GAMMA SPECTROSCOPY BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 123290 Batch Start Date: 05/21/14 11:19 Batch Analyst: Lockhart, Justin D

Batch Method: Fill_Geo-0 Batch End Date: 05/21/14 13:00

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	TareWeight	GrossWeight	Geometry	Tuna Can LCS 00003	
MB 160-123290/1		Fill_Geo-0, GA-01-R		291.18 g			tuna can		
LCS 160-123290/2		Fill_Geo-0, GA-01-R		341.9 g			tuna can	# g	
160-6694-A-1-A	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-1-A DU	2222-SD01	Fill_Geo-0, GA-01-R	T	331.8 g	46.02 g	377.82 g	tuna can		
160-6694-A-2-A	2222-SD02	Fill_Geo-0, GA-01-R	T	401.13 g	45.92 g	447.05 g	tuna can		
160-6694-A-3-A	2222-SD03	Fill_Geo-0, GA-01-R	T	212.91 g	46.07 g	258.98 g	tuna can		
160-6694-A-4-A	2222-SD04	Fill_Geo-0, GA-01-R	T	192.24 g	46.46 g	238.70 g	tuna can		
160-6694-A-5-A	2222-SD05	Fill_Geo-0, GA-01-R	T	419.97 g	45.90 g	465.87 g	tuna can		
160-6694-A-6-A	2222-SD06	Fill_Geo-0, GA-01-R	T	204.66 g	46.10 g	250.76 g	tuna can		

Batch Notes	
Balance ID	1125353055
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.

Daily Checks

Test America
St. Louis
Quality Control Check

Spectrum: 4_20140521001_QCAsLeft
Acquired: 5/21/2014 12:21:36 AM
Detector: Ge 4 SN/181
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	59.22	59.29	59.59	59.79	59.86	PASS
FWHM	0.77	0.00	0.00	0.77	1.87	1.97	PASS
ActivityDiff	650.60	-5.00	-4.00	-2.72	4.00	5.00	PASS
QA-662							
FWHM	1.34	0.00	0.00	1.34	3.04	3.14	PASS
ActivityDiff	609.90	-5.00	-4.00	-3.97	4.00	5.00	PASS
QA-1332							
Channel	5330.00	5327.00	5328.00	5328.70	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.25	1333.01	1333.26	PASS
FWHM	1.84	0.00	0.00	1.83	4.04	4.14	PASS
ActivityDiff	1189.70	-5.00	-4.00	-1.61	4.00	5.00	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica Spectrum name: 4_20140521001_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'D') Post Stabilization

Spectrum Filename: C:\User\SPC\Det4\4_20140521001_QCAsLeft.An1

Acquisition information
Start time:	5/21/2014 12:21:36 AM
Live time:	1000
Real time:	1018
Dead time:	1.74 %
Detector ID:	4

Detector system
Ge 4 SN/181

Calibration
Filename: 4_QC.Clb
4_QA-D_Rad11-0018_032612

Energy Calibration
Created:	2/28/2012 2:55:17 PM
Zero offset:	0.091 keV
Gain:	0.250 keV/channel
Quadratic:	-2.917E-08 keV/channel^2

Efficiency Calibration
Created:	3/27/2012 7:34:55 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_QC.lib
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (1999.44keV)
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:	1.0000000E+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	4/1/2009 12:00:00 PM
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. 5 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1216

***** 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. GPS	Nuc
59.59	29130.	0.66	0.77	4.398E-02	59.54	100.000	6.683E+02	QA60
88.10	3574.	2.06	0.78	6.283E-02	88.03	100.000	9.451E+02	QA88
661.37	8444.	1.16	1.34	1.502E-02	661.66	100.000	6.341E+02	QA662
1173.02	5582.	1.44	1.64	8.792E-03	1173.23	100.000	1.248E+03	QA1173
1332.25	4822.	1.45	1.83	7.839E-03	1332.51	100.000	1.209E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	237.85	59.59	1814.	29130.	29.129	0.66	0.765
QA-88	351.83	88.10	476.	3574.	3.574	2.06	0.780
QA-662	2644.32	661.37	225.	8444.	8.444	1.16	1.338
QA-1173	4691.43	1173.02	145.	5582.	5.582	1.44	1.641
QA-1332	5328.72	1332.25	6.	4822.	4.822	1.45	1.826

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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS		Peak Code	MDA Value GPS			COMMENTS
QA-60		6.6829E+02					1.58E+05			
			59.54	6.683E+02	(	4.616E+00	6.58E-01	1.00E+02	G	
QA-88		9.4515E+02					4.63E+02			
			88.03	9.451E+02	(	2.760E+01	2.06E+00	1.00E+02	G	
QA-662		6.3414E+02					1.10E+04			
			661.66	6.341E+02	(	5.453E+00	1.16E+00	1.00E+02	G	
QA-1173		1.2476E+03					1.92E+03			
			1173.23	1.248E+03	(	1.315E+01	1.44E+00	1.00E+02	G	
QA-1332		1.2088E+03					1.92E+03			
			1332.51	1.209E+03	(	3.620E+00	1.45E+00	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
N - Naturally Occurring Isotope
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape
K - Key Line
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60		6.6281E+02	6.6829E+02	6.576E-01%	4.62E+00
QA-88		5.6890E+01	9.4515E+02	2.056E+00%	2.76E+01
QA-122	<	1.8529E+00	2.2138E+02		
QA-166		>12 Halflives			
QA-279		>12 Halflives			
QA-392		>12 Halflives			
QA-514		>12 Halflives			
QA-662		5.6335E+02	6.3414E+02	1.161E+00%	5.45E+00
QA-898		>12 Halflives			
QA-1173		6.3498E+02	1.2476E+03	1.436E+00%	1.31E+01
QA-1332		6.1524E+02	1.2088E+03	1.447E+00%	3.62E+00
QA-1836		>12 Halflives			

< - 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) 2.533E+03 GPS
Total Decayed Activity (37.6 to 1999.4 keV) 4.7040205E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 4_20140521002_BG
Acquired: 5/21/2014 12:40:33 AM
Detector: Ge 4 SN/181
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	1.32	1.20	1.24	1.35	1.39	1.43	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica Spectrum name: 4_20140521002_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det4\4_20140521002_BG.An1

Acquisition information
Start time:	5/21/2014 12:40:33 AM
Live time:	1800
Real time:	1802
Dead time:	0.10 %
Detector ID:	4

Detector system
Ge 4 SN/181

Calibration
Filename: 4_QC.Clb
4_QA-D_Rad11-0018_032612

Energy Calibration
Created:	2/28/2012 2:55:17 PM
Zero offset:	0.091 keV
Gain:	0.250 keV/channel
Quadratic:	-2.917E-08 keV/channel^2

Efficiency Calibration
Created:	3/27/2012 7:34:55 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 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (1999.44keV)
Peak rejection level:	30.000%
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:	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. 2 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1777

***** 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
46.40	21.	27.36	0.36	3.524E-02	46.54	4.250	7.769E+00	PB210
238.21	24.	28.67	0.51	5.337E-02	238.63	43.300	5.769E-01	PB212

No unknown peaks passed sensitivity test.

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	185.11	46.40	3.	21.	0.012	27.36	0.356s
PB-212	952.00	238.21	7.	24.	0.013	28.67	0.512s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS	COMMENTS
PB-210	N	7.7687E+00				8.14E+03	
			46.54	7.769E+00	(	3.988E+00	2.74E+01 4.25E+00 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-212	N 5.7695E-01					6.98E+02	
		238.63	5.769E-01 ?(		3.615E-01	2.87E+01	4.33E+01 G
		300.03	0.000E+00 %		2.602E+00	1.00E+03	3.28E+00 GA

(- 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

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 1 Sigma Counting	MDA
BE-7	<	1.2163E+00		
NA-22	<	5.0059E-01		
K-40	<	4.8985E+00		
Sc-46	<	3.9205E-01		
CR-51	<	1.3036E+00		
MN-54	<	3.5513E-01		
FE-59	<	7.8867E-01		
Co-56	<	3.6277E-01		
CO-57	<	1.0800E-01		
CO-58	<	3.4270E-01		
CO-60	<	5.2255E-01		
ZN-65	<	8.8910E-01		
NB-94	<	3.7242E-01		
ZR-95	<	5.7430E-01		
NB-95	<	6.8524E-01		
RU-103	<	2.6571E-01		
RH-106	<	3.2322E+00		
AG-108M	<	1.2558E-01		
AG-110M	<	5.3464E-01		
SN-113	<	2.8537E-01		
SB-124	<	2.0391E-01		
SB-125	<	4.7699E-01		
I-131	<	1.1840E-01		
BA-133	<	1.5320E-01		
CS-134	<	2.0710E-01		
CS-137	<	3.2058E-01		
CE-139	<	1.8489E-01		
Ba-140	<	9.2721E-01		
La-140	<	5.4812E-01		
CE-141	<	2.0010E-01		
CE-144	<	7.3405E-01		
PM-144	<	5.9048E-01		
EU-152	<	5.1253E-01		
EU-154	<	3.0996E+00		
EU-155	<	6.5248E-01		
HF-181	<	1.6099E-01		
Ta-182	<	1.2935E+00		
Hg-203	<	1.0091E-01		
TL-208	<	3.1848E-01		
pm-146	<	9.0667E-01		
y-88	<	4.2545E-01		
PB-210		7.7687E+00	2.7355E+01%	3.988E+00
PB-212	#	5.7695E-01	2.8666E+01%	3.615E-01

PB-214	<	3.1642E-01
BI-207	<	2.6091E-01
BI-212	<	3.9639E+00
BI-214	<	4.4806E-01
BI-210M	<	2.8614E-01
RA-224	<	3.3464E+00
AC-228	<	1.3842E+00
TH-227	<	6.2098E-01
TH-229	<	1.6231E+00
TH-234	<	8.3132E+00
PA-231	<	6.4190E+00
PA-233	<	2.4234E-01
PA-234	<	7.2838E-01
PA-234M	<	5.0342E+01
Ra-226	<	5.5063E+00
U-235	<	1.4782E+00
AM-241	<	3.2750E-01
Np-237	<	9.0098E-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 1999.4 keV) 8.346E+00 DPS

Test America
St. Louis
Quality Control Check

Spectrum: 5_20140521001_QCAsLeft
Acquired: 5/21/2014 12:21:41 AM
Detector: Ge 5 SN/157
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	59.60	59.79	60.04	PASS
FWHM	0.74	0.00	0.00	0.72	1.84	1.94	PASS
ActivityDiff	636.60	-5.00	-4.00	-1.60	4.00	5.00	PASS
QA-662							
FWHM	1.36	0.00	0.00	1.35	3.06	3.16	PASS
ActivityDiff	596.80	-5.00	-4.00	-2.52	4.00	5.00	PASS
QA-1332							
Channel	5330.00	5327.00	5328.00	5329.30	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.37	1333.01	1333.26	PASS
FWHM	1.90	0.00	0.00	1.99	4.10	4.20	PASS
ActivityDiff	1164.20	-5.00	-4.00	-2.83	4.00	5.00	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica Spectrum name: 5_20140521001_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'A') Post Stabilization

Spectrum Filename: C:\User\SPC\Det5\5_20140521001_QCAsLeft.An1

Acquisition information
Start time:	5/21/2014 12:21:41 AM
Live time:	1000
Real time:	1011
Dead time:	1.12 %
Detector ID:	5

Detector system
Ge 5 SN/157

Calibration
Filename: 5_QC.Clb
Ge5_QC

Energy Calibration
Created:	2/28/2012 7:35:48 PM
Zero offset:	0.158 keV
Gain:	0.250 keV/channel
Quadratic:	3.911E-08 keV/channel^2

Efficiency Calibration
Created:	1/6/2011 8:03:22 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_QC.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 (2000.81keV)
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:	1.0000000E+00
Systematic error:	4.0000000E+00
Fraction Limit:	0.000%
Background width:	average of three points.

TestAmerica Spectrum name: 5_20140521001_QCAsLeft.An1

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	4/1/2009 12:00:00 PM
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. 6 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0652

***** 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. GPS	Nuc
59.60	47599.	0.50	0.72	7.429E-02	59.54	100.000	6.468E+02	QA60
87.97	6204.	1.49	0.79	1.124E-01	88.03	100.000	9.167E+02	QA88
121.93	556.	9.66	0.91	1.160E-01	122.06	100.000	5.723E+02	QA122
661.63	15547.	0.88	1.35	2.861E-02	661.66	100.000	6.118E+02	QA662
1173.09	9312.	1.13	1.75	1.552E-02	1173.23	100.000	1.179E+03	QA1173
1332.37	8420.	1.11	1.99	1.382E-02	1332.51	100.000	1.197E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	238.00	59.60	2505.	47599.	47.599	0.50	0.724
QA-88	351.56	87.97	672.	6204.	6.205	1.49	0.785
QA-122	487.52	121.93	606.	556.	0.556	9.66	0.915s
QA-662	2647.23	661.63	522.	15547.	15.547	0.88	1.352
QA-1173	4692.64	1173.09	280.	9312.	9.312	1.13	1.748
QA-1332	5329.34	1332.37	48.	8420.	8.420	1.11	1.986

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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS	Peak Code	Peak MDA Value GPS		COMMENTS
QA-60		6.4678E+02				1.58E+05		
			59.54	6.468E+02	(	3.206E+00	5.02E-01	1.00E+02 G
QA-88		9.1674E+02				4.63E+02		
			88.03	9.167E+02	(	1.826E+01	1.49E+00	1.00E+02 G
QA-122		5.7228E+02				2.72E+02		
			122.06	5.723E+02	@(	1.210E+02	9.66E+00	1.00E+02 G
QA-662		6.1184E+02				1.10E+04		
			661.66	6.118E+02	(	4.296E+00	8.81E-01	1.00E+02 G
QA-1173		1.1793E+03				1.92E+03		
			1173.23	1.179E+03	(	1.023E+01	1.13E+00	1.00E+02 G
QA-1332		1.1971E+03				1.92E+03		
			1332.51	1.197E+03	(	4.975E+00	1.11E+00	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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape

C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60	6.4147E+02	6.4678E+02	5.025E-01%	3.21E+00
QA-88	5.5180E+01	9.1674E+02	1.491E+00%	1.83E+01
QA-122 #	4.7898E+00	5.7228E+02	9.658E+00%	1.21E+02
QA-166		>12 Halflives		
QA-279		>12 Halflives		
QA-392		>12 Halflives		
QA-514		>12 Halflives		
QA-662	5.4354E+02	6.1184E+02	8.811E-01%	4.30E+00
QA-898		>12 Halflives		
QA-1173	6.0022E+02	1.1793E+03	1.133E+00%	1.02E+01
QA-1332	6.0926E+02	1.1971E+03	1.111E+00%	4.98E+00
QA-1836		>12 Halflives		

\# - 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 2000.8 keV) 2.454E+03 GPS
Total Decayed Activity (37.6 to 2000.8 keV) 5.1240186E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 5_20140521002_BG
Acquired: 5/21/2014 12:40:20 AM
Detector: Ge 5 SN/157
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	1.45	1.30	1.35	1.41	1.55	1.60	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica Spectrum name: 5_20140521002_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det5\5_20140521002_BG.An1

Acquisition information
Start time:	5/21/2014 12:40:20 AM
Live time:	1800
Real time:	1805
Dead time:	0.26 %
Detector ID:	5

Detector system
Ge 5 SN/157

Calibration
Filename: 5_QC.Clb
Ge5_QC

Energy Calibration
Created:	2/28/2012 7:35:48 PM
Zero offset:	0.158 keV
Gain:	0.250 keV/channel
Quadratic:	3.911E-08 keV/channel^2

Efficiency Calibration
Created:	1/6/2011 8:03:22 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 G53W4.25
Start channel:	150 (37.62keV)
Stop channel:	8000 (2000.81keV)
Peak rejection level:	30.000%
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:	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. 2 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1595

***** 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

No unknown peaks passed sensitivity test.

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	186.19	46.66	3.	21.	0.012	25.42	0.877
TH-234	252.76	63.29	1.	14.	0.008	29.97	0.552s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS	COMMENTS
PB-210	N	4.8368E+00				8.14E+03	
			46.54	4.837E+00	(	2.483E+00	2.54E+01 4.25E+00 G

TestAmerica Spectrum name: 5_20140521002_BG.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
TH-234 N	2.5151E+00					1.63E+12	
		63.29	2.515E+00	?(	1.489E+00	3.00E+01	3.81E+00 G
		92.59	0.000E+00	%	1.590E+00	3.16E+01	5.58E+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:	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

P - Peakbackground subtraction

TestAmerica Spectrum name: 5_20140521002_BG.An1

***** 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 1 Sigma Counting	MDA
BE-7	<	1.8408E+00		
NA-22	<	2.8378E-01		
K-40	<	3.7255E+00		
Sc-46	<	1.9738E-01		
CR-51	<	1.2439E+00		
MN-54	<	1.8100E-01		
FE-59	<	4.3032E-01		
Co-56	<	1.8443E-01		
CO-57	<	6.7302E-02		
CO-58	<	1.7550E-01		
CO-60	<	2.9632E-01		
ZN-65	<	4.8897E-01		
NB-94	<	1.5382E-01		
ZR-95	<	2.9690E-01		
NB-95	<	2.4000E-01		
RU-103	<	1.1472E-01		
RH-106	<	1.3225E+00		
AG-108M	<	1.0439E-01		
AG-110M	<	2.6947E-01		
SN-113	<	1.3882E-01		
SB-124	<	1.2853E-01		
SB-125	<	3.1623E-01		
I-131	<	1.2003E-01		
BA-133	<	1.7632E-01		
CS-134	<	1.6391E-01		
CS-137	<	1.6799E-01		
CE-139	<	9.7338E-02		
Ba-140	<	5.7787E-01		
La-140	<	3.5380E-01		
CE-141	<	1.5082E-01		
CE-144	<	3.2950E-01		
PM-144	<	1.5094E-01		
EU-152	<	5.4747E-01		
EU-154	<	1.5666E+00		
EU-155	<	1.6904E-01		
HF-181	<	1.2641E-01		
Ta-182	<	7.1338E-01		
Hg-203	<	8.6430E-02		
TL-208	<	1.4380E-01		
pm-146	<	4.6944E-01		
y-88	<	2.1373E-01		
PB-210		4.8368E+00	2.5422E+01%	2.483E+00
PB-212	<	2.8002E-01		

PB-214	<	5.3409E-01			
BI-207	<	1.5297E-01			
BI-212	<	2.0587E+00			
BI-214	<	4.5324E-01			
BI-210M	<	1.0686E-01			
RA-224	<	1.7673E+00			
AC-228	<	6.9860E-01			
TH-227	<	1.2105E+00			
TH-229	<	2.1303E+00			
TH-234	#	2.5151E+00	2.9971E+01%		1.489E+00
PA-231	<	2.1001E+00			
PA-233	<	3.5475E-01			
PA-234	<	2.5442E-01			
PA-234M	<	2.6299E+01			
Ra-226	<	4.2455E+00			
U-235	<	8.8067E-01			
AM-241	<	4.2017E-01			
Np-237	<	6.1056E-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 2000.8 keV) 7.352E+00 DPS

Test America
St. Louis
Background Check

Spectrum: 7_20140520002_BG
Acquired: 5/20/2014 12:43:47 AM
Detector: Ge 7 SN/154
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	1.30	1.16	1.21	1.25	1.40	1.45	PASS

Analyst: Rachel Mueller Reviewer: Rachel Mueller

TestAmerica Spectrum name: 7_20140520002_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det7\7_20140520002_BG.An1

Acquisition information
Start time:	5/20/2014 12:43:47 AM
Live time:	1800
Real time:	1824
Dead time:	1.33 %
Detector ID:	7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_QC.Clb
Ge7_QC

Energy Calibration
Created:	2/23/2012 8:40:56 AM
Zero offset:	0.117 keV
Gain:	0.250 keV/channel
Quadratic:	3.508E-09 keV/channel^2

Efficiency Calibration
Created:	1/6/2011 8:06:10 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 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (2000.12keV)
Peak rejection level:	30.000%
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.

TestAmerica Spectrum name: 7_20140520002_BG.An1

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. 2 cutoff: 5.00E+01%

***** 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

No unknown peaks passed sensitivity test.

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

***** 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 DPS	Peak Energy keV	Peak Activity DPS	Peak Code	MDA Value DPS	COMMENTS

(- 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.
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$ - 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

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*************** 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

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 1 Sigma Counting	MDA
BE-7	<	5.6504E-01		
NA-22	<	1.8434E-01		
K-40	<	1.9219E+00		
Sc-46	<	1.2787E-01		
CR-51	<	3.7990E-01		
MN-54	<	1.1516E-01		
FE-59	<	2.7928E-01		
Co-56	<	1.1777E-01		
CO-57	<	5.5198E-02		
CO-58	<	1.1088E-01		
CO-60	<	1.9268E-01		
ZN-65	<	3.1730E-01		
NB-94	<	9.4723E-02		
ZR-95	<	1.8500E-01		
NB-95	<	1.0245E-01		
RU-103	<	8.5413E-02		
RH-106	<	7.9941E-01		
AG-108M	<	9.9663E-02		
AG-110M	<	1.7428E-01		
SN-113	<	8.0798E-02		

SB-124	<	1.4822E-01
SB-125	<	1.8482E-01
I-131	<	8.1195E-02
BA-133	<	7.0380E-02
CS-134	<	7.8190E-02
CS-137	<	1.0264E-01
CE-139	<	4.3730E-02
Ba-140	<	2.7196E-01
La-140	<	2.3065E-01
CE-141	<	1.0009E-01
CE-144	<	2.4555E-01
PM-144	<	9.2839E-02
EU-152	<	1.5679E-01
EU-154	<	1.0091E+00
EU-155	<	1.4834E-01
HF-181	<	7.4411E-02
Ta-182	<	4.6290E-01
Hg-203	<	4.0170E-02
TL-208	<	8.6154E-02
pm-146	<	2.9187E-01
y-88	<	1.3891E-01
PB-210	<	3.8779E+00
PB-212	<	1.8242E-01
PB-214	<	2.0332E-01
BI-207	<	1.0595E-01
BI-212	<	2.2702E+00
BI-214	<	2.1115E-01
BI-210M	<	1.3521E-01
RA-224	<	1.0380E+00
AC-228	<	4.5399E-01
TH-227	<	5.0266E-01
TH-229	<	1.3160E+00
TH-234	<	3.4012E+00
PA-231	<	1.2304E+00
PA-233	<	1.0180E-01
PA-234	<	1.1909E-01
PA-234M	<	1.7081E+01
Ra-226	<	1.9566E+00
U-235	<	3.6185E-01
AM-241	<	2.1665E-01
Np-237	<	3.0822E-01

  < - 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

TestAmerica Spectrum name: 7_20140520002_BG.An1

---------- S U M M A R Y ----------

Total Activity (37.6 to 2000.1 keV)	0.000E+00	DPS

Test America
St. Louis
Quality Control Check

Spectrum: 7_20140520003_QCAsLeft
Acquired: 5/20/2014 1:44:54 AM
Detector: Ge 7 SN/154
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	59.58	59.04	59.29	59.59	59.79	60.04	PASS
FWHM	0.84	0.00	0.00	0.86	1.94	2.04	PASS
ActivityDiff	647.00	-5.00	-4.00	0.81	4.00	5.00	PASS
QA-662							
FWHM	1.45	0.00	0.00	1.46	3.15	3.25	PASS
ActivityDiff	606.50	-5.00	-4.00	-0.30	4.00	5.00	PASS
QA-1332							
Channel	5330.00	5327.00	5328.00	5330.40	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.69	1333.01	1333.26	PASS
FWHM	1.98	0.00	0.00	2.07	4.18	4.28	PASS
ActivityDiff	1183.00	-5.00	-4.00	0.19	4.00	5.00	PASS

Analyst: Rachel Mueller Reviewer: Rachel Mueller

TestAmerica Spectrum name: 7_20140520003_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'C') Post Stabilization

Spectrum Filename: C:\User\SPC\Det7\7_20140520003_QCAsLeft.An1

Acquisition information
Start time:	5/20/2014 1:44:54 AM
Live time:	1000
Real time:	1028
Dead time:	2.74 %
Detector ID:	7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_QC.Clb
Ge7_QC

Energy Calibration
Created:	2/23/2012 8:40:56 AM
Zero offset:	0.117 keV
Gain:	0.250 keV/channel
Quadratic:	3.508E-09 keV/channel^2

Efficiency Calibration
Created:	1/6/2011 8:06:10 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_QC.lib
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (2000.12keV)
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:	1.0000000E+00
Systematic error:	4.0000000E+00
Fraction Limit:	0.000%
Background width:	average of three points.

TestAmerica Spectrum name: 7_20140520003_QCAsLeft.An1

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	4/1/2009 12:00:00 PM
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. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0639

***** 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. GPS	Nuc
59.59	72251.	0.40	0.86	1.136E-01	59.54	100.000	6.418E+02	QA60
88.04	10132.	1.28	0.89	1.845E-01	88.03	100.000	9.111E+02	QA88
122.02	816.	8.71	0.76	1.962E-01	122.06	100.000	4.959E+02	QA122
661.76	25301.	0.70	1.45	4.681E-02	661.66	100.000	6.083E+02	QA662
1173.44	14488.	0.92	1.87	2.392E-02	1173.23	100.000	1.190E+03	QA1173
1332.69	12777.	0.94	2.07	2.125E-02	1332.51	100.000	1.181E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	237.91	59.59	3360.	72251.	72.251	0.40	0.860
QA-88	351.72	88.04	1466.	10132.	10.132	1.28	0.894
QA-122	487.65	122.02	1016.	816.	0.817	8.71	0.758
QA-662	2646.76	661.76	924.	25301.	25.301	0.70	1.455
QA-1173	4693.49	1173.44	492.	14488.	14.488	0.92	1.868
QA-1332	5330.47	1332.69	172.	12777.	12.777	0.94	2.069

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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS	Peak Code	MDA Value GPS		COMMENTS
QA-60		6.4175E+02				1.58E+05		
			59.54	6.418E+02	(	2.423E+00	4.04E-01 1.00E+02	G
QA-88		9.1111E+02				4.63E+02		
			88.03	9.111E+02	(	1.629E+01	1.28E+00 1.00E+02	G
QA-122		4.9592E+02				2.72E+02		
			122.06	4.959E+02	(	9.189E+01	8.71E+00 1.00E+02	G
QA-662		6.0834E+02				1.10E+04		
			661.66	6.083E+02	(	3.470E+00	7.01E-01 1.00E+02	G
QA-1173		1.1895E+03				1.92E+03		
			1173.23	1.190E+03	(	8.709E+00	9.24E-01 1.00E+02	G
QA-1332		1.1807E+03				1.92E+03		
			1332.51	1.181E+03	(	5.904E+00	9.36E-01 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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
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

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********** 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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60	6.3649E+02	6.4175E+02	4.038E-01%	2.42E+00
QA-88	5.4919E+01	9.1111E+02	1.277E+00%	1.63E+01
QA-122	4.1607E+00	4.9592E+02	8.705E+00%	9.19E+01
QA-166		>12 Halflives		
QA-279		>12 Halflives		
QA-392		>12 Halflives		
QA-514		>12 Halflives		
QA-662	5.4046E+02	6.0834E+02	7.010E-01%	3.47E+00
QA-898		>12 Halflives		
QA-1173	6.0562E+02	1.1895E+03	9.243E-01%	8.71E+00
QA-1332	6.0115E+02	1.1807E+03	9.359E-01%	5.90E+00
QA-1836		>12 Halflives		

< - 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 2000.1 keV) 2.443E+03 GPS
Total Decayed Activity (37.6 to 2000.1 keV) 5.0273896E+03 GPS

Test America
St. Louis
Quality Control Check

Spectrum: 7_20140521001_QCAsLeft
Acquired: 5/21/2014 12:22:34 AM
Detector: Ge 7 SN/154
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	237.70	239.00	240.00	PASS
Energy	59.58	59.04	59.29	59.56	59.79	60.04	PASS
FWHM	0.84	0.00	0.00	0.85	1.94	2.04	PASS
ActivityDiff	647.00	-5.00	-4.00	0.83	4.00	5.00	PASS
QA-662							
FWHM	1.45	0.00	0.00	1.44	3.15	3.25	PASS
ActivityDiff	606.50	-5.00	-4.00	0.39	4.00	5.00	PASS
QA-1332							
Channel	5330.00	5327.00	5328.00	5329.90	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.57	1333.01	1333.26	PASS
FWHM	1.98	0.00	0.00	1.93	4.18	4.28	PASS
ActivityDiff	1183.00	-5.00	-4.00	0.25	4.00	5.00	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica Spectrum name: 7_20140521001_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'C') Post Stabilization

Spectrum Filename: C:\User\SPC\Det7\7_20140521001_QCAsLeft.An1

Acquisition information
Start time:	5/21/2014 12:22:34 AM
Live time:	1000
Real time:	1028
Dead time:	2.76 %
Detector ID:	7

Detector system
Ge 7 SN/154

Calibration
Filename:	7_QC.Clb

Ge7_QC

Energy Calibration
Created:	2/23/2012 8:40:56 AM
Zero offset:	0.117 keV
Gain:	0.250 keV/channel
Quadratic:	3.508E-09 keV/channel^2

Efficiency Calibration
Created:	1/6/2011 8:06:10 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_QC.lib
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (2000.12keV)
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:	1.0000000E+00
Systematic error:	4.0000000E+00
Fraction Limit:	0.000%
Background width:	average of three points.

TestAmerica Spectrum name: 7_20140521001_QCAsLeft.An1

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	4/1/2009 12:00:00 PM
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. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0312

***** 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. GPS	Nuc
59.56	72236.	0.40	0.85	1.136E-01	59.54	100.000	6.416E+02	QA60
88.00	10206.	1.20	0.93	1.844E-01	88.03	100.000	9.190E+02	QA88
122.01	909.	7.27	1.05	1.962E-01	122.06	100.000	5.535E+02	QA122
661.69	25124.	0.68	1.44	4.681E-02	661.66	100.000	6.041E+02	QA662
1173.30	14511.	0.93	1.88	2.392E-02	1173.23	100.000	1.192E+03	QA1173
1332.57	12764.	0.92	1.93	2.125E-02	1332.51	100.000	1.180E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	237.78	59.56	3256.	72236.	72.235	0.40	0.849
QA-88	351.59	88.00	1221.	10206.	10.206	1.20	0.926
QA-122	487.61	122.01	904.	909.	0.909	7.27	1.050
QA-662	2646.47	661.69	735.	25124.	25.124	0.68	1.442
QA-1173	4692.92	1173.30	518.	14511.	14.511	0.93	1.876
QA-1332	5329.98	1332.57	147.	12764.	12.764	0.92	1.930

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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS	Peak Code	MDA Value GPS	COMMENTS
QA-60		6.4162E+02				1.58E+05	
			59.54	6.416E+02 (		2.386E+00 4.03E-01 1.00E+02	G
QA-88		9.1900E+02				4.63E+02	
			88.03	9.190E+02 (		1.491E+01 1.20E+00 1.00E+02	G
QA-122		5.5353E+02				2.72E+02	
			122.06	5.535E+02 (		8.695E+01 7.27E+00 1.00E+02	G
QA-662		6.0412E+02				1.10E+04	
			661.66	6.041E+02 (		3.102E+00 6.83E-01 1.00E+02	G
QA-1173		1.1918E+03				1.92E+03	
			1173.23	1.192E+03 (		8.934E+00 9.30E-01 1.00E+02	G
QA-1332		1.1800E+03				1.92E+03	
			1332.51	1.180E+03 (		5.468E+00 9.23E-01 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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
D - Double-Escape

C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60	6.3636E+02	6.4162E+02	4.029E-01%	2.39E+00
QA-88	5.5316E+01	9.1900E+02	1.196E+00%	1.49E+01
QA-122	4.6329E+00	5.5353E+02	7.274E+00%	8.69E+01
QA-166		>12 Halflives		
QA-279		>12 Halflives		
QA-392		>12 Halflives		
QA-514		>12 Halflives		
QA-662	5.3668E+02	6.0412E+02	6.826E-01%	3.10E+00
QA-898		>12 Halflives		
QA-1173	6.0659E+02	1.1918E+03	9.303E-01%	8.93E+00
QA-1332	6.0057E+02	1.1800E+03	9.233E-01%	5.47E+00
QA-1836		>12 Halflives		

< - 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 2000.1 keV) 2.440E+03 GPS
Total Decayed Activity (37.6 to 2000.1 keV) 5.0900952E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 7_20140521002_BG
Acquired: 5/21/2014 12:40:50 AM
Detector: Ge 7 SN/154
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	1.30	1.16	1.21	1.28	1.40	1.45	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica Spectrum name: 7_20140521002_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det7\7_20140521002_BG.An1

Acquisition information
Start time:	5/21/2014 12:40:50 AM
Live time:	1800
Real time:	1826
Dead time:	1.43 %
Detector ID:	7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_QC.Clb
Ge7_QC

Energy Calibration
Created:	2/23/2012 8:40:56 AM
Zero offset:	0.117 keV
Gain:	0.250 keV/channel
Quadratic:	3.508E-09 keV/channel^2

Efficiency Calibration
Created:	1/6/2011 8:06:10 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 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (2000.12keV)
Peak rejection level:	30.000%
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.

TestAmerica Spectrum name: 7_20140521002_BG.An1

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. 1 cutoff: 5.00E+01%

***** 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

No unknown peaks passed sensitivity test.

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

***** 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 DPS	Peak Energy keV	Peak Activity DPS	Peak Code	MDA Value DPS	COMMENTS

(- 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

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 1 Sigma Counting	MDA
BE-7	<	7.1303E-01		
NA-22	<	2.3261E-01		
K-40	<	2.4253E+00		
Sc-46	<	1.2787E-01		
CR-51	<	3.7990E-01		
MN-54	<	1.1516E-01		
FE-59	<	2.7928E-01		
Co-56	<	1.1777E-01		
CO-57	<	5.7699E-02		
CO-58	<	1.1088E-01		
CO-60	<	1.9268E-01		
ZN-65	<	3.1730E-01		
NB-94	<	9.4723E-02		
ZR-95	<	1.8500E-01		
NB-95	<	1.0245E-01		
RU-103	<	6.7685E-02		
RH-106	<	7.9941E-01		
AG-108M	<	1.2459E-01		
AG-110M	<	1.7428E-01		
SN-113	<	1.3189E-01		

SB-124	<	7.7339E-02
SB-125	<	1.8482E-01
I-131	<	1.1967E-01
BA-133	<	1.0296E-01
CS-134	<	1.3930E-01
CS-137	<	1.0264E-01
CE-139	<	8.6598E-02
Ba-140	<	2.7196E-01
La-140	<	2.3065E-01
CE-141	<	7.5773E-02
CE-144	<	4.7961E-01
PM-144	<	9.2839E-02
EU-152	<	1.5679E-01
EU-154	<	1.0091E+00
EU-155	<	2.5939E-01
HF-181	<	7.4411E-02
Ta-182	<	4.6290E-01
Hg-203	<	9.0968E-02
TL-208	<	8.6154E-02
pm-146	<	2.9187E-01
y-88	<	1.3891E-01
PB-210	<	4.7504E+00
PB-212	<	6.6734E-02
PB-214	<	2.5844E-01
BI-207	<	7.2427E-02
BI-212	<	2.2702E+00
BI-214	<	2.1115E-01
BI-210M	<	1.3521E-01
RA-224	<	1.7490E+00
AC-228	<	4.5399E-01
TH-227	<	5.9637E-01
TH-229	<	1.5385E+00
TH-234	<	3.2484E+00
PA-231	<	1.2304E+00
PA-233	<	1.6617E-01
PA-234	<	1.5028E-01
PA-234M	<	1.7081E+01
Ra-226	<	1.8853E+00
U-235	<	2.9713E-01
AM-241	<	2.1665E-01
Np-237	<	3.0822E-01

  < - 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

TestAmerica Spectrum name: 7_20140521002_BG.An1

---------- S U M M A R Y ----------

Total Activity (	37.6 to	2000.1 keV)	0.000E+00 DPS

Test America
St. Louis
Quality Control Check

Spectrum: 9_20140521001_QCAsLeft
Acquired: 5/21/2014 12:24:24 AM
Detector: Ge9 S/N100228730
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	1.08	0.00	0.00	0.95	2.18	2.28	PASS
ActivityDiff	649.44	-5.00	-4.00	-0.50	4.00	5.00	PASS
QA-662							
FWHM	1.62	0.00	0.00	1.51	3.32	3.42	PASS
ActivityDiff	607.56	-5.00	-4.00	-0.45	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	1332.19	1333.01	1333.26	PASS
FWHM	2.12	0.00	0.00	2.03	4.32	4.42	PASS
ActivityDiff	1191.31	-5.00	-4.00	-0.57	4.00	5.00	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica, Inc Spectrum name: 9_20140521001_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'E') Post Stabilization

Spectrum Filename: C:\User\SPC\Det9\9_20140521001_QCAsLeft.An1

Acquisition information
Start time:	5/21/2014 12:24:24 AM
Live time:	1000
Real time:	1014
Dead time:	1.39 %
Detector ID:	9

Detector system
Ge9 S/N100228730

Calibration
Filename: 9_QC.Clb
9_QC-E_79670-334_060211

Energy Calibration
Created:	3/1/2012 1:57:17 PM
Zero offset:	0.074 keV
Gain:	0.250 keV/channel
Quadratic:	-2.269E-08 keV/channel^2

Efficiency Calibration
Created:	6/3/2011 12:03:10 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_QC.lib
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.59keV)
Stop channel:	8000 (1999.34keV)
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:	1.0000000E+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	4/1/2009 12:00:00 PM
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. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0854

***** 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. GPS	Nuc
59.59	64208.	0.43	0.94	9.930E-02	59.54	100.000	6.527E+02	QA60
88.07	8655.	1.30	1.00	1.545E-01	88.03	100.000	9.308E+02	QA88
122.09	786.	7.94	0.94	1.634E-01	122.06	100.000	5.745E+02	QA122
661.51	25765.	0.67	1.51	4.754E-02	661.66	100.000	6.103E+02	QA662
1172.96	16391.	0.87	1.98	2.680E-02	1173.23	100.000	1.202E+03	QA1173
1332.19	14727.	0.86	2.03	2.416E-02	1332.51	100.000	1.198E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	238.00	59.59	3020.	64208.	64.208	0.43	0.945
QA-88	351.87	88.07	953.	8655.	8.655	1.30	1.003
QA-122	487.90	122.09	777.	786.	0.786	7.94	0.943
QA-662	2645.44	661.51	730.	25765.	25.765	0.67	1.513
QA-1173	4691.85	1172.96	480.	16391.	16.391	0.87	1.981
QA-1332	5329.11	1332.19	136.	14727.	14.727	0.86	2.032

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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS		Peak Code	MDA Value GPS			COMMENTS
QA-60		6.5266E+02					1.58E+05			
			59.54	6.527E+02	(	2.631E+00	4.33E-01	1.00E+02	G	
QA-88		9.3080E+02					4.63E+02			
			88.03	9.308E+02	(	1.576E+01	1.30E+00	1.00E+02	G	
QA-122		5.7452E+02					2.72E+02			
			122.06	5.745E+02	(	9.693E+01	7.94E+00	1.00E+02	G	
QA-662		6.1031E+02					1.10E+04			
			661.66	6.103E+02	(	3.047E+00	6.74E-01	1.00E+02	G	
QA-1173		1.2019E+03					1.92E+03			
			1173.23	1.202E+03	(	7.685E+00	8.73E-01	1.00E+02	G	
QA-1332		1.1981E+03					1.92E+03			
			1332.51	1.198E+03	(	4.641E+00	8.58E-01	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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60	6.4731E+02	6.5266E+02	4.330E-01%	2.63E+00
QA-88	5.6026E+01	9.3080E+02	1.298E+00%	1.58E+01
QA-122	4.8085E+00	5.7452E+02	7.939E+00%	9.69E+01
QA-166		>12 Halflives		
QA-279		>12 Halflives		
QA-392		>12 Halflives		
QA-514		>12 Halflives		
QA-662	5.4218E+02	6.1031E+02	6.739E-01%	3.05E+00
QA-898		>12 Halflives		
QA-1173	6.1173E+02	1.2019E+03	8.729E-01%	7.69E+00
QA-1332	6.0976E+02	1.1981E+03	8.576E-01%	4.64E+00
QA-1836		>12 Halflives		

< - 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 1999.3 keV) 2.472E+03 GPS
Total Decayed Activity (37.6 to 1999.3 keV) 5.1682822E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 9_20140521002_BG
Acquired: 5/21/2014 12:45:15 AM
Detector: Ge9 S/N100228730
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	1.89	1.53	1.65	1.76	2.14	2.26	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica, Inc Spectrum name: 9_20140521002_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det9\9_20140521002_BG.An1

Acquisition information

Start time:	5/21/2014 12:45:15 AM
Live time:	1800
Real time:	1802
Dead time:	0.13 %
Detector ID:	9

Detector system
Ge9 S/N100228730

Calibration

Filename:	9_QC.Clb

9_QC-E_79670-334_060211

Energy Calibration

Created:	3/1/2012 1:57:17 PM
Zero offset:	0.074 keV
Gain:	0.250 keV/channel
Quadratic:	-2.269E-08 keV/channel^2

Efficiency Calibration

Created:	6/3/2011 12:03:10 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 G53W4.25
Start channel:	150 (37.59keV)
Stop channel:	8000 (1999.34keV)
Peak rejection level:	30.000%
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:          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.    0 cutoff: 5.00E+01%

 *****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
  Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
  Energy                             Factor    Energy   Ratio    DPS
 ____________________________________________________________________________
 No unknown peaks passed sensitivity test.

------------------------------------------------------------
 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
 ____________________________________________________________________________

 *****   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
 ____________________________________________________________________________
   ( - 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

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 1 Sigma Counting	MDA
BE-7	<	5.9594E-01		
NA-22	<	1.6313E-01		
K-40	<	2.9225E+00		
Sc-46	<	1.2935E-01		
CR-51	<	8.6973E-01		
MN-54	<	1.6898E-01		
FE-59	<	2.5938E-01		
Co-56	<	1.1834E-01		
CO-57	<	5.6082E-02		
CO-58	<	1.1087E-01		
CO-60	<	1.6956E-01		
ZN-65	<	2.9226E-01		
NB-94	<	2.3952E-01		
ZR-95	<	1.8384E-01		
NB-95	<	1.2859E-01		
RU-103	<	7.1014E-02		
RH-106	<	8.0279E-01		
AG-108M	<	1.1595E-01		
AG-110M	<	1.7616E-01		
SN-113	<	2.1422E-01		

SB-124	<	9.8810E-02
SB-125	<	2.8860E-01
I-131	<	7.6783E-02
BA-133	<	1.8357E-01
CS-134	<	1.6141E-01
CS-137	<	1.0111E-01
CE-139	<	9.5773E-02
Ba-140	<	2.8194E-01
La-140	<	1.8998E-01
CE-141	<	8.0547E-02
CE-144	<	4.4515E-01
PM-144	<	9.1722E-02
EU-152	<	1.7388E-01
EU-154	<	1.0180E+00
EU-155	<	4.7901E-01
HF-181	<	7.8390E-02
Ta-182	<	4.2511E-01
Hg-203	<	9.3414E-02
TL-208	<	2.4030E-01
pm-146	<	2.8974E-01
y-88	<	1.4073E-01
PB-210	<	2.3205E+00
PB-212	<	1.6596E-01
PB-214	<	3.4452E-01
BI-207	<	7.4264E-02
BI-212	<	1.5931E+00
BI-214	<	4.4730E-01
BI-210M	<	1.8359E-01
RA-224	<	1.6691E+00
AC-228	<	4.5769E-01
TH-227	<	5.4911E-01
TH-229	<	1.6036E+00
TH-234	<	2.0598E+00
PA-231	<	1.7545E+00
PA-233	<	2.1964E-01
PA-234	<	3.8903E-01
PA-234M	<	1.6606E+01
Ra-226	<	2.3643E+00
U-235	<	3.9360E-01
AM-241	<	3.8331E-01
Np-237	<	2.0632E-01

  < - 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

TestAmerica, Inc Spectrum name: 9_20140521002_BG.An1

---------- S U M M A R Y ----------

Total Activity (	37.6 to	1999.3 keV)	0.000E+00 DPS

Test America
St. Louis
Quality Control Check

Spectrum: 11_20140520001_QCAsLeft
Acquired: 5/20/2014 12:25:04 AM
Detector: Ge11 S/N09363993
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	0.86	2.00	2.10	PASS
ActivityDiff	627.52	-5.00	-4.00	-0.24	4.00	5.00	PASS
QA-662							
FWHM	1.48	0.00	0.00	1.38	3.18	3.28	PASS
ActivityDiff	604.82	-5.00	-4.00	-0.03	4.00	5.00	PASS
QA-1332							
Channel	5330.00	5327.00	5328.00	5329.80	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.55	1333.01	1333.26	PASS
FWHM	2.05	0.00	0.00	1.98	4.25	4.35	PASS
ActivityDiff	1163.60	-5.00	-4.00	-0.79	4.00	5.00	PASS

Analyst: Rachel Mueller Reviewer: Rachel Mueller

TestAmerica, Inc Spectrum name: 11_20140520001_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'G') Post Stabilization

Spectrum Filename: C:\User\SPC\Det11\11_20140520001_QCAsLeft.An1

Acquisition information
Start time:	5/20/2014 12:25:04 AM
Live time:	1000
Real time:	1015
Dead time:	1.46 %
Detector ID:	11

Detector system
Ge11 S/N09363993

Calibration
Filename:	11_QC.Clb

11_QC-G_092511

Energy Calibration
Created:	2/28/2012 1:09:34 PM
Zero offset:	0.055 keV
Gain:	0.250 keV/channel
Quadratic:	-2.946E-08 keV/channel^2

Efficiency Calibration
Created:	10/4/2011 1:15:19 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_QC.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 (1999.47keV)
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:	1.0000000E+00
Systematic error:	4.0000000E+00
Fraction Limit:	0.000%
Background width:	average of three points.

TestAmerica, Inc Spectrum name: 11_20140520001_QCAsLeft.An1

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	1/1/2011 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. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0225

***** 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. GPS	Nuc
59.56	50899.	0.50	0.86	8.138E-02	59.54	100.000	6.290E+02	QA60
88.04	17586.	0.89	0.87	1.193E-01	88.03	100.000	9.370E+02	QA88
122.08	2710.	2.97	0.92	1.236E-01	122.06	100.000	5.109E+02	QA122
661.71	20104.	0.76	1.38	3.592E-02	661.66	100.000	6.050E+02	QA662
1173.28	15175.	0.88	1.85	2.018E-02	1173.23	100.000	1.173E+03	QA1173
1332.55	13642.	0.88	1.98	1.814E-02	1332.51	100.000	1.173E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	237.88	59.56	3179.	50899.	50.899	0.50	0.856
QA-88	351.73	88.04	1529.	17586.	17.586	0.89	0.874
QA-122	487.81	122.08	836.	2710.	2.711	2.97	0.916
QA-662	2645.72	661.71	608.	20104.	20.104	0.76	1.384
QA-1173	4692.43	1173.28	390.	15175.	15.175	0.88	1.851
QA-1332	5329.88	1332.55	79.	13642.	13.642	0.88	1.978

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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS		Peak Code	MDA Value GPS			COMMENTS
QA-60		6.2903E+02					1.58E+05			
			59.54	6.290E+02	(	3.281E+00	4.98E-01	1.00E+02	G	
QA-88		9.3700E+02					4.63E+02			
			88.03	9.370E+02	(	9.853E+00	8.94E-01	1.00E+02	G	
QA-122		5.1088E+02					2.72E+02			
			122.06	5.109E+02	(	2.591E+01	2.97E+00	1.00E+02	G	
QA-662		6.0500E+02					1.10E+04			
			661.66	6.050E+02	(	3.538E+00	7.62E-01	1.00E+02	G	
QA-1173		1.1729E+03					1.92E+03			
			1173.23	1.173E+03	(	7.322E+00	8.82E-01	1.00E+02	G	
QA-1332		1.1728E+03					1.92E+03			
			1332.51	1.173E+03	(	3.790E+00	8.76E-01	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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60		6.2563E+02	6.2903E+02	4.976E-01%	3.28E+00
QA-88		1.4736E+02	9.3700E+02	8.941E-01%	9.85E+00
QA-122		2.1925E+01	5.1088E+02	2.969E+00%	2.59E+01
QA-166	<	1.1615E+00	5.8328E+02		
QA-279		>12 Halflives			
QA-392	<	2.3146E+00	3.9202E+03		
QA-514		>12 Halflives			
QA-662		5.5965E+02	6.0500E+02	7.616E-01%	3.54E+00
QA-898	<	5.5619E+00	1.7042E+04		
QA-1173		7.5195E+02	1.1729E+03	8.818E-01%	7.32E+00
QA-1332		7.5187E+02	1.1728E+03	8.761E-01%	3.79E+00
QA-1836	<	2.4598E+00	7.5369E+03		

< - 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) 2.858E+03 GPS
Total Decayed Activity (37.6 to 1999.5 keV) 5.0276162E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 11_20140520002_BG
Acquired: 5/20/2014 12:45:08 AM
Detector: Ge11 S/N09363993
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	2.13	2.00	2.04	2.09	2.21	2.25	PASS

Analyst: Rachel Mueller Reviewer: Rachel Mueller

TestAmerica, Inc Spectrum name: 11_20140520002_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det11\11_20140520002_BG.An1

Acquisition information
Start time:	5/20/2014 12:45:08 AM
Live time:	1800
Real time:	1807
Dead time:	0.39 %
Detector ID:	11

Detector system
Ge11 S/N09363993

Calibration
Filename: 11_QC.Clb
11_QC-G_092511

Energy Calibration
Created:	2/28/2012 1:09:34 PM
Zero offset:	0.055 keV
Gain:	0.250 keV/channel
Quadratic:	-2.946E-08 keV/channel^2

Efficiency Calibration
Created:	10/4/2011 1:15:19 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 G53W4.25
Start channel:	150 (37.58keV)
Stop channel:	8000 (1999.47keV)
Peak rejection level:	30.000%
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:          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.    6 cutoff: 5.00E+01%
       Energy Calibration
            Normalized diff:       0.2163

 *****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
  Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
  Energy                             Factor    Energy   Ratio    DPS
 ____________________________________________________________________________
 No unknown peaks passed sensitivity test.

 ------------------------------------------------------------
 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    185.04    46.34         9.        51.     0.028    18.29   0.914
 Ra-226    742.36   185.75         6.        47.     0.026    17.93   1.112s

   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
 ____________________________________________________________________________

PB-210   N   1.0413E+01                                        8.14E+03
                           46.54 1.041E+01  (  3.408E+00 1.83E+01 4.25E+00 G
```

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ra-226	7.5534E+00					5.84E+05	
		185.99	7.553E+00	*(	2.270E+00	1.79E+01	3.28E+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:	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

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	Activity DPS	Time of Count Uncertainty Counting 1 Sigma	MDA
BE-7	< 7.9123E-01		
NA-22	< 2.1693E-01		
K-40	< 4.8353E+00		
Sc-46	< 1.5948E-01		

CR-51	<	1.4982E+00		
MN-54	<	1.8373E-01		
FE-59	<	5.4883E-01		
Co-56	<	1.4849E-01		
CO-57	<	1.1802E-01		
CO-58	<	1.4093E-01		
CO-60	<	2.2570E-01		
ZN-65	<	3.8078E-01		
NB-94	<	1.2273E-01		
ZR-95	<	2.3759E-01		
NB-95	<	1.3136E-01		
RU-103	<	1.5386E-01		
RH-106	<	1.0631E+00		
AG-108M	<	8.6463E-02		
AG-110M	<	4.1709E-01		
SN-113	<	1.1552E-01		
SB-124	<	2.5568E-01		
SB-125	<	4.6696E-01		
I-131	<	1.6495E-01		
BA-133	<	1.0301E-01		
CS-134	<	2.1383E-01		
CS-137	<	1.3377E-01		
CE-139	<	4.6464E-02		
Ba-140	<	5.4708E-01		
La-140	<	2.6790E-01		
CE-141	<	2.2777E-01		
CE-144	<	8.9032E-01		
PM-144	<	1.2040E-01		
EU-152	<	5.4665E-01		
EU-154	<	1.2640E+00		
EU-155	<	2.8315E-01		
HF-181	<	1.0407E-01		
Ta-182	<	5.5486E-01		
Hg-203	<	6.0755E-02		
TL-208	<	1.1651E-01		
pm-146	<	3.7546E-01		
y-88	<	1.7282E-01		
PB-210		1.0413E+01	1.8289E+01%	3.408E+00
PB-212	<	3.4723E-01		
PB-214	<	4.9798E-01		
BI-207	<	2.7729E-01		
BI-212	<	2.6846E+00		
BI-214	<	6.6573E-01		
BI-210M	<	1.5546E-01		
RA-224	<	2.7760E+00		
AC-228	<	1.0045E+00		
TH-227	<	4.5051E-01		
TH-229	<	1.1339E+00		
TH-234	<	6.5018E+00		

PA-231	<	1.8456E+00		
PA-233	<	2.7106E-01		
PA-234	<	3.0733E-01		
PA-234M	<	2.6408E+01		
Ra-226	#	7.5534E+00	1.7928E+01%	2.270E+00
U-235	<	4.8597E-01		
AM-241	<	5.0356E-01		
Np-237	<	4.7475E-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) 1.797E+01 DPS

Test America
St. Louis
Quality Control Check

Spectrum: 12_20140520001_QCAsLeft
Acquired: 5/20/2014 12:25:57 AM
Detector: Ge12 S/N10034336
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	59.62	59.79	60.04	PASS
FWHM	0.90	0.00	0.00	1.12	2.00	2.10	PASS
ActivityDiff	691.00	-5.00	-4.00	1.28	4.00	5.00	PASS
QA-662							
FWHM	1.48	0.00	0.00	1.66	3.18	3.28	PASS
ActivityDiff	659.00	-5.00	-4.00	-0.65	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	1332.54	1333.01	1333.26	PASS
FWHM	2.00	0.00	0.00	2.06	4.20	4.30	PASS
ActivityDiff	1274.00	-5.00	-4.00	-1.81	4.00	5.00	PASS

Analyst: Rachel Mueller Reviewer: Rachel Mueller

TestAmerica, Inc Spectrum name: 12_20140520001_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'H') Post Stabilization

Spectrum Filename: C:\User\SPC\Det12\12_20140520001_QCAsLeft.An1

Acquisition information
Start time:	5/20/2014 12:25:57 AM
Live time:	1000
Real time:	1015
Dead time:	1.50 %
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_QC.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:	1.0000000E+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       1/1/2011 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.    6 cutoff: 5.00E+01%
       Energy Calibration
            Normalized diff:       0.0485

*****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
 Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
 Energy                             Factor    Energy   Ratio    GPS
_____________________________________________________________________________
   59.62    54685.   0.49   1.12  8.070E-02    59.54 100.000  6.822E+02 QA60
   88.12    18871.   0.85   1.18  1.192E-01    88.03 100.000  1.007E+03 QA88
  122.16     2711.   3.02   1.11  1.237E-01   122.06 100.000  5.104E+02 QA122
  661.73    22845.   0.76   1.66  3.723E-02   661.66 100.000  6.633E+02 QA662
 1173.28    17038.   0.88   1.99  2.088E-02  1173.23 100.000  1.273E+03 QA1173
 1332.54    15561.   0.85   2.06  1.871E-02  1332.51 100.000  1.297E+03 QA1332
No unknown peaks passed sensitivity test.

-------------------------------------------------------------
This section based on library: DET_QC.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
_____________________________________________________________________________
QA-60     238.06    59.62      3740.     54685.    54.685     0.49   1.122s
QA-88     351.99    88.12      1587.     18871.    18.871     0.85   1.182s
QA-122    488.03   122.16       963.      2711.     2.711     3.02   1.107
QA-662   2645.40   661.73      1056.     22845.    22.845     0.76   1.657
QA-1173  4692.10  1173.28       687.     17038.    17.038     0.88   1.992
QA-1332  5329.54  1332.54       227.     15561.    15.561     0.85   2.064

  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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS		Peak Code	MDA Value GPS		COMMENTS
QA-60		6.8218E+02					1.58E+05		
			59.54	6.822E+02	*(	3.589E+00	4.87E-01	1.00E+02	G
QA-88		1.0066E+03					4.63E+02		
			88.03	1.007E+03	*(	1.005E+01	8.50E-01	1.00E+02	G
QA-122		5.1041E+02					2.72E+02		
			122.06	5.104E+02	(	2.773E+01	3.02E+00	1.00E+02	G
QA-662		6.6329E+02					1.10E+04		
			661.66	6.633E+02	(	4.475E+00	7.59E-01	1.00E+02	G
QA-1173		1.2728E+03					1.92E+03		
			1173.23	1.273E+03	(	9.324E+00	8.77E-01	1.00E+02	G
QA-1332		1.2970E+03					1.92E+03		
			1332.51	1.297E+03	(	6.073E+00	8.45E-01	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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60	#	6.7850E+02	6.8218E+02	4.869E-01%	3.59E+00
QA-88	#	1.5829E+02	1.0066E+03	8.503E-01%	1.00E+01
QA-122		2.1905E+01	5.1041E+02	3.024E+00%	2.77E+01
QA-166	<	1.1629E+00	5.8399E+02		
QA-279			>12 Halflives		
QA-392	<	2.8188E+00	4.7742E+03		
QA-514			>12 Halflives		
QA-662		6.1357E+02	6.6329E+02	7.589E-01%	4.48E+00
QA-898	<	5.8450E+00	1.7909E+04		
QA-1173		8.1598E+02	1.2728E+03	8.765E-01%	9.32E+00
QA-1332		8.3151E+02	1.2970E+03	8.452E-01%	6.07E+00
QA-1836	<	1.4180E+00	4.3448E+03		

\# - 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) 3.120E+03 GPS
Total Decayed Activity (37.6 to 1999.4 keV) 5.4322490E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 12_20140520002_BG
Acquired: 5/20/2014 12:44:44 AM
Detector: Ge12 S/N10034336
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	2.16	1.95	2.02	2.16	2.29	2.36	PASS

Analyst: Rachel Mueller Reviewer: Rachel Mueller

TestAmerica, Inc Spectrum name: 12_20140520002_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det12\12_20140520002_BG.An1

Acquisition information
Start time:	5/20/2014 12:44:44 AM
Live time:	1800
Real time:	1804
Dead time:	0.23 %
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 G53W4.25
Start channel:	150 (37.58keV)
Stop channel:	8000 (1999.36keV)
Peak rejection level:	30.000%
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:          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.    4 cutoff: 5.00E+01%

 *****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
  Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
  Energy                             Factor    Energy   Ratio    DPS
 ____________________________________________________________________________
 No unknown peaks passed sensitivity test.

------------------------------------------------------------
 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
 ____________________________________________________________________________

 *****   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
 ____________________________________________________________________________
   ( - 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

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 1 Sigma Counting	MDA
BE-7	<	9.7010E-01		
NA-22	<	2.1006E-01		
K-40	<	5.1391E+00		
Sc-46	<	1.5552E-01		
CR-51	<	5.5502E-01		
MN-54	<	1.4151E-01		
FE-59	<	3.2594E-01		
Co-56	<	1.8225E-01		
CO-57	<	1.0231E-01		
CO-58	<	2.2330E-01		
CO-60	<	2.7614E-01		
ZN-65	<	3.6889E-01		
NB-94	<	1.1857E-01		
ZR-95	<	2.3005E-01		
NB-95	<	1.2724E-01		
RU-103	<	1.6307E-01		
RH-106	<	2.3271E+00		
AG-108M	<	1.4984E-01		
AG-110M	<	2.1217E-01		
SN-113	<	1.1248E-01		

SB-124	<	1.2664E-01
SB-125	<	5.2035E-01
I-131	<	1.8692E-01
BA-133	<	1.4733E-01
CS-134	<	3.4465E-01
CS-137	<	1.2905E-01
CE-139	<	9.3733E-02
Ba-140	<	6.9509E-01
La-140	<	2.5886E-01
CE-141	<	2.7332E-01
CE-144	<	5.8683E-01
PM-144	<	1.8983E-01
EU-152	<	4.6124E-01
EU-154	<	1.2313E+00
EU-155	<	1.5892E-01
HF-181	<	2.4920E-01
Ta-182	<	5.3741E-01
Hg-203	<	1.3532E-01
TL-208	<	3.1771E-01
pm-146	<	3.6340E-01
y-88	<	1.6863E-01
PB-210	<	7.5378E+00
PB-212	<	3.6155E-01
PB-214	<	5.4581E-01
BI-207	<	9.5370E-02
BI-212	<	2.3268E+00
BI-214	<	4.4168E-01
BI-210M	<	1.3714E-01
RA-224	<	3.0125E+00
AC-228	<	1.4559E+00
TH-227	<	9.0029E-01
TH-229	<	1.7007E+00
TH-234	<	6.5012E+00
PA-231	<	3.6986E+00
PA-233	<	1.8842E-01
PA-234	<	4.4427E-01
PA-234M	<	2.0357E+01
Ra-226	<	3.9784E+00
U-235	<	4.0047E-01
AM-241	<	3.3500E-01
Np-237	<	4.7540E-01

  < - 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

TestAmerica, Inc Spectrum name: 12_20140520002_BG.An1

---------- S U M M A R Y ----------

Total Activity (37.6 to 1999.4 keV)	0.000E+00	DPS

Test America
St. Louis
Quality Control Check

Spectrum: 12_20140521001_QCAsLeft
Acquired: 5/21/2014 12:25:36 AM
Detector: Ge12 S/N10034336
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	59.57	59.79	60.04	PASS
FWHM	0.90	0.00	0.00	1.14	2.00	2.10	PASS
ActivityDiff	691.00	-5.00	-4.00	0.69	4.00	5.00	PASS
QA-662							
FWHM	1.48	0.00	0.00	1.63	3.18	3.28	PASS
ActivityDiff	659.00	-5.00	-4.00	-0.19	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	1332.45	1333.01	1333.26	PASS
FWHM	2.00	0.00	0.00	2.03	4.20	4.30	PASS
ActivityDiff	1274.00	-5.00	-4.00	-0.90	4.00	5.00	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica, Inc Spectrum name: 12_20140521001_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'H') Post Stabilization

Spectrum Filename: C:\User\SPC\Det12\12_20140521001_QCAsLeft.An1

Acquisition information
Start time:	5/21/2014 12:25:36 AM
Live time:	1000
Real time:	1016
Dead time:	1.54 %
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_QC.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:	1.0000000E+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	1/1/2011 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. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0191

***** 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. GPS	Nuc
59.57	55012.	0.48	1.14	8.063E-02	59.54	100.000	6.863E+02	QA60
88.07	18643.	0.86	1.14	1.192E-01	88.03	100.000	9.959E+02	QA88
122.12	2419.	2.69	0.96	1.238E-01	122.06	100.000	4.565E+02	QA122
661.66	22739.	0.74	1.63	3.723E-02	661.66	100.000	6.602E+02	QA662
1173.18	17160.	0.86	1.96	2.088E-02	1173.23	100.000	1.282E+03	QA1173
1332.45	15418.	0.86	2.03	1.872E-02	1332.51	100.000	1.286E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	237.87	59.57	3562.	55012.	55.012	0.48	1.140s
QA-88	351.77	88.07	1624.	18643.	18.643	0.86	1.136s
QA-122	487.93	122.13	1123.	2769.	2.769	3.27	1.220s
QA-662	2645.11	661.66	900.	22739.	22.739	0.74	1.631
QA-1173	4691.70	1173.18	630.	17160.	17.160	0.86	1.958
QA-1332	5329.18	1332.45	240.	15418.	15.418	0.86	2.027

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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS		Peak Code	MDA Value GPS		COMMENTS
QA-60		6.8626E+02					1.58E+05		
			59.54	6.863E+02	*(	3.504E+00	4.80E-01	1.00E+02	G
QA-88		9.9587E+02					4.63E+02		
			88.03	9.959E+02	*(	1.018E+01	8.64E-01	1.00E+02	G
QA-122		5.2256E+02					2.72E+02		
			122.06	5.226E+02	*(	2.999E+01	3.27E+00	1.00E+02	G
QA-662		6.6025E+02					1.10E+04		
			661.66	6.602E+02	(	4.138E+00	7.38E-01	1.00E+02	G
QA-1173		1.2823E+03					1.92E+03		
			1173.23	1.282E+03	(	8.943E+00	8.56E-01	1.00E+02	G
QA-1332		1.2855E+03					1.92E+03		
			1332.51	1.286E+03	(	6.245E+00	8.57E-01	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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60	#	6.8255E+02	6.8626E+02	4.804E-01%	3.50E+00
QA-88	#	1.5638E+02	9.9587E+02	8.641E-01%	1.02E+01
QA-122	#	2.2369E+01	5.2256E+02	3.270E+00%	3.00E+01
QA-166	<	1.4210E+00	7.1719E+02		
QA-279			>12 Halflives		
QA-392	<	2.5822E+00	4.3999E+03		
QA-514			>12 Halflives		
QA-662		6.1072E+02	6.6025E+02	7.377E-01%	4.14E+00
QA-898	<	5.1237E+00	1.5802E+04		
QA-1173		8.2181E+02	1.2823E+03	8.559E-01%	8.94E+00
QA-1332		8.2385E+02	1.2855E+03	8.570E-01%	6.25E+00
QA-1836	<	2.6916E+00	8.3011E+03		

\# - 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) 3.118E+03 GPS
Total Decayed Activity (37.6 to 1999.4 keV) 5.4328174E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 12_20140521002_BG
Acquired: 5/21/2014 12:47:14 AM
Detector: Ge12 S/N10034336
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	2.16	1.95	2.02	2.11	2.29	2.36	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica, Inc Spectrum name: 12_20140521002_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det12\12_20140521002_BG.An1

Acquisition information
Start time:	5/21/2014 12:47:14 AM
Live time:	1800
Real time:	1805
Dead time:	0.25 %
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 G53W4.25
Start channel:	150 (37.58keV)
Stop channel:	8000 (1999.36keV)
Peak rejection level:	30.000%
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:          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.    4 cutoff: 5.00E+01%
       Energy Calibration
            Normalized diff:       0.0063

 *****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
  Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
  Energy                             Factor    Energy   Ratio    DPS
 ____________________________________________________________________________
 No unknown peaks passed sensitivity test.

 ------------------------------------------------------------
 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    185.77    46.53        16.        31.     0.017    28.67   0.872

   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
 ____________________________________________________________________________

PB-210   N   6.4348E+00                                        8.14E+03
                           46.54 6.435E+00  (  4.432E+00 2.87E+01 4.25E+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:                      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

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		Activity	Time of Count Uncertainty 1 Sigma Counting	MDA DPS
BE-7	<	1.1246E+00		
NA-22	<	2.1006E-01		
K-40	<	2.1709E+00		
Sc-46	<	2.5385E-01		
CR-51	<	8.1192E-01		
MN-54	<	3.6199E-01		
FE-59	<	3.2594E-01		
Co-56	<	2.3575E-01		
CO-57	<	1.2882E-01		
CO-58	<	3.0980E-01		
CO-60	<	2.1883E-01		
ZN-65	<	3.6889E-01		

NB-94	<	1.9355E-01			
ZR-95	<	2.3005E-01			
NB-95	<	1.2724E-01			
RU-103	<	9.1530E-02			
RH-106	<	1.0276E+00			
AG-108M	<	1.8134E-01			
AG-110M	<	2.1217E-01			
SN-113	<	2.1556E-01			
SB-124	<	1.2664E-01			
SB-125	<	5.2035E-01			
I-131	<	2.2875E-01			
BA-133	<	1.0071E-01			
CS-134	<	2.0685E-01			
CS-137	<	1.2905E-01			
CE-139	<	1.1750E-01			
Ba-140	<	5.3057E-01			
La-140	<	2.5886E-01			
CE-141	<	2.0405E-01			
CE-144	<	3.8639E-01			
PM-144	<	1.1630E-01			
EU-152	<	4.0269E-01			
EU-154	<	1.2313E+00			
EU-155	<	3.5988E-01			
HF-181	<	1.0110E-01			
Ta-182	<	5.3741E-01			
Hg-203	<	7.5405E-02			
TL-208	<	2.9864E-01			
pm-146	<	3.6340E-01			
y-88	<	1.6863E-01			
PB-210		6.4348E+00	2.8672E+01%		4.432E+00
PB-212	<	2.4811E-01			
PB-214	<	2.9171E-01			
BI-207	<	1.6991E-01			
BI-212	<	3.6019E+00			
BI-214	<	2.1645E-01			
BI-210M	<	9.3745E-02			
RA-224	<	3.1817E+00			
AC-228	<	8.9766E-01			
TH-227	<	5.1485E-01			
TH-229	<	2.7068E+00			
TH-234	<	4.9476E+00			
PA-231	<	2.2872E+00			
PA-233	<	1.4931E-01			
PA-234	<	3.5969E-01			
PA-234M	<	4.3891E+01			
Ra-226	<	5.2249E+00			
U-235	<	1.0790E+00			
AM-241	<	2.7122E-01			
Np-237	<	8.1396E-01			

  < - 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)	6.435E+00 DPS

Test America
St. Louis
Background Check

Spectrum: 15_20140521001_BG
Acquired: 5/21/2014 12:02:40 AM
Detector: Ge15 SN/11012216
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	1.72	1.60	1.64	1.71	1.80	1.84	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica, Inc. Spectrum name: 15_20140521001_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det15\15_20140521001_BG.An1

Acquisition information
Start time: 5/21/2014 12:02:40 AM
Live time: 1800
Real time: 1801
Dead time: 0.06 %
Detector ID: 15

Detector system
Ge15 SN/11012216

Calibration
Filename: 15_20140521001_BG.An1
15_QC_83725-334_SOURCE F_2011

Energy Calibration
Created: 2/28/2012 4:29:17 PM
Zero offset: 0.044 keV
Gain: 0.250 keV/channel
Quadratic: -3.267E-08 keV/channel^2

Efficiency Calibration
Created: 8/2/2011 8:55:45 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 G53W4.25
Start channel: 150 (37.57keV)
Stop channel: 8000 (1999.52keV)
Peak rejection level: 30.000%
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:          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.    3 cutoff: 5.00E+01%

 *****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
  Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
  Energy                             Factor    Energy   Ratio    DPS
 ____________________________________________________________________________
 No unknown peaks passed sensitivity test.

------------------------------------------------------------
 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
 ____________________________________________________________________________

 *****   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
 ____________________________________________________________________________
   ( - 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	

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*************** 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

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 1 Sigma Counting	MDA
BE-7	<	9.3188E-01		
NA-22	<	3.5035E-01		
K-40	<	2.9206E+00		
Sc-46	<	1.9584E-01		
CR-51	<	6.3063E-01		
MN-54	<	1.8040E-01		
FE-59	<	4.1935E-01		
Co-56	<	1.8366E-01		
CO-57	<	1.2446E-01		
CO-58	<	1.7523E-01		
CO-60	<	4.2747E-01		
ZN-65	<	4.7569E-01		
NB-94	<	1.9511E-01		
ZR-95	<	2.9752E-01		
NB-95	<	1.6431E-01		
RU-103	<	1.1163E-01		
RH-106	<	2.6896E+00		
AG-108M	<	1.2708E-01		
AG-110M	<	2.6748E-01		
SN-113	<	1.3327E-01		

SB-124	<	1.6092E-01
SB-125	<	5.4309E-01
I-131	<	1.1586E-01
BA-133	<	2.0757E-01
CS-134	<	2.6308E-01
CS-137	<	2.4753E-01
CE-139	<	7.3057E-02
Ba-140	<	1.0156E+00
La-140	<	3.5136E-01
CE-141	<	1.7580E-01
CE-144	<	1.0404E+00
PM-144	<	1.5177E-01
EU-152	<	6.1505E-01
EU-154	<	3.1763E+00
EU-155	<	2.4465E-01
HF-181	<	1.7952E-01
Ta-182	<	6.9359E-01
Hg-203	<	1.5136E-01
TL-208	<	3.0630E-01
pm-146	<	5.9396E-01
y-88	<	2.1189E-01
PB-210	<	6.9475E+00
PB-212	<	4.1964E-01
PB-214	<	3.6221E-01
BI-207	<	2.5750E-01
BI-212	<	2.0665E+00
BI-214	<	2.7589E-01
BI-210M	<	1.3175E-01
RA-224	<	2.7995E+00
AC-228	<	6.9194E-01
TH-227	<	3.8862E-01
TH-229	<	2.3911E+00
TH-234	<	6.7929E+00
PA-231	<	4.1722E+00
PA-233	<	2.4733E-01
PA-234	<	4.2966E-01
PA-234M	<	2.5865E+01
Ra-226	<	4.8183E+00
U-235	<	8.3726E-01
AM-241	<	2.4116E-01
Np-237	<	1.1192E+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

TestAmerica, Inc. Spectrum name: 15_20140521001_BG.An1

--- S U M M A R Y ---

Total Activity (37.6 to 1999.5 keV) 0.000E+00 DPS

Test America
St. Louis
Quality Control Check

Spectrum: 15_20140521002_QCAsLeft
Acquired: 5/21/2014 1:07:05 AM
Detector: Ge15 SN/11012216
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	0.95	0.00	0.00	1.06	2.05	2.15	PASS
ActivityDiff	670.56	-5.00	-4.00	1.63	4.00	5.00	PASS
QA-662							
FWHM	1.51	0.00	0.00	1.55	3.21	3.31	PASS
ActivityDiff	668.76	-5.00	-4.00	1.40	4.00	5.00	PASS
QA-1332							
Channel	5330.00	5327.00	5328.00	5329.70	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.61	1333.01	1333.26	PASS
FWHM	1.99	0.00	0.00	2.00	4.19	4.29	PASS
ActivityDiff	1277.79	-5.00	-4.00	0.89	4.00	5.00	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica, Inc. Spectrum name: 15_20140521002_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'F') Post Stabilization

Spectrum Filename: C:\User\SPC\Det15\15_20140521002_QCAsLeft.An1

Acquisition information
Start time:	5/21/2014 1:07:05 AM
Live time:	1000
Real time:	1012
Dead time:	1.17 %
Detector ID:	15

Detector system
Ge15 SN/11012216

Calibration
Filename: 15_20140521002_QCAsLeft.An1
15_QC_83725-334_SOURCE F_2011

Energy Calibration
Created:	2/28/2012 4:29:17 PM
Zero offset:	0.044 keV
Gain:	0.250 keV/channel
Quadratic:	-3.267E-08 keV/channel^2

Efficiency Calibration
Created:	8/2/2011 8:55:45 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_QC.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 (1999.52keV)
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:	1.0000000E+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	1/1/2011 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. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0321

***** 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. GPS	Nuc
59.56	50645.	0.50	1.06	7.722E-02	59.54	100.000	6.596E+02	QA60
88.05	16863.	0.91	1.11	1.137E-01	88.03	100.000	9.447E+02	QA88
122.08	2350.	2.56	1.02	1.172E-01	122.06	100.000	4.682E+02	QA122
661.69	17321.	0.84	1.55	2.840E-02	661.66	100.000	6.594E+02	QA662
1173.33	12727.	0.98	1.86	1.605E-02	1173.23	100.000	1.237E+03	QA1173
1332.61	11374.	0.95	2.00	1.401E-02	1332.51	100.000	1.266E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	237.87	59.56	3007.	50645.	50.645	0.50	1.063
QA-88	351.77	88.05	1485.	16863.	16.863	0.91	1.105
QA-122	487.71	122.06	640.	2349.	2.349	2.56	1.016D
QA-662	2645.41	661.69	644.	17321.	17.321	0.84	1.552
QA-1173	4692.35	1173.33	414.	12727.	12.727	0.98	1.861
QA-1332	5329.79	1332.61	50.	11374.	11.374	0.95	2.000

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 GPS	Peak Energy keV	Peak Activity GPS		Peak Code	MDA Value GPS		COMMENTS
QA-60		6.5960E+02					1.58E+05		
			59.54	6.596E+02	(	3.363E+00	5.02E-01	1.00E+02	G
QA-88		9.4469E+02					4.63E+02		
			88.03	9.447E+02	(	1.021E+01	9.15E-01	1.00E+02	G
QA-122		4.6822E+02					2.72E+02		
			122.06	4.682E+02	(	2.403E+01	2.56E+00	1.00E+02	G
QA-662		6.5942E+02					1.10E+04		
			661.66	6.594E+02	(	4.605E+00	8.36E-01	1.00E+02	G
QA-1173		1.2371E+03					1.92E+03		
			1173.23	1.237E+03	(	9.480E+00	9.82E-01	1.00E+02	G
QA-1332		1.2664E+03					1.92E+03		
			1332.51	1.266E+03	(	3.977E+00	9.54E-01	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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60	6.5603E+02	6.5960E+02	5.022E-01%	3.36E+00
QA-88	1.4834E+02	9.4469E+02	9.147E-01%	1.02E+01
QA-122	2.0042E+01	4.6822E+02	2.564E+00%	2.40E+01
QA-166 <	1.4173E+00	7.1545E+02		
QA-279		>12 Halflives		
QA-392 <	2.2097E+00	3.7659E+03		
QA-514		>12 Halflives		
QA-662	6.0996E+02	6.5942E+02	8.360E-01%	4.61E+00
QA-898 <	3.8990E+00	1.2027E+04		
QA-1173	7.9283E+02	1.2371E+03	9.822E-01%	9.48E+00
QA-1332	8.1157E+02	1.2664E+03	9.544E-01%	3.98E+00
QA-1836 <	1.7172E+00	5.2969E+03		

< - 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 (136.4 to 1999.5 keV) 3.039E+03 GPS
Total Decayed Activity (136.4 to 1999.5 keV) 5.2354600E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 17_20140521001_BG
Acquired: 5/21/2014 12:03:13 AM
Detector: Ge17 SN/11080671
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	2.47	2.30	2.35	2.39	2.58	2.63	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica, Inc. Spectrum name: 17_20140521001_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det17\17_20140521001_BG.An1

Acquisition information
Start time:	5/21/2014 12:03:13 AM
Live time:	1800
Real time:	1806
Dead time:	0.33 %
Detector ID:	17

Detector system
Ge17 SN/11080671

Calibration
Filename: 17_QC.Clb
17_QC_83725-334_SOURCE H_042211

Energy Calibration
Created:	2/29/2012 10:33:23 AM
Zero offset:	0.108 keV
Gain:	0.250 keV/channel
Quadratic:	-2.584E-08 keV/channel^2

Efficiency Calibration
Created:	5/1/2011 11:17:56 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 G53W4.25
Start channel:	150 (37.63keV)
Stop channel:	8000 (1999.54keV)
Peak rejection level:	30.000%
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:         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.    6 cutoff: 5.00E+01%
       Energy Calibration
            Normalized diff:       0.0303
```

***** 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
46.56	42.	24.05	1.04	5.941E-02	46.54	4.250	9.242E+00	PB210
62.93	40.	24.24	0.68	8.036E-02	63.29	3.810	7.258E+00	TH234
92.49	48.	25.24	0.93	1.119E-01	92.59	5.584	4.224E+00	TH234
					93.35	5.561	4.238E+00	AC228
351.56	25.	20.00	0.40	6.080E-02	351.93	37.600	6.075E-01	PB214

No unknown peaks passed sensitivity test.

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	185.72	46.56	20.	42.	0.023	24.05	1.037s
TH-234	251.14	62.93	18.	40.	0.022	24.24	0.680s
TH-234	369.33	92.49	28.	48.	0.026	25.24	0.925s
PB-214	1405.24	351.56	0.	25.	0.014	20.00	0.400s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS		COMMENTS
PB-210	N	9.2419E+00				8.14E+03		
			46.54	9.242E+00	(	5.182E+00	2.40E+01 4.25E+00	G
PB-214	N	6.0751E-01				5.84E+05		
			351.93	6.075E-01	(	1.791E-01	2.00E+01 3.76E+01	G
			295.09	0.000E+00	%	5.515E-01	4.28E+01 1.93E+01	G
			242.00	0.000E+00	%	6.424E-01	1.00E+03 7.43E+00	GA
TH-234	N	7.2577E+00				1.63E+12		
			63.29	7.258E+00	*(	4.079E+00	2.42E+01 3.81E+00	G
			92.59	4.224E+00	-	2.414E+00	2.52E+01 5.58E+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

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 1 Sigma Counting	MDA
BE-7	< 8.4647E-01		
NA-22	< 2.3087E-01		
K-40	< 2.3857E+00		
Sc-46	< 1.6963E-01		
CR-51	< 1.2354E+00		
MN-54	< 1.9578E-01		
FE-59	< 3.5771E-01		
Co-56	< 1.5818E-01		
CO-57	< 7.3781E-02		
CO-58	< 1.8964E-01		
CO-60	< 2.4023E-01		
ZN-65	< 4.0512E-01		
NB-94	< 1.3122E-01		
ZR-95	< 2.5373E-01		
NB-95	< 3.3199E-01		
RU-103	< 1.0084E-01		
RH-106	< 1.1375E+00		
AG-108M	< 9.2497E-02		
AG-110M	< 2.9217E-01		
SN-113	< 3.3779E-01		
SB-124	< 2.2649E-01		
SB-125	< 4.1019E-01		
I-131	< 1.0913E-01		
BA-133	< 2.1120E-01		
CS-134	< 1.1212E-01		
CS-137	< 1.4314E-01		
CE-139	< 7.2728E-02		
Ba-140	< 5.0490E-01		
La-140	< 2.8480E-01		
CE-141	< 1.9960E-01		
CE-144	< 1.3157E+00		
PM-144	< 1.2874E-01		
EU-152	< 5.8482E-01		
EU-154	< 1.3452E+00		
EU-155	< 4.1961E-01		
HF-181	< 1.4050E-01		

Ta-182	<	8.6360E-01			
Hg-203	<	9.5089E-02			
TL-208	<	3.0725E-01			
pm-146	<	7.1449E-01			
y-88	<	1.8377E-01			
PB-210		9.2419E+00	2.4046E+01%		5.182E+00
PB-212	<	3.9917E-01			
PB-214	#	6.0751E-01	2.0000E+01%		1.791E-01
BI-207	<	1.3292E-01			
BI-212	<	2.2179E+00			
BI-214	<	6.7445E-01			
BI-210M	<	2.9519E-01			
RA-224	<	1.4652E+00			
AC-228	<	7.5657E-01			
TH-227	<	8.2359E-01			
TH-229	<	2.6280E+00			
TH-234	#	7.2577E+00	2.4238E+01%		4.079E+00
PA-231	<	4.4716E+00			
PA-233	<	2.0541E-01			
PA-234	<	3.5901E-01			
PA-234M	<	2.2258E+01			
Ra-226	<	4.9275E+00			
U-235	<	1.1617E+00			
AM-241	<	3.4132E-01			
Np-237	<	6.1599E-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) 1.711E+01 DPS

Test America
St. Louis
Quality Control Check

Spectrum: 17_20140521002_QCAsLeft
Acquired: 5/21/2014 1:08:03 AM
Detector: Ge17 SN/11080671
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	59.62	59.79	60.04	PASS
FWHM	0.77	0.00	0.00	0.77	1.87	1.97	PASS
ActivityDiff	691.00	-5.00	-4.00	0.52	4.00	5.00	PASS
QA-662							
FWHM	1.37	0.00	0.00	1.34	3.07	3.17	PASS
ActivityDiff	659.00	-5.00	-4.00	1.06	4.00	5.00	PASS
QA-1332							
Channel	5330.00	5327.00	5328.00	5329.60	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.50	1333.01	1333.26	PASS
FWHM	1.88	0.00	0.00	1.82	4.08	4.18	PASS
ActivityDiff	1274.00	-5.00	-4.00	0.16	4.00	5.00	PASS

Analyst: Siobhan Perry Reviewer: Siobhan Perry

TestAmerica, Inc. Spectrum name: 17_20140521002_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'H') Post Stabilization

Spectrum Filename: C:\User\SPC\Det17\17_20140521002_QCAsLeft.An1

Acquisition information
Start time:	5/21/2014 1:08:03 AM
Live time:	1000
Real time:	1015
Dead time:	1.52 %
Detector ID:	17

Detector system
Ge17 SN/11080671

Calibration
Filename: 17_QC.Clb
17_QC_83725-334_SOURCE H_042211

Energy Calibration
Created:	2/29/2012 10:33:23 AM
Zero offset:	0.108 keV
Gain:	0.250 keV/channel
Quadratic:	-2.584E-08 keV/channel^2

Efficiency Calibration
Created:	5/1/2011 11:17:56 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_QC.lib
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.63keV)
Stop channel:	8000 (1999.54keV)
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:	1.0000000E+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	1/1/2011 12:00:00 PM
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. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0452

***** 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. GPS	Nuc
59.62	51736.	0.48	0.77	7.577E-02	59.54	100.000	6.874E+02	QA60
88.09	17566.	0.82	0.81	1.113E-01	88.03	100.000	1.005E+03	QA88
121.99	2599.	2.92	0.88	1.155E-01	122.06	100.000	5.257E+02	QA122
661.66	20246.	0.75	1.34	3.357E-02	661.66	100.000	6.520E+02	QA662
1173.29	15153.	0.83	1.76	1.896E-02	1173.23	100.000	1.247E+03	QA1173
1332.50	13897.	0.88	1.82	1.705E-02	1332.51	100.000	1.272E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	237.91	59.62	2832.	51736.	51.736	0.48	0.767
QA-88	351.74	88.09	966.	17566.	17.566	0.82	0.812
QA-122	487.30	121.99	795.	2599.	2.599	2.92	0.883
QA-662	2645.48	661.66	598.	20246.	20.246	0.75	1.344
QA-1173	4692.32	1173.26	485.	15361.	15.361	0.90	1.796
QA-1332	5329.60	1332.50	112.	13897.	13.897	0.88	1.815

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	Nuclide Code	Average Activity GPS	Peak Energy keV	Peak Activity GPS		Peak Code	MDA Value GPS			COMMENTS
QA-60		6.8738E+02					1.58E+05			
			59.54	6.874E+02	(	3.331E+00	4.82E-01	1.00E+02	G	
QA-88		1.0048E+03					4.63E+02			
			88.03	1.005E+03	(	8.441E+00	8.18E-01	1.00E+02	G	
QA-122		5.2565E+02					2.72E+02			
			122.06	5.257E+02	(	2.712E+01	2.92E+00	1.00E+02	G	
QA-662		6.5203E+02					1.10E+04			
			661.66	6.520E+02	(	3.757E+00	7.51E-01	1.00E+02	G	
QA-1173		1.2639E+03					1.92E+03			
			1173.23	1.264E+03	(	8.668E+00	9.01E-01	1.00E+02	G	
QA-1332		1.2720E+03					1.92E+03			
			1332.51	1.272E+03	(	4.762E+00	8.75E-01	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
N - Naturally Occurring Isotope
P - Photon Reaction

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape
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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60		6.8366E+02	6.8738E+02	4.818E-01%	3.33E+00
QA-88		1.5778E+02	1.0048E+03	8.176E-01%	8.44E+00
QA-122		2.2502E+01	5.2565E+02	2.925E+00%	2.71E+01
QA-166	<	1.1789E+00	5.9499E+02		
QA-279		>12 Halflives			
QA-392	<	2.1652E+00	3.6892E+03		
QA-514		>12 Halflives			
QA-662		6.0311E+02	6.5203E+02	7.513E-01%	3.76E+00
QA-898	<	4.6511E+00	1.4343E+04		
QA-1173		8.0997E+02	1.2639E+03	9.012E-01%	8.67E+00
QA-1332		8.1520E+02	1.2720E+03	8.752E-01%	4.76E+00
QA-1836	<	2.5067E+00	7.7303E+03		

< - 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) 3.092E+03 GPS
Total Decayed Activity (37.6 to 1999.5 keV) 5.4057617E+03 GPS

Test America
St. Louis
Background Check

Spectrum: 18_20140520001_BG
Acquired: 5/20/2014 12:03:31 AM
Detector: Ge18 SN/11164036
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	2.58	2.45	2.50	2.52	2.66	2.71	PASS

Analyst: Rachel Mueller Reviewer: Rachel Mueller

Test America Spectrum name: 18_20140520001_BG.An1

Sample description
Background Contamination Check

Spectrum Filename: C:\User\SPC\Det18\18_20140520001_BG.An1

Acquisition information
Start time:	5/20/2014 12:03:31 AM
Live time:	1800
Real time:	1809
Dead time:	0.49 %
Detector ID:	18

Detector system
Ge18 SN/11164036

Calibration
Filename: 18_QC.Clb
Ge18_QA Source E

Energy Calibration
Created:	3/1/2012 1:27:55 PM
Zero offset:	0.007 keV
Gain:	0.250 keV/channel
Quadratic:	-3.202E-08 keV/channel^2

Efficiency Calibration
Created:	6/23/2011 2:02:37 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 G53W4.25
Start channel:	150 (37.54keV)
Stop channel:	8000 (1999.55keV)
Peak rejection level:	30.000%
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:	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. 5 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0350

***** 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

No unknown peaks passed sensitivity test.

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	186.12	46.57	27.	41.	0.023	28.54	1.004
PB-212	951.97	238.16	18.	42.	0.023	26.42	0.798s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS	COMMENTS
PB-210	N	8.9074E+00				8.14E+03	
			46.54	8.907E+00	(	5.770E+00	2.85E+01 4.25E+00 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-212	N 5.7996E-01					6.98E+02	
		238.63	5.800E-01 ?(		3.103E-01	2.64E+01	4.33E+01 G
		300.03	0.000E+00 %		2.194E+00	4.12E+02	3.28E+00 GA

(- 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.
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% - 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

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 1 Sigma Counting	MDA
BE-7	<	7.8173E-01		
NA-22	<	2.1869E-01		
K-40	<	2.2445E+00		
Sc-46	<	2.8069E-01		
CR-51	<	1.6294E+00		
MN-54	<	1.4606E-01		
FE-59	<	3.3693E-01		
Co-56	<	1.4850E-01		
CO-57	<	8.4782E-02		
CO-58	<	1.4224E-01		
CO-60	<	2.2725E-01		
ZN-65	<	3.8219E-01		
NB-94	<	2.7320E-01		
ZR-95	<	2.4273E-01		
NB-95	<	2.3863E-01		
RU-103	<	2.9876E-01		
RH-106	<	1.5941E+00		
AG-108M	<	2.0886E-01		
AG-110M	<	2.1531E-01		
SN-113	<	2.6615E-01		
SB-124	<	1.7252E-01		
SB-125	<	2.5661E-01		
I-131	<	7.9415E-02		
BA-133	<	2.0702E-01		
CS-134	<	1.0683E-01		
CS-137	<	2.8383E-01		
CE-139	<	1.2092E-01		
Ba-140	<	3.7432E-01		
La-140	<	2.6622E-01		
CE-141	<	3.2742E-01		
CE-144	<	5.0996E-01		
PM-144	<	1.5703E-01		
EU-152	<	2.2818E-01		
EU-154	<	1.2547E+00		
EU-155	<	6.8439E-01		
HF-181	<	1.2987E-01		
Ta-182	<	5.5725E-01		
Hg-203	<	7.6828E-02		
TL-208	<	2.5445E-01		
pm-146	<	7.3658E-01		
y-88	<	1.7028E-01		
PB-210		8.9074E+00	2.8535E+01%	5.770E+00
PB-212	#	5.7996E-01	2.6424E+01%	3.103E-01

PB-214	<	4.5122E-01
BI-207	<	2.2501E-01
BI-212	<	2.1329E+00
BI-214	<	5.4086E-01
BI-210M	<	1.8333E-01
RA-224	<	3.1695E+00
AC-228	<	1.0656E+00
TH-227	<	1.0434E+00
TH-229	<	3.0988E+00
TH-234	<	6.4333E+00
PA-231	<	6.2607E+00
PA-233	<	3.2664E-01
PA-234	<	7.9645E-01
PA-234M	<	3.3925E+01
Ra-226	<	5.1288E+00
U-235	<	5.2989E-01
AM-241	<	5.9267E-01
Np-237	<	1.3504E+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 (37.5 to 1999.5 keV)   9.487E+00 DPS

Test America
St. Louis
Quality Control Check

Spectrum: 18_20140520002_QCAsLeft
Acquired: 5/20/2014 1:45:47 AM
Detector: Ge18 SN/11164036
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	59.56	59.79	60.04	PASS
FWHM	0.94	0.00	0.00	0.94	2.04	2.14	PASS
ActivityDiff	669.75	-5.00	-4.00	-1.47	4.00	5.00	PASS
QA-662							
FWHM	1.54	0.00	0.00	1.55	3.24	3.34	PASS
ActivityDiff	630.92	-5.00	-4.00	-0.76	4.00	5.00	PASS
QA-1332							
Channel	5330.00	5327.00	5328.00	5329.90	5332.00	5333.00	PASS
Energy	1332.51	1331.76	1332.01	1332.65	1333.01	1333.26	PASS
FWHM	2.03	0.00	0.00	1.98	4.23	4.33	PASS
ActivityDiff	1228.08	-5.00	-4.00	-2.52	4.00	5.00	PASS

Analyst: Rachel Mueller Reviewer: Rachel Mueller

Test America Spectrum name: 18_20140520002_QCAsLeft.An1

Sample description
Quality control Check (QC Source 'E') Post Stabilization

Spectrum Filename: C:\User\SPC\Det18\18_20140520002_QCAsLeft.An1

Acquisition information
Start time:	5/20/2014 1:45:47 AM
Live time:	1000
Real time:	1015
Dead time:	1.51 %
Detector ID:	18

Detector system
Ge18 SN/11164036

Calibration
Filename: 18_QC.Clb
Ge18_QA Source E

Energy Calibration
Created:	3/1/2012 1:27:55 PM
Zero offset:	0.007 keV
Gain:	0.250 keV/channel
Quadratic:	-3.202E-08 keV/channel^2

Efficiency Calibration
Created:	6/23/2011 2:02:37 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_QC.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 (1999.55keV)
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:	1.0000000E+00
Systematic error:	4.0000000E+00
Fraction Limit:	0.000%
Background width:	average of three points.

Test America Spectrum name: 18_20140520002_QCAsLeft.An1

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	4/1/2009 12:00:00 PM
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. 6 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0479

***** 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. GPS	Nuc
59.56	52591.	0.49	0.94	7.806E-02	59.54	100.000	6.796E+02	QA60
88.05	6709.	1.59	0.95	1.161E-01	88.03	100.000	9.587E+02	QA88
661.75	19512.	0.83	1.55	3.454E-02	661.66	100.000	6.357E+02	QA662
1173.36	12930.	0.98	1.91	1.998E-02	1173.23	100.000	1.271E+03	QA1173
1332.65	11552.	0.98	1.98	1.802E-02	1332.51	100.000	1.259E+03	QA1332

No unknown peaks passed sensitivity test.

This section based on library: DET_QC.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
QA-60	238.03	59.56	3037.	52591.	52.591	0.49	0.938
QA-88	351.90	88.05	1070.	6709.	6.709	1.59	0.952
QA-662	2645.78	661.75	948.	19512.	19.512	0.83	1.551
QA-1173	4692.52	1173.36	413.	12930.	12.930	0.98	1.915
QA-1332	5329.95	1332.65	150.	11552.	11.552	0.98	1.983

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 GPS	Peak Energy keV	Peak Activity GPS		Peak Code	MDA Value GPS		COMMENTS
QA-60		6.7957E+02					1.58E+05		
			59.54	6.796E+02	(	3.353E+00	4.88E-01	1.00E+02	G
QA-88		9.5871E+02					4.63E+02		
			88.03	9.587E+02	(	2.217E+01	1.59E+00	1.00E+02	G
QA-662		6.3574E+02					1.10E+04		
			661.66	6.357E+02	(	4.763E+00	8.29E-01	1.00E+02	G
QA-1173		1.2710E+03					1.92E+03		
			1173.23	1.271E+03	(	9.579E+00	9.81E-01	1.00E+02	G
QA-1332		1.2590E+03					1.92E+03		
			1332.51	1.259E+03	(	6.526E+00	9.79E-01	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
N - Naturally Occurring Isotope
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation

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

Test America Spectrum name: 18_20140520002_QCAsLeft.An1

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

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 GPS	Time Corrected Activity GPS	Uncertainty 1 Sigma Counting	MDA
QA-60		6.7399E+02	6.7957E+02	4.876E-01%	3.35E+00
QA-88		5.7788E+01	9.5871E+02	1.588E+00%	2.22E+01
QA-122	<	1.1299E+00	1.3468E+02		
QA-166			>12 Halflives		
QA-279			>12 Halflives		
QA-392			>12 Halflives		
QA-514			>12 Halflives		
QA-662		5.6480E+02	6.3574E+02	8.287E-01%	4.76E+00
QA-898			>12 Halflives		
QA-1173		6.4710E+02	1.2710E+03	9.813E-01%	9.58E+00
QA-1332		6.4101E+02	1.2590E+03	9.787E-01%	6.53E+00
QA-1836			>12 Halflives		

< - 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 (37.5 to 1999.5 keV) 2.585E+03 GPS
Total Decayed Activity (37.5 to 1999.5 keV) 4.8040430E+03 GPS

Initial Calibrations

Gamma Verification per Geometry

Detector:	Ge4
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	14534	97.4
Am-241	2037	418	0.3590	1163	1211.4	104.1
Cd-109	2881	591	0.0361	16363	16123	98.5
Co-57	1511	310	0.8560	362	353.51	97.7
Ce-139	2139	439	0.7990	549	541.9	98.7
Hg-203	4651	954	0.8146	1171	1197.5	102.3
Sn-113	3015	618	0.6400	966	965.83	100.0
Cs-137	1938	397	0.8510	467	464.8	99.5
Y-88	7264	1489	0.9370	1589	1568.4	98.7
Co-60	3580	734	0.9997	734	732.09	99.7
Co-60	3581	734	0.9999	734	730.52	99.5
Y-88	7690	1577	0.9920	1589	1608.9	101.2

Reviewed By: Jody Watson

Date: 4/2/2012

Calibration Data from file: 4_Soil_TunaCan.Clb
Energy Calibration Date: 4/2/2012 Time: 1:19:28 PM
Efficiency Calibration Date: 4/2/2012 Time: 1:19:41 PM

Calibration Description:
4_Soil_TunaCan_90099_033012

Energy Calibration Fit
Energy = 0.0841 +0.250111*Channel -2.82165e-008*Channel**2
FWHM (ch) = 2.9699 +0.000905*Channel -1.12861e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta	
185.86	46.54	46.57	-0.06%	0.77	0.78	-2.05%	*
237.99	59.54	59.61	-0.11%	0.77	0.80	-2.87%	*
352.07	88.03	88.14	-0.12%	0.80	0.82	-3.00%	*
487.89	122.06	122.10	-0.04%	0.85	0.85	-0.79%	
662.68	165.85	165.81	0.02%	0.92	0.89	2.85%	
1115.49	279.17	279.05	0.04%	1.04	0.99	4.71%	*
1565.30	391.69	391.51	0.04%	1.10	1.09	0.87%	
2645.59	661.66	661.58	0.01%	1.34	1.32	1.45%	
3591.88	898.02	898.09	-0.01%	1.50	1.52	-1.26%	*
4693.38	1173.24	1173.33	-0.01%	1.74	1.74	0.11%	
5330.90	1332.50	1332.60	-0.01%	1.83	1.87	-2.11%	*
7346.21	1836.01	1835.93	0.00%	2.27	2.25	0.88%	*

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.7786 %
Ln(Eff) = -0.3984 -0.574628*Ln(Eng) -0.0204644*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 0.8003 %
Ln(Eff) = -25.4679 +9.285295*Ln(Eng) -0.990443*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	1.1765E-002	1.2076E-002	-2.64%
59.54	1.7788E-002	1.7193E-002	3.35%
88.03	2.3178E-002	2.3534E-002	-1.53%
122.06	2.3675E-002	2.4250E-002	-2.43%
165.85	========== Knee ==========		
165.85	2.0578E-002	2.0860E-002	-1.37%
279.17	1.4119E-002	1.3792E-002	2.32%
391.69	1.0481E-002	1.0476E-002	0.05%
661.66	6.7648E-003	6.7809E-003	-0.24%
898.02	5.1688E-003	5.2356E-003	-1.29%
1173.24	4.1471E-003	4.1620E-003	-0.36%
1332.50	3.7091E-003	3.7274E-003	-0.49%
1836.01	2.8499E-003	2.8152E-003	1.22%

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

ORTEC g v - i (1087) Env32 G53W4.25 4/2/2012 2:16:12 PM
TestAmerica Spectrum name: 4_TunaCan_20120147.An1

Sample description
4_TunaCan_90099_033012

Spectrum Filename: C:\User\Cal\Spectra\Det4\4_TunaCan_20120147.An1

Acquisition information
Start time: 3/30/2012 1:58:17 PM
Live time: 7200
Real time: 7338
Dead time: 1.88 %
Detector ID: 4

Detector system
Ge 4 SN/181

Calibration
Filename: 4_Soil_TunaCan.Clb
4_Soil_TunaCan_90099_033012

Energy Calibration
Created: 4/2/2012 1:19:28 PM
Zero offset: 0.084 keV
Gain: 0.250 keV/channel
Quadratic: -2.822E-08 keV/channel^2

Efficiency Calibration
Created: 4/2/2012 1:19:41 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.78 %
Log(Eff): -3.983609E-01 + (-5.746278E-01*Log(E)) +
(-2.046438E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.80 %
Log(Eff): -2.546791E+01 + (9.285295E+00*Log(E)) +
(-9.904428E-01*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 (37.60keV)
Stop channel: 8000 (1999.16keV)
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 4/2/2012 2:16:12 PM
TestAmerica Spectrum name: 4_TunaCan_20120147.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:	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. 12 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0727

***** 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
46.57	53301.	0.71	0.77	1.209E-02	46.54	4.250	1.453E+04	Pb210
59.61	53514.	0.70	0.77	1.722E-02	59.54	35.700	1.211E+03	AM241
72.99	2672.	6.56	0.81	2.103E-02				
88.14	86292.	0.46	0.80	2.355E-02	88.03	3.610	1.612E+04	CD109
122.10	42094.	0.74	0.85	2.425E-02	122.06	85.600	3.535E+02	CO57
136.52	5015.	4.27	0.87	2.334E-02				
165.81	41514.	0.70	0.92	2.058E-02	165.85	79.900	5.419E+02	Ce139
254.94	1501.	9.38	0.88	1.484E-02				
279.05	25767.	0.82	1.04	1.380E-02	279.17	81.500	1.198E+03	Hg203
391.51	27259.	0.80	1.10	1.048E-02	391.69	64.000	9.658E+02	SN113
661.58	19228.	1.08	1.34	6.782E-03	661.66	85.210	4.648E+02	CS137
898.08	31032.	0.70	1.50	5.235E-03	898.02	93.700	1.568E+03	Y898
1173.32	21224.	0.86	1.74	4.162E-03	1173.24	99.900	7.321E+02	Co1173
1332.60	18983.	0.84	1.83	3.727E-03	1332.50	99.982	7.305E+02	Co1332
1835.92	18122.	0.77	2.27	2.815E-03	1836.01	99.200	1.609E+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	
291.55	73.00	15410.	2435.	1.158E+05	9.06	0.811	-	D
545.54	136.52	10631.	5015.	2.149E+05	4.27	0.869	-	
1019.10	254.94	4774.	1501.	1.012E+05	9.38	0.884	-	

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	185.86	46.57	22518.	53301.	7.403	0.71	0.769
AM-241	237.99	59.61	21765.	53514.	7.432	0.70	0.774
CD-109	352.07	88.14	19168.	86292.	11.985	0.46	0.798
CO-57	487.89	122.10	12939.	42094.	5.846	0.74	0.846
Ce-139	662.68	165.81	9873.	41514.	5.766	0.70	0.918
Hg-203	1115.49	279.05	4611.	25767.	3.579	0.82	1.041
SN-113	1565.30	391.51	4016.	27259.	3.786	0.80	1.099
CS-137	2645.59	661.58	4040.	19228.	2.671	1.08	1.341
Y-898	3591.86	898.08	2594.	31032.	4.310	0.70	1.500
Co-1173	4693.36	1173.32	1627.	21224.	2.948	0.86	1.745
Co-1332	5330.90	1332.60	968.	18983.	2.636	0.84	1.828
Y-1836	7346.17	1835.92	184.	18122.	2.517	0.77	2.271

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	Peak Energy keV	Peak Activity Bq	Code	MDA Value Bq		COMMENTS
Pb-210	N	1.4534E+04				8.15E+03		
			46.54	1.453E+04	(	1.914E+02	7.10E-01	4.25E+00 G
AM-241		1.2114E+03				1.58E+05		
			59.54	1.211E+03	(	1.562E+01	7.01E-01	3.57E+01 G
CD-109		1.6123E+04				4.63E+02		
			88.03	1.612E+04	(	1.210E+02	4.63E-01	3.61E+00 G
CO-57		3.5351E+02				2.72E+02		
			122.06	3.535E+02	(	4.474E+00	7.36E-01	8.56E+01 G

ORTEC g v - i (1087) Env32 G53W4.25 4/2/2012 2:16:12 PM
TestAmerica Spectrum name: 4_TunaCan_20120147.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA		Comments
Ce-139	5.4190E+02						1.38E+02	
		165.85	5.419E+02	(	6.080E+00	6.99E-01	7.99E+01	G
Hg-203	1.1975E+03						4.66E+01	
		279.17	1.198E+03	(	1.483E+01	8.16E-01	8.15E+01	G
SN-113	9.6583E+02						1.15E+02	
		391.69	9.658E+02	(	1.056E+01	7.98E-01	6.40E+01	G
CS-137	4.6480E+02						1.10E+04	
		661.66	4.648E+02	(	7.225E+00	1.08E+00	8.52E+01	G
Y-898	1.5684E+03						1.07E+02	
		898.02	1.568E+03	(	1.213E+01	6.99E-01	9.37E+01	G
Co-1173	7.3209E+02						1.93E+03	
		1173.24	7.321E+02	(	6.576E+00	8.65E-01	9.99E+01	G
Co-1332	7.3052E+02						1.93E+03	
		1332.50	7.305E+02	(	5.685E+00	8.43E-01	1.00E+02	G
Y-1836	1.6089E+03						1.07E+02	
		1836.01	1.609E+03	(	5.860E+00	7.72E-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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape

ORTEC g v - i (1087) Env32 G53W4.25 4/2/2012 2:16:12 PM
TestAmerica Spectrum name: 4_TunaCan_20120147.An1

P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
Pb-210	1.4424E+04	1.4534E+04	7.104E-01%	1.91E+02
AM-241	1.2109E+03	1.2114E+03	7.006E-01%	1.56E+01
CD-109	1.4107E+04	1.6123E+04	4.632E-01%	1.21E+02
CO-57	2.8164E+02	3.5351E+02	7.361E-01%	4.47E+00
Ce-139	3.4594E+02	5.4190E+02	6.994E-01%	6.08E+00
Hg-203	3.1837E+02	1.1975E+03	8.160E-01%	1.48E+01
SN-113	5.6466E+02	9.6583E+02	7.982E-01%	1.06E+01
CS-137	4.6220E+02	4.6480E+02	1.084E+00%	7.23E+00
Y-898	8.7856E+02	1.5684E+03	6.988E-01%	1.21E+01
Co-1173	7.0897E+02	7.3209E+02	8.649E-01%	6.58E+00
Co-1332	7.0745E+02	7.3052E+02	8.429E-01%	5.68E+00
Y-1836	9.0125E+02	1.6089E+03	7.719E-01%	5.86E+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 1999.2 keV) 3.491E+04 Bq
Total Decayed Activity (37.6 to 1999.2 keV) 4.0031488E+04 Bq

Analyzed by: _____
Admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica

Gamma Verification per Geometry

Detector: Ge5

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	14353	96.2
Am-241	2037	418	0.3590	1163	1230.2	105.7
Cd-109	2881	591	0.0361	16363	16101	98.4
Co-57	1511	310	0.8560	362	347.72	96.1
Ce-139	2139	439	0.7990	549	538.4	98.1
Hg-203	4651	954	0.8146	1171	1208.4	103.2
Sn-113	3015	618	0.6400	966	972.07	100.6
Cs-137	1938	397	0.8510	467	462.35	99.0
Y-88	7264	1489	0.9370	1589	1559.3	98.1
Co-60	3580	734	0.9997	734	722.51	98.4
Co-60	3581	734	0.9999	734	739.67	100.7
Y-88	7690	1577	0.9920	1589	1613.8	101.5

Reviewed By: Jody Watson

Date: 3/27/2012

ORTEC g v - i (1087) Env32 G53W4.25 3/27/2012 5:22:03 PM
TestAmerica Spectrum name: 5_TunaCan_20120810.An1

Sample description
5_TunaCan_90099_032612

Spectrum Filename: C:\User\SPC\Det5\5_TunaCan_20120810.An1

Acquisition information
Start time: 3/26/2012 3:05:42 PM
Live time: 3600
Real time: 3652
Dead time: 1.44 %
Detector ID: 5

Detector system
Ge 5 SN/157

Calibration
Filename: 5_Soil_TunaCan.Clb
5_Soil_TunaCan_90099_032612

Energy Calibration
Created: 3/27/2012 5:20:02 PM
Zero offset: 0.135 keV
Gain: 0.250 keV/channel
Quadratic: 2.720E-08 keV/channel^2

Efficiency Calibration
Created: 3/27/2012 5:20:37 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.87 %
Log(Eff): 6.466115E-01 + (-7.830454E-01*Log(E)) +
(-4.117504E-03*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.43 %
Log(Eff): -2.462251E+01 + (9.075211E+00*Log(E)) +
(-9.664422E-01*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 (37.61keV)
Stop channel: 8000 (2000.53keV)
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 3/27/2012 5:22:03 PM
TestAmerica Spectrum name: 5_TunaCan_20120810.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:	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. 12 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0527

***** 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
46.61	38986.	0.74	0.74	1.793E-02	46.54	4.250	1.435E+04	Pb210
59.56	40041.	0.74	0.74	2.535E-02	59.54	35.700	1.230E+03	AM241
70.85	1493.	9.22	0.78	3.019E-02				
72.87	2354.	5.96	0.78	3.089E-02				
87.95	63754.	0.53	0.80	3.460E-02	88.03	3.610	1.610E+04	CD109
121.94	30888.	0.76	0.85	3.583E-02	122.06	85.600	3.477E+02	CO57
136.41	3768.	3.80	0.89	3.457E-02				
165.85	31597.	0.74	0.88	3.066E-02	165.85	79.900	5.384E+02	Ce139
279.20	20358.	0.87	0.97	2.036E-02	279.17	81.500	1.208E+03	Hg203
391.78	20611.	0.93	1.12	1.537E-02	391.69	64.000	9.721E+02	SN113
661.74	14000.	1.10	1.38	9.923E-03	661.66	85.210	4.623E+02	CS137
898.01	23228.	0.82	1.55	7.684E-03	898.02	93.700	1.559E+03	Y898
1173.18	15468.	0.93	1.77	6.138E-03	1173.24	99.900	7.225E+02	Co1173
1332.44	14238.	0.98	1.93	5.515E-03	1332.50	99.982	7.397E+02	Co1332
1836.04	13938.	0.87	2.30	4.208E-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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide
291.16	72.88	8722.	2253.	7.295E+04	7.09	0.801	-
545.44	136.41	5274.	3768.	1.090E+05	3.80	0.888	-

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	186.01	46.61	12895.	38986.	10.829	0.74	0.743
AM-241	237.86	59.56	13293.	40041.	11.122	0.74	0.735
CD-109	351.46	87.95	12894.	63754.	17.710	0.53	0.805
CO-57	487.52	121.94	6935.	30888.	8.580	0.76	0.852
Ce-139	663.26	165.85	5616.	31597.	8.777	0.74	0.883
Hg-203	1116.90	279.20	2848.	20358.	5.655	0.87	0.966
SN-113	1567.36	391.78	3046.	20611.	5.725	0.93	1.119
CS-137	2647.45	661.74	1982.	14000.	3.889	1.10	1.380
Y-898	3592.51	898.01	1944.	23228.	6.452	0.82	1.547
Co-1173	4692.96	1173.18	847.	15468.	4.297	0.93	1.774
Co-1332	5329.75	1332.44	693.	14238.	3.955	0.98	1.927
Y-1836	7342.72	1836.04	102.	13938.	3.872	0.87	2.295

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	Peak Energy keV	Peak Activity Bq	Code	MDA Value Bq		COMMENTS
Pb-210	N	1.4353E+04				8.15E+03		
			46.54	1.435E+04	(	1.958E+02	7.44E-01	4.25E+00 G
AM-241		1.2302E+03				1.58E+05		
			59.54	1.230E+03	(	1.659E+01	7.44E-01	3.57E+01 G
CD-109		1.6101E+04				4.63E+02		
			88.03	1.610E+04	(	1.343E+02	5.28E-01	3.61E+00 G
CO-57		3.4772E+02				2.72E+02		
			122.06	3.477E+02	(	4.399E+00	7.60E-01	8.56E+01 G

ORTEC g v - i (1087) Env32 G53W4.25 3/27/2012 5:22:03 PM
TestAmerica Spectrum name: 5_TunaCan_20120810.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ce-139	5.3840E+02					1.38E+02	
		165.85	5.384E+02	(	5.997E+00	7.36E-01	7.99E+01 G
Hg-203	1.2084E+03					4.66E+01	
		279.17	1.208E+03	(	1.492E+01	8.69E-01	8.15E+01 G
SN-113	9.7207E+02					1.15E+02	
		391.69	9.721E+02	(	1.226E+01	9.31E-01	6.40E+01 G
CS-137	4.6235E+02					1.10E+04	
		661.66	4.623E+02	(	6.941E+00	1.10E+00	8.52E+01 G
Y-898	1.5593E+03					1.07E+02	
		898.02	1.559E+03	(	1.397E+01	8.19E-01	9.37E+01 G
Co-1173	7.2251E+02					1.93E+03	
		1173.24	7.225E+02	(	6.463E+00	9.30E-01	9.99E+01 G
Co-1332	7.3967E+02					1.93E+03	
		1332.50	7.397E+02	(	6.515E+00	9.82E-01	1.00E+02 G
Y-1836	1.6138E+03					1.07E+02	
		1836.01	1.614E+03	(	5.776E+00	8.71E-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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape

ORTEC g v - i (1087) Env32 G53W4.25 3/27/2012 5:22:03 PM
TestAmerica Spectrum name: 5_TunaCan_20120810.An1

P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
Pb-210	1.4250E+04	1.4353E+04	7.439E-01%	1.96E+02
AM-241	1.2297E+03	1.2302E+03	7.442E-01%	1.66E+01
CD-109	1.4172E+04	1.6101E+04	5.277E-01%	1.34E+02
CO-57	2.7983E+02	3.4772E+02	7.604E-01%	4.40E+00
Ce-139	3.5061E+02	5.3840E+02	7.359E-01%	6.00E+00
Hg-203	3.4071E+02	1.2084E+03	8.687E-01%	1.49E+01
SN-113	5.8200E+02	9.7207E+02	9.315E-01%	1.23E+01
CS-137	4.5987E+02	4.6235E+02	1.097E+00%	6.94E+00
Y-898	8.9620E+02	1.5593E+03	8.189E-01%	1.40E+01
Co-1173	7.0069E+02	7.2251E+02	9.300E-01%	6.46E+00
Co-1332	7.1733E+02	7.3967E+02	9.821E-01%	6.52E+00
Y-1836	9.2756E+02	1.6138E+03	8.711E-01%	5.78E+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 2000.5 keV) 3.491E+04 Bq
Total Decayed Activity (37.6 to 2000.5 keV) 3.9848164E+04 Bq

Analyzed by: _____
Admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica

Gamma Verification per Geometry

Detector: Ge7

Geometry: 1L Marn

Reference date 1/1/2012

Calibration Standard: 90062

Standard volume g / vial 1

Standard volume transferred in g / geometry 1

lab ID# of cal standard 6707

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	Abundance	Activity Bq/L	Count Results	%recovery
Am-241	1821	1821	0.359	**5072.4**	5093.3	100.4
Cd-109	2602	2602	0.0361	**72077.6**	69699	96.7
Co-57	1364	1364	0.856	**1593.5**	1580.4	99.2
Ce-139	1932	1932	0.799	**2418.0**	2383.5	98.6
Hg-203	4200	4200	0.8146	**5155.9**	5281.6	102.4
Sn-113	2722	2722	0.64	**4253.1**	4257.7	100.1
Cs-137	1750	1750	0.851	**2056.4**	2033.3	98.9
Mn-54	3114	3114	0.9998	**3114.6**	3150.2	101.1
Y-88	6559	6559	0.937	**7000.0**	6734.2	96.2
Zn-65	3134	3134	0.506	**6193.7**	6490.5	104.8
Co-60	3233	3233	0.99974	**3233.8**	3132.2	96.9
Co-60	3233	3233	0.99986	**3233.5**	3149.5	97.4
Y-88	6944	6944	0.992	**7000.0**	7117.9	101.7

Reviewed By: Megan McAfee

Date: 3/26/2012

Calibration Data from file: 7_Liquid_Marinelli 1L.Clb
Energy Calibration Date: 3/28/2012 Time: 9:18:12 AM
Efficiency Calibration Date: 3/28/2012 Time: 9:18:24 AM

Calibration Description:
7_1Lmarn_90062_032612

Energy Calibration Fit
Energy = 0.1874 +0.249932*Channel +7.03104e-009*Channel**2
FWHM (ch) = 3.4322 +0.000971*Channel -1.53808e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
237.59	59.54	59.57	-0.05%	0.88	0.92	-3.43%
351.44	88.03	88.03	0.01%	0.94	0.94	0.22%
487.37	122.06	122.00	0.05%	0.98	0.98	0.43%
662.51	165.85	165.77	0.05%	1.02	1.02	-0.14%
1116.55	279.17	279.26	-0.03%	1.14	1.12	1.21%
1566.60	391.69	391.75	-0.02%	1.24	1.23	0.70%
2646.39	661.66	661.65	0.00%	1.51	1.47	2.26%
3339.20	834.85	834.84	0.00%	1.63	1.63	0.15%
3592.04	898.02	898.04	-0.00%	1.68	1.68	0.00%
4462.03	1115.55	1115.53	0.00%	1.85	1.86	-0.81%
4692.79	1173.24	1173.22	0.00%	1.89	1.91	-0.96%
5329.78	1332.50	1332.47	0.00%	2.03	2.04	-0.79%
7343.85	1836.01	1836.03	-0.00%	2.45	2.43	0.65%

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.4210 %
Ln(Eff) = -0.7055 -0.284825*Ln(Eng) -0.04424*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 0.4307 %
Ln(Eff) = -14.8444 +5.183775*Ln(Eng) -0.573052*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
59.54	3.9481E-002	3.9540E-002	-0.15%
88.03	4.4466E-002	4.4045E-002	0.95%
122.06	4.1797E-002	4.2138E-002	-0.82%
165.85	========== Knee ==========		
165.85	3.5751E-002	3.6265E-002	-1.44%
279.17	2.5027E-002	2.4411E-002	2.46%
391.69	1.8652E-002	1.8630E-002	0.12%
661.66	1.1897E-002	1.2017E-002	-1.00%
834.85	9.9346E-003	9.8167E-003	1.19%
898.02	8.8561E-003	9.2042E-003	-3.93%
1115.55	7.9420E-003	7.5782E-003	4.58%
1173.24	7.0066E-003	7.2392E-003	-3.32%
1332.50	6.2752E-003	6.4426E-003	-2.67%
1836.01	4.8544E-003	4.7733E-003	1.67%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Am-241	59.54	35.70	1.58E+005	5100.80	1821.00	3.50%	1/1/2012 11:00:00 AM
Cd-109	88.03	3.61	4.63E+002	72078.00	2602.00	4.70%	1/1/2012 11:00:00 AM
Co-57	122.06	85.60	2.72E+002	1593.50	1364.00	4.10%	1/1/2012 11:00:00 AM
Ce-139	165.85	79.90	1.38E+002	2418.00	1932.00	3.90%	1/1/2012 11:00:00 AM
Hg-203	279.17	81.50	4.66E+001	5153.40	4200.00	3.80%	1/1/2012 11:00:00 AM
Sn-113	391.69	64.00	1.15E+002	4253.10	2722.00	3.90%	1/1/2012 11:00:00 AM
Cs-137	661.66	85.21	1.10E+004	2053.70	1750.00	4.00%	1/1/2012 11:00:00 AM
Mn-54	834.85	99.98	3.12E+002	3114.60	3114.00	3.30%	1/1/2012 11:00:00 AM
Y-88	898.02	93.70	1.07E+002	7000.00	6559.00	3.90%	1/1/2012 11:00:00 AM
Zn-65	1115.55	50.60	2.44E+002	6193.70	3134.00	3.50%	1/1/2012 11:00:00 AM
Co-60	1173.24	99.90	1.93E+003	3236.20	3233.00	4.00%	1/1/2012 11:00:00 AM
Co-60	1332.50	99.98	1.93E+003	3233.60	3233.00	4.00%	1/1/2012 11:00:00 AM
Y-88	1836.01	99.20	1.07E+002	7000.00	6944.00	4.00%	1/1/2012 11:00:00 AM

ORTEC g v - i (1087) Env32 G53W4.25 3/28/2012 9:26:09 AM Page 1
TestAmerica Spectrum name: 7_1Lmarn_20120463.An1

Sample description
7_1Lmarn_90062_032612

Spectrum Filename: C:\User\Cal\Spectra\Det7\7_1Lmarn_20120463.An1

Acquisition information
Start time: 3/26/2012 6:37:24 AM
Live time: 3600
Real time: 4044
Dead time: 10.97 %
Detector ID: 7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Liquid_Marinelli 1L.Clb
7_1Lmarn_90062_032612

Energy Calibration
Created: 3/28/2012 9:18:12 AM
Zero offset: 0.187 keV
Gain: 0.250 keV/channel
Quadratic: 7.031E-09 keV/channel^2

Efficiency Calibration
Created: 3/28/2012 9:18:24 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.42 %
Log(Eff): -7.054602E-01 + (-2.848254E-01*Log(E)) + (-4.423998E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.43 %
Log(Eff): -1.484435E+01 + (5.183775E+00*Log(E)) + (-5.730519E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix & Mn, Zn.L
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.68keV)
Stop channel: 8000 (2000.10keV)
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	1/1/2012 11:00:00 AM
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. 13 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0281

***** 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
37.93	20996.	2.35	0.98	2.809E-02				
49.58	10390.	5.72	1.78	3.540E-02				
59.57	258725.	0.32	0.88	3.955E-02	59.54	35.700	5.093E+03	AM241
70.77	8653.	4.55	0.93	4.237E-02				
72.95	14085.	2.76	0.93	4.274E-02				
82.51	7182.	5.10	0.94	4.379E-02				
84.92	9567.	3.85	0.94	4.393E-02				
88.04	365268.	0.19	0.94	4.405E-02	88.03	3.610	7.246E+04	CD109
122.00	165308.	0.41	0.98	4.215E-02	122.06	85.600	1.580E+03	CO57
136.39	20328.	2.30	0.95	4.037E-02				
165.77	162197.	0.40	1.02	3.618E-02	165.85	79.900	2.383E+03	Ce139
255.17	5383.	4.05	1.10	2.619E-02				
279.26	107214.	0.47	1.14	2.441E-02	279.17	81.500	5.282E+03	Hg203
391.75	109651.	0.43	1.24	1.863E-02	391.69	64.000	4.258E+03	SN113
511.09	7966.	4.06	2.42	1.496E-02				
661.65	74553.	0.54	1.51	1.202E-02	661.66	85.210	2.033E+03	CS137
813.91	2256.	8.87	1.49	1.004E-02				
834.90	92175.	0.36	1.63	9.815E-03	834.85	99.980	3.149E+03	Mn54
898.04	120447.	0.39	1.68	9.204E-03	898.02	93.700	6.734E+03	Y898
1115.53	70435.	0.55	1.85	7.578E-03	1115.55	50.600	6.491E+03	Zn65
1173.22	79095.	0.48	1.89	7.239E-03	1173.24	99.900	3.132E+03	Co1173
1324.75	2192.	6.90	2.97	6.477E-03				
1332.47	70838.	0.46	2.03	6.443E-03	1332.50	99.982	3.150E+03	Co1332
1836.01	69898.	0.41	2.46	4.773E-03	1836.01	99.200	7.118E+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
151.03	37.93	57996.	20996.	7.475E+05	2.35	0.976	- s
197.64	49.58	98022.	10390.	2.935E+05	5.72	1.780	- s
282.39	70.75	73097.	8653.	2.042E+05	4.55	0.926	- D

ORTEC g v - i (1087) Env32 G53W4.25 3/28/2012 9:26:09 AM Page 3
TestAmerica Spectrum name: 7_1Lmarn_20120463.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
291.11	72.93	68727.	14085.	3.295E+05	2.76	0.928	- D
329.40	82.50	63478.	7182.	8.098E+04	5.10	0.937	- lD
339.04	84.91	63224.	9567.	2.997E+04	3.85	0.940	- lD
544.97	136.39	49365.	20328.	5.036E+05	2.30	0.951	-
1020.02	255.13	23704.	5677.	2.168E+05	5.36	1.096	- s
2044.04	511.09	18658.	7966.	5.325E+05	4.06	2.416	- s
3255.49	813.91	8727.	2256.	2.248E+05	8.87	1.494	-
5298.91	1324.75	3552.	2192.	3.385E+05	6.90	2.967	- 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: DET_EnergyStandardMix & Mn, Zn.L

********** 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	237.59	59.57	108036.	258725.	71.868	0.32	0.885
CD-109	351.44	88.03	94147.	351348.	97.597	0.25	0.945
CO-57	487.37	122.00	62912.	165308.	45.919	0.41	0.979
Ce-139	662.50	165.77	52768.	162197.	45.055	0.40	1.015
Hg-203	1116.55	279.26	29908.	107214.	29.782	0.47	1.138
SN-113	1566.60	391.75	21940.	109651.	30.459	0.43	1.237
CS-137	2646.39	661.65	16600.	74553.	20.709	0.54	1.507
Mn-54	3339.24	834.85	10174.	92207.	25.613	0.36	1.626D
Y-898	3592.02	898.04	15389.	120447.	33.458	0.39	1.681
Zn-65	4462.01	1115.53	9956.	70435.	19.565	0.55	1.851
Co-1173	4692.77	1173.22	7268.	79095.	21.971	0.48	1.895
Co-1332	5329.78	1332.47	4608.	70838.	19.677	0.46	2.027
Y-1836	7343.76	1836.01	1125.	69898.	19.416	0.41	2.456

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	Peak Energy keV	Peak Activity Bq	Code	MDA Value Bq	COMMENTS
AM-241		5.0933E+03				1.58E+05	
			59.54	5.093E+03	(	3.021E+01 3.21E-01 3.57E+01	G

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TestAmerica Spectrum name: 7_1Lmarn_20120463.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments

CD-109		6.9699E+04						4.63E+02	
			88.03	6.970E+04	(	2.842E+02	2.48E-01	3.61E+00	G
CO-57		1.5804E+03						2.72E+02	
			122.06	1.580E+03	(	1.120E+01	4.05E-01	8.56E+01	G
Ce-139		2.3835E+03						1.38E+02	
			165.85	2.383E+03	(	1.577E+01	4.02E-01	7.99E+01	G
Hg-203		5.2816E+03						4.66E+01	
			279.17	5.282E+03	(	3.983E+01	4.73E-01	8.15E+01	G
SN-113		4.2577E+03						1.15E+02	
			391.69	4.258E+03	(	2.691E+01	4.34E-01	6.40E+01	G
CS-137		2.0333E+03						1.10E+04	
			661.66	2.033E+03	(	1.645E+01	5.37E-01	8.52E+01	G
Mn-54		3.1502E+03						3.12E+02	
			834.85	3.150E+03	(	1.615E+01	3.64E-01	1.00E+02	G
Y-898		6.7342E+03						1.07E+02	
			898.02	6.734E+03	(	3.247E+01	3.90E-01	9.37E+01	G
Zn-65	F	6.4905E+03						2.44E+02	
			1115.55	6.491E+03	(	4.310E+01	5.47E-01	5.06E+01	G
Co-1173		3.1322E+03						1.93E+03	
			1173.24	3.132E+03	(	1.584E+01	4.77E-01	9.99E+01	G
Co-1332		3.1495E+03						1.93E+03	
			1332.50	3.150E+03	(	1.419E+01	4.58E-01	1.00E+02	G
Y-1836		7.1179E+03						1.07E+02	
			1836.01	7.118E+03	(	1.619E+01	4.08E-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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay

N - Naturally Occurring Isotope
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
AM-241	5.0914E+03	5.0933E+03	3.213E-01%	3.02E+01
CD-109	6.1380E+04	6.9699E+04	2.480E-01%	2.84E+02
CO-57	1.2730E+03	1.5804E+03	4.051E-01%	1.12E+01
Ce-139	1.5549E+03	2.3835E+03	4.024E-01%	1.58E+01
Hg-203	1.4969E+03	5.2816E+03	4.726E-01%	3.98E+01
SN-113	2.5546E+03	4.2577E+03	4.342E-01%	2.69E+01
CS-137	2.0225E+03	2.0333E+03	5.371E-01%	1.64E+01
Mn-54	2.6097E+03	3.1502E+03	3.638E-01%	1.62E+01
Y-898	3.8795E+03	6.7342E+03	3.898E-01%	3.25E+01
Zn-65	5.1023E+03	6.4905E+03	5.470E-01%	4.31E+01
Co-1173	3.0380E+03	3.1322E+03	4.766E-01%	1.58E+01
Co-1332	3.0548E+03	3.1495E+03	4.583E-01%	1.42E+01
Y-1836	4.1005E+03	7.1179E+03	4.075E-01%	1.62E+01

< - 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

ORTEC g v - i (1087) Env32 G53W4.25 3/28/2012 9:26:09 AM Page 6
TestAmerica Spectrum name: 7_1Lmarn_20120463.An1

--- S U M M A R Y ---

Total Activity (877.5 to 2000.1 keV) 9.716E+04 Bq
Total Decayed Activity (877.5 to 2000.1 keV) 1.2010304E+05 Bq

Gamma Verification per Geometry

Detector: Ge7

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	14726	98.7
Am-241	2037	418	0.3590	1163	1241.6	106.7
Cd-109	2881	591	0.0361	16363	15976	97.6
Co-57	1511	310	0.8560	362	346.77	95.8
Ce-139	2139	439	0.7990	549	539.48	98.3
Hg-203	4651	954	0.8146	1171	1199.2	102.4
Sn-113	3015	618	0.6400	966	976.76	101.1
Cs-137	1938	397	0.8510	467	467.66	100.2
Y-88	7264	1489	0.9370	1589	1567.3	98.6
Co-60	3580	734	0.9997	734	726.23	98.9
Co-60	3581	734	0.9999	734	719.64	98.0
Y-88	7690	1577	0.9920	1589	1635.7	102.9

Reviewed By: Jody Watson

Date: 3/16/2012

Calibration Data from file: 7_Soil_TunaCan.Clb
Energy Calibration Date: 3/16/2012 Time: 11:44:50 AM
Efficiency Calibration Date: 3/16/2012 Time: 11:45:14 AM

Calibration Description:
7_TunaCan_90099_030512

Energy Calibration Fit
Energy = 0.1533 +0.249954*Channel +6.71576e-009*Channel**2
FWHM (ch) = 3.2969 +0.001030*Channel -2.25091e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
185.73	46.54	46.58	-0.08%	0.86	0.87	-1.80%
237.72	59.54	59.57	-0.06%	0.86	0.88	-3.29%
351.56	88.03	88.03	0.00%	0.91	0.91	-0.17%
487.42	122.06	121.99	0.06%	0.97	0.95	2.36%
662.55	165.85	165.76	0.05%	1.00	0.99	1.26%
1116.52	279.17	279.24	-0.03%	1.13	1.10	1.85%
1566.54	391.69	391.73	-0.01%	1.21	1.21	-0.23%
2646.25	661.66	661.64	0.00%	1.47	1.47	0.54%
3591.85	898.02	898.04	-0.00%	1.66	1.68	-1.15%
4692.53	1173.24	1173.22	0.00%	1.92	1.91	0.69%
5329.58	1332.50	1332.49	0.00%	2.02	2.04	-0.87%
7343.37	1836.01	1836.02	-0.00%	2.42	2.41	0.28%

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.8690 %
Ln(Eff) = 0.6717 -0.616654*Ln(Eng) -0.0206592*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 1.4845 %
Ln(Eff) = -26.8969 +10.195443*Ln(Eng) -1.08167*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	2.3732E-002	2.4829E-002	-4.62%
59.54	3.9252E-002	3.7016E-002	5.70%
88.03	5.1999E-002	5.3285E-002	-2.47%
122.06	5.3679E-002	5.6057E-002	-4.43%
165.85	========== Knee ==========		
165.85	4.7932E-002	4.8811E-002	-1.83%
279.17	3.2322E-002	3.1541E-002	2.42%
391.69	2.3837E-002	2.3601E-002	0.99%
661.66	1.4947E-002	1.4924E-002	0.15%
898.02	1.1205E-002	1.1367E-002	-1.45%
1173.24	8.8255E-003	8.9287E-003	-1.17%
1332.50	7.7833E-003	7.9508E-003	-2.15%
1836.01	6.0876E-003	5.9192E-003	2.77%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Pb-210	46.54	4.25	8.15E+003	14941.00	635.00	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	967.19	619.00	3.90%	1/1/2012 11:00:00 AM
Cs-137	661.66	85.21	1.10E+004	467.08	398.00	4.00%	1/1/2012 11:00:00 AM
Y-88	898.02	93.70	1.07E+002	1590.20	1490.00	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	735.15	735.00	4.00%	1/1/2012 11:00:00 AM
Y-88	1836.01	99.20	1.07E+002	1590.70	1578.00	4.00%	1/1/2012 11:00:00 AM

ORTEC g v - i (1087) Env32 G53W4.25 2/28/2014 11:43:43 AM
TestAmerica Spectrum name: 7_TunaCan_20120388.An1

Sample description
7_TunaCan_90099_030512

Spectrum Filename: C:\User\SPC\Det7\7_TunaCan_20120388.An1

Acquisition information
Start time: 3/5/2012 2:07:36 PM
Live time: 3600
Real time: 3721
Dead time: 3.25 %
Detector ID: 7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Soil_TunaCan.Clb
7_TunaCan_90099_032712

Energy Calibration
Created: 3/16/2012 11:44:50 AM
Zero offset: 0.153 keV
Gain: 0.250 keV/channel
Quadratic: 6.716E-09 keV/channel^2

Efficiency Calibration
Created: 3/16/2012 11:45:14 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.87 %
Log(Eff): 6.716580E-01 + (-6.166540E-01*Log(E)) +
(-2.065917E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.48 %
Log(Eff): -2.689695E+01 + (1.019544E+01*Log(E)) +
(-1.081671E+00*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 (37.65keV)
Stop channel: 8000 (2000.21keV)
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	1/1/2012 11:00:00 AM
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. 12 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0324

***** 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
46.63	53946.	0.53	0.87	2.487E-02	46.54	4.250	1.428E+04	Pb210
59.57	59050.	0.65	0.86	3.704E-02	59.54	35.700	1.242E+03	AM241
70.74	2770.	6.58	0.90	4.527E-02				
72.95	4536.	4.27	0.90	4.661E-02				
88.03	100494.	0.43	0.91	5.328E-02	88.03	3.610	1.598E+04	CD109
121.99	50865.	0.71	0.97	5.606E-02	122.06	85.600	3.468E+02	CO57
136.41	6524.	3.77	0.93	5.411E-02				
165.76	54838.	0.57	1.00	4.767E-02	165.85	79.900	5.395E+02	Ce139
255.13	1772.	7.37	1.21	3.404E-02				
279.24	42776.	0.59	1.13	3.153E-02	279.17	81.500	1.199E+03	Hg203
391.73	36096.	0.66	1.21	2.360E-02	391.69	64.000	9.768E+02	SN113
661.68	21323.	0.77	1.47	1.492E-02	661.66	85.210	4.677E+02	CS137
898.03	39603.	0.63	1.66	1.137E-02	898.02	93.700	1.567E+03	Y898
1173.21	22788.	0.85	1.92	8.929E-03	1173.24	99.900	7.262E+02	Co1173
1332.49	20124.	0.85	2.02	7.951E-03	1332.50	99.982	7.196E+02	Co1332
1836.00	22787.	0.70	2.43	5.919E-03	1836.01	99.200	1.636E+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
282.41	70.73	15146.	2828.	6.248E+04	6.43	0.896	-	D
291.25	72.94	16305.	4682.	1.005E+05	4.12	0.899	-	D
545.11	136.41	12980.	6524.	1.206E+05	3.77	0.932	-	
1020.07	255.13	4580.	1772.	5.204E+04	7.37	1.209	-	

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	185.73	46.58	19825.	55636.	15.454	0.65	0.856
AM-241	237.72	59.57	21942.	59050.	16.403	0.65	0.857
CD-109	351.56	88.03	21396.	100494.	27.915	0.43	0.912
CO-57	487.42	121.99	16859.	50865.	14.129	0.71	0.971
Ce-139	662.55	165.76	9893.	54838.	15.233	0.57	1.005
Hg-203	1116.52	279.24	5111.	42776.	11.882	0.59	1.126
SN-113	1566.54	391.73	4106.	36096.	10.027	0.66	1.211
CS-137	2646.33	661.66	2922.	21323.	5.923	0.77	1.466D
Y-898	3591.84	898.03	3210.	39603.	11.001	0.63	1.659
Co-1173	4692.50	1173.21	1804.	22788.	6.330	0.85	1.924
Co-1332	5329.58	1332.49	1286.	20124.	5.590	0.85	2.020
Y-1836	7343.30	1836.00	283.	22787.	6.330	0.70	2.426

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	Peak Energy keV	Peak Activity Bq		Peak MDA Value Bq			COMMENTS
Pb-210	N	1.4726E+04						8.15E+03	
			46.54	1.473E+04	(	1.744E+02	6.52E-01	4.25E+00	G
AM-241		1.2416E+03						1.58E+05	
			59.54	1.242E+03	(	1.457E+01	6.49E-01	3.57E+01	G
CD-109		1.5976E+04						4.63E+02	
			88.03	1.598E+04	(	1.088E+02	4.29E-01	3.61E+00	G
CO-57		3.4677E+02						2.72E+02	
			122.06	3.468E+02	(	4.144E+00	7.08E-01	8.56E+01	G

ORTEC g v - i (1087) Env32 G53W4.25 2/28/2014 11:43:43 AM
TestAmerica Spectrum name: 7_TunaCan_20120388.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
Ce-139	5.3948E+02				1.38E+02	
		165.85	5.395E+02	(	4.586E+00 5.65E-01 7.99E+01	G
Hg-203	1.1992E+03				4.66E+01	
		279.17	1.199E+03	(	9.415E+00 5.92E-01 8.15E+01	G
SN-113	9.7676E+02				1.15E+02	
		391.69	9.768E+02	(	8.153E+00 6.55E-01 6.40E+01	G
CS-137	4.6766E+02				1.10E+04	
		661.66	4.677E+02	(	5.584E+00 7.73E-01 8.52E+01	G
Y-898	1.5673E+03				1.07E+02	
		898.02	1.567E+03	(	1.056E+01 6.29E-01 9.37E+01	G
Co-1173	7.2623E+02				1.93E+03	
		1173.24	7.262E+02	(	6.394E+00 8.53E-01 9.99E+01	G
Co-1332	7.1964E+02				1.93E+03	
		1332.50	7.196E+02	(	6.072E+00 8.54E-01 1.00E+02	G
Y-1836	1.6357E+03				1.07E+02	
		1836.01	1.636E+03	(	5.819E+00 7.02E-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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape

ORTEC g v - i (1087) Env32 G53W4.25 2/28/2014 11:43:43 AM
TestAmerica Spectrum name: 7_TunaCan_20120388.An1

P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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	Time Corrected Activity Bq	Uncertainty Counting	1 Sigma	MDA
Pb-210	1.4646E+04	1.4726E+04	6.521E-01%		1.74E+02
AM-241	1.2413E+03	1.2416E+03	6.489E-01%		1.46E+01
CD-109	1.4512E+04	1.5976E+04	4.292E-01%		1.09E+02
CO-57	2.9445E+02	3.4677E+02	7.076E-01%		4.14E+00
Ce-139	3.9059E+02	5.3948E+02	5.652E-01%		4.59E+00
Hg-203	4.6224E+02	1.1992E+03	5.917E-01%		9.42E+00
SN-113	6.6381E+02	9.7676E+02	6.552E-01%		8.15E+00
CS-137	4.6577E+02	4.6766E+02	7.730E-01%		5.58E+00
Y-898	1.0329E+03	1.5673E+03	6.291E-01%		1.06E+01
Co-1173	7.0966E+02	7.2623E+02	8.534E-01%		6.39E+00
Co-1332	7.0321E+02	7.1964E+02	8.542E-01%		6.07E+00
Y-1836	1.0780E+03	1.6357E+03	7.017E-01%		5.82E+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 (701.8 to 2000.2 keV) 3.620E+04 Bq
Total Decayed Activity (701.8 to 2000.2 keV) 4.0121711E+04 Bq

Analyzed by: _____
Admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica

Gamma Verification per Geometry

Detector: Ge9

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	14240	95.4
Am-241	2037	418	0.3590	1163	1244.5	107.0
Cd-109	2881	591	0.0361	16363	15902	97.2
Co-57	1511	310	0.8560	362	347.48	96.0
Ce-139	2139	439	0.7990	549	535.87	97.6
Hg-203	4651	954	0.8146	1171	1216.7	103.9
Sn-113	3015	618	0.6400	966	970.65	100.5
Cs-137	1938	397	0.8510	467	466.58	99.9
Y-88	7264	1489	0.9370	1589	1552.5	97.7
Co-60	3580	734	0.9997	734	727.12	99.0
Co-60	3581	734	0.9999	734	719.75	98.0
Y-88	7690	1577	0.9920	1589	1638.8	103.1

Reviewed By: Jody Watson

Date: 6/14/2012

Calibration Data from file: 9_Soil_TunaCan.Clb
Energy Calibration Date: 6/14/2012 Time: 10:19:40 AM
Efficiency Calibration Date: 6/14/2012 Time: 10:19:51 AM

Calibration Description:
9_Soil_TunaCan_90099_050312

Energy Calibration Fit
Energy = 0.0875 +0.250109*Channel -2.0385e-008*Channel**2
FWHM (ch) = 4.1690 +0.000934*Channel -2.36522e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
185.85	46.54	46.57	-0.06%	1.07	1.09	-1.37%
237.85	59.54	59.58	-0.06%	1.08	1.10	-1.96%
351.79	88.03	88.07	-0.05%	1.12	1.12	-0.18%
487.79	122.06	122.08	-0.02%	1.14	1.16	-1.17%
662.64	165.85	165.81	0.02%	1.23	1.19	2.51%
1115.53	279.17	279.07	0.04%	1.30	1.30	0.44%
1565.74	391.69	391.64	0.01%	1.43	1.39	2.81%
2645.81	661.66	661.69	-0.00%	1.60	1.62	-0.83%
3591.21	898.02	898.02	0.00%	1.80	1.80	-0.02%
4692.44	1173.24	1173.26	-0.00%	2.01	2.01	0.18%
5329.80	1332.50	1332.54	-0.00%	2.09	2.12	-1.38%
7344.77	1836.01	1835.98	0.00%	2.45	2.44	0.55%

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.3038 %
Ln(Eff) = -0.8080 -0.236727*Ln(Eng) -0.0395064*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 1.4241 %
Ln(Eff) = -23.8792 +8.875647*Ln(Eng) -0.94011*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	2.4596E-002	2.5767E-002	-4.76%
59.54	3.8891E-002	3.6589E-002	5.92%
88.03	4.9059E-002	5.0504E-002	-2.95%
122.06	5.0886E-002	5.3031E-002	-4.22%
165.85	========== Knee ==========		
165.85	4.6197E-002	4.7361E-002	-2.52%
279.17	3.4900E-002	3.3566E-002	3.82%
391.69	2.6668E-002	2.6526E-002	0.53%
661.66	1.8125E-002	1.8099E-002	0.14%
898.02	1.4012E-002	1.4341E-002	-2.34%
1173.24	1.1507E-002	1.1627E-002	-1.05%
1332.50	1.0296E-002	1.0501E-002	-2.00%
1836.01	8.3305E-003	8.0796E-003	3.01%

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

```
     ORTEC g v - i (1087) Env32  G53W4.25  6/14/2012 10:20:07 AM
TestAmerica, Inc                Spectrum name: 9_TunaCan_20120147.An1

Sample description
     9_TunaCan_90099_050312


Spectrum Filename: C:\User\SPC\Det9\9_TunaCan_20120147.An1

Acquisition information
       Start time:                5/3/2012 1:37:42 PM
       Live time:               3600
       Real time:               3661
       Dead time:                 1.65 %
       Detector ID:                  9

Detector system
     Ge 9 SN/100113


Calibration
       Filename:                  9_Soil_TunaCan.Clb
     9_Soil_TunaCan_90099_050312


       Energy Calibration
            Created:              6/14/2012 10:19:40 AM
            Zero offset:          0.088 keV
            Gain:                 0.250 keV/channel
            Quadratic:           -2.039E-08 keV/channel^2

       Efficiency Calibration
            Created:              6/14/2012 10:19:51 AM
            Knee Energy:        165.85 keV
            Above the Knee:       Quadratic        Uncertainty =   1.30 %
            Log(Eff):            -8.079856E-01 + (-2.367265E-01*Log(E) ) +
                                  ( -3.950640E-02*Log(E)^2 )
            Below the Knee:       Quadratic        Uncertainty =   1.42 %
            Log(Eff):            -2.387916E+01 + ( 8.875647E+00*Log(E) ) +
                                  ( -9.401100E-01*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 (    37.60keV )
       Stop channel:           8000 (  1999.66keV )
       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 6/14/2012 10:20:07 AM
TestAmerica, Inc Spectrum name: 9_TunaCan_20120147.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: 0.0265

***** 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
46.57	55553.	0.67	1.07	2.579E-02	46.54	4.250	1.424E+04	Pb210
59.56	58492.	0.66	1.08	3.660E-02	59.54	35.700	1.245E+03	AM241
88.07	86792.	0.48	1.12	5.052E-02	88.03	3.610	1.590E+04	CD109
122.08	41484.	0.73	1.14	5.303E-02	122.06	85.600	3.475E+02	CO57
136.48	5266.	4.55	1.22	5.150E-02				
165.81	39272.	0.74	1.23	4.626E-02	165.85	79.900	5.359E+02	Ce139
279.06	19221.	1.24	1.30	3.358E-02	279.17	81.500	1.217E+03	Hg203
391.64	28263.	0.86	1.43	2.653E-02	391.69	64.000	9.707E+02	SN113
661.69	25703.	0.90	1.61	1.810E-02	661.66	85.210	4.666E+02	CS137
898.02	33728.	0.69	1.80	1.434E-02	898.02	93.700	1.552E+03	Y898
1173.24	29087.	0.72	2.01	1.163E-02	1173.24	99.900	7.271E+02	Co1173
1332.54	26026.	0.70	2.09	1.050E-02	1332.50	99.982	7.198E+02	Co1332
1835.94	21237.	0.73	2.46	8.080E-03	1836.01	99.200	1.639E+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 keV	Suspected Nuclide
545.34	136.48	10776.	5266.	1.023E+05	4.55	1.225	-

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	185.85	46.57	18837.	55553.	15.431	0.67	1.071
AM-241	237.79	59.56	19448.	58492.	16.248	0.66	1.078
CD-109	351.79	88.07	19261.	86792.	24.109	0.48	1.122
CO-57	487.79	122.08	11232.	41484.	11.523	0.73	1.142
Ce-139	662.64	165.81	9084.	39272.	10.909	0.74	1.225
Hg-203	1115.51	279.06	6250.	19221.	5.339	1.24	1.302
SN-113	1565.73	391.64	4864.	28263.	7.851	0.86	1.434
CS-137	2645.81	661.69	4037.	25703.	7.140	0.90	1.605
Y-898	3591.21	898.02	2958.	33728.	9.369	0.69	1.803
Co-1173	4692.36	1173.24	1710.	29087.	8.080	0.72	2.014
Co-1332	5329.80	1332.54	1048.	26026.	7.229	0.70	2.088
Y-1836	7344.62	1835.94	304.	21237.	5.899	0.73	2.457

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	Peak Energy keV	Peak Activity Bq	Code	MDA Value Bq		COMMENTS
Pb-210	N	1.4240E+04				8.15E+03		
			46.54	1.424E+04	(	1.646E+02	6.67E-01 4.25E+00 G	
AM-241		1.2445E+03				1.58E+05		
			59.54	1.245E+03	(	1.388E+01	6.60E-01 3.57E+01 G	
CD-109		1.5902E+04				4.63E+02		
			88.03	1.590E+04	(	1.190E+02	4.84E-01 3.61E+00 G	
CO-57		3.4748E+02				2.72E+02		
			122.06	3.475E+02	(	4.159E+00	7.31E-01 8.56E+01 G	

ORTEC g v - i (1087) Env32 G53W4.25 6/14/2012 10:20:07 AM
TestAmerica, Inc Spectrum name: 9_TunaCan_20120147.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA		Comments
Ce-139	5.3587E+02						1.38E+02	
		165.85	5.359E+02	(	6.097E+00	7.41E-01	7.99E+01	G
Hg-203	1.2167E+03						4.66E+01	
		279.17	1.217E+03	(	2.349E+01	1.24E+00	8.15E+01	G
SN-113	9.7065E+02						1.15E+02	
		391.69	9.707E+02	(	1.125E+01	8.60E-01	6.40E+01	G
CS-137	4.6658E+02						1.10E+04	
		661.66	4.666E+02	(	5.424E+00	8.98E-01	8.52E+01	G
Y-898	1.5525E+03						1.07E+02	
		898.02	1.552E+03	(	1.179E+01	6.92E-01	9.37E+01	G
Co-1173	7.2712E+02						1.93E+03	
		1173.24	7.271E+02	(	4.884E+00	7.20E-01	9.99E+01	G
Co-1332	7.1975E+02						1.93E+03	
		1332.50	7.198E+02	(	4.248E+00	6.98E-01	1.00E+02	G
Y-1836	1.6388E+03						1.07E+02	
		1836.01	1.639E+03	(	6.479E+00	7.29E-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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape

ORTEC g v - i (1087) Env32 G53W4.25 6/14/2012 10:20:07 AM
TestAmerica, Inc Spectrum name: 9_TunaCan_20120147.An1

P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
Pb-210	1.4091E+04	1.4240E+04	6.667E-01%	1.65E+02
AM-241	1.2439E+03	1.2445E+03	6.605E-01%	1.39E+01
CD-109	1.3223E+04	1.5902E+04	4.843E-01%	1.19E+02
CO-57	2.5385E+02	3.4748E+02	7.313E-01%	4.16E+00
Ce-139	2.8828E+02	5.3587E+02	7.410E-01%	6.10E+00
Hg-203	1.9517E+02	1.2167E+03	1.239E+00%	2.35E+01
SN-113	4.6244E+02	9.7065E+02	8.599E-01%	1.13E+01
CS-137	4.6297E+02	4.6658E+02	8.981E-01%	5.42E+00
Y-898	6.9723E+02	1.5525E+03	6.917E-01%	1.18E+01
Co-1173	6.9559E+02	7.2712E+02	7.204E-01%	4.88E+00
Co-1332	6.8854E+02	7.1975E+02	6.982E-01%	4.25E+00
Y-1836	7.3602E+02	1.6388E+03	7.291E-01%	6.48E+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 1999.7 keV) 3.304E+04 Bq
Total Decayed Activity (37.6 to 1999.7 keV) 3.9561668E+04 Bq

Analyzed by: _____
admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica, Inc

Gamma Verification per Geometry

Detector: Ge 11

Geometry: 1L Marn

Reference date 1/1/2011

Calibration Standard: 83924-334

Standard volume g / vial 1

Standard volume transferred in g / geometry 1

lab ID# of cal standard Rad11-0032

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	Abundance	Activity Bq/L	Count Results	%recovery
Am-241	1830	1830	0.359	**5097.5**	5128.6	100.6
Cd-109	2609	2609	0.0361	**72271.5**	70492	97.5
Co-57	1339	1339	0.856	**1564.3**	1568.3	100.3
Ce-139	1917	1917	0.799	**2399.2**	2350.2	98.0
Hg-203	4232	4232	0.8146	**5195.2**	5319.7	102.4
Sn-113	2719	2719	0.64	**4248.4**	4283.1	100.8
Cs-137	1705	1705	0.851	**2003.5**	1997.7	99.7
Mn-54	3083	3083	0.9998	**3083.6**	3059.4	99.2
Y-88	6493	6493	0.937	**6929.6**	6602.2	95.3
Zn-65	3181	3181	0.506	**6286.6**	6620.4	105.3
Co-60	3293	3293	0.99974	**3293.9**	3187.2	96.8
Co-60	3294	3294	0.99986	**3294.5**	3225	97.9
Y-88	6874	6874	0.992	**6929.4**	7070.4	102.0

Reviewed By: Jody Watson

Date: 10/31/2011

Calibration Data from file: 11_Liquid_Marinelli 1L.Clb
Energy Calibration Date: 11/1/2011 Time: 11:26:50 AM
Efficiency Calibration Date: 11/1/2011 Time: 11:27:06 AM

Calibration Description:
Ge11_1Lmarn_83924_334_101210 ✓

Energy Calibration Fit
Energy = 0.0977 +0.250130*Channel -2.6695e-008*Channel**2
FWHM (ch) = 3.4252 +0.000986*Channel -2.86452e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
237.71	59.54	59.55	-0.02%	0.90	0.91	-1.80%
351.58	88.03	88.03	-0.01%	0.96	0.94	1.36%
487.74	122.06	122.09	-0.02%	0.98	0.98	0.68%
662.93	165.85	165.90	-0.03%	1.00	1.02	-1.35%
1115.42	279.17	279.06	0.04%	1.14	1.12	1.10%
1565.62	391.69	391.64	0.01%	1.23	1.22	0.51%
2645.74	661.66	661.69	-0.00%	1.44	1.46	-0.98%
3338.49	834.85	834.86	-0.00%	1.60	1.60	0.00%
3591.24	898.02	898.03	-0.00%	1.65	1.65	0.36%
4461.62	1115.55	1115.55	-0.00%	1.81	1.81	-0.17%
4692.51	1173.24	1173.25	-0.00%	1.86	1.85	0.49%
5329.92	1332.50	1332.51	-0.00%	1.96	1.97	-0.42%
7345.54	1836.01	1836.00	0.00%	2.28	2.28	0.07%

✓ ✓ ✓

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.6925 %
Ln(Eff) = -1.7287 +0.059982*Ln(Eng) -0.0639924*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 0.1511 %
Ln(Eff) = -13.4091 +4.619770*Ln(Eng) -0.50897*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
59.54	4.8346E-002	4.8322E-002	0.05%
88.03	5.3328E-002	5.3510E-002	-0.34%
122.06	5.1850E-002	5.1711E-002	0.27%
165.85	========== Knee ==========		
165.85	4.4411E-002	4.5327E-002	-2.06%
279.17	3.3580E-002	3.2693E-002	2.64%
391.69	2.6161E-002	2.5946E-002	0.82%
661.66	1.7595E-002	1.7624E-002	-0.16%
834.85	1.4573E-002	1.4680E-002	-0.74%
898.02	1.3192E-002	1.3842E-002	-4.93%
1115.55	1.2201E-002	1.1576E-002	5.12%
1173.24	1.0728E-002	1.1095E-002	-3.42%
1332.50	9.7442E-003	9.9541E-003	-2.15%
1836.01	7.6592E-003	7.5043E-003	2.02%

✓ ✓

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Am-241	59.54	35.90	1.58E+005	5097.50	1830.00	3.50%	1/1/2011 11:00:00 AM
Cd-109	88.03	3.61	4.63E+002	72271.00	2609.00	4.90%	1/1/2011 11:00:00 AM
Co-57	122.07	85.59	2.72E+002	1564.40	1339.00	4.10%	1/1/2011 11:00:00 AM
Ce-139	165.85	80.00	1.38E+002	2396.30	1917.00	3.90%	1/1/2011 11:00:00 AM
Hg-203	279.19	81.50	4.66E+001	5192.60	4232.00	3.90%	1/1/2011 11:00:00 AM
Sn-113	391.71	64.00	1.15E+002	4248.40	2719.00	2.50%	1/1/2011 11:00:00 AM
Cs-137	661.66	85.10	1.10E+004	2003.50	1705.00	4.00%	1/1/2011 11:00:00 AM
Mn-54	834.83	99.98	3.12E+002	3083.60	3083.00	3.30%	1/1/2011 11:00:00 AM
Y-88	898.02	93.70	1.07E+002	6929.60	6493.00	3.90%	1/1/2011 11:00:00 AM
Zn-65	1115.52	50.75	2.44E+002	6268.00	3181.00	3.50%	1/1/2011 11:00:00 AM
Co-60	1173.24	99.97	1.93E+003	3293.90	3293.00	4.00%	1/1/2011 11:00:00 AM
Co-60	1332.50	99.99	1.93E+003	3294.50	3294.00	4.00%	1/1/2011 11:00:00 AM

Y-88	1836.01	99.20	1.07E+002	6929.40	6874.00	3.90%	1/1/2011 11:00:00 AM

ORTEC g v - i (1087) Env32 G53W4.25 11/4/2011 9:30:44 AM
TestAmerica, Inc Spectrum name: 11_Liquid_20110906.An1

Sample description
11_Liquid_Marn83924

Spectrum Filename: C:\User\SPC\Det11\11_Liquid_20110906.An1

Acquisition information
Start time: 10/31/2011 1:03:19 PM
Live time: 7200
Real time: 7874
Dead time: 8.55 %
Detector ID: 11

Detector system
Ge11 SN/09363993

Calibration
Filename: 11_Liquid_Marinelli 1L.Clb
Ge11_1Lmarn_83924_334_101210

Energy Calibration
Created: 11/1/2011 11:26:50 AM
Zero offset: 0.098 keV
Gain: 0.250 keV/channel
Quadratic: -2.669E-08 keV/channel^2

Efficiency Calibration
Created: 11/1/2011 11:27:06 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.69 %
Log(Eff): -1.728738E+00 + (5.998209E-02*Log(E)) +
(-6.399241E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.15 %
Log(Eff): -1.340909E+01 + (4.619770E+00*Log(E)) +
(-5.089701E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix & Mn, Zn.L
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.62keV)
Stop channel: 8000 (1999.43keV)
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:	1.0000000E+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	1/1/2011 11:00:00 AM
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. 13 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0219

***** 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
36.40	4803.	7.38	0.89	3.403E-02				
37.91	13900.	2.80	0.89	3.536E-02				
49.56	27222.	2.92	1.86	4.366E-02				
59.55	636154.	0.18	0.90	4.833E-02	59.54	35.700	5.129E+03	AM241
84.72	8804.	4.81	0.94	5.334E-02				
88.05	635801.	0.14	0.94	5.351E-02	88.03	3.610	7.199E+04	CD109
122.09	230744.	0.30	0.98	5.171E-02	122.06	85.600	1.568E+03	CO57
136.51	28230.	1.43	1.01	4.985E-02				
165.90	133190.	0.42	1.00	4.532E-02	165.85	79.900	2.350E+03	Ce139
199.08	4380.	8.87	1.41	4.058E-02				
255.07	3570.	8.99	1.11	3.468E-02				
279.06	11277.	3.22	1.14	3.270E-02	279.17	81.500	5.320E+03	Hg203
391.64	82527.	0.56	1.23	2.595E-02	391.69	64.000	4.283E+03	SN113
510.98	12173.	3.16	2.44	2.142E-02				
661.69	211908.	0.28	1.44	1.762E-02	661.66	85.210	1.998E+03	CS137
834.86	164992.	0.34	1.60	1.468E-02	834.85	99.980	3.059E+03	Mn54
898.03	85918.	0.65	1.66	1.384E-02	898.02	93.700	6.602E+03	Y898
1115.55	118160.	0.42	1.81	1.158E-02	1115.55	50.600	6.620E+03	Zn65
1173.25	228064.	0.25	1.86	1.110E-02	1173.24	99.900	3.187E+03	Co1173
1324.90	1722.	9.54	2.17	1.000E-02				
1332.51	207205.	0.24	1.96	9.954E-03	1332.50	99.982	3.225E+03	Co1332
1835.99	52809.	0.48	2.28	7.504E-03	1836.01	99.200	7.070E+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	
145.12	36.36	60498.	4803.	1.412E+05	7.38	0.892	-	D
151.17	37.87	69051.	13900.	3.931E+05	2.80	0.894	-	D
197.75	49.56	172998.	27222.	6.235E+05	2.92	1.859	-	s

ORTEC g v - i (1087) Env32 G53W4.25 11/4/2011 9:30:44 AM
TestAmerica, Inc Spectrum name: 11_Liquid_20110906.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
338.33	84.71	85213.	8804.	4.543E+04	4.81	0.939	- lD
545.40	136.51	38738.	28230.	5.663E+05	1.43	1.007	-
795.60	199.08	38224.	4380.	1.079E+05	8.87	1.414	- s
1019.49	255.07	28430.	3570.	1.029E+05	8.99	1.106	-
2042.93	510.98	26229.	12173.	5.683E+05	3.16	2.436	- s
5299.47	1324.90	3888.	1722.	1.722E+05	9.54	2.166	- 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: DET_EnergyStandardMix & Mn, Zn.L

********** 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	237.71	59.55	163443.	636154.	88.355	0.18	0.899
CD-109	351.58	88.03	115340.	622562.	86.467	0.17	0.955
CO-57	487.74	122.09	58659.	230744.	32.048	0.30	0.982
Ce-139	662.93	165.90	42937.	133190.	18.499	0.42	1.003
Hg-203	1115.42	279.06	30048.	11277.	1.566	3.22	1.135
SN-113	1565.62	391.64	27516.	82527.	11.462	0.56	1.231
CS-137	2645.74	661.69	24411.	211908.	29.432	0.28	1.444
Mn-54	3338.49	834.86	23287.	164992.	22.916	0.34	1.599
Y-898	3591.25	898.03	30463.	85918.	11.933	0.65	1.655
Zn-65	4461.62	1115.55	17466.	118160.	16.411	0.42	1.809
Co-1173	4692.50	1173.25	12008.	228064.	31.676	0.25	1.864
Co-1332	5329.92	1332.51	4290.	207205.	28.778	0.24	1.957
Y-1836	7345.52	1835.99	1272.	52809.	7.335	0.48	2.281

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	Peak Energy keV	Peak Activity Bq	Peak Code	Peak MDA Value Bq	COMMENTS
AM-241		5.1286E+03				1.58E+05	
			59.54	5.129E+03	(	1.521E+01 1.79E-01 3.57E+01	G

ORTEC g v - i (1087) Env32 G53W4.25 11/4/2011 9:30:44 AM
TestAmerica, Inc Spectrum name: 11_Liquid_20110906.An1

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
CD-109		7.0492E+04					4.63E+02	
			88.03	7.049E+04	(	1.795E+02	1.70E-01	3.61E+00 G
CO-57		1.5683E+03					2.72E+02	
			122.06	1.568E+03	(	7.689E+00	2.99E-01	8.56E+01 G
Ce-139		2.3502E+03					1.38E+02	
			165.85	2.350E+03	(	1.709E+01	4.19E-01	7.99E+01 G
Hg-203		5.3197E+03					4.66E+01	
			279.17	5.320E+03	(	3.823E+02	3.22E+00	8.15E+01 G
SN-113		4.2831E+03					1.15E+02	
			391.69	4.283E+03	(	4.026E+01	5.63E-01	6.40E+01 G
CS-137		1.9977E+03					1.10E+04	
			661.66	1.998E+03	(	6.889E+00	2.79E-01	8.52E+01 G
Mn-54		3.0594E+03					3.12E+02	
			834.85	3.059E+03	(	1.324E+01	3.41E-01	1.00E+02 G
Y-898		6.6022E+03					1.07E+02	
			898.02	6.602E+03	(	6.271E+01	6.47E-01	9.37E+01 G
Zn-65	F	6.6204E+03					2.44E+02	
			1115.55	6.620E+03	(	3.466E+01	4.22E-01	5.06E+01 G
Co-1173		3.1872E+03					1.93E+03	
			1173.24	3.187E+03	(	7.174E+00	2.52E-01	9.99E+01 G
Co-1332		3.2250E+03					1.93E+03	
			1332.50	3.225E+03	(	4.793E+00	2.36E-01	1.00E+02 G
Y-1836		7.0704E+03					1.07E+02	
			1836.01	7.070E+03	(	2.261E+01	4.84E-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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
AM-241	5.1217E+03	5.1286E+03	1.785E-01%	1.52E+01
CD-109	4.4762E+04	7.0492E+04	1.702E-01%	1.80E+02
CO-57	7.2400E+02	1.5683E+03	2.987E-01%	7.69E+00
Ce-139	5.1078E+02	2.3502E+03	4.194E-01%	1.71E+01
Hg-203	5.8783E+01	5.3197E+03	3.215E+00%	3.82E+02
SN-113	6.9025E+02	4.2831E+03	5.625E-01%	4.03E+01
CS-137	1.9598E+03	1.9977E+03	2.793E-01%	6.89E+00
Mn-54	1.5613E+03	3.0594E+03	3.409E-01%	1.32E+01
Y-898	9.2003E+02	6.6022E+03	6.473E-01%	6.27E+01
Zn-65	2.8017E+03	6.6204E+03	4.224E-01%	3.47E+01
Co-1173	2.8577E+03	3.1872E+03	2.519E-01%	7.17E+00
Co-1332	2.8916E+03	3.2250E+03	2.361E-01%	4.79E+00
Y-1836	9.8526E+02	7.0704E+03	4.840E-01%	2.26E+01

- < - 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

ORTEC g v - i (1087) Env32 G53W4.25 11/4/2011 9:30:44 AM
TestAmerica, Inc Spectrum name: 11_Liquid_20110906.An1

---------- S U M M A R Y ----------

Total Activity (42.9 to 1999.4 keV) 6.585E+04 Bq
Total Decayed Activity (42.9 to 1999.4 keV) 1.2090427E+05 Bq

Analyzed by: _____
admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica, Inc

Gamma Verification per Geometry

Detector: Ge12

Geometry: 1L Marn

Reference date 1/1/2012

Calibration Standard: 90062

Standard volume g / vial 1

Standard volume transferred in g / geometry 1

lab ID# of cal standard 6707

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	Abundance	Activity Bq/L	Count Results	%recovery
Am-241	1821	1821	0.359	**5072.4**	5105.3	100.6
Cd-109	2602	2602	0.0361	**72077.6**	69937	97.0
Co-57	1364	1364	0.856	**1593.5**	1601	100.5
Ce-139	1932	1932	0.799	**2418.0**	2419.8	100.1
Hg-203	4200	4200	0.8146	**5155.9**	5250	101.8
Sn-113	2722	2722	0.64	**4253.1**	4232.6	99.5
Cs-137	1750	1750	0.851	**2056.4**	2043.2	99.4
Mn-54	3114	3114	0.9998	**3114.6**	3226.9	103.6
Y-88	6559	6559	0.937	**7000.0**	6535.5	93.4
Zn-65	3134	3134	0.506	**6193.7**	6567.8	106.0
Co-60	3233	3233	0.99974	**3233.8**	3114.7	96.3
Co-60	3233	3233	0.99986	**3233.5**	3112.9	96.3
Y-88	6944	6944	0.992	**7000.0**	7133.6	101.9

Reviewed By: Megan McAfee

Date: 4/10/2012

Calibration Data from file: 12_Liquid_Marinelli 1L.Clb
Energy Calibration Date: 4/2/2012 Time: 5:16:59 PM
Efficiency Calibration Date: 4/2/2012 Time: 5:17:10 PM

Calibration Description:
Ge12_Marn1LCal_90062_032612

Energy Calibration Fit
Energy = 0.1071 +0.250201*Channel -3.54049e-008*Channel**2
FWHM (ch) = 3.6433 +0.000897*Channel -1.85195e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
237.63	59.54	59.56	-0.03%	0.95	0.96	-1.95%
351.51	88.03	88.05	-0.02%	1.00	0.99	1.12%
487.56	122.06	122.09	-0.02%	1.02	1.02	0.27%
662.76	165.85	165.91	-0.04%	1.05	1.06	-0.48%
1115.13	279.17	279.07	0.04%	1.16	1.16	0.39%
1565.05	391.69	391.60	0.02%	1.26	1.25	0.73%
2645.14	661.66	661.67	-0.00%	1.47	1.47	-0.15%
3337.89	834.85	834.86	-0.00%	1.61	1.61	0.30%
3590.66	898.02	898.04	-0.00%	1.66	1.66	0.21%
4461.02	1115.55	1115.55	-0.00%	1.82	1.82	-0.08%
4691.91	1173.24	1173.25	-0.00%	1.85	1.86	-0.28%
5329.51	1332.50	1332.55	-0.00%	1.96	1.97	-0.48%
7345.24	1836.01	1835.98	0.00%	2.31	2.31	0.24%

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.1819 %
Ln(Eff) = -2.7712 +0.400977*Ln(Eng) -0.0891117*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 0.2531 %
Ln(Eff) = -13.2459 +4.570937*Ln(Eng) -0.503944*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
59.54	5.0722E-002	5.0677E-002	0.09%
88.03	5.5677E-002	5.5991E-002	-0.56%
122.06	5.4332E-002	5.4071E-002	0.48%
165.85	========== Knee ==========		
165.85	4.6910E-002	4.7377E-002	-1.00%
279.17	3.6139E-002	3.5461E-002	1.88%
391.69	2.8486E-002	2.8620E-002	-0.47%
661.66	1.9624E-002	1.9726E-002	-0.52%
834.85	1.7060E-002	1.6465E-002	3.49%
898.02	1.4498E-002	1.5526E-002	-7.09%
1115.55	1.3752E-002	1.2968E-002	5.70%
1173.24	1.1955E-002	1.2421E-002	-3.90%
1332.50	1.0704E-002	1.1119E-002	-3.88%
1836.01	8.4660E-003	8.3061E-003	1.89%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Am-241	59.54	35.70	1.58E+005	5100.80	1821.00	3.50%	1/1/2012 11:00:00 AM
Cd-109	88.03	3.61	4.63E+002	72078.00	2602.00	4.70%	1/1/2012 11:00:00 AM
Co-57	122.06	85.60	2.72E+002	1593.50	1364.00	4.10%	1/1/2012 11:00:00 AM
Ce-139	165.85	79.90	1.38E+002	2418.00	1932.00	3.90%	1/1/2012 11:00:00 AM
Hg-203	279.17	81.50	4.66E+001	5153.40	4200.00	3.80%	1/1/2012 11:00:00 AM
Sn-113	391.69	64.00	1.15E+002	4253.10	2722.00	3.90%	1/1/2012 11:00:00 AM
Cs-137	661.66	85.21	1.10E+004	2053.70	1750.00	4.00%	1/1/2012 11:00:00 AM
Mn-54	834.85	99.98	3.12E+002	3114.60	3114.00	3.30%	1/1/2012 11:00:00 AM
Y-88	898.02	93.70	1.07E+002	7000.00	6559.00	3.90%	1/1/2012 11:00:00 AM
Zn-65	1115.55	50.60	2.44E+002	6193.70	3134.00	3.50%	1/1/2012 11:00:00 AM
Co-60	1173.24	99.90	1.93E+003	3236.20	3233.00	4.00%	1/1/2012 11:00:00 AM
Co-60	1332.50	99.98	1.93E+003	3233.60	3233.00	4.00%	1/1/2012 11:00:00 AM
Y-88	1836.01	99.20	1.07E+002	7000.00	6944.00	4.00%	1/1/2012 11:00:00 AM

ORTEC g v - i (1087) Env32 G53W4.25 4/2/2012 5:17:37 PM
TestAmerica, Inc Spectrum name: 12_1LMarn_20120731.An1

Sample description
12_1LMarn_90062_032612

Spectrum Filename: C:\User\SPC\Det12\12_1LMarn_20120731.An1

Acquisition information
Start time: 3/26/2012 11:38:29 AM
Live time: 3600
Real time: 4205
Dead time: 14.40 %
Detector ID: 12

Detector system
Ge12 SN/10034336

Calibration
Filename: 12_Liquid_Marinelli 1L.Clb
Ge12_Marn1LCal_90062_032612

Energy Calibration
Created: 4/2/2012 5:16:59 PM
Zero offset: 0.107 keV
Gain: 0.250 keV/channel
Quadratic: -3.540E-08 keV/channel^2

Efficiency Calibration
Created: 4/2/2012 5:17:10 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.18 %
Log(Eff): -2.771167E+00 + (4.009767E-01*Log(E)) +
(-8.911171E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.25 %
Log(Eff): -1.324587E+01 + (4.570937E+00*Log(E)) +
(-5.039442E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix & Mn, Zn.L
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.64keV)
Stop channel: 8000 (1999.45keV)
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	1/1/2012 11:00:00 AM
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. 13 cutoff: 5.00E+01%

Energy Calibration
Normalized diff: 0.0272

***** 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
37.94	28085.	2.05	1.02	3.732E-02				
49.79	13754.	4.70	2.04	4.600E-02				
59.56	332388.	0.30	0.95	5.068E-02	59.54	35.700	5.105E+03	AM241
66.67	7205.	8.69	2.85	5.299E-02				
70.79	10394.	4.12	0.97	5.398E-02				
72.94	16670.	2.56	0.98	5.440E-02				
82.51	9156.	4.53	0.98	5.566E-02				
84.95	13122.	3.07	0.99	5.584E-02				
88.07	457312.	0.17	0.99	5.599E-02	88.03	3.610	7.139E+04	CD109
122.08	214769.	0.38	1.02	5.407E-02	122.06	85.600	1.601E+03	CO57
136.51	26655.	1.93	1.03	5.212E-02				
165.93	212593.	0.25	1.06	4.737E-02	165.85	79.900	2.394E+03	Ce139
199.16	6079.	6.77	1.22	4.303E-02				
255.00	7424.	5.34	1.11	3.742E-02				
279.07	154333.	0.41	1.16	3.547E-02	279.17	81.500	5.250E+03	Hg203
391.60	167246.	0.36	1.26	2.862E-02	391.69	64.000	4.233E+03	SN113
510.99	14530.	2.70	2.58	2.384E-02				
661.67	122972.	0.46	1.47	1.973E-02	661.66	85.210	2.043E+03	CS137
813.80	2410.	9.44	1.64	1.680E-02				
834.85	158346.	0.36	1.61	1.646E-02	834.85	99.980	3.227E+03	Mn54
898.03	196917.	0.32	1.66	1.553E-02	898.02	93.700	6.535E+03	Y898
1115.54	121888.	0.40	1.82	1.297E-02	1115.55	50.600	6.568E+03	Zn65
1173.24	134942.	0.34	1.86	1.242E-02	1173.24	99.900	3.115E+03	Co1173
1324.88	3374.	5.94	2.79	1.118E-02				
1332.55	120824.	0.36	1.96	1.112E-02	1332.50	99.982	3.113E+03	Co1332
1835.96	121734.	0.32	2.32	8.306E-03	1836.01	99.200	7.134E+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
151.23	37.94	78730.	28085.	7.525E+05	2.05	1.015	- s
198.58	49.79	115542.	13754.	2.990E+05	4.70	2.040	- s
266.05	66.67	104952.	7205.	1.360E+05	8.69	2.853	- s

ORTEC g v - i (1087) Env32 G53W4.25 4/2/2012 5:17:37 PM
TestAmerica, Inc Spectrum name: 12_1LMarn_20120731.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
282.52	70.79	86523.	10394.	1.926E+05	4.12	0.975 -	D
291.09	72.93	82453.	16670.	3.064E+05	2.56	0.976 -	D
329.38	82.50	81479.	9156.	7.561E+04	4.53	0.985 -	lD
339.11	84.93	74517.	13122.	2.766E+04	3.07	0.987 -	lD
545.20	136.51	59598.	26655.	5.114E+05	1.93	1.034 -	
795.67	199.16	42585.	6079.	1.413E+05	6.77	1.221 -	
1018.90	255.00	36005.	7424.	1.984E+05	5.34	1.112 -	
2042.47	510.99	25384.	14530.	6.094E+05	2.70	2.579 -	s
3253.66	813.80	11387.	2410.	1.434E+05	9.44	1.639 -	
5298.83	1324.88	6125.	3374.	3.019E+05	5.94	2.787 -	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: DET_EnergyStandardMix & Mn, Zn.L

********** 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	237.63	59.56	146464.	332388.	92.330	0.30	0.946
CD-109	351.51	88.05	113553.	448029.	124.452	0.22	1.001
CO-57	487.55	122.08	87100.	214769.	59.658	0.38	1.023
Ce-139	662.76	165.91	57396.	214900.	59.694	0.32	1.053
Hg-203	1115.13	279.07	44199.	154333.	42.870	0.41	1.160
SN-113	1565.05	391.60	32591.	167246.	46.457	0.36	1.260
CS-137	2645.12	661.67	30520.	122972.	34.159	0.46	1.470
Mn-54	3337.88	834.85	23845.	158346.	43.985	0.36	1.613
Y-898	3590.64	898.03	26904.	196917.	54.699	0.32	1.661
Zn-65	4460.98	1115.54	14600.	121888.	33.858	0.40	1.819
Co-1173	4691.89	1173.24	10127.	134942.	37.484	0.34	1.856
Co-1332	5329.51	1332.55	8323.	120824.	33.562	0.36	1.964
Y-1836	7345.16	1835.96	3494.	121734.	33.815	0.32	2.315

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	Peak Energy keV	Peak Activity Bq		Peak MDA Value Bq			Code	COMMENTS
AM-241		5.1053E+03						1.58E+05		
			59.54	5.105E+03	(	2.743E+01	3.00E-01	3.57E+01	G	
CD-109		6.9937E+04						4.63E+02		
			88.03	6.994E+04	(	2.455E+02	2.16E-01	3.61E+00	G	
CO-57		1.6010E+03						2.72E+02		
			122.06	1.601E+03	(	1.027E+01	3.75E-01	8.56E+01	G	
Ce-139		2.4198E+03						1.38E+02		
			165.85	2.420E+03	(	1.260E+01	3.20E-01	7.99E+01	G	
Hg-203		5.2500E+03						4.66E+01		
			279.17	5.250E+03	(	3.342E+01	4.08E-01	8.15E+01	G	
SN-113		4.2326E+03						1.15E+02		
			391.69	4.233E+03	(	2.136E+01	3.57E-01	6.40E+01	G	
CS-137		2.0432E+03						1.10E+04		
			661.66	2.043E+03	(	1.357E+01	4.61E-01	8.52E+01	G	
Mn-54		3.2269E+03						3.12E+02		
			834.85	3.227E+03	(	1.472E+01	3.65E-01	1.00E+02	G	
Y-898		6.5355E+03						1.07E+02		
			898.02	6.535E+03	(	2.546E+01	3.19E-01	9.37E+01	G	
Zn-65	F	6.5678E+03						2.44E+02		
			1115.55	6.568E+03	(	3.049E+01	3.97E-01	5.06E+01	G	
Co-1173		3.1147E+03						1.93E+03		
			1173.24	3.115E+03	(	1.089E+01	3.42E-01	9.99E+01	G	
Co-1332		3.1129E+03						1.93E+03		
			1332.50	3.113E+03	(	1.102E+01	3.57E-01	1.00E+02	G	
Y-1836		7.1336E+03						1.07E+02		
			1836.01	7.134E+03	(	1.630E+01	3.23E-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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
AM-241	5.1034E+03	5.1053E+03	2.996E-01%	2.74E+01
CD-109	6.1571E+04	6.9937E+04	2.164E-01%	2.46E+02
CO-57	1.2889E+03	1.6010E+03	3.755E-01%	1.03E+01
Ce-139	1.5770E+03	2.4198E+03	3.201E-01%	1.26E+01
Hg-203	1.4834E+03	5.2500E+03	4.085E-01%	3.34E+01
SN-113	2.5364E+03	4.2326E+03	3.574E-01%	2.14E+01
CS-137	2.0322E+03	2.0432E+03	4.610E-01%	1.36E+01
Mn-54	2.6720E+03	3.2269E+03	3.645E-01%	1.47E+01
Y-898	3.7598E+03	6.5355E+03	3.188E-01%	2.55E+01
Zn-65	5.1600E+03	6.5678E+03	3.967E-01%	3.05E+01
Co-1173	3.0208E+03	3.1147E+03	3.417E-01%	1.09E+01
Co-1332	3.0190E+03	3.1129E+03	3.570E-01%	1.10E+01

ORTEC g v - i (1087) Env32 G53W4.25 4/2/2012 5:17:37 PM
TestAmerica, Inc Spectrum name: 12_1LMarn_20120731.An1

Y-1836	4.1039E+03	7.1336E+03	3.233E-01%	1.63E+01

< - 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 (77.7 to 1999.4 keV) 9.733E+04 Bq
Total Decayed Activity (77.7 to 1999.4 keV) 1.2028057E+05 Bq

Analyzed by: _____
admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica, Inc

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

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: -3.662E-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*Log(E)) +
(-3.369562E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.96 %
Log(Eff): -2.288409E+01 + (8.352717E+00*Log(E)) +
(-8.812368E-01*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: 1.0000E+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 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 Channel	Centroid Energy	Background Counts	Net 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	Code	Average Activity Bq	Peak Energy keV	Peak Activity Bq	Code	MDA Value Bq		COMMENTS
Pb-210	N	1.4446E+04				8.15E+03		
			46.54	1.445E+04	(	1.174E+02	4.69E-01 4.25E+00 G	
AM-241		1.2212E+03				1.58E+05		
			59.54	1.221E+03	(	1.009E+01	4.87E-01 3.57E+01 G	
CD-109		1.6047E+04				4.63E+02		
			88.03	1.605E+04	(	9.875E+01	4.00E-01 3.61E+00 G	
CO-57		3.5189E+02				2.72E+02		
			122.06	3.519E+02	(	3.789E+00	6.59E-01 8.56E+01 G	

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

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

Peak Codes:
G - Gamma Ray
X - X-Ray
P - Positron Decay
S - Single-Escape

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

P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
Pb-210	1.4112E+04	1.4446E+04	4.686E-01%	1.17E+02
AM-241	1.2198E+03	1.2212E+03	4.873E-01%	1.01E+01
CD-109	1.0628E+04	1.6047E+04	3.995E-01%	9.87E+01
CO-57	1.7453E+02	3.5189E+02	6.590E-01%	3.79E+00
Ce-139	1.3551E+02	5.4118E+02	7.998E-01%	7.10E+00
Hg-203	1.9895E+01	1.1854E+03	4.682E+00%	1.19E+02
SN-113	1.8819E+02	9.8586E+02	1.108E+00%	1.68E+01
CS-137	4.5695E+02	4.6495E+02	5.986E-01%	3.23E+00
Y-898	2.6230E+02	1.5678E+03	1.088E+00%	2.30E+01
Co-1173	6.5520E+02	7.2338E+02	5.354E-01%	3.45E+00
Co-1332	6.5470E+02	7.2283E+02	5.311E-01%	2.91E+00
Y-1836	2.7290E+02	1.6311E+03	9.660E-01%	1.16E+01

< - 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 (37.5 to 1999.5 keV) 2.878E+04 Bq
Total Decayed Activity (37.5 to 1999.5 keV) 3.9888684E+04 Bq

Analyzed by: _____
admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica, Inc

Gamma Verification per Geometry

Detector: Ge15

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	14410	96.5
Am-241	2037	418	0.3590	1163	1206.9	103.7
Cd-109	2881	591	0.0361	16363	16069	98.2
Co-57	1511	310	0.8560	362	356.06	98.4
Ce-139	2139	439	0.7990	549	538.81	98.2
Hg-203	4651	954	0.8146	1171	1202.4	102.7
Sn-113	3015	618	0.6400	966	974.62	100.9
Cs-137	1938	397	0.8510	467	465.43	99.7
Y-88	7264	1489	0.9370	1589	1573.7	99.0
Co-60	3580	734	0.9997	734	716.44	97.6
Co-60	3581	734	0.9999	734	726.55	98.9
Y-88	7690	1577	0.9920	1589	1633.2	102.8

Reviewed By: Jody Watson

Date: 3/22/2012

Calibration Data from file: 15_Soil_TunaCan.Clb
Energy Calibration Date: 3/22/2012 Time: 1:02:46 PM
Efficiency Calibration Date: 3/22/2012 Time: 1:03:01 PM

Calibration Description:
15_TunaCan_90099_032212

Energy Calibration Fit
Energy = 0.0042 +0.250192*Channel -3.10425e-008*Channel**2
FWHM (ch) = 3.5032 +0.001000*Channel -3.73783e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
185.91	46.54	46.52	0.05%	0.90	0.92	-2.54%
237.99	59.54	59.55	-0.01%	0.91	0.94	-2.43%
352.01	88.03	88.07	-0.05%	0.95	0.96	-1.92%
487.92	122.06	122.07	-0.01%	1.00	1.00	0.30%
663.08	165.85	165.89	-0.02%	1.05	1.04	1.34%
1115.99	279.17	279.18	-0.00%	1.18	1.14	3.23%
1565.41	391.69	391.58	0.03%	1.26	1.24	1.14%
2645.35	661.66	661.63	0.00%	1.50	1.47	2.11%
3590.98	898.02	898.04	-0.00%	1.67	1.65	0.79%
4692.06	1173.24	1173.24	-0.00%	1.80	1.84	-2.06%
5329.66	1332.50	1332.56	-0.00%	1.90	1.94	-2.28%
7344.95	1836.01	1835.98	0.00%	2.23	2.21	1.30%

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.9975 %
Ln(Eff) = -0.6895 -0.329061*Ln(Eng) -0.0387563*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 1.1273 %
Ln(Eff) = -23.6268 +8.666669*Ln(Eng) -0.921464*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	1.8904E-002	1.9569E-002	-3.52%
59.54	2.8630E-002	2.7372E-002	4.39%
88.03	3.6378E-002	3.7061E-002	-1.88%
122.06	3.7201E-002	3.8461E-002	-3.39%
165.85	========== Knee ==========		
165.85	3.3266E-002	3.3919E-002	-1.96%
279.17	2.3641E-002	2.3007E-002	2.68%
391.69	1.7841E-002	1.7674E-002	0.94%
661.66	1.1534E-002	1.1545E-002	-0.10%
898.02	8.8355E-003	8.9209E-003	-0.97%
1173.24	6.9001E-003	7.0763E-003	-2.55%
1332.50	6.2597E-003	6.3249E-003	-1.04%
1836.01	4.8716E-003	4.7412E-003	2.68%

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

ORTEC g v - i (1087) Env32 G53W4.25 3/22/2012 1:04:51 PM Page 1
TestAmerica, Inc. Spectrum name: 15_TunaCan_20120283.An1

Sample description
15_TunaCan_90099_032212

Spectrum Filename: C:\User\SPC\Det15\15_TunaCan_20120283.An1

Acquisition information
Start time: 3/22/2012 11:06:02 AM
Live time: 3600
Real time: 3653
Dead time: 1.44 %
Detector ID: 15

Detector system
Ge15 SN/1102216

Calibration
Filename: 15_TunaCan.Clb
15_TunaCan_90099_032212

Energy Calibration
Created: 3/22/2012 1:02:46 PM
Zero offset: 0.004 keV
Gain: 0.250 keV/channel
Quadratic: -3.104E-08 keV/channel^2

Efficiency Calibration
Created: 3/22/2012 1:03:01 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.00 %
Log(Eff): -6.894897E-01 + (-3.290613E-01*Log(E)) + (-3.875629E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.13 %
Log(Eff): -2.362677E+01 + (8.666669E+00*Log(E)) + (-9.214638E-01*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 (37.53keV)
Stop channel: 8000 (1999.56keV)
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	1/1/2012 11:00:00 AM
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. 12 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0249

***** 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
46.52	42849.	0.75	0.90	1.955E-02	46.54	4.250	1.441E+04	Pb210
59.55	42443.	0.72	0.91	2.738E-02	59.54	35.700	1.207E+03	AM241
72.95	2606.	6.34	0.95	3.318E-02				
88.07	68550.	0.54	0.95	3.707E-02	88.03	3.610	1.607E+04	CD109
122.10	33756.	0.64	1.00	3.846E-02	122.06	85.600	3.502E+02	CO57
136.52	4295.	2.96	1.01	3.724E-02				
165.89	34959.	0.78	1.05	3.391E-02	165.85	79.900	5.388E+02	Ce139
279.18	24347.	0.88	1.18	2.301E-02	279.17	81.500	1.202E+03	Hg203
391.58	24366.	0.82	1.26	1.768E-02	391.69	64.000	9.746E+02	SN113
661.63	16400.	1.16	1.50	1.155E-02	661.66	85.210	4.654E+02	CS137
898.03	27965.	0.74	1.67	8.921E-03	898.02	93.700	1.574E+03	Y898
1173.23	17709.	0.94	1.81	7.076E-03	1173.24	99.900	7.164E+02	Co1173
1332.55	16065.	0.98	1.90	6.325E-03	1332.50	99.982	7.266E+02	Co1332
1835.95	16330.	0.85	2.24	4.741E-03	1836.01	99.200	1.633E+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 keV	Suspected Nuclide	
291.58	72.93	12341.	2606.	7.854E+04	6.34	0.949	-	D
545.42	136.45	8010.	4524.	1.215E+05	4.23	1.054	-	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: 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	185.91	46.52	15447.	42849.	11.903	0.75	0.900
AM-241	237.99	59.55	14029.	42443.	11.790	0.72	0.913
CD-109	352.01	88.07	16260.	68550.	19.042	0.54	0.945
CO-57	487.92	122.07	9130.	34324.	9.535	0.78	0.999
Ce-139	663.08	165.89	8215.	34959.	9.711	0.78	1.052
Hg-203	1115.99	279.18	4252.	24347.	6.763	0.88	1.182
SN-113	1565.41	391.58	3012.	24366.	6.768	0.82	1.259
CS-137	2645.35	661.63	3077.	16400.	4.555	1.16	1.503
Y-898	3590.94	898.03	2252.	27965.	7.768	0.74	1.667
Co-1173	4692.02	1173.23	1355.	17709.	4.919	0.94	1.807
Co-1332	5329.60	1332.55	1160.	16065.	4.463	0.98	1.900
Y-1836	7344.81	1835.95	345.	16330.	4.536	0.85	2.240

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	Peak Energy keV	Peak Activity Bq	Code	MDA Value Bq		COMMENTS
Pb-210	N	1.4410E+04				8.15E+03		
			46.54	1.441E+04	(	1.957E+02	7.55E-01 4.25E+00	G
AM-241		1.2069E+03				1.58E+05		
			59.54	1.207E+03	(	1.577E+01	7.22E-01 3.57E+01	G
CD-109		1.6069E+04				4.63E+02		
			88.03	1.607E+04	(	1.399E+02	5.44E-01 3.61E+00	G
CO-57		3.5606E+02				2.72E+02		
			122.06	3.561E+02	(	4.647E+00	7.84E-01 8.56E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA		Comments
Ce-139	5.3881E+02				1.38E+02		
		165.85	5.388E+02	(	6.551E+00	7.82E-01 7.99E+01	G
Hg-203	1.2024E+03				4.66E+01		
		279.17	1.202E+03	(	1.514E+01	8.77E-01 8.15E+01	G
SN-113	9.7462E+02				1.15E+02		
		391.69	9.746E+02	(	1.034E+01	8.20E-01 6.40E+01	G
CS-137	4.6543E+02				1.10E+04		
		661.66	4.654E+02	(	7.413E+00	1.16E+00 8.52E+01	G
Y-898	1.5737E+03				1.07E+02		

898.02 1.574E+03 (1.260E+01 7.45E-01 9.37E+01 G

Co-1173 7.1644E+02 1.93E+03
1173.24 7.164E+02 (7.050E+00 9.39E-01 9.99E+01 G

Co-1332 7.2655E+02 1.93E+03
1332.50 7.266E+02 (7.301E+00 9.83E-01 1.00E+02 G

Y-1836 1.6332E+03 1.07E+02
1836.01 1.633E+03 (8.923E+00 8.49E-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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
Pb-210	1.4311E+04	1.4410E+04	7.549E-01%	1.96E+02
AM-241	1.2065E+03	1.2069E+03	7.219E-01%	1.58E+01
CD-109	1.4233E+04	1.6069E+04	5.439E-01%	1.40E+02

CO-57	2.8961E+02	3.5606E+02	7.837E-01%	4.65E+00
Ce-139	3.5832E+02	5.3881E+02	7.816E-01%	6.55E+00
Hg-203	3.6068E+02	1.2024E+03	8.771E-01%	1.51E+01
SN-113	5.9836E+02	9.7462E+02	8.201E-01%	1.03E+01
CS-137	4.6306E+02	4.6543E+02	1.155E+00%	7.41E+00
Y-898	9.2933E+02	1.5737E+03	7.445E-01%	1.26E+01
Co-1173	6.9585E+02	7.1644E+02	9.390E-01%	7.05E+00
Co-1332	7.0567E+02	7.2655E+02	9.834E-01%	7.30E+00
Y-1836	9.6449E+02	1.6332E+03	8.486E-01%	8.92E+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 (82.3 to 1999.6 keV) 3.512E+04 Bq
Total Decayed Activity (82.3 to 1999.6 keV) 3.9873703E+04 Bq

Gamma Verification per Geometry

Detector: Ge17

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	14476	97.0
Am-241	2037	418	0.3590	1163	1217.3	104.6
Cd-109	2881	591	0.0361	16363	16121	98.5
Co-57	1511	310	0.8560	362	351.58	97.1
Ce-139	2139	439	0.7990	549	540.43	98.5
Hg-203	4651	954	0.8146	1171	1200.7	102.6
Sn-113	3015	618	0.6400	966	969.38	100.4
Cs-137	1938	397	0.8510	467	466.08	99.8
Y-88	7264	1489	0.9370	1589	1562.4	98.3
Co-60	3580	734	0.9997	734	724.88	98.7
Co-60	3581	734	0.9999	734	733.12	99.8
Y-88	7690	1577	0.9920	1589	1616.3	101.7

Reviewed By: Megan McAfee

Date: 4/13/2012

Calibration Data from file: 17_Soil_TunaCan.Clb
Energy Calibration Date: 4/12/2012 Time: 9:28:30 AM
Efficiency Calibration Date: 4/12/2012 Time: 9:28:42 AM

Calibration Description:
17_TunaCan_90099_032612

Energy Calibration Fit
Energy = 0.1178 +0.250077*Channel -2.37566e-008*Channel**2
FWHM (ch) = 2.9772 +0.000994*Channel -3.22638e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
185.96	46.54	46.62	-0.17%	0.77	0.79	-3.16%
237.92	59.54	59.61	-0.12%	0.78	0.80	-3.33%
351.79	88.03	88.09	-0.07%	0.82	0.83	-1.16%
487.44	122.06	122.01	0.04%	0.89	0.86	3.09%
662.32	165.85	165.74	0.07%	0.93	0.91	2.22%
1115.65	279.17	279.09	0.03%	1.03	1.01	2.15%
1565.90	391.69	391.66	0.01%	1.10	1.11	-0.78%
2646.02	661.66	661.66	-0.00%	1.37	1.35	1.74%
3591.93	898.02	898.07	-0.01%	1.52	1.53	-0.67%
4693.19	1173.24	1173.25	-0.00%	1.72	1.73	-0.81%
5330.69	1332.50	1332.53	-0.00%	1.82	1.84	-0.74%
7346.32	1836.01	1835.98	0.00%	2.14	2.13	0.55%

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.9072 %
Ln(Eff) = -0.5264 -0.402416*Ln(Eng) -0.0260446*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 1.0020 %
Ln(Eff) = -23.4389 +8.582715*Ln(Eng) -0.907543*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	2.0383E-002	2.1004E-002	-3.05%
59.54	3.0743E-002	2.9571E-002	3.81%
88.03	3.9976E-002	4.0594E-002	-1.55%
122.06	4.1510E-002	4.2756E-002	-3.00%
165.85	========== Knee ==========		
165.85	3.7629E-002	3.8252E-002	-1.65%
279.17	2.7514E-002	2.6814E-002	2.54%
391.69	2.1207E-002	2.1122E-002	0.40%
661.66	1.4433E-002	1.4427E-002	0.04%
898.02	1.1287E-002	1.1478E-002	-1.69%
1173.24	9.2333E-003	9.3589E-003	-1.36%
1332.50	8.4692E-003	8.4809E-003	-0.14%
1836.01	6.7041E-003	6.5931E-003	1.66%

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

ORTEC g v - i (1087) Env32 G53W4.25 7/6/2012 10:31:21 AM Page 1
TestAmerica, Inc. Spectrum name: 17_TunaCan_20120263.An1

Sample description
17_TunaCan_90099_032612

Spectrum Filename: C:\User\SPC\Det17\17_TunaCan_20120263.An1

Acquisition information
Start time: 3/26/2012 6:29:58 AM
Live time: 3600
Real time: 3672
Dead time: 1.95 %
Detector ID: 17

Detector system
Ge17 SN/11080671

Calibration
Filename: 17_Soil_TunaCan.Clb
17_TunaCan_90099_032612

Energy Calibration
Created: 4/12/2012 9:28:30 AM
Zero offset: 0.118 keV
Gain: 0.250 keV/channel
Quadratic: -2.376E-08 keV/channel^2

Efficiency Calibration
Created: 4/12/2012 9:28:42 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.91 %
Log(Eff): -5.264190E-01 + (-4.024164E-01*Log(E)) +
(-2.604461E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.00 %
Log(Eff): -2.343889E+01 + (8.582715E+00*Log(E)) +
(-9.075430E-01*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 (37.63keV)
Stop channel: 8000 (1999.21keV)
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	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: 0.0522

***** 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
46.62	46187.	0.69	0.77	2.106E-02	46.54	4.250	1.448E+04	Pb210
59.61	46245.	0.74	0.78	2.961E-02	59.54	35.700	1.217E+03	AM241
72.97	2852.	5.64	0.82	3.610E-02				
88.09	74900.	0.46	0.82	4.061E-02	88.03	3.610	1.612E+04	CD109
122.01	37313.	0.73	0.89	4.276E-02	122.06	85.600	3.516E+02	CO57
136.40	4536.	4.09	0.81	4.164E-02				
165.74	38793.	0.66	0.93	3.765E-02	165.85	79.900	5.404E+02	Ce139
255.04	1259.	9.59	1.07	2.855E-02				
279.09	26776.	0.82	1.03	2.682E-02	279.17	81.500	1.201E+03	Hg203
391.66	28306.	0.76	1.11	2.112E-02	391.69	64.000	9.694E+02	SN113
661.66	20517.	0.91	1.37	1.443E-02	661.66	85.210	4.661E+02	CS137
898.07	34851.	0.63	1.52	1.148E-02	898.02	93.700	1.562E+03	Y898
1173.25	23664.	0.80	1.72	9.359E-03	1173.24	99.900	7.249E+02	Co1173
1332.52	21706.	0.78	1.83	8.481E-03	1332.50	99.982	7.331E+02	Co1332
1835.97	21924.	0.70	2.15	6.593E-03	1836.01	99.200	1.616E+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	
291.30	72.97	10374.	2884.	7.989E+04	5.33	0.816	-	D
544.98	136.40	8136.	4536.	1.089E+05	4.09	0.813	-	
1019.46	255.04	3805.	1259.	4.410E+04	9.59	1.072	-	

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	185.96	46.62	15035.	46187.	12.830	0.69	0.766
AM-241	237.92	59.61	17361.	46245.	12.846	0.74	0.777
CD-109	351.79	88.09	12661.	74900.	20.806	0.46	0.821
CO-57	487.44	122.01	9755.	37313.	10.365	0.73	0.891
Ce-139	662.32	165.74	6828.	38793.	10.776	0.66	0.926
Hg-203	1115.65	279.09	4528.	26776.	7.438	0.82	1.034
SN-113	1565.90	391.66	3496.	28306.	7.863	0.76	1.105
CS-137	2646.02	661.66	2816.	20517.	5.699	0.91	1.369
Y-898	3591.91	898.07	2257.	34851.	9.681	0.63	1.523
Co-1173	4693.17	1173.25	1531.	23664.	6.573	0.80	1.720
Co-1332	5330.69	1332.52	1002.	21706.	6.029	0.78	1.825
Y-1836	7346.26	1835.97	205.	21924.	6.090	0.70	2.146

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	Peak Energy keV	Peak Activity Bq	Code	MDA Value Bq		COMMENTS
Pb-210	N	1.4476E+04				8.15E+03		
			46.54	1.448E+04	(	1.799E+02	6.89E-01	4.25E+00 G
AM-241		1.2173E+03				1.58E+05		
			59.54	1.217E+03	(	1.623E+01	7.35E-01	3.57E+01 G
CD-109		1.6121E+04				4.63E+02		
			88.03	1.612E+04	(	1.134E+02	4.57E-01	3.61E+00 G
CO-57		3.5158E+02				2.72E+02		
			122.06	3.516E+02	(	4.362E+00	7.33E-01	8.56E+01 G

□

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
Ce-139	5.4043E+02				1.38E+02	
		165.85	5.404E+02	(	5.402E+00 6.57E-01	7.99E+01 G
Hg-203	1.2007E+03				4.66E+01	
		279.17	1.201E+03	(	1.418E+01 8.17E-01	8.15E+01 G
SN-113	9.6938E+02				1.15E+02	
		391.69	9.694E+02	(	9.529E+00 7.56E-01	6.40E+01 G
CS-137	4.6608E+02				1.10E+04	
		661.66	4.661E+02	(	5.679E+00 9.07E-01	8.52E+01 G

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Y-898        1.5624E+03                                          1.07E+02
                          898.02 1.562E+03  (  1.005E+01 6.29E-01 9.37E+01 G

Co-1173      7.2488E+02                                          1.93E+03
                         1173.24 7.249E+02  (  5.668E+00 7.98E-01 9.99E+01 G

Co-1332      7.3312E+02                                          1.93E+03
                         1332.50 7.331E+02  (  5.074E+00 7.81E-01 1.00E+02 G

Y-1836       1.6163E+03                                          1.07E+02
                         1836.01 1.616E+03  (  5.123E+00 7.01E-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  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       1.4372E+04    1.4476E+04    6.891E-01%                 1.80E+02
```

AM-241	1.2168E+03	1.2173E+03	7.355E-01%	1.62E+01
CD-109	1.4197E+04	1.6121E+04	4.569E-01%	1.13E+02
CO-57	2.8320E+02	3.5158E+02	7.325E-01%	4.36E+00
Ce-139	3.5257E+02	5.4043E+02	6.571E-01%	5.40E+00
Hg-203	3.4034E+02	1.2007E+03	8.175E-01%	1.42E+01
SN-113	5.8164E+02	9.6938E+02	7.559E-01%	9.53E+00
CS-137	4.6359E+02	4.6608E+02	9.066E-01%	5.68E+00
Y-898	9.0011E+02	1.5624E+03	6.288E-01%	1.00E+01
Co-1173	7.0308E+02	7.2488E+02	7.979E-01%	5.67E+00
Co-1332	7.1107E+02	7.3312E+02	7.808E-01%	5.07E+00
Y-1836	9.3113E+02	1.6163E+03	7.012E-01%	5.12E+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 (77.1 to 1999.2 keV) 3.505E+04 Bq
Total Decayed Activity (77.1 to 1999.2 keV) 3.9979633E+04 Bq

Gamma Verification per Geometry

Detector: Ge 18

Geometry: 1L Marn

Reference date 1/1/2011

Calibration Standard: 83924-334

Standard volume g / vial 1

Standard volume transferred in g / geometry 1

lab ID# of cal standard Rad11-0032

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	Abundance	Activity Bq/L	Count Results	%recovery
Am-241	1830	1830	0.359	**5097.5**	5141	100.9
Cd-109	2609	2609	0.0361	**72271.5**	70815	98.0
Co-57	1339	1339	0.856	**1564.3**	1589.4	101.6
Ce-139	1917	1917	0.799	**2399.2**	2389.3	99.6
Sn-113	2719	2719	0.64	**4248.4**	4277.8	100.7
Cs-137	1705	1705	0.851	**2003.5**	1991.7	99.4
Mn-54	3083	3083	0.9998	**3083.6**	3065.8	99.4
Y-88	6493	6493	0.937	**6929.6**	6642.5	95.9
Zn-65	3181	3181	0.506	**6286.6**	6776	107.8
Co-60	3293	3293	0.99974	**3293.9**	3181.2	96.6
Co-60	3294	3294	0.99986	**3294.5**	3215.2	97.6
Y-88	6874	6874	0.992	**6929.4**	6956.5	100.4

Reviewed By: Michaela Korrinhizer

Date: 12/9/2011

Calibration Data from file: 18_1LMarinelli.Clb
Energy Calibration Date: 12/8/2011 Time: 10:13:49 AM
Efficiency Calibration Date: 12/8/2011 Time: 10:14:04 AM

Calibration Description:
18_1Lmarn_83924-334_120711

Energy Calibration Fit
Energy = 0.0388 +0.250152*Channel -2.73379e-008*Channel**2
FWHM (ch) = 3.6883 +0.000929*Channel -2.53975e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
237.84	59.54	59.53	0.01%	0.95	0.98	-2.43%
351.71	88.03	88.02	0.02%	1.00	1.00	-0.56%
487.88	122.06	122.08	-0.01%	1.05	1.03	1.66%
663.14	165.85	165.91	-0.04%	1.09	1.07	1.13%
1565.58	391.69	391.60	0.02%	1.28	1.27	0.68%
2645.64	661.66	661.66	0.00%	1.48	1.49	-0.98%
3338.49	834.85	834.86	-0.00%	1.62	1.63	-0.14%
3591.15	898.02	898.02	-0.00%	1.70	1.67	1.39%
4461.52	1115.55	1115.55	-0.00%	1.80	1.83	-1.46%
4692.31	1173.24	1173.23	0.00%	1.87	1.87	-0.14%
5329.82	1332.50	1332.53	-0.00%	1.99	1.98	0.58%
7345.25	1836.01	1836.00	0.00%	2.28	2.28	0.04%

Efficiency Calibration Fit
Knee Energy = 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.5547 %
Ln(Eff) = -1.6459 +0.032277*Ln(Eng) -0.0618758*(Ln(Eng))**2
Below the Knee: Quadratic Uncertainty = 0.9000 %
Ln(Eff) = -13.1819 +4.538566*Ln(Eng) -0.501748*(Ln(Eng))**2

Efficiency Table

Energy	Efficiency	Fit	Delta
59.54	4.9245E-002	4.9101E-002	0.29%
88.03	5.2877E-002	5.3963E-002	-2.05%
122.06	5.2746E-002	5.1908E-002	1.59%
165.85	========== Knee ==========		
165.85	4.4987E-002	4.5168E-002	-0.40%
391.69	2.5938E-002	2.5761E-002	0.68%
661.66	1.7406E-002	1.7486E-002	-0.46%
834.85	1.4490E-002	1.4566E-002	-0.53%
898.02	1.3169E-002	1.3736E-002	-4.31%
1115.55	1.2396E-002	1.1491E-002	7.30%
1173.24	1.0630E-002	1.1015E-002	-3.62%
1332.50	9.6470E-003	9.8851E-003	-2.47%
1836.01	7.4907E-003	7.4605E-003	0.40%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Am-241	59.54	35.90	1.58E+005	5097.50	1830.00	3.50%	1/1/2011 11:00:00 AM
Cd-109	88.03	3.61	4.63E+002	72271.00	2609.00	4.90%	1/1/2011 11:00:00 AM
Co-57	122.07	85.59	2.72E+002	1564.40	1339.00	4.10%	1/1/2011 11:00:00 AM
Ce-139	165.85	80.00	1.38E+002	2396.30	1917.00	3.90%	1/1/2011 11:00:00 AM
Hg-203	279.19	81.50	4.66E+001	5192.60	4232.00	3.90%	1/1/2011 11:00:00 AM
Sn-113	391.71	64.00	1.15E+002	4248.40	2719.00	2.50%	1/1/2011 11:00:00 AM
Cs-137	661.66	85.10	1.10E+004	2003.50	1705.00	4.00%	1/1/2011 11:00:00 AM
Mn-54	834.83	99.98	3.12E+002	3083.60	3083.00	3.30%	1/1/2011 11:00:00 AM
Y-88	898.02	93.70	1.07E+002	6929.60	6493.00	3.90%	1/1/2011 11:00:00 AM
Zn-65	1115.52	50.75	2.44E+002	6268.00	3181.00	3.50%	1/1/2011 11:00:00 AM
Co-60	1173.24	99.97	1.93E+003	3293.90	3293.00	4.00%	1/1/2011 11:00:00 AM
Co-60	1332.50	99.99	1.93E+003	3294.50	3294.00	4.00%	1/1/2011 11:00:00 AM
Y-88	1836.01	99.20	1.07E+002	6929.40	6874.00	3.90%	1/1/2011 11:00:00 AM

ORTEC g v - i (1087) Env32 G53W4.25 12/8/2011 10:14:50 AM
Test America Spectrum name: 18_1LMarnCal_20111552.An1

Sample description
18_1LMarnCal_83924

Spectrum Filename: C:\User\SPC\Det18\18_1LMarnCal_20111552.An1

Acquisition information
Start time: 12/7/2011 1:13:41 PM
Live time: 3600
Real time: 3927
Dead time: 8.32 %
Detector ID: 18

Detector system
Ge18 SN/11164036

Calibration
Filename: 18_1LMarinelli.Clb
18_1Lmarn_83924-334_120711

Energy Calibration
Created: 12/8/2011 10:13:49 AM
Zero offset: 0.039 keV
Gain: 0.250 keV/channel
Quadratic: -2.734E-08 keV/channel^2

Efficiency Calibration
Created: 12/8/2011 10:14:04 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.55 %
Log(Eff): -1.645931E+00 + (3.227669E-02*Log(E)) + (-6.187585E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.90 %
Log(Eff): -1.318185E+01 + (4.538566E+00*Log(E)) + (-5.017483E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix & Mn, Zn.L
Library Match Width: 0.500
Peak stripping: Library based.

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.56keV)
Stop channel: 8000 (1999.51keV)
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 12/8/2011 10:14:50 AM
Test America Spectrum name: 18_1LMarnCal_20111552.An1

Random error:	1.0000000E+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	1/1/2011 11:00:00 AM
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. 13 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0207

***** 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
36.42	2624.	9.34	0.96	3.504E-02				
37.86	6289.	4.27	0.96	3.630E-02				
49.57	16197.	3.79	2.05	4.456E-02				
59.53	323940.	0.26	0.95	4.910E-02	59.54	35.700	5.141E+03	AM241
88.02	298345.	0.26	1.00	5.396E-02	88.03	3.610	7.082E+04	CD109
122.08	106802.	0.50	1.05	5.191E-02	122.06	85.600	1.589E+03	CO57
136.52	13056.	2.75	1.04	4.998E-02				
165.91	55995.	0.77	1.09	4.516E-02	165.85	79.900	2.389E+03	Ce139
279.20	3341.	7.68	1.23	3.249E-02	279.17	81.500	5.497E+03	Hg203
391.60	32743.	1.03	1.28	2.577E-02	391.69	64.000	4.278E+03	SN113
511.00	5243.	5.07	2.49	2.126E-02				
661.66	104567.	0.42	1.48	1.749E-02	661.66	85.210	1.992E+03	CS137
834.85	75386.	0.57	1.63	1.457E-02	834.85	99.980	3.059E+03	Mn54
898.00	33716.	1.08	1.70	1.374E-02	898.02	93.700	6.643E+03	Y898
1115.52	54040.	0.66	1.81	1.149E-02	1115.55	50.600	6.776E+03	Zn65
1173.21	111495.	0.35	1.87	1.102E-02	1173.24	99.900	3.181E+03	Co1173
1332.51	101212.	0.35	1.99	9.885E-03	1332.50	99.982	3.215E+03	Co1332
1835.93	20304.	0.84	2.30	7.461E-03	1836.01	99.200	6.956E+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	
145.44	36.37	28698.	2624.	7.488E+04	9.34	0.956	-	D
151.19	37.81	32970.	6289.	1.732E+05	4.27	0.958	-	D
198.01	49.57	94234.	16197.	3.635E+05	3.79	2.046	-	s

ORTEC g v - i (1087) Env32 G53W4.25 12/8/2011 10:14:50 AM
Test America Spectrum name: 18_1LMarnCal_20111552.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected	
545.62	136.52	25792.	13056.	2.613E+05	2.75	1.036	-	
2043.07	511.00	12642.	5243.	2.467E+05	5.07	2.485	-	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: DET_EnergyStandardMix & Mn, Zn.L

********** 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	59.53	90927.	323940.	89.983	0.26	0.954
CD-109	351.71	88.02	63078.	298345.	82.874	0.26	0.998
CO-57	487.88	122.08	35088.	106802.	29.667	0.50	1.052
Ce-139	663.14	165.91	26192.	55995.	15.554	0.77	1.086
Hg-203	1116.12	279.20	15016.	3341.	0.928	7.68	1.233
SN-113	1565.55	391.60	15310.	32743.	9.095	1.03	1.280
CS-137	2645.63	661.66	14213.	104567.	29.046	0.42	1.478
Mn-54	3338.41	834.85	12382.	75560.	20.989	0.53	1.627
Y-898	3591.07	898.00	14232.	33716.	9.366	1.08	1.701
Zn-65	4461.37	1115.52	9246.	54040.	15.011	0.66	1.812
Co-1173	4692.23	1173.21	5402.	111495.	30.971	0.35	1.871
Co-1332	5329.73	1332.51	3198.	101212.	28.114	0.35	1.993
Y-1836	7345.00	1835.93	883.	20304.	5.640	0.84	2.296s

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	Peak Energy keV	Peak Activity Bq	Code	MDA Value Bq		COMMENTS
AM-241		5.1410E+03				1.58E+05		
			59.54	5.141E+03	(	2.234E+01	2.62E-01 3.57E+01 G	
CD-109		7.0815E+04				4.63E+02		
			88.03	7.082E+04	(	2.784E+02	2.58E-01 3.61E+00 G	
CO-57		1.5894E+03				2.72E+02		
			122.06	1.589E+03	(	1.303E+01	4.97E-01 8.56E+01 G	

ORTEC g v - i (1087) Env32 G53W4.25 12/8/2011 10:14:50 AM
Test America Spectrum name: 18_1LMarnCal_20111552.An1

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ce-139		2.3893E+03					1.38E+02	
			165.85	2.389E+03	(	3.230E+01	7.72E-01	7.99E+01 G
Hg-203		5.4968E+03					4.66E+01	
			279.17	5.497E+03	(	9.441E+02	7.68E+00	8.15E+01 G
SN-113		4.2778E+03					1.15E+02	
			391.69	4.278E+03	(	7.568E+01	1.03E+00	6.40E+01 G
CS-137		1.9917E+03					1.10E+04	
			661.66	1.992E+03	(	1.063E+01	4.22E-01	8.52E+01 G
Mn-54		3.0658E+03					3.12E+02	
			834.85	3.066E+03	(	2.115E+01	5.26E-01	1.00E+02 G
Y-898		6.6425E+03					1.07E+02	
			898.02	6.643E+03	(	1.101E+02	1.08E+00	9.37E+01 G
Zn-65	F	6.7760E+03					2.44E+02	
			1115.55	6.776E+03	(	5.652E+01	6.58E-01	5.06E+01 G
Co-1173		3.1812E+03					1.93E+03	
			1173.24	3.181E+03	(	9.850E+00	3.48E-01	9.99E+01 G
Co-1332		3.2152E+03					1.93E+03	
			1332.50	3.215E+03	(	8.458E+00	3.49E-01	1.00E+02 G
Y-1836		6.9565E+03					1.07E+02	
			1836.01	6.956E+03	@(	4.838E+01	8.39E-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

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	Time Corrected Activity Bq	Uncertainty 1 Sigma Counting	MDA
AM-241	5.1334E+03	5.1410E+03	2.616E-01%	2.23E+01
CD-109	4.2542E+04	7.0815E+04	2.580E-01%	2.78E+02
CO-57	6.6768E+02	1.5894E+03	4.974E-01%	1.30E+01
Ce-139	4.3099E+02	2.3893E+03	7.722E-01%	3.23E+01
Hg-203	3.5040E+01	5.4968E+03	7.685E+00%	9.44E+02
SN-113	5.5166E+02	4.2778E+03	1.033E+00%	7.57E+01
CS-137	1.9494E+03	1.9917E+03	4.219E-01%	1.06E+01
Mn-54	1.4412E+03	3.0658E+03	5.262E-01%	2.11E+01
Y-898	7.2768E+02	6.6425E+03	1.083E+00%	1.10E+02
Zn-65	2.5817E+03	6.7760E+03	6.581E-01%	5.65E+01
Co-1173	2.8145E+03	3.1812E+03	3.476E-01%	9.85E+00
Co-1332	2.8446E+03	3.2152E+03	3.489E-01%	8.46E+00
Y-1836 #	7.6207E+02	6.9565E+03	8.386E-01%	4.84E+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

ORTEC g v - i (1087) Env32 G53W4.25 12/8/2011 10:14:50 AM
Test America Spectrum name: 18_1LMarnCal_20111552.An1

---------- S U M M A R Y ----------

Total Activity (49.6 to 1999.5 keV) 6.248E+04 Bq
Total Decayed Activity (49.6 to 1999.5 keV) 1.2153873E+05 Bq

Analyzed by: _____
Admin

Reviewed by: _____
Supervisor

Laboratory: Test America

Initial Calibration Verifications

2nd Source Verification

Detector: Ge4

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 Tuna Can_00002

Isotope	Certified Activity gammas/sec	Geometry Activity	γ abundance	Bq/sample	Count Results	%recovery
Am-241	2034	418	0.359	1164	1179.4	101.3
Cs-137	1926	396	0.851	465	435.81	93.7
Co-60	3611	742	0.99974	742	706.01	95.1
Co-60	3612	742	0.999856	742	707.18	95.3

Reviewed By: Megan McAfee

Date: 4/5/2012

ORTEC g v - i (3263) Env32 G53W4.25 4/3/2012 8:08:30 AM Page 1
TestAmerica Spectrum name: 4_TunaCan2nd_20120155.An1

Sample description
4_TunaCan2nd_Rad11_040212

Spectrum Filename: C:\User\SPC\Det4\4_TunaCan2nd_20120155.An1

Acquisition information
Start time: 4/2/2012 4:50:30 PM
Live time: 7200
Real time: 7269
Dead time: 0.95 %
Detector ID: 4

Detector system
Ge 4 SN/181

Calibration
Filename: 4_Soil_TunaCan.Clb
4_Soil_TunaCan_90099_033012

Energy Calibration
Created: 4/2/2012 1:19:28 PM
Zero offset: 0.084 keV
Gain: 0.250 keV/channel
Quadratic: -2.822E-08 keV/channel^2

Efficiency Calibration
Created: 4/2/2012 1:19:41 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.78 %
Log(Eff): -3.983609E-01 + (-5.746278E-01*Log(E)) +
(-2.046438E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.80 %
Log(Eff): -2.546791E+01 + (9.285295E+00*Log(E)) +
(-9.904428E-01*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 (37.60keV)
Stop channel: 8000 (1999.16keV)
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 4/3/2012 8:08:30 AM Page 2
TestAmerica Spectrum name: 4_TunaCan2nd_20120155.An1
Page 1

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	4_2012-04-01_0505.PBC 4/1/2012 5:05:33 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 11 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0600

***** 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
36.42	806.	13.21	0.80	7.538E-03				
46.54	50484.	0.61	0.75	1.208E-02	46.54	4.250	1.463E+04	Pb210
49.71	736.	21.48	1.02	1.343E-02				
59.58	51934.	0.60	0.77	1.721E-02	59.54	35.700	1.179E+03	AM241
63.49	155.	63.51	0.54	1.848E-02				
88.11	27333.	0.79	0.79	2.354E-02	88.03	3.610	1.532E+04	CD109
122.09	6277.	1.96	0.86	2.425E-02	122.06	85.600	3.419E+02	CO57
134.27	52.	97.34	0.86	2.351E-02				
136.47	659.	9.66	0.87	2.334E-02				
148.82	69.	86.21	0.36	2.228E-02				
158.85	43.	92.59	0.33	2.130E-02				
165.81	1043.	6.61	0.81	2.058E-02	165.85	79.900	5.464E+02	Ce139
238.49	236.	22.32	0.96	1.565E-02				
241.88	116.	42.88	0.96	1.547E-02				
313.38	122.	47.39	0.75	1.256E-02				
344.70	47.	65.34	0.49	1.163E-02				
351.68	160.	27.20	0.66	1.144E-02				
391.67	434.	16.95	1.10	1.048E-02	391.69	64.000	1.272E+03	SN113
419.11	117.	48.70	0.60	9.911E-03				
473.76	122.	50.01	0.45	8.958E-03				
537.00	45.	87.01	0.37	8.074E-03				
592.99	36.	69.91	0.40	7.433E-03				
620.80	59.	58.25	0.37	7.153E-03				
661.57	17213.	0.84	1.29	6.782E-03	661.66	85.210	4.358E+02	CS137
860.29	61.	44.90	0.75	5.431E-03				
898.19	323.	17.33	1.63	5.236E-03	898.02	93.700	1.920E+03	Y898
935.59	77.	51.48	0.57	5.056E-03				
1173.33	15720.	0.87	1.73	4.162E-03	1173.24	99.900	7.060E+02	Co1173
1332.63	14113.	0.86	1.81	3.727E-03	1332.50	99.982	7.072E+02	Co1332
1835.84	135.	10.17	1.24	2.815E-03	1836.01	99.200	1.406E+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 keV	Suspected Nuclide
145.26	36.42	3510.	806.	1.069E+05	13.21	0.797	- s
198.40	49.71	8086.	736.	5.481E+04	21.48	1.022	- s
253.51	63.49	3351.	155.	8.368E+03	63.51	0.538	- s
536.51	134.26	898.	64.	2.722E+03	67.39	0.281	- sc

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
545.30	136.46	2079.	727.	3.115E+04	12.04	0.949	- s
594.74	148.82	1288.	69.	3.082E+03	86.21	0.363	- sc
634.84	158.85	771.	43.	2.019E+03	92.59	0.329	- sc
953.28	238.48	1188.	206.	1.316E+04	29.01	1.147	-
966.87	241.88	864.	60.	3.878E+03	75.94	0.463	- c
1252.81	313.38	1023.	122.	9.737E+03	47.39	0.746	- s
1378.05	344.70	448.	47.	4.042E+03	65.34	0.489	- sc
1405.98	351.68	650.	160.	1.399E+04	27.20	0.659	- s
1675.68	419.11	933.	117.	1.177E+04	48.70	0.600	- s
1894.25	473.76	1038.	122.	1.367E+04	50.01	0.454	- s
2147.23	537.00	496.	45.	5.573E+03	87.01	0.368	- sc
2371.22	592.99	256.	36.	4.843E+03	69.91	0.402	- sc
2482.47	620.80	374.	59.	8.248E+03	58.25	0.372	- s
3440.64	860.29	299.	61.	1.129E+04	44.90	0.752	- s
3741.93	935.59	530.	77.	1.526E+04	51.48	0.570	- 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: 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	185.75	46.54	12490.	50416.	7.002	0.61	0.755
AM-241	237.88	59.58	11109.	51934.	7.213	0.60	0.767
CD-109	351.97	88.11	5395.	27333.	3.796	0.79	0.790
CO-57	487.82	122.09	2530.	6277.	0.872	1.96	0.855
Ce-139	662.66	165.81	1311.	1043.	0.145	6.61	0.812
SN-113	1565.91	391.67	1245.	434.	0.060	16.95	1.102s
CS-137	2645.56	661.57	829.	17213.	2.391	0.84	1.295
Y-898	3592.29	898.19	734.	323.	0.045	17.33	1.625
Co-1173	4693.38	1173.33	470.	15720.	2.183	0.87	1.726
Co-1332	5331.03	1332.63	76.	14113.	1.960	0.86	1.814
Y-1836	7345.88	1835.84	9.	135.	0.019	10.17	1.237s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
Pb-210	N	1.4632E+04				8.15E+03		
			46.54	1.463E+04	(P	1.519E+02	6.07E-01 4.25E+00	G
AM-241		1.1794E+03				1.58E+05		
			59.54	1.179E+03	(	1.122E+01	5.98E-01 3.57E+01	G
CD-109		1.5319E+04				4.63E+02		
			88.03	1.532E+04	(	1.933E+02	7.94E-01 3.61E+00	G
CO-57		3.4190E+02				2.72E+02		
			122.06	3.419E+02	(	1.291E+01	1.96E+00 8.56E+01	G
Ce-139		5.4636E+02				1.38E+02		
			165.85	5.464E+02	(	8.978E+01	6.61E+00 7.99E+01	G
Hg-203		-4.3324E-04				4.66E+01		
			279.17	-4.332E-04	%(	2.541E+00	1.76E+05 8.15E+01	G
SN-113		1.2718E+03				1.15E+02		
			391.69	1.272E+03	(	4.898E+02	1.70E+01 6.40E+01	G
CS-137		4.3581E+02				1.10E+04		
			661.66	4.358E+02	(	3.465E+00	8.43E-01 8.52E+01	G
Y-898		1.9202E+03				1.07E+02		
			898.02	1.920E+03	(	7.662E+02	1.73E+01 9.37E+01	G
Co-1173		7.0601E+02				1.93E+03		
			1173.24	7.060E+02	(	4.661E+00	8.74E-01 9.99E+01	G
Co-1332		7.0718E+02				1.93E+03		
			1332.50	7.072E+02	(	2.171E+00	8.58E-01 1.00E+02	G
Y-1836		1.4056E+03				1.07E+02		
			1836.01	1.406E+03	(	1.769E+02	1.02E+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

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 1 Sigma Counting		MDA Bq/Sample
Pb-210	1.3643E+04	1.4632E+04	6.080E-01%		1.52E+02
AM-241	1.1752E+03	1.1794E+03	5.977E-01%		1.12E+01
CD-109	4.4685E+03	1.5319E+04	7.941E-01%		1.93E+02
CO-57	4.1998E+01	3.4190E+02	1.960E+00%		1.29E+01
Ce-139	8.6929E+00	5.4636E+02	6.612E+00%		8.98E+01
Hg-203 #A	-4.3324E-04	>12 Halflives	1.7564E+05%	2.5409E+00	
SN-113 #	8.9902E+00	1.2718E+03	1.695E+01%		4.90E+02
CS-137	4.1377E+02	4.3581E+02	8.435E-01%		3.46E+00
Y-898	9.1492E+00	1.9202E+03	1.733E+01%		7.66E+02
Co-1173	5.2510E+02	7.0601E+02	8.735E-01%		4.66E+00
Co-1332	5.2597E+02	7.0718E+02	8.582E-01%		2.17E+00
Y-1836	6.6974E+00	1.4056E+03	1.017E+01%		1.77E+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 (37.6 to 1999.2 keV)	2.083E+04	Bq/Sample
Total Decayed Activity (37.6 to 1999.2 keV)	3.8465293E+04	Bq/Sample

2nd Source Verification

Detector: Ge5

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	1160.9	99.7
Cs-137	1926	396	0.851	465	442.36	95.1
Co-60	3611	742	0.99974	742	700.21	94.3
Co-60	3612	742	0.999856	742	701.86	94.6

Reviewed By: Jody Watson

Date: 3/27/2012

```
     ORTEC g v - i (3263) Env32  G53W4.25  3/28/2012 7:35:49 AM    Page  1
TestAmerica                     Spectrum name: 5_TunaCan2nd_20120813.An1

Sample description
     5_TunaCan2nd_Rad10_032712


Spectrum Filename: C:\User\SPC\Det5\5_TunaCan2nd_20120813.An1

Acquisition information
       Start time:                 3/27/2012 10:12:05 AM
       Live time:                7200
       Real time:                7250
       Dead time:                   0.69 %
       Detector ID:                    5

Detector system
     Ge 5 SN/157


Calibration
       Filename:                   5_Soil_TunaCan.Clb
     5_Soil_TunaCan_90099_032612


       Energy Calibration
            Created:               3/27/2012 5:20:02 PM
            Zero offset:           0.135 keV
            Gain:                  0.250 keV/channel
            Quadratic:             2.720E-08 keV/channel^2

       Efficiency Calibration
            Created:               3/27/2012 5:20:37 PM
            Knee Energy:         165.85 keV
            Above the Knee:        Quadratic        Uncertainty =   0.87 %
            Log(Eff):              6.466115E-01 + (-7.830454E-01*Log(E) ) +
                                   ( -4.117504E-03*Log(E)^2 )
            Below the Knee:        Quadratic        Uncertainty =   1.43 %
            Log(Eff):             -2.462251E+01 + ( 9.075211E+00*Log(E) ) +
                                   ( -9.664422E-01*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 (    37.61keV )
       Stop channel:            8000 (  2000.53keV )
       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  3/28/2012 7:35:49 AM    Page  2
TestAmerica                     Spectrum name: 5_TunaCan2nd_20120813.An1
                                      Page 1
```

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	5_2012-02-26_0305.PBC 2/26/2012 3:05:30 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 33.1557

***** 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
36.81	1005.	12.08	0.62	1.151E-02				
46.61	72616.	0.49	0.73	1.792E-02	46.54	4.250	1.421E+04	Pb210
49.73	1326.	15.18	0.68	1.987E-02				
59.57	75329.	0.49	0.74	2.535E-02	59.54	35.700	1.161E+03	AM241
87.94	40851.	0.68	0.80	3.460E-02	88.03	3.610	1.542E+04	CD109
96.44	148.	47.31	0.80	3.568E-02				
99.01	160.	48.52	0.81	3.589E-02				
105.59	109.	69.79	0.52	3.619E-02				
121.94	9225.	1.66	0.84	3.583E-02	122.06	85.600	3.348E+02	CO57
129.89	126.	62.97	0.30	3.522E-02				
136.43	1263.	7.42	0.90	3.457E-02				
165.86	1574.	6.14	0.84	3.133E-02	165.85	79.900	5.319E+02	Ce139
238.72	327.	27.04	0.86	2.319E-02				
247.25	57.	84.47	0.31	2.252E-02				
259.02	93.	60.17	0.97	2.167E-02				
260.46	98.	58.62	0.97	2.157E-02				
322.65	45.	91.14	0.46	1.806E-02				
351.63	256.	27.79	1.06	1.681E-02				
391.95	494.	16.33	1.15	1.536E-02	391.69	64.000	9.501E+02	SN113
407.02	43.	90.43	0.56	1.489E-02				
412.80	202.	35.90	0.77	1.471E-02				
420.83	123.	52.91	0.72	1.448E-02				
510.72	188.	44.32	0.50	1.232E-02				
542.81	148.	28.69	0.36	1.171E-02				
583.30	161.	33.50	0.69	1.103E-02				
661.70	25605.	0.71	1.39	9.924E-03	661.66	85.210	4.424E+02	CS137
762.61	129.	36.06	0.79	8.812E-03				
796.90	151.	38.71	0.30	8.493E-03				
886.67	129.	46.77	0.30	7.766E-03				
897.77	428.	19.21	1.38	7.686E-03	898.02	93.700	1.665E+03	Y898
932.49	230.	35.52	0.82	7.445E-03				

1008.65	104.	56.29	0.28	6.970E-03				
1173.15	23044.	0.73	1.79	6.138E-03	1173.24	99.900	7.002E+02	Co1173
1332.39	20769.	0.71	1.87	5.515E-03	1332.50	99.982	7.019E+02	Co1332
1836.05	245.	7.47	1.56	4.208E-03	1836.01	99.200	1.642E+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	
146.78	36.81	4847.	1005.	8.731E+04	12.08	0.625	-	
198.52	49.73	12365.	1326.	6.673E+04	15.18	0.681	-	s
385.40	96.42	1874.	90.	2.532E+03	71.31	0.588	-	sc
395.68	98.99	2103.	121.	3.381E+03	58.44	0.394	-	s

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected	
422.09	105.59	2271.	109.	3.012E+03	69.79	0.518	-	sc
519.32	129.89	2194.	126.	3.592E+03	62.97	0.298	-	s
545.51	136.43	2377.	1263.	3.654E+04	7.42	0.900	-	s
954.90	238.72	2247.	327.	1.410E+04	27.04	0.863	-	sM
989.00	247.25	1031.	57.	2.516E+03	84.47	0.312	-	sc
1036.13	259.01	1532.	93.	4.309E+03	60.17	0.968	-	D
1041.90	260.46	1588.	98.	4.525E+03	58.62	0.970	-	D
1290.76	322.65	744.	45.	2.473E+03	91.14	0.455	-	c
1406.70	351.63	1442.	256.	1.523E+04	27.79	1.058	-	s
1628.36	407.02	667.	43.	2.866E+03	90.43	0.562	-	sc
1651.47	412.80	1438.	202.	1.370E+04	35.90	0.775	-	s
1683.60	420.83	1291.	123.	8.472E+03	52.91	0.720	-	s
2043.25	510.72	1553.	188.	1.523E+04	44.32	0.503	-	s
2171.67	542.81	587.	148.	1.267E+04	28.69	0.362	-	s
2333.63	583.30	785.	161.	1.460E+04	33.50	0.694	-	s
3050.97	762.61	614.	129.	1.468E+04	36.06	0.794	-	s
3188.11	796.90	856.	151.	1.782E+04	38.71	0.295	-	s
3547.15	886.67	963.	129.	1.665E+04	46.77	0.296	-	s
3730.41	932.49	1438.	230.	3.096E+04	35.52	0.818	-	s
4035.01	1008.65	864.	104.	1.490E+04	56.29	0.275	-	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	186.01	46.61	16470.	72552.	10.077	0.49	0.733
AM-241	237.88	59.57	15419.	75329.	10.462	0.49	0.735
CD-109	351.46	87.94	8772.	40851.	5.674	0.68	0.804
CO-57	487.54	121.94	3880.	9225.	1.281	1.66	0.838
Ce-139	663.30	165.86	2329.	1574.	0.219	6.14	0.840
SN-113	1568.04	391.95	1640.	494.	0.069	16.33	1.153
CS-137	2647.28	661.70	1362.	25582.	3.553	0.71	1.394
Y-898	3591.55	897.77	1410.	428.	0.060	19.21	1.376

Co-1173	4692.83	1173.15	788.	23044.	3.201	0.73	1.786
Co-1332	5329.55	1332.39	98.	20769.	2.885	0.71	1.870
Y-1836	7342.76	1836.05	15.	245.	0.034	7.47	1.556s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample			COMMENTS
Pb-210	N	1.4212E+04				8.15E+03			
			46.54	1.421E+04	(P	1.177E+02	4.91E-01	4.25E+00	G
AM-241		1.1609E+03				1.58E+05			
			59.54	1.161E+03	(	8.959E+00	4.87E-01	3.57E+01	G
CD-109		1.5419E+04				4.63E+02			
			88.03	1.542E+04	(	1.658E+02	6.81E-01	3.61E+00	G
CO-57		3.3478E+02				2.72E+02			
			122.06	3.348E+02	(	1.063E+01	1.66E+00	8.56E+01	G
Ce-139		5.3191E+02				1.38E+02			
			165.85	5.319E+02	(	7.689E+01	6.14E+00	7.99E+01	G
Hg-203		-6.5193E-03				4.66E+01			
			279.17	-6.519E-03	%(	1.788E+00	8.22E+03	8.15E+01	G
SN-113		9.5011E+02				1.15E+02			
			391.69	9.501E+02	(	3.682E+02	1.63E+01	6.40E+01	G
CS-137		4.4236E+02				1.10E+04			
			661.66	4.424E+02	(P	3.020E+00	7.12E-01	8.52E+01	G
Y-898		1.6655E+03				1.07E+02			
			898.02	1.665E+03	(	6.908E+02	1.92E+01	9.37E+01	G
Co-1173		7.0021E+02				1.93E+03			
			1173.24	7.002E+02	(	4.056E+00	7.32E-01	9.99E+01	G
Co-1332		7.0186E+02				1.93E+03			
			1332.50	7.019E+02	(	1.651E+00	7.07E-01	1.00E+02	G
Y-1836		1.6424E+03				1.07E+02			
			1836.01	1.642E+03	(	1.392E+02	7.47E+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.

@ - 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

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 1 Sigma Counting		MDA Bq/Sample
Pb-210	1.3259E+04	1.4212E+04	4.918E-01%		1.18E+02
AM-241	1.1568E+03	1.1609E+03	4.867E-01%		8.96E+00
CD-109	4.5403E+03	1.5419E+04	6.810E-01%		1.66E+02
CO-57	4.1787E+01	3.3478E+02	1.660E+00%		1.06E+01
Ce-139	8.7347E+00	5.3191E+02	6.138E+00%		7.69E+01
Hg-203 #A	-6.5193E-03	>12 Halflives	8.2197E+03%	1.7882E+00	
SN-113	6.9747E+00	9.5011E+02	1.633E+01%		3.68E+02
CS-137	4.2015E+02	4.4236E+02	7.122E-01%		3.02E+00
Y-898	8.2662E+00	1.6655E+03	1.921E+01%		6.91E+02
Co-1173	5.2196E+02	7.0021E+02	7.316E-01%		4.06E+00
Co-1332	5.2320E+02	7.0186E+02	7.069E-01%		1.65E+00
Y-1836	8.1520E+00	1.6424E+03	7.471E+00%		1.39E+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 (  279.0 to  2000.5 keV)     2.050E+04  Bq/Sample
Total Decayed Activity (  279.0 to  2000.5 keV) 3.7761527E+04  Bq/Sample
```

2nd Source Verification

Detector:	Ge7
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	1150.4	98.8
Cs-137	1926	396	0.851	465	440.47	94.7
Co-60	3611	742	0.99974	742	681.72	91.9
Co-60	3612	742	0.999856	742	692.1	93.2

Reviewed By: Jody Watson

Date: 3/27/2012

ORTEC g v - i (3263) Env32 G53W4.25 3/28/2012 8:52:25 AM
TestAmerica Spectrum name: 7_TunaCan2ndSource_20120479.An1

Sample description
7_TunaCan2ndSource_81427-334_032712

Spectrum Filename: C:\User\SPC\Det7\7_TunaCan2ndSource_20120479.An1

Acquisition information
Start time: 3/27/2012 3:25:25 PM
Live time: 3600
Real time: 3684
Dead time: 2.28 %
Detector ID: 7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Soil_TunaCan.Clb
7_TunaCan_90099_032712

Energy Calibration
Created: 3/16/2012 11:44:50 AM
Zero offset: 0.153 keV
Gain: 0.250 keV/channel
Quadratic: 6.716E-09 keV/channel^2

Efficiency Calibration
Created: 3/16/2012 11:45:14 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.87 %
Log(Eff): 6.716580E-01 + (-6.166540E-01*Log(E)) +
(-2.065917E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.48 %
Log(Eff): -2.689695E+01 + (1.019544E+01*Log(E)) +
(-1.081671E+00*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 (37.65keV)
Stop channel: 8000 (2000.21keV)
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

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	7_2012-02-26_0327.PBC 2/26/2012 3:27:47 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 11 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0270

***** 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
36.65	788.	12.78	0.82	1.487E-02				
40.49	109.	96.90	0.59	1.869E-02				
46.62	49142.	0.63	0.84	2.491E-02	46.54	4.250	1.386E+04	Pb210
49.64	876.	18.72	0.86	2.792E-02				
59.61	54530.	0.58	0.87	3.707E-02	59.54	35.700	1.150E+03	AM241
76.99	260.	38.90	1.03	4.881E-02				
88.06	31019.	0.77	0.89	5.329E-02	88.03	3.610	1.522E+04	CD109
122.04	6834.	2.04	0.94	5.606E-02	122.06	85.600	3.171E+02	CO57
136.41	810.	9.51	1.00	5.411E-02				
165.84	1193.	6.45	0.96	4.765E-02	165.85	79.900	5.180E+02	Ce139
185.66	92.	57.01	0.73	4.445E-02				
213.19	122.	50.56	0.75	3.960E-02				
272.80	146.	47.29	0.28	3.217E-02				
391.67	372.	19.60	1.11	2.360E-02	391.69	64.000	9.332E+02	SN113
442.91	47.	93.72	0.45	2.122E-02				
483.77	95.	38.10	0.62	1.965E-02				
524.63	67.	65.12	0.73	1.831E-02				
604.78	31.	59.37	0.27	1.616E-02				
628.99	32.	94.37	0.58	1.561E-02				
661.67	19152.	0.86	1.47	1.492E-02	661.66	85.210	4.405E+02	CS137
898.03	322.	23.53	1.90	1.137E-02	898.02	93.700	1.694E+03	Y898
910.18	180.	33.99	0.85	1.123E-02				
963.79	49.	71.39	0.69	1.067E-02				
1173.23	16317.	0.86	1.89	8.929E-03	1173.24	99.900	6.817E+02	Co1173
1332.49	14763.	0.85	2.04	7.951E-03	1332.50	99.982	6.921E+02	Co1332
1836.09	186.	9.19	1.40	5.919E-03	1836.01	99.200	1.780E+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	
146.00	36.65	3116.	788.	5.300E+04	12.78	0.819	-	
161.37	40.49	4419.	109.	5.831E+03	96.90	0.587	-	c
197.99	49.64	8222.	876.	3.138E+04	18.72	0.855	-	sM

307.39	76.99	3728.	260.	5.319E+03	38.90	1.033	-

ORTEC g v - i (3263) Env32 G53W4.25 3/28/2012 8:52:25 AM
TestAmerica Spectrum name: 7_TunaCan2ndSource_20120479.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected	
545.11	136.41	1706.	810.	1.497E+04	9.51	1.002	-	
742.15	185.66	1076.	92.	2.081E+03	57.01	0.725	-	s
852.30	213.19	1296.	122.	3.077E+03	50.56	0.748	-	s
1090.74	272.80	1320.	146.	4.539E+03	47.29	0.283	-	s
1771.26	442.91	710.	47.	2.215E+03	93.72	0.453	-	sc
1934.71	483.77	486.	95.	4.835E+03	38.10	0.616	-	s
2098.18	524.63	583.	67.	3.669E+03	65.12	0.732	-	s
2418.80	604.78	172.	31.	1.939E+03	59.37	0.268	-	s
2515.62	628.99	330.	32.	2.050E+03	94.37	0.581	-	sc
3640.41	910.18	855.	180.	1.603E+04	33.99	0.852	-	s
3854.87	963.79	447.	49.	4.625E+03	71.39	0.695	-	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	185.90	46.62	12530.	49107.	13.641	0.63	0.840
AM-241	237.87	59.61	10985.	54530.	15.147	0.58	0.871
CD-109	351.70	88.06	6100.	31019.	8.616	0.77	0.892
CO-57	487.62	122.04	3040.	6834.	1.898	2.04	0.937
Ce-139	662.88	165.84	1495.	1193.	0.331	6.45	0.956
Hg-203	1114.79	278.81	2119.	-42.	-0.012	155.58	1.105s
SN-113	1566.31	391.67	1236.	372.	0.103	19.60	1.107
CS-137	2646.35	661.67	1156.	19152.	5.320	0.86	1.474
Y-898	3591.81	898.03	1084.	322.	0.089	23.53	1.897
Co-1173	4692.59	1173.23	493.	16317.	4.532	0.86	1.893
Co-1332	5329.55	1332.49	127.	14763.	4.101	0.85	2.038
Y-1836	7343.66	1836.09	16.	186.	0.052	9.19	1.399s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	Peak MDA Value Bq/Sample		COMMENTS
Pb-210	N	1.3857E+04				8.15E+03		
			46.54	1.386E+04	(P	1.480E+02	6.34E-01	4.25E+00 G
AM-241		1.1504E+03				1.58E+05		
			59.54	1.150E+03	(	1.036E+01	5.81E-01	3.57E+01 G
CD-109		1.5217E+04				4.63E+02		
			88.03	1.522E+04	(	1.799E+02	7.73E-01	3.61E+00 G
CO-57		3.1712E+02				2.72E+02		
			122.06	3.171E+02	(	1.205E+01	2.04E+00	8.56E+01 G
Ce-139		5.1801E+02				1.38E+02		
			165.85	5.180E+02	(	7.941E+01	6.45E+00	7.99E+01 G
Hg-203		-4.5441E-01				4.66E+01		
			279.17	-4.544E-01	?(	2.347E+00	1.56E+02	8.15E+01 G
SN-113		9.3315E+02				1.15E+02		
			391.69	9.332E+02	(	4.178E+02	1.96E+01	6.40E+01 G
CS-137		4.4047E+02				1.10E+04		
			661.66	4.405E+02	(	3.706E+00	8.56E-01	8.52E+01 G
Y-898		1.6944E+03				1.07E+02		
			898.02	1.694E+03	(	8.216E+02	2.35E+01	9.37E+01 G
Co-1173		6.8172E+02				1.93E+03		
			1173.24	6.817E+02	(	4.436E+00	8.58E-01	9.99E+01 G
Co-1332		6.9210E+02				1.93E+03		
			1332.50	6.921E+02	(	2.586E+00	8.49E-01	1.00E+02 G
Y-1836		1.7801E+03				1.07E+02		
			1836.01	1.780E+03	(	2.065E+02	9.19E+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.

@ - 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	278.81	2119.	-42.	-0.012	155.58	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	1.2927E+04	1.3857E+04	6.344E-01%		1.48E+02
AM-241	1.1462E+03	1.1504E+03	5.808E-01%		1.04E+01
CD-109	4.4794E+03	1.5217E+04	7.727E-01%		1.80E+02
CO-57	3.9561E+01	3.1712E+02	2.043E+00%		1.20E+01
Ce-139	8.4971E+00	5.1801E+02	6.453E+00%		7.94E+01
Hg-203 #A	-4.5441E-01	>12 Halflives	1.5558E+02%	2.3474E+00	
SN-113	6.8413E+00	9.3315E+02	1.960E+01%		4.18E+02
CS-137	4.1835E+02	4.4047E+02	8.557E-01%		3.71E+00
Y-898	8.3979E+00	1.6944E+03	2.353E+01%		8.22E+02
Co-1173	5.0814E+02	6.8172E+02	8.581E-01%		4.44E+00
Co-1332	5.1588E+02	6.9210E+02	8.485E-01%		2.59E+00
Y-1836	8.8227E+00	1.7801E+03	9.190E+00%		2.07E+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 (37.6 to 2000.2 keV) 2.007E+04 Bq/Sample
Total Decayed Activity (37.6 to 2000.2 keV) 3.7281199E+04 Bq/Sample

Analyzed by: _____
Admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica

Second Source Verification

Detector: Ge7

Geometry: 1L Marn

Reference date 1/1/2011

Calibration Standard: 83924-334

Standard volume g / vial 1

Standard volume transferred in g / geometry 1

lab ID# of cal standard 6675

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	Abundance	Activity Bq/L	Count Results	%recovery
Am-241	1830	1830	0.359	**5097.5**	5064.7	99.4
Cs-137	1705	1705	0.851	**2003.5**	1974.8	98.6
Co-60	3293	3293	0.99974	**3293.9**	3224.4	97.9
Co-60	3294	3294	0.99986	**3294.5**	3228.8	98.0

Reviewed By: Megan McAfee

Date: 4/5/2012

ORTEC g v - i (3263) Env32 G53W4.25 4/3/2012 8:09:21 AM Page 1
TestAmerica Spectrum name: 7_1Lmarn2nd_20120523.An1

Sample description
7_1Lmarn2nd_83924-334_040212

Spectrum Filename: C:\User\SPC\Det7\7_1Lmarn2nd_20120523.An1

Acquisition information
Start time: 4/2/2012 2:43:08 PM
Live time: 7200
Real time: 7709
Dead time: 6.60 %
Detector ID: 7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Liquid_Marinelli 1L.Clb
7_1Lmarn_90062_032612

Energy Calibration
Created: 3/28/2012 9:18:12 AM
Zero offset: 0.187 keV
Gain: 0.250 keV/channel
Quadratic: 7.031E-09 keV/channel^2

Efficiency Calibration
Created: 3/28/2012 9:18:24 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.42 %
Log(Eff): -7.054602E-01 + (-2.848254E-01*Log(E)) + (-4.423998E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.43 %
Log(Eff): -1.484435E+01 + (5.183775E+00*Log(E)) + (-5.730519E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix & Mn, Zn.L
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.68keV)
Stop channel: 8000 (2000.10keV)
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 4/3/2012 8:09:21 AM Page 2
TestAmerica Spectrum name: 7_1Lmarn2nd_20120523.An1
Page 1

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	1/1/2011 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	7_2012-04-01_0533.PBC 4/1/2012 5:33:35 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 13 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0302

***** 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
36.43	3528.	8.11	0.89	2.696E-02				
37.87	4819.	6.33	0.89	2.806E-02				
42.90	850.	39.80	0.39	3.156E-02				
49.61	22317.	3.24	1.78	3.541E-02				
59.56	513708.	0.20	0.87	3.954E-02	59.54	35.700	5.065E+03	AM241
66.30	486.	67.51	0.38	4.145E-02				
77.88	972.	42.49	0.64	4.339E-02				
88.01	406256.	0.22	0.93	4.404E-02	88.03	3.610	7.040E+04	CD109
122.00	128434.	0.44	0.98	4.215E-02	122.06	85.600	1.587E+03	CO57
136.37	15240.	2.23	0.97	4.037E-02				
165.78	49846.	0.96	1.00	3.618E-02	165.85	79.900	2.388E+03	Ce139
170.81	156.	93.30	0.31	3.548E-02				
198.91	1359.	20.81	1.11	3.167E-02				
216.38	511.	53.39	0.29	2.972E-02				
225.00	424.	43.72	0.57	2.884E-02				
235.83	344.	47.73	0.65	2.782E-02				
255.11	1122.	21.90	0.63	2.619E-02				
279.47	1059.	21.56	1.15	2.439E-02	279.17	81.500	6.606E+03	Hg203
310.33	357.	52.58	0.82	2.246E-02				
391.75	24138.	1.65	1.24	1.863E-02	391.69	64.000	4.413E+03	SN113
472.35	388.	47.11	0.40	1.597E-02				
477.47	212.	66.81	0.43	1.583E-02				
500.69	264.	57.74	0.61	1.522E-02				
511.06	4978.	5.72	2.29	1.496E-02				
558.51	102.	92.01	0.46	1.388E-02				
597.84	146.	71.13	0.52	1.311E-02				
661.68	141450.	0.32	1.47	1.202E-02	661.66	85.210	1.975E+03	CS137
724.87	115.	70.60	0.54	1.111E-02				
828.41	306.	39.09	0.49	9.884E-03				
834.88	77158.	0.59	1.63	9.816E-03	834.85	99.980	3.012E+03	Mn54
898.08	21460.	1.63	1.71	9.204E-03	898.02	93.700	6.754E+03	Y898

954.58	398.	42.37	0.34	8.718E-03				
1115.57	49573.	0.78	1.87	7.578E-03	1115.55	50.600	6.569E+03	Zn65
1173.26	142414.	0.30	1.91	7.239E-03	1173.24	99.900	3.224E+03	Co1173
1189.08	147.	45.22	0.46	7.151E-03				
1199.08	67.	61.19	0.67	7.097E-03				
1246.07	162.	33.31	1.97	6.853E-03				
1251.95	100.	45.66	1.98	6.823E-03				
1320.19	83.	48.25	2.03	6.498E-03				
1324.82	263.	22.63	2.04	6.477E-03				
1332.52	127020.	0.30	2.01	6.442E-03	1332.50	99.982	3.229E+03	Co1332
1522.24	110.	39.93	0.31	5.694E-03				
1836.08	12210.	1.03	2.43	4.773E-03	1836.01	99.200	6.999E+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 keV	Suspected Nuclide	
145.03	36.46	39179.	3528.	1.309E+05	8.11	0.893	-	D
150.78	37.90	44171.	4819.	1.717E+05	6.33	0.894	-	D

ORTEC g v - i (3263) Env32 G53W4.25 4/3/2012 8:09:21 AM Page 3
TestAmerica Spectrum name: 7_1Lmarn2nd_20120523.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected	
170.90	42.90	45388.	850.	2.692E+04	39.80	0.388	-	s
197.73	49.61	142965.	22317.	6.303E+05	3.24	1.783	-	s
264.52	66.30	42956.	486.	1.174E+04	67.51	0.375	-	s
310.85	77.88	56534.	972.	2.240E+04	42.49	0.642	-	s
544.89	136.37	27355.	15240.	3.775E+05	2.23	0.970	-	
682.65	170.81	9642.	156.	4.382E+03	93.30	0.315	-	C
795.10	198.91	22460.	1359.	4.291E+04	20.81	1.113	-	
864.99	216.38	22202.	511.	1.721E+04	53.39	0.287	-	s
899.46	225.00	13540.	424.	1.468E+04	43.72	0.573	-	s
942.81	235.83	11431.	344.	1.238E+04	47.73	0.647	-	s
1019.95	255.11	17792.	1122.	4.286E+04	21.90	0.629	-	s
1240.85	310.33	11626.	357.	1.590E+04	52.58	0.816	-	s
1889.05	472.35	10437.	388.	2.430E+04	47.11	0.400	-	s
1909.56	477.47	7467.	212.	1.341E+04	66.81	0.432	-	s
2002.45	500.69	7658.	264.	1.735E+04	57.74	0.606	-	s
2043.92	511.06	15755.	4978.	3.328E+05	5.72	2.285	-	s
2233.76	558.51	4005.	102.	7.335E+03	92.01	0.456	-	sC
2391.11	597.84	4560.	146.	1.114E+04	71.13	0.523	-	sC
2899.28	724.87	2989.	115.	1.035E+04	70.60	0.541	-	sC
3313.47	828.41	4937.	306.	3.094E+04	39.09	0.489	-	sM
3818.18	954.58	7992.	398.	4.560E+04	42.37	0.339	-	s
4756.20	1189.08	1424.	147.	2.056E+04	45.22	0.459	-	s
4796.24	1199.08	737.	67.	9.394E+03	61.19	0.666	-	s
4983.38	1245.87	1280.	201.	2.938E+04	39.02	0.270	-	s
5006.88	1251.75	1011.	134.	1.964E+04	48.24	0.468	-	s
5280.66	1320.19	769.	83.	1.284E+04	48.25	2.033	-	D
5299.17	1324.82	1646.	263.	4.068E+04	22.63	2.036	-	D
6088.83	1522.24	473.	110.	1.929E+04	39.93	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 & Mn, Zn.L

********** 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	237.54	59.56	133662.	513708.	71.348	0.20	0.869
CD-109	351.37	88.01	88190.	406256.	56.424	0.22	0.933
CO-57	487.38	122.00	42014.	128434.	17.838	0.44	0.979
Ce-139	662.53	165.78	35420.	49846.	6.923	0.96	0.997
Hg-203	1117.41	279.47	15318.	1059.	0.147	21.56	1.154s
SN-113	1566.61	391.75	23045.	24138.	3.352	1.65	1.236

ORTEC g v - i (3263) Env32 G53W4.25 4/3/2012 8:09:21 AM Page 4
TestAmerica Spectrum name: 7_1Lmarn2nd_20120523.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
CS-137	2646.50	661.68	12931.	141450.	19.646	0.32	1.470
Mn-54	3339.35	834.88	17455.	77158.	10.716	0.59	1.627
Y-898	3592.18	898.08	16384.	21460.	2.980	1.63	1.714
Zn-65	4462.19	1115.57	12614.	49573.	6.885	0.78	1.871
Co-1173	4692.95	1173.26	5998.	142414.	19.780	0.30	1.906
Co-1332	5329.99	1332.52	2348.	127020.	17.642	0.30	2.013
Y-1836	7344.06	1836.08	428.	12210.	1.696	1.03	2.425

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
AM-241		5.0647E+03				1.58E+05		
			59.54	5.065E+03	(	1.682E+01	2.01E-01 3.57E+01	G
CD-109		7.0396E+04				4.63E+02		
			88.03	7.040E+04	(	2.403E+02	2.25E-01 3.61E+00	G
CO-57		1.5868E+03				2.72E+02		
			122.06	1.587E+03	(	1.183E+01	4.39E-01 8.56E+01	G
Ce-139		2.3884E+03				1.38E+02		
			165.85	2.388E+03	(	4.215E+01	9.56E-01 7.99E+01	G
Hg-203		6.6061E+03				4.66E+01		
			279.17	6.606E+03	*(	3.616E+03	2.16E+01 8.15E+01	G
SN-113		4.4128E+03				1.15E+02		
			391.69	4.413E+03	(	1.298E+02	1.65E+00 6.40E+01	G
CS-137		1.9748E+03				1.10E+04		
			661.66	1.975E+03	(	7.436E+00	3.24E-01 8.52E+01	G
Mn-54		3.0118E+03				3.12E+02		
			834.85	3.012E+03	(	2.414E+01	5.87E-01 1.00E+02	G
Y-898		6.7536E+03				1.07E+02		
			898.02	6.754E+03	(	1.886E+02	1.63E+00 9.37E+01	G

Zn-65 F 6.5691E+03 2.44E+02
1115.55 6.569E+03 (6.971E+01 7.83E-01 5.06E+01 G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Co-1173	3.2244E+03					1.93E+03	
		1173.24	3.224E+03	(	8.232E+00	3.03E-01	9.99E+01 G
Co-1332	3.2288E+03					1.93E+03	
		1332.50	3.229E+03	(	5.808E+00	3.02E-01	1.00E+02 G
Y-1836	6.9991E+03					1.07E+02	
		1836.01	6.999E+03	(	5.678E+01	1.03E+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.
@ - 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

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 *****

7_1Lmarn2nd_20120523

Nuclide	Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting	MDA Bq/Sample
AM-241	5.0546E+03	5.0647E+03	2.014E-01%	1.68E+01
CD-109	3.5486E+04	7.0396E+04	2.246E-01%	2.40E+02
CO-57	4.9453E+02	1.5868E+03	4.387E-01%	1.18E+01
Ce-139	2.3893E+02	2.3884E+03	9.557E-01%	4.22E+01
Hg-203 #	7.3907E+00	6.6061E+03	2.156E+01%	3.62E+03
SN-113	2.8118E+02	4.4128E+03	1.650E+00%	1.30E+02
CS-137	1.9186E+03	1.9748E+03	3.243E-01%	7.44E+00
Mn-54	1.0919E+03	3.0118E+03	5.870E-01%	2.41E+01
Y-898	3.4559E+02	6.7536E+03	1.631E+00%	1.89E+02
Zn-65	1.7955E+03	6.5691E+03	7.825E-01%	6.97E+01
Co-1173	2.7351E+03	3.2244E+03	3.032E-01%	8.23E+00
Co-1332	2.7388E+03	3.2288E+03	3.018E-01%	5.81E+00
Y-1836	3.5815E+02	6.9991E+03	1.031E+00%	5.68E+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 (1332.3 to 2000.1 keV) 5.255E+04 Bq/Sample
Total Decayed Activity (1332.3 to 2000.1 keV) 1.2221653E+05 Bq/Sample

2nd Source Verification

Detector: Ge9

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	1169.4	100.4
Cs-137	1926	396	0.851	465	444.52	95.6
Co-60	3611	742	0.99974	742	687.72	92.7
Co-60	3612	742	0.999856	742	692.56	93.3

Reviewed By: Jody Watson

Date: 6/14/2012

ORTEC g v - i (3263) Env32 G53W4.25 6/14/2012 1:20:45 PM Page 1
TestAmerica, Inc Spectrum name: 9_TunaCan_20120371.An1

Sample description
9_TunaCan_90099_061412

Spectrum Filename: C:\User\SPC\Det9\9_TunaCan_20120371.An1

Acquisition information
Start time: 6/14/2012 10:54:15 AM
Live time: 3600
Real time: 3629
Dead time: 0.81 %
Detector ID: 9

Detector system
Ge 9 SN/100113

Calibration
Filename: 9_Soil_TunaCan.Clb
9_Soil_TunaCan_90099_050312

Energy Calibration
Created: 6/14/2012 10:19:40 AM
Zero offset: 0.088 keV
Gain: 0.250 keV/channel
Quadratic: -2.039E-08 keV/channel^2

Efficiency Calibration
Created: 6/14/2012 10:19:51 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.30 %
Log(Eff): -8.079856E-01 + (-2.367265E-01*Log(E)) + (-3.950640E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.42 %
Log(Eff): -2.387916E+01 + (8.875647E+00*Log(E)) + (-9.401100E-01*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 (37.60keV)
Stop channel: 8000 (1999.66keV)
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 6/14/2012 1:20:45 PM Page 2
TestAmerica, Inc Spectrum name: 9_TunaCan_20120371.An1
Page 1

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	9_2012-05-27_0502.PBC 5/27/2012 5:02:59 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 11 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0390

***** 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
36.54	860.	12.66	1.34	1.634E-02				
46.62	48876.	0.54	1.09	2.580E-02	46.54	4.250	1.338E+04	Pb210
50.03	116.	122.12	1.09	2.886E-02				
59.57	54776.	0.62	1.11	3.661E-02	59.54	35.700	1.169E+03	AM241
63.90	47.	193.18	0.35	3.962E-02				
88.09	26880.	0.87	1.14	5.052E-02	88.03	3.610	1.566E+04	CD109
122.10	5522.	2.86	1.15	5.303E-02	122.06	85.600	3.312E+02	CO57
136.38	729.	11.64	1.25	5.151E-02				
165.67	814.	10.74	1.30	4.629E-02	165.85	79.900	5.417E+02	Ce139
295.46	252.	33.13	0.56	3.229E-02				
316.16	66.	75.82	0.25	3.082E-02				
356.41	45.	97.50	1.36	2.835E-02				
358.68	42.	110.02	1.37	2.822E-02				
379.76	37.	75.05	0.46	2.711E-02				
391.75	310.	24.80	1.08	2.652E-02	391.69	64.000	1.113E+03	SN113
454.98	83.	53.05	0.37	2.383E-02				
568.66	103.	37.41	0.47	2.026E-02				
626.42	84.	49.00	0.45	1.885E-02				
661.66	23324.	0.76	1.61	1.810E-02	661.66	85.210	4.445E+02	CS137
821.54	239.	27.43	0.39	1.536E-02				
876.16	66.	52.19	0.61	1.462E-02				
898.25	346.	23.61	1.52	1.434E-02	898.02	93.700	2.406E+03	Y898
937.90	34.	79.64	0.44	1.387E-02				
1071.41	38.	61.01	0.57	1.249E-02				
1085.31	68.	35.74	1.00	1.237E-02				
1098.64	14.	140.33	0.47	1.225E-02				
1173.23	20836.	0.81	2.05	1.163E-02	1173.24	99.900	6.877E+02	Co1173
1332.49	18966.	0.75	2.11	1.050E-02	1332.50	99.982	6.926E+02	Co1332
1835.90	150.	10.23	1.72	8.080E-03	1836.01	99.200	1.745E+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 keV	Suspected Nuclide
145.76	36.54	3297.	860.	5.262E+04	12.66	1.336	- s
199.48	49.98	8660.	956.	3.313E+04	18.50	0.958	- sM
255.13	63.90	2893.	47.	1.186E+03	193.18	0.347	- sc
544.97	136.38	1941.	729.	1.415E+04	11.64	1.247	-

TestAmerica, Inc Spectrum name: 9_TunaCan_20120371.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
1181.07	295.46	1550.	252.	7.804E+03	33.13	0.562	- s
1263.87	316.16	856.	66.	2.136E+03	75.82	0.245	- sc
1424.84	356.47	930.	45.	1.579E+03	97.50	1.363	- sc
1433.89	358.73	1025.	42.	1.473E+03	110.02	1.365	- sc
1518.22	379.76	367.	37.	1.365E+03	75.05	0.460	- sc
1819.03	454.98	702.	83.	3.496E+03	53.05	0.375	- s
2273.73	568.66	433.	103.	5.068E+03	37.41	0.468	- s
2504.73	626.42	460.	84.	4.455E+03	49.00	0.451	- s
3285.25	821.54	812.	239.	1.556E+04	27.43	0.391	- s
3503.76	876.16	400.	66.	4.538E+03	52.19	0.608	- s
3750.76	937.90	332.	34.	2.488E+03	79.64	0.436	- sc
4284.91	1071.41	226.	38.	3.015E+03	61.01	0.571	- s
4340.51	1085.31	224.	68.	5.498E+03	35.74	1.000	- s
4393.86	1098.64	186.	14.	1.143E+03	140.33	0.472	- sc

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	185.86	46.57	13300.	51041.	14.178	0.65	1.116
AM-241	237.82	59.57	11784.	54776.	15.216	0.62	1.111
CD-109	351.87	88.09	5995.	26880.	7.467	0.87	1.137
CO-57	487.85	122.10	3767.	5522.	1.534	2.86	1.155
Ce-139	662.09	165.67	1864.	814.	0.226	10.74	1.299
Hg-203	1120.44	280.29	2362.	-52.	-0.014	133.84	1.296s
SN-113	1565.85	391.67	1962.	266.	0.074	24.38	1.393
CS-137	2645.72	661.66	1258.	23324.	6.479	0.76	1.614
Y-898	3592.12	898.25	1148.	346.	0.096	23.61	1.524s
Co-1173	4692.30	1173.23	840.	20836.	5.788	0.81	2.049
Co-1332	5329.58	1332.49	131.	18966.	5.268	0.75	2.109
Y-1836	7344.43	1835.90	14.	150.	0.042	10.23	1.719s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
Pb-210	N	1.3971E+04				8.15E+03		
			46.54	1.397E+04	(	1.478E+02	6.46E-01 4.25E+00	G
AM-241		1.1694E+03				1.58E+05		
			59.54	1.169E+03	(	1.086E+01	6.16E-01 3.57E+01	G
CD-109		1.5657E+04				4.63E+02		
			88.03	1.566E+04	(	2.117E+02	8.71E-01 3.61E+00	G
CO-57		3.3118E+02				2.72E+02		
			122.06	3.312E+02	(	1.731E+01	2.86E+00 8.56E+01	G
Ce-139		5.4173E+02				1.38E+02		
			165.85	5.417E+02	(	1.357E+02	1.07E+01 7.99E+01	G
Hg-203		-5.2429E-01				4.66E+01		
			279.17	-5.243E-01	?(	2.327E+00	1.34E+02 8.15E+01	G
SN-113		9.5260E+02				1.15E+02		
			391.69	9.526E+02	?(	7.503E+02	2.44E+01 6.40E+01	G
CS-137		4.4452E+02				1.10E+04		
			661.66	4.445E+02	(	3.202E+00	7.63E-01 8.52E+01	G
Y-898		2.4057E+03				1.07E+02		
			898.02	2.406E+03	@(	1.118E+03	2.36E+01 9.37E+01	G
Co-1173		6.8772E+02				1.93E+03		
			1173.24	6.877E+02	(	4.547E+00	8.09E-01 9.99E+01	G
Co-1332		6.9256E+02				1.93E+03		
			1332.50	6.926E+02	(	2.044E+00	7.49E-01 1.00E+02	G
Y-1836		1.7452E+03				1.07E+02		
			1836.01	1.745E+03	(	2.388E+02	1.02E+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	280.29	2362.	-52.	-0.014	133.84	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 1 Sigma Counting		MDA Bq/Sample
Pb-210	1.2947E+04	1.3971E+04	6.459E-01%		1.48E+02
AM-241	1.1648E+03	1.1694E+03	6.156E-01%		1.09E+01
CD-109	4.0954E+03	1.5657E+04	8.713E-01%		2.12E+02
CO-57	3.3792E+01	3.3118E+02	2.862E+00%		1.73E+01
Ce-139	5.9752E+00	5.4173E+02	1.074E+01%		1.36E+02
Hg-203 #A	-5.2429E-01	>12 Halflives	1.3384E+02%	2.3272E+00	
SN-113 #	4.3447E+00	9.5260E+02	2.438E+01%		7.50E+02
CS-137	4.2011E+02	4.4452E+02	7.635E-01%		3.20E+00
Y-898 #	7.1422E+00	2.4057E+03	2.361E+01%		1.12E+03
Co-1173	4.9827E+02	6.8772E+02	8.087E-01%		4.55E+00
Co-1332	5.0178E+02	6.9256E+02	7.487E-01%		2.04E+00
Y-1836	5.1813E+00	1.7452E+03	1.023E+01%		2.39E+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 (379.7 to 1999.7 keV) 1.968E+04 Bq/Sample
Total Decayed Activity (379.7 to 1999.7 keV) 3.8598309E+04 Bq/Sample

Second Source Verification

Detecter: Ge 11

Geometry: 1L Marn

Reference date 1/1/2010

Calibration Standard: 81592-334

Standard volume g / vial 1

Standard volume transferred in g / geometry 1

lab ID# of cal standard Rad 10-0030

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	Abundance*	Activity Bq/L	Count Results	%recovery
Am-241	1929	1929	0.359	**5373.3**	5254.3	97.8
Cs-137	1826	1826	0.851	**2145.7**	2118.8	98.7
Co-60	3424	3424	0.99974	**3424.9**	3249.3	94.9
Co-60	3426	3426	0.99986	**3426.5**	3300.3	96.3

Reviewed By: Jody Watson

Date: 9/2/2011

ORTEC g v - i (3263) Env32 G53W4.25 11/23/2011 8:51:25 AM
TestAmerica, Inc Spectrum name: 11_marn1L_20110937.An1

Sample description
11_marn1L_2ndsource_111011

Spectrum Filename: C:\User\SPC\Det11\11_marn1L_20110937.An1

Acquisition information
Start time: 11/10/2011 2:13:51 AM
Live time: 7200
Real time: 7613
Dead time: 5.42 %
Detector ID: 11

Detector system
Ge11 SN/09363993

Calibration
Filename: 11_Liquid_Marinelli 1L.Clb
Ge11_1Lmarn_83924_334_101210

Energy Calibration
Created: 11/1/2011 11:26:50 AM
Zero offset: 0.098 keV
Gain: 0.250 keV/channel
Quadratic: -2.669E-08 keV/channel^2

Efficiency Calibration
Created: 11/1/2011 11:27:06 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.69 %
Log(Eff): -1.728738E+00 + (5.998209E-02*Log(E)) +
(-6.399241E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.15 %
Log(Eff): -1.340909E+01 + (4.619770E+00*Log(E)) +
(-5.089701E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix & Mn, Zn.L
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.25
Start channel: 150 (37.62keV)
Stop channel: 8000 (1999.43keV)
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 11/23/2011 8:51:25 AM
TestAmerica, Inc Spectrum name: 11_marn1L_20110937.An1

Random error:	1.0000000E+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:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	11_2011-10-29_1022.PBC 10/29/2011 10:22:41 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0277

***** 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
36.50	4518.	6.39	0.89	3.408E-02				
37.97	2037.	14.55	0.89	3.538E-02				
42.39	422.	79.51	0.35	3.897E-02				
49.58	28212.	2.68	1.80	4.367E-02				
59.56	652750.	0.17	0.89	4.833E-02	59.54	35.700	5.271E+03	AM241
66.17	2473.	12.86	0.92	5.042E-02				
67.20	2984.	11.16	0.92	5.069E-02				
74.97	1326.	26.91	0.93	5.229E-02				
88.04	361346.	0.22	0.94	5.351E-02	88.03	3.610	7.172E+04	CD109
103.13	614.	46.51	0.69	5.335E-02				
122.08	91666.	0.51	0.97	5.171E-02	122.06	85.600	1.619E+03	CO57
136.50	11480.	3.07	1.00	4.985E-02				
165.92	21866.	1.59	1.01	4.532E-02	165.85	79.900	2.544E+03	Ce139
198.80	643.	37.03	0.42	4.062E-02				
215.88	289.	57.37	0.91	3.858E-02				
228.14	331.	63.22	0.46	3.726E-02				
279.33	101.	220.86	1.12	3.269E-02	279.17	81.500	HL>Cutoff	Hg203
370.00	248.	74.51	0.40	2.700E-02				
379.97	225.	76.51	0.32	2.651E-02				
391.60	8985.	3.15	1.18	2.595E-02	391.69	64.000	4.450E+03	SN113
496.10	111.	90.09	0.66	2.189E-02				
503.03	134.	73.41	0.48	2.167E-02				
510.83	2730.	10.10	1.79	2.142E-02				
530.79	573.	37.26	0.73	2.082E-02				
566.47	77.	103.81	0.56	1.984E-02				
661.67	218136.	0.26	1.45	1.762E-02	661.66	85.210	2.106E+03	CS137
703.72	347.	44.49	0.56	1.680E-02				
819.03	269.	51.05	1.59	1.490E-02				
821.78	583.	23.01	1.59	1.486E-02				
834.83	72294.	0.57	1.59	1.468E-02	834.85	99.980	3.078E+03	Mn54
897.95	7974.	3.79	1.57	1.384E-02	898.02	93.700	6.998E+03	Y898
920.50	375.	55.07	0.34	1.357E-02				
935.61	478.	46.46	0.35	1.339E-02				
998.23	417.	33.41	0.48	1.270E-02				
1022.42	402.	33.34	1.74	1.245E-02				

1026.05	228.	48.12	1.75	1.241E-02				
1115.53	26774.	1.22	1.78	1.158E-02	1115.55	50.600	4.342E+03	Zn65
1126.42	75.	103.86	0.44	1.148E-02				
1173.21	204379.	0.25	1.87	1.110E-02	1173.24	99.900	3.269E+03	Co1173
1212.84	166.	49.95	1.09	1.079E-02				
1332.47	185866.	0.24	1.97	9.954E-03	1332.50	99.982	3.311E+03	Co1332
1549.65	146.	27.79	0.75	8.728E-03				
1835.92	4968.	1.95	2.19	7.505E-03	1836.01	99.200	7.596E+03	Y1836
1959.08	87.	46.83	0.65	7.076E-03				

********** 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	
145.53	36.42	39453.	4518.	1.326E+05	6.39	0.892	-	D
151.42	37.89	42893.	2037.	5.757E+04	14.55	0.894	-	D

ORTEC g v - i (3263) Env32 G53W4.25 11/23/2011 8:51:25 AM
TestAmerica, Inc Spectrum name: 11_marn1L_20110937.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
169.07	42.39	44968.	422.	1.084E+04	79.51	0.351	- c
197.83	49.58	155190.	28212.	6.460E+05	2.68	1.798	- s
264.17	66.10	49331.	2473.	4.904E+04	12.86	0.921	- D
268.28	67.13	53935.	2984.	5.887E+04	11.16	0.922	- D
299.34	74.97	44486.	1326.	2.536E+04	26.91	0.930	-
411.93	103.13	24283.	614.	1.151E+04	46.51	0.692	- s
545.34	136.50	26974.	11480.	2.303E+05	3.07	1.003	-
794.46	198.80	17695.	643.	1.583E+04	37.03	0.419	- s
862.75	215.88	11629.	289.	7.482E+03	57.37	0.905	- s
911.79	228.14	15308.	331.	8.874E+03	63.22	0.458	- s
1479.08	370.00	10734.	248.	9.197E+03	74.51	0.400	- s
1518.94	379.97	9802.	225.	8.489E+03	76.51	0.318	- sc
1983.39	496.10	4564.	111.	5.071E+03	90.09	0.665	- sc
2011.10	503.03	4416.	134.	6.192E+03	73.41	0.484	- sc
2042.31	510.83	15161.	2730.	1.274E+05	10.10	1.793	- s
2122.14	530.79	10795.	573.	2.751E+04	37.26	0.728	- s
2264.84	566.47	3156.	77.	3.882E+03	103.81	0.562	- sc
2813.85	703.72	6419.	347.	2.067E+04	44.49	0.556	- s
3275.18	819.24	9265.	269.	1.802E+04	51.05	1.586	- D
3286.16	821.98	8714.	583.	3.923E+04	23.01	1.588	- D
3681.15	920.50	10146.	375.	2.764E+04	55.07	0.345	- s
3741.59	935.61	11253.	478.	3.568E+04	46.46	0.352	- s
3992.16	998.23	5698.	417.	3.284E+04	33.41	0.479	- s
4088.94	1022.20	8777.	402.	3.228E+04	33.34	1.744	- D
4103.46	1025.83	5905.	228.	1.837E+04	48.12	1.746	- D
4505.11	1126.42	2397.	75.	6.532E+03	103.86	0.443	- c
4850.96	1212.84	1677.	166.	1.539E+04	49.95	1.086	- s
6199.08	1549.65	375.	146.	1.673E+04	27.79	0.747	- s
7838.42	1959.08	275.	87.	1.225E+04	46.83	0.646	- 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: DET_EnergyStandardMix & Mn, Zn.L

********** 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	237.73	59.56	135134.	652750.	90.660	0.17	0.891
CD-109	351.59	88.04	61150.	361346.	50.187	0.22	0.943
CO-57	487.69	122.08	30435.	91666.	12.731	0.51	0.972
Ce-139	662.99	165.92	23769.	21866.	3.037	1.59	1.006
Hg-203	1116.48	279.33	24665.	101.	0.014	220.86	1.123s
SN-113	1565.47	391.60	16353.	8985.	1.248	3.15	1.179

ORTEC g v - i (3263) Env32 G53W4.25 11/23/2011 8:51:25 AM
TestAmerica, Inc Spectrum name: 11_marn1L_20110937.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
CS-137	2645.66	661.67	15752.	218136.	30.297	0.26	1.450
Mn-54	3338.37	834.83	15290.	72294.	10.041	0.57	1.592
Y-898	3590.93	897.95	14742.	7974.	1.107	3.79	1.572
Zn-65	4461.52	1115.53	11807.	26774.	3.719	1.22	1.777
Co-1173	4692.35	1173.21	7749.	204379.	28.386	0.25	1.871
Co-1332	5329.74	1332.47	2143.	185866.	25.815	0.24	1.966
Y-1836	7345.27	1835.93	506.	4954.	0.688	1.95	2.189

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
AM-241		5.2710E+03				1.58E+05	
			59.54	5.271E+03	(	1.385E+01 1.69E-01 3.57E+01	G
CD-109		7.1716E+04				4.63E+02	
			88.03	7.172E+04	(	2.292E+02 2.19E-01 3.61E+00	G
CO-57		1.6193E+03				2.72E+02	
			122.06	1.619E+03	(	1.441E+01 5.10E-01 8.56E+01	G
Ce-139		2.5443E+03				1.38E+02	
			165.85	2.544E+03	(	8.391E+01 1.59E+00 7.99E+01	G
Hg-203		5.2474E-01				4.66E+01	
			279.17	5.247E-01	?(	3.829E+00 2.21E+02 8.15E+01	G
SN-113		4.4498E+03				1.15E+02	
			391.69	4.450E+03	(	2.965E+02 3.15E+00 6.40E+01	G
CS-137		2.1056E+03				1.10E+04	
			661.66	2.106E+03	(	5.672E+00 2.60E-01 8.52E+01	G
Mn-54		3.0783E+03				3.12E+02	
			834.85	3.078E+03	(	2.465E+01 5.73E-01 1.00E+02	G
Y-898		6.9981E+03				1.07E+02	
			898.02	6.998E+03	(	4.989E+02 3.79E+00 9.37E+01	G
Zn-65	F	4.3417E+03				2.44E+02	
			1115.55	4.342E+03	(	8.255E+01 1.22E+00 5.06E+01	G

```
     ORTEC g v - i (3263) Env32  G53W4.25  11/23/2011 8:51:25 AM
 TestAmerica, Inc                Spectrum name: 11_marn1L_20110937.An1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Co-1173      3.2685E+03                                      1.93E+03
                         1173.24 3.269E+03  (  6.604E+00 2.53E-01 9.99E+01 G

Co-1332      3.3105E+03                                      1.93E+03
                         1332.50 3.311E+03  (  3.890E+00 2.43E-01 1.00E+02 G

Y-1836       7.5751E+03                                      1.07E+02
                         1836.01 7.575E+03  (  1.644E+02 1.95E+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.
   @ - 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  Background  Net Area   Intensity   Uncert   Activity
           Energy   Counts     Counts     Cts/Sec  1 Sigma %
 ____________________________________________________________________________
 Hg-203     279.33     24665.       101.      0.014   220.86   0.000E+00
   P - Peakbackground subtraction
```

ORTEC g v - i (3263) Env32 G53W4.25 11/23/2011 8:51:25 AM
TestAmerica, Inc Spectrum name: 11_marn1L_20110937.An1

***** 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 1 Sigma Counting		MDA Bq/Sample
AM-241	5.2554E+03	5.2710E+03	1.689E-01%		1.39E+01
CD-109	2.5981E+04	7.1716E+04	2.190E-01%		2.29E+02
CO-57	2.8762E+02	1.6193E+03	5.099E-01%		1.44E+01
Ce-139	8.3856E+01	2.5443E+03	1.590E+00%		8.39E+01
Hg-203 #A	5.2474E-01	>12 Halflives	2.2086E+02%	3.8291E+00	
SN-113	7.5147E+01	4.4498E+03	3.145E+00%		2.96E+02
CS-137	2.0174E+03	2.1056E+03	2.595E-01%		5.67E+00
Mn-54	6.8411E+02	3.0783E+03	5.731E-01%		2.47E+01
Y-898	8.5388E+01	6.9981E+03	3.794E+00%		4.99E+02
Zn-65	6.3485E+02	4.3417E+03	1.224E+00%		8.25E+01
Co-1173	2.5609E+03	3.2685E+03	2.525E-01%		6.60E+00
Co-1332	2.5938E+03	3.3105E+03	2.426E-01%		3.89E+00
Y-1836	9.2427E+01	7.5751E+03	1.951E+00%		1.64E+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 (1115.4 to 1999.4 keV) 4.035E+04 Bq/Sample
Total Decayed Activity (1115.4 to 1999.4 keV) 1.1627776E+05 Bq/Sample

Analyzed by: _____
admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica, Inc

Second Source Verification

Detector:	Ge12
Geometry:	1L Marn
Reference date	1/1/2011
Calibration Standard:	83924-334
Standard volume g / vial	1
Standard volume transferred in g / geometry	1
lab ID# of cal standard	6675

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	Abundance	Activity Bq/L	Count Results	%recovery
Am-241	1830	1830	0.359	**5097.5**	4962.7	97.4
Cs-137	1705	1705	0.851	**2003.5**	1940	96.8
Co-60	3293	3293	0.99974	**3293.9**	3113.9	94.5
Co-60	3294	3294	0.99986	**3294.5**	3167.4	96.1

Reviewed By: Megan McAfee

Date: 4/17/2012

ORTEC g v - i (3263) Env32 G53W4.25 4/17/2012 11:19:58 AM
TestAmerica, Inc Spectrum name: 12_Marn1L2ND_20120863.An1

Sample description
12_Marn1L_83924-334_2nd_041112

Spectrum Filename: C:\User\SPC\Det12\12_Marn1L2ND_20120863.An1

Acquisition information
Start time: 4/11/2012 10:47:52 PM
Live time: 3600
Real time: 3890
Dead time: 7.45 %
Detector ID: 12

Detector system
Ge12 SN/10034336

Calibration
Filename: 12_Liquid_Marinelli 1L.Clb
Ge12_Marn1LCal_90062_032612

Energy Calibration
Created: 4/2/2012 5:16:59 PM
Zero offset: 0.107 keV
Gain: 0.250 keV/channel
Quadratic: -3.540E-08 keV/channel^2

Efficiency Calibration
Created: 4/2/2012 5:17:10 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.18 %
Log(Eff): -2.771167E+00 + (4.009767E-01*Log(E)) +
(-8.911171E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.25 %
Log(Eff): -1.324587E+01 + (4.570937E+00*Log(E)) +
(-5.039442E-01*Log(E)^2)

Library Files
Main analysis library: DET_EnergyStandardMix.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 (1999.45keV)
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 4/17/2012 11:19:58 AM
TestAmerica, Inc Spectrum name: 12_Marn1L2ND_20120863.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	1/1/2011 11:00:00 AM
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	12_2012-04-01_0338.PBC 4/1/2012 3:38:18 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 11 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0659

***** 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	2472.	8.84	0.94	3.597E-02				
37.92	3328.	7.28	0.95	3.726E-02				
49.75	12975.	4.28	1.82	4.597E-02				
59.60	322562.	0.27	0.91	5.070E-02	59.54	35.700	4.963E+03	AM241
66.88	777.	36.05	0.66	5.305E-02				
77.86	900.	39.37	0.64	5.517E-02				
88.09	254212.	0.26	0.96	5.599E-02	88.03	3.610	7.028E+04	CD109
97.15	234.	59.20	0.48	5.604E-02				
122.14	80010.	0.53	0.99	5.406E-02	122.06	85.600	1.578E+03	CO57
136.55	10228.	2.96	1.02	5.212E-02				
165.96	30780.	0.99	1.00	4.736E-02	165.85	79.900	2.367E+03	Ce139
199.44	1045.	22.16	1.33	4.299E-02				
223.94	177.	68.09	0.45	4.033E-02				
235.23	325.	54.92	0.60	3.921E-02				
255.16	1069.	20.88	1.11	3.741E-02				
265.07	172.	54.33	0.60	3.658E-02				
277.37	94.	131.56	1.15	3.561E-02				
279.33	518.	27.97	1.16	3.545E-02	279.17	81.500	5.115E+03	Hg203
296.19	287.	48.39	0.46	3.421E-02				
312.62	144.	79.60	0.41	3.308E-02				
332.92	164.	74.20	0.42	3.180E-02				
353.05	364.	45.88	0.57	3.063E-02				
361.18	122.	87.66	1.23	3.019E-02				
363.73	171.	65.12	1.23	3.005E-02				
391.65	16610.	1.43	1.23	2.862E-02	391.69	64.000	4.182E+03	SN113
427.01	250.	64.66	0.54	2.701E-02				
511.01	4277.	5.46	2.54	2.384E-02				
661.75	113984.	0.39	1.45	1.972E-02	661.66	85.210	1.940E+03	CS137
734.88	198.	49.36	0.41	1.820E-02				
754.71	47.	120.45	0.32	1.783E-02				
834.95	62740.	0.57	1.60	1.646E-02				
898.12	16564.	1.64	1.62	1.553E-02	898.02	93.700	6.567E+03	Y898
936.14	84.	103.31	0.27	1.501E-02				
1019.42	297.	41.34	0.38	1.399E-02				
1036.99	170.	45.98	0.45	1.379E-02				

1108.75	93.	100.45	0.57	1.304E-02				
1115.65	40641.	0.83	1.83	1.297E-02				
1173.35	117595.	0.35	1.86	1.242E-02	1173.24	99.900	3.114E+03	Co1173
1316.33	102.	48.57	0.54	1.124E-02				
1332.65	107164.	0.34	1.97	1.112E-02	1332.50	99.982	3.167E+03	Co1332
1416.40	113.	44.71	0.55	1.053E-02				
1601.07	37.	81.44	2.16	9.430E-03				
1607.55	76.	48.86	2.16	9.395E-03				
1836.12	10106.	1.23	2.37	8.306E-03	1836.01	99.200	7.075E+03	Y1836
1880.57	60.	48.25	0.36	8.121E-03				

********** 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	
145.51	36.46	22627.	2472.	6.874E+04	8.84	0.944	-	D
151.14	37.87	27659.	3328.	8.932E+04	7.28	0.945	-	D
198.42	49.75	84350.	12975.	2.822E+05	4.28	1.816	-	s
266.91	66.88	29162.	777.	1.465E+04	36.05	0.662	-	s

ORTEC g v - i (3263) Env32 G53W4.25 4/17/2012 11:19:58 AM
TestAmerica, Inc Spectrum name: 12_Marn1L2ND_20120863.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
310.79	77.86	37394.	900.	1.631E+04	39.37	0.644	- s
387.87	97.15	8724.	234.	4.170E+03	59.20	0.481	- s
545.39	136.55	18737.	10228.	1.963E+05	2.96	1.019	- s
796.79	199.44	14347.	1045.	2.431E+04	22.16	1.331	- s
894.71	223.94	6635.	177.	4.393E+03	68.09	0.453	- sc
939.86	235.23	10510.	325.	8.288E+03	54.92	0.602	- s
1019.54	255.16	12722.	1069.	2.858E+04	20.88	1.114	-
1059.15	265.07	4280.	172.	4.702E+03	54.33	0.598	- s
1108.62	277.29	7589.	83.	2.328E+03	149.01	1.154	- sc
1183.58	296.19	6697.	287.	8.385E+03	48.39	0.458	- s
1249.26	312.62	5162.	144.	4.337E+03	79.60	0.408	- sc
1330.44	332.92	5468.	164.	5.146E+03	74.20	0.423	- sc
1410.92	353.05	7842.	364.	1.187E+04	45.88	0.569	- s
1443.42	361.14	5648.	122.	4.038E+03	87.66	1.225	- sc
1453.62	363.69	6129.	171.	5.697E+03	65.12	1.228	- sc
1706.66	427.01	7395.	250.	9.256E+03	64.66	0.539	- s
2042.57	511.01	10064.	4277.	1.794E+05	5.46	2.541	- s
2937.97	734.88	3118.	198.	1.088E+04	49.36	0.406	- s
3017.29	754.71	1579.	47.	2.636E+03	120.45	0.315	- sc
3338.29	834.95	10224.	62740.	3.811E+06	0.57	1.598	-
3743.11	936.14	2979.	84.	5.596E+03	103.31	0.270	- c
4076.33	1019.42	3865.	297.	2.125E+04	41.34	0.375	- s
4146.65	1036.99	2218.	170.	1.230E+04	45.98	0.447	- s
4433.80	1108.75	2878.	93.	7.135E+03	100.45	0.568	- sc
4461.39	1115.65	9191.	40641.	3.134E+06	0.83	1.832	-
5264.61	1316.33	618.	102.	9.105E+03	48.57	0.544	- s
5665.17	1416.40	488.	113.	1.073E+04	44.71	0.550	- s
6404.28	1601.01	176.	36.	3.818E+03	58.71	0.336	- s
6430.25	1607.50	396.	95.	1.011E+04	43.13	0.401	- s
7523.83	1880.57	161.	60.	7.388E+03	48.25	0.362	- 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: DET_EnergyStandardMix.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	237.77	59.60	93392.	322562.	89.601	0.27	0.914
CD-109	351.66	88.09	42424.	254212.	70.614	0.26	0.959
CO-57	487.77	122.14	23227.	80010.	22.225	0.53	0.985
Ce-139	662.95	165.96	15411.	30780.	8.550	0.99	0.998
Hg-203	1115.53	279.17	10243.	518.	0.144	27.99	1.156D

ORTEC g v - i (3263) Env32 G53W4.25 4/17/2012 11:19:58 AM
TestAmerica, Inc Spectrum name: 12_Marn1L2ND_20120863.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
SN-113	1565.27	391.65	9513.	16610.	4.614	1.43	1.234
CS-137	2645.43	661.75	12139.	113984.	31.662	0.39	1.453
Y-898	3591.02	898.12	9797.	16564.	4.601	1.64	1.618
Co-1173	4692.34	1173.35	6277.	117595.	32.665	0.35	1.864
Co-1332	5329.92	1332.65	2845.	107164.	29.768	0.34	1.966
Y-1836	7345.79	1836.12	556.	10106.	2.807	1.23	2.365

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
AM-241		4.9627E+03				1.58E+05		
			59.54	4.963E+03	(	2.195E+01	2.73E-01 3.57E+01	G
CD-109		7.0280E+04				4.63E+02		
			88.03	7.028E+04	(	2.661E+02	2.58E-01 3.61E+00	G
CO-57		1.5779E+03				2.72E+02		
			122.06	1.578E+03	(	1.406E+01	5.31E-01 8.56E+01	G
Ce-139		2.3665E+03				1.38E+02		
			165.85	2.367E+03	(	4.469E+01	9.88E-01 7.99E+01	G
Hg-203		5.1112E+03				4.66E+01		
			279.17	5.111E+03	(	4.682E+03	2.80E+01 8.15E+01	G
SN-113		4.1821E+03				1.15E+02		
			391.69	4.182E+03	(	1.151E+02	1.43E+00 6.40E+01	G
CS-137		1.9400E+03				1.10E+04		
			661.66	1.940E+03	(	8.785E+00	3.89E-01 8.52E+01	G
Y-898		6.5672E+03				1.07E+02		
			898.02	6.567E+03	(	1.840E+02	1.64E+00 9.37E+01	G
Co-1173		3.1139E+03				1.93E+03		
			1173.24	3.114E+03	(	9.849E+00	3.51E-01 9.99E+01	G
Co-1332		3.1674E+03				1.93E+03		
			1332.50	3.167E+03	(	7.427E+00	3.38E-01 1.00E+02	G

ORTEC g v - i (3263) Env32 G53W4.25 4/17/2012 11:19:58 AM
TestAmerica, Inc Spectrum name: 12_Marn1L2ND_20120863.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Y-1836	7.0749E+03					1.07E+02	
		1836.01	7.075E+03	(	7.885E+01	1.23E+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.
@ - 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

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 1 Sigma Counting	MDA Bq/Sample
AM-241	4.9525E+03	4.9627E+03	2.727E-01%	2.20E+01
CD-109	3.4936E+04	7.0280E+04	2.582E-01%	2.66E+02
CO-57	4.8018E+02	1.5779E+03	5.312E-01%	1.41E+01
Ce-139	2.2587E+02	2.3665E+03	9.877E-01%	4.47E+01

ORTEC g v - i (3263) Env32 G53W4.25 4/17/2012 11:19:58 AM
TestAmerica, Inc Spectrum name: 12_Marn1L2ND_20120863.An1

Hg-203	4.9772E+00	5.1112E+03	2.799E+01%	4.68E+03
SN-113	2.5190E+02	4.1821E+03	1.428E+00%	1.15E+02
CS-137	1.8837E+03	1.9400E+03	3.893E-01%	8.78E+00
Y-898	3.1626E+02	6.5672E+03	1.639E+00%	1.84E+02
Co-1173	2.6325E+03	3.1139E+03	3.505E-01%	9.85E+00
Co-1332	2.6777E+03	3.1674E+03	3.376E-01%	7.43E+00
Y-1836	3.4071E+02	7.0749E+03	1.235E+00%	7.89E+01

< - 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 (391.6 to 1999.4 keV) 4.870E+04 Bq/Sample
Total Decayed Activity (391.6 to 1999.4 keV) 1.1034369E+05 Bq/Sample

Analyzed by: _____
admin

Reviewed by: _____
Supervisor

Laboratory: TestAmerica, Inc

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 1:47:56 PM Page 1
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: -3.662E-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*Log(E)) + (-3.369562E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.96 %
Log(Eff): -2.288409E+01 + (8.352717E+00*Log(E)) + (-8.812368E-01*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: 1.0000E+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 10/4/2012 1:47:56 PM Page 2
TestAmerica, Inc Spectrum name: 12_TunaCan2nd_20122201.An1
Page 1

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	Background	Net Area	Efficiency	Uncert	FWHM	Suspected

12_TunaCan2nd_20122201

Channel	Energy	Counts	Counts	* Area	1 Sigma %	keV	Nuclide
145.90	36.51	6010.	1416.	9.823E+04	10.10	0.958	- s
198.34	49.64	14478.	1661.	6.754E+04	13.12	1.174	- sM
298.51	74.70	5238.	192.	4.958E+03	60.04	0.372	- s

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	

12_TunaCan2nd_20122201

Name	Code	Activity Bq/Sample	Energy keV	Activity Bq/Sample	Code	MDA Value 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:
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	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 1 Sigma Counting		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

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: -3.662E-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*Log(E)) +
(-3.369562E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.96 %
Log(Eff): -2.288409E+01 + (8.352717E+00*Log(E)) +
(-8.812368E-01*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: 1.0000E+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 10/4/2012 1:47:48 PM
TestAmerica, Inc Spectrum name: 12_TunaCan2nd_20122201.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	1/1/2010 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.	6.754E+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 - Name	Code	Average Activity Bq/Sample	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value 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.

ORTEC g v - i (3263) Env32 G53W4.25 10/4/2012 1:47:48 PM
TestAmerica, Inc Spectrum name: 12_TunaCan2nd_20122201.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
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	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 1 Sigma Counting		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: Ge 15

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	1151	98.9
Cs-137	1926	396	0.851	465	435.18	93.6
Co-60	3611	742	0.99974	742	687.16	92.6
Co-60	3612	742	0.999856	742	696.46	93.8

Reviewed By: Jody Watson

Date: 3/23/2012

ORTEC g v - i (3263) Env32 G53W4.25 7/5/2012 1:14:04 PM Page 1
TestAmerica, Inc. Spectrum name: 15_TunaCan2nd_20120288.An1

Sample description
15_TunaCan2nd_rad10_032312

Spectrum Filename: C:\User\SPC\Det15\15_TunaCan2nd_20120288.An1

Acquisition information
Start time: 3/23/2012 6:10:28 AM
Live time: 7200
Real time: 7248
Dead time: 0.66 %
Detector ID: 15

Detector system
Ge15 SN/1102216

Calibration
Filename: 15_Soil_TunaCan.Clb
15_TunaCan_90099_032212

Energy Calibration
Created: 3/22/2012 1:02:46 PM
Zero offset: 0.004 keV
Gain: 0.250 keV/channel
Quadratic: -3.104E-08 keV/channel^2

Efficiency Calibration
Created: 3/22/2012 1:03:01 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.00 %
Log(Eff): -6.894897E-01 + (-3.290613E-01*Log(E)) + (-3.875629E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.13 %
Log(Eff): -2.362677E+01 + (8.666669E+00*Log(E)) + (-9.214638E-01*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 (37.53keV)
Stop channel: 8000 (1999.56keV)
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 7/5/2012 1:14:04 PM Page 2
TestAmerica, Inc. Spectrum name: 15_TunaCan2nd_20120288.An1
Page 1

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	15_2012-02-26_0425.PBC 2/26/2012 4:25:10 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 26.5953

***** 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
36.48	1231.	11.17	1.20	1.258E-02				
46.44	76440.	0.51	0.91	1.950E-02	46.54	4.250	1.366E+04	Pb210
49.65	1514.	14.37	1.25	2.160E-02				
59.44	80694.	0.48	0.94	2.732E-02	59.54	35.700	1.151E+03	AM241
87.99	43578.	0.68	0.97	3.705E-02	88.03	3.610	1.527E+04	CD109
92.63	219.	44.56	0.42	3.776E-02				
122.00	10133.	1.58	1.01	3.846E-02	122.06	85.600	3.389E+02	CO57
136.33	1390.	8.77	1.13	3.725E-02				
165.85	1699.	7.29	1.05	3.392E-02	165.85	79.900	5.192E+02	Ce139
238.39	480.	20.10	1.42	2.594E-02				
260.67	81.	57.86	0.33	2.424E-02				
279.32	56.	141.32	1.14	2.301E-02	279.17	81.500	HL>Cutoff	Hg203
352.13	110.	54.66	0.68	1.922E-02				
368.26	125.	49.84	0.46	1.856E-02				
391.56	581.	13.59	1.28	1.768E-02	391.69	64.000	9.477E+02	SN113
400.57	73.	61.58	0.54	1.736E-02				
661.57	29285.	0.71	1.46	1.155E-02	661.66	85.210	4.352E+02	CS137
754.74	100.	52.53	0.39	1.034E-02				
898.10	516.	14.74	1.96	8.921E-03	898.02	93.700	1.681E+03	Y898
904.89	86.	54.53	0.36	8.863E-03				
1000.75	82.	43.22	0.58	8.127E-03				
1096.51	181.	26.16	0.80	7.507E-03				
1173.15	26111.	0.71	1.80	7.077E-03	1173.24	99.900	6.872E+02	Co1173
1226.66	98.	36.87	0.74	6.805E-03				
1332.45	23674.	0.68	1.95	6.325E-03	1332.50	99.982	6.965E+02	Co1332
1835.96	284.	9.76	1.20	4.741E-03	1836.01	99.200	1.642E+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

145.78	36.48	5577.	1231.	9.786E+04	11.17	1.202	-	s
198.43	49.65	13746.	1514.	7.010E+04	14.37	1.248	-	sM
370.24	92.63	3274.	219.	5.791E+03	44.56	0.421	-	s

ORTEC g v - i (3263) Env32 G53W4.25 7/5/2012 1:14:04 PM Page 3
TestAmerica, Inc. Spectrum name: 15_TunaCan2nd_20120288.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
544.93	136.33	3516.	1390.	3.731E+04	8.77	1.130	- s
952.92	238.39	2518.	480.	1.849E+04	20.10	1.422	- sM
1042.01	260.67	968.	81.	3.328E+03	57.86	0.332	- sM
1407.66	352.13	1248.	110.	5.749E+03	54.66	0.679	- s
1472.16	368.26	1252.	125.	6.736E+03	49.84	0.459	- s
1601.36	400.57	843.	73.	4.224E+03	61.58	0.543	- s
3017.75	754.74	768.	100.	9.719E+03	52.53	0.393	- s
3618.39	904.89	752.	86.	9.741E+03	54.53	0.363	- s
4001.87	1000.75	476.	82.	1.015E+04	43.22	0.582	- s
4385.05	1096.51	621.	181.	2.415E+04	26.16	0.796	- s
4905.82	1226.66	215.	98.	1.445E+04	36.87	0.740	- 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	185.62	46.44	19930.	76355.	10.605	0.51	0.907
AM-241	237.58	59.44	16824.	80694.	11.208	0.48	0.935
CD-109	351.67	87.99	9695.	43578.	6.052	0.68	0.972
CO-57	487.63	122.00	4069.	10133.	1.407	1.58	1.014
Ce-139	662.95	165.85	3411.	1699.	0.236	7.29	1.054
Hg-203	1116.56	279.32	3139.	56.	0.008	141.32	1.144
SN-113	1565.32	391.56	1615.	581.	0.081	13.59	1.282
CS-137	2645.11	661.57	2071.	29285.	4.067	0.71	1.459
Y-898	3591.24	898.10	1317.	516.	0.072	14.74	1.959
Co-1173	4691.69	1173.15	1159.	26111.	3.627	0.71	1.803
Co-1332	5329.20	1332.45	323.	23674.	3.288	0.68	1.945
Y-1836	7345.58	1836.14	48.	260.	0.036	8.96	1.181s

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

ORTEC g v - i (3263) Env32 G53W4.25 7/5/2012 1:14:04 PM Page 4
TestAmerica, Inc. Spectrum name: 15_TunaCan2nd_20120288.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			
Name	Code	Activity Bq/Sample	Energy keV	Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS

Pb-210	N	1.3663E+04						8.15E+03		
			46.54	1.366E+04	(	P 1.182E+02	5.11E-01	4.25E+00	G	
AM-241		1.1510E+03						1.58E+05		
			59.54	1.151E+03	(	8.660E+00	4.81E-01	3.57E+01	G	
CD-109		1.5268E+04						4.63E+02		
			88.03	1.527E+04	(	1.617E+02	6.78E-01	3.61E+00	G	
CO-57		3.3887E+02						2.72E+02		
			122.06	3.389E+02	(	1.003E+01	1.58E+00	8.56E+01	G	
Ce-139		5.1921E+02						1.38E+02		
			165.85	5.192E+02	(	8.400E+01	7.29E+00	7.99E+01	G	
Hg-203		4.1717E-01						4.66E+01		
			279.17	4.172E-01	(	1.954E+00	1.41E+02	8.15E+01	G	
SN-113		9.4771E+02						1.15E+02		
			391.69	9.477E+02	(	3.099E+02	1.36E+01	6.40E+01	G	
CS-137		4.3518E+02						1.10E+04		
			661.66	4.352E+02	(	3.191E+00	7.12E-01	8.52E+01	G	
Y-898		1.6812E+03						1.07E+02		
			898.02	1.681E+03	(	5.598E+02	1.47E+01	9.37E+01	G	
Co-1173		6.8716E+02						1.93E+03		
			1173.24	6.872E+02	(	4.246E+00	7.12E-01	9.99E+01	G	
Co-1332		6.9646E+02						1.93E+03		
			1332.50	6.965E+02	(	2.544E+00	6.82E-01	1.00E+02	G	
Y-1836		1.5036E+03						1.07E+02		
			1836.01	1.504E+03	(	2.033E+02	8.96E+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.

@ - 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

Peak Codes:
G - Gamma Ray

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
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
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		Activity Bq/Sample	Time of Count Activity Bq/Sample	Time Corrected Uncertainty Counting	1 Sigma	MDA Bq/Sample
Pb-210		1.2751E+04	1.3663E+04	5.115E-01%		1.18E+02
AM-241		1.1469E+03	1.1510E+03	4.812E-01%		8.66E+00
CD-109		4.5239E+03	1.5268E+04	6.776E-01%		1.62E+02
CO-57		4.2749E+01	3.3887E+02	1.583E+00%		1.00E+01
Ce-139		8.7071E+00	5.1921E+02	7.291E+00%		8.40E+01
Hg-203	A	4.1717E-01	>12 Halflives	1.4132E+02%	1.9540E+00	
SN-113		7.1340E+00	9.4771E+02	1.359E+01%		3.10E+02
CS-137		4.1344E+02	4.3518E+02	7.117E-01%		3.19E+00
Y-898		8.5738E+00	1.6812E+03	1.474E+01%		5.60E+02
Co-1173		5.1301E+02	6.8716E+02	7.125E-01%		4.25E+00
Co-1332		5.1995E+02	6.9646E+02	6.817E-01%		2.54E+00
Y-1836		7.6681E+00	1.5036E+03	8.962E+00%		2.03E+02

< - 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 (37.5 to 1999.6 keV) 1.994E+04 Bq/Sample
Total Decayed Activity (37.5 to 1999.6 keV) 3.6891324E+04 Bq/Sample

2nd Source Verification

Detector: Ge17

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	1140.2	97.9
Cs-137	1926	396	0.851	465	440.98	94.8
Co-60	3611	742	0.99974	742	682.05	91.9
Co-60	3612	742	0.999856	742	689.63	92.9

Reviewed By: Megan McAfee

Date: 4/13/2012

ORTEC g v - i (3263) Env32 G53W4.25 7/6/2012 9:25:36 AM Page 1
TestAmerica, Inc. Spectrum name: 17_Tuna2nd_20120265.An1

Sample description
17_Tuna2nd_81427_032612

Spectrum Filename: C:\User\SPC\Det17\17_Tuna2nd_20120265.An1

Acquisition information
Start time: 3/26/2012 9:29:21 AM
Live time: 3600
Real time: 3637
Dead time: 1.02 %
Detector ID: 17

Detector system
Ge17 SN/11080671

Calibration
Filename: 17_Soil_TunaCan.Clb
17_TunaCan_90099_032612

Energy Calibration
Created: 4/12/2012 9:28:30 AM
Zero offset: 0.118 keV
Gain: 0.250 keV/channel
Quadratic: -2.376E-08 keV/channel^2

Efficiency Calibration
Created: 4/12/2012 9:28:42 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.91 %
Log(Eff): -5.264190E-01 + (-4.024164E-01*Log(E)) +
(-2.604461E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.00 %
Log(Eff): -2.343889E+01 + (8.582715E+00*Log(E)) +
(-9.075430E-01*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 (37.63keV)
Stop channel: 8000 (1999.21keV)
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 9:25:36 AM Page 2
TestAmerica, Inc. Spectrum name: 17_Tuna2nd_20120265.An1
Page 1

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	17_2012-02-26_0520.PBC 2/26/2012 5:20:29 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 11 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0590

***** 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
36.64	681.	13.12	0.69	1.356E-02				
40.87	116.	86.09	0.16	1.677E-02				
46.62	41004.	0.69	0.76	2.106E-02	46.54	4.250	1.365E+04	Pb210
49.59	775.	17.97	0.63	2.318E-02				
59.61	43179.	0.65	0.77	2.961E-02	59.54	35.700	1.140E+03	AM241
77.20	214.	40.60	1.02	3.765E-02				
88.08	23344.	0.86	0.81	4.060E-02	88.03	3.610	1.500E+04	CD109
121.99	5536.	2.31	0.89	4.276E-02	122.06	85.600	3.357E+02	CO57
136.39	771.	11.84	0.71	4.164E-02				
162.22	87.	50.79	0.72	3.820E-02				
165.73	964.	7.35	1.09	3.765E-02	165.85	79.900	5.310E+02	Ce139
216.43	116.	39.82	0.95	3.196E-02				
217.94	83.	57.15	0.95	3.181E-02				
238.21	247.	27.84	0.94	2.992E-02				
265.99	94.	61.67	0.61	2.773E-02				
301.12	44.	67.34	0.41	2.544E-02				
340.53	91.	61.26	0.55	2.333E-02				
351.73	148.	32.96	0.62	2.280E-02				
391.54	336.	18.56	0.91	2.113E-02	391.69	64.000	9.356E+02	SN113
464.58	72.	65.99	1.18	1.868E-02				
466.04	44.	93.25	1.18	1.864E-02				
582.96	167.	29.62	0.45	1.584E-02				
661.66	18538.	0.82	1.37	1.443E-02	661.66	85.210	4.410E+02	CS137
738.88	57.	57.41	0.44	1.329E-02				
833.91	110.	41.26	0.51	1.214E-02				
856.69	111.	46.51	0.75	1.189E-02				
898.10	352.	17.10	1.23	1.148E-02	898.02	93.700	1.818E+03	Y898
1026.09	89.	47.19	0.52	1.037E-02				
1173.27	17119.	0.83	1.74	9.359E-03	1173.24	99.900	6.820E+02	Co1173
1332.53	15698.	0.82	1.79	8.481E-03	1332.50	99.982	6.896E+02	Co1332
1835.81	220.	7.55	1.96	6.593E-03	1836.01	99.200	1.873E+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 keV	Suspected Nuclide
146.04	36.64	2578.	681.	5.025E+04	13.12	0.695	-
162.95	40.87	4224.	116.	6.916E+03	86.09	0.161	- c
197.82	49.59	6204.	775.	3.343E+04	17.97	0.635	- sM
308.25	77.20	2934.	214.	5.685E+03	40.60	1.020	- s

ORTEC g v - i (3263) Env32 G53W4.25 7/6/2012 9:25:36 AM Page 3
TestAmerica, Inc. Spectrum name: 17_Tuna2nd_20120265.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
544.96	136.39	1975.	771.	1.852E+04	11.84	0.713	-
648.26	162.22	793.	87.	2.269E+03	50.79	0.719	- s
865.04	216.40	1003.	116.	3.620E+03	39.82	0.953	- D
871.09	217.91	1078.	83.	2.603E+03	57.15	0.955	- D
952.16	238.21	1349.	247.	8.265E+03	27.84	0.937	- s
1063.26	265.99	1020.	94.	3.372E+03	61.67	0.615	- s
1203.77	301.12	417.	44.	1.730E+03	67.34	0.412	- sc
1361.41	340.53	898.	91.	3.887E+03	61.26	0.553	- s
1406.20	351.73	744.	148.	6.491E+03	32.96	0.618	- s
1857.60	464.69	1086.	72.	3.842E+03	65.99	1.178	- sc
1863.46	466.15	839.	44.	2.387E+03	93.25	1.179	- sc
2331.15	582.96	570.	167.	1.054E+04	29.62	0.448	- s
2954.96	738.88	338.	57.	4.289E+03	57.41	0.442	- s
3335.20	833.91	507.	110.	9.049E+03	41.26	0.506	- s
3426.35	856.69	611.	111.	9.318E+03	46.51	0.755	- s
4104.24	1026.09	453.	89.	8.549E+03	47.19	0.517	- 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	185.95	46.62	10512.	40927.	11.369	0.69	0.761
AM-241	237.89	59.61	9192.	43179.	11.994	0.65	0.771
CD-109	351.75	88.08	4394.	23344.	6.484	0.86	0.812
CO-57	487.38	121.99	2606.	5536.	1.538	2.31	0.891
Ce-139	662.30	165.73	1283.	964.	0.268	7.35	1.085
Hg-203	1119.82	280.13	1632.	-52.	-0.015	109.81	1.012s
SN-113	1565.42	391.54	971.	336.	0.093	18.56	0.910s
CS-137	2646.04	661.66	840.	18538.	5.149	0.82	1.373
Y-898	3592.05	898.10	753.	352.	0.098	17.10	1.228
Co-1173	4693.24	1173.27	496.	17119.	4.755	0.83	1.743
Co-1332	5330.69	1332.53	136.	15698.	4.361	0.82	1.789
Y-1836	7345.64	1835.81	10.	220.	0.061	7.55	1.956s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample		COMMENTS
Pb-210	N	1.365OE+04				8.15E+03		
			46.54	1.365E+04	(P	1.603E+02	6.87E-01 4.25E+00	G
AM-241		1.1402E+03				1.58E+05		
			59.54	1.140E+03	(	1.187E+01	6.55E-01 3.57E+01	G
CD-109		1.5004E+04				4.63E+02		
			88.03	1.500E+04	(	2.003E+02	8.59E-01 3.61E+00	G
CO-57		3.3573E+02				2.72E+02		
			122.06	3.357E+02	(	1.459E+01	2.31E+00 8.56E+01	G
Ce-139		5.3096E+02				1.38E+02		
			165.85	5.310E+02	(	9.338E+01	7.35E+00 7.99E+01	G
Hg-203		-6.6653E-01				4.66E+01		
			279.17	-6.665E-01	?(	2.427E+00	1.10E+02 8.15E+01	G
SN-113		9.3563E+02				1.15E+02		
			391.69	9.356E+02	@(	4.114E+02	1.86E+01 6.40E+01	G
CS-137		4.4098E+02				1.10E+04		
			661.66	4.410E+02	(	3.277E+00	8.23E-01 8.52E+01	G
Y-898		1.8177E+03				1.07E+02		
			898.02	1.818E+03	(	6.751E+02	1.71E+01 9.37E+01	G
Co-1173		6.8205E+02				1.93E+03		
			1173.24	6.820E+02	(	4.243E+00	8.31E-01 9.99E+01	G
Co-1332		6.8963E+02				1.93E+03		
			1332.50	6.896E+02	(	2.503E+00	8.22E-01 1.00E+02	G
Y-1836		1.8728E+03				1.07E+02		
			1836.01	1.873E+03	(	1.462E+02	7.55E+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.

@ - 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	280.13	1632.	-52.	-0.015	109.81	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 1 Sigma Counting		MDA Bq/Sample
Pb-210	1.2735E+04	1.3650E+04	6.879E-01%		1.60E+02
AM-241	1.1361E+03	1.1402E+03	6.548E-01%		1.19E+01
CD-109	4.4248E+03	1.5004E+04	8.588E-01%		2.00E+02
CO-57	4.2016E+01	3.3573E+02	2.313E+00%		1.46E+01
Ce-139	8.7645E+00	5.3096E+02	7.352E+00%		9.34E+01
Hg-203 #A	-6.6653E-01	>12 Halflives	1.0981E+02%	2.4271E+00	
SN-113 #	6.9111E+00	9.3563E+02	1.856E+01%		4.11E+02
CS-137	4.1887E+02	4.4098E+02	8.234E-01%		3.28E+00
Y-898	9.0827E+00	1.8177E+03	1.710E+01%		6.75E+02
Co-1173	5.0861E+02	6.8205E+02	8.315E-01%		4.24E+00
Co-1332	5.1427E+02	6.8963E+02	8.225E-01%		2.50E+00
Y-1836 #	9.3579E+00	1.8728E+03	7.550E+00%		1.46E+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

17_Tuna2nd_20120265

---------- S U M M A R Y ----------

Total Activity (582.9 to 1999.2 keV)   1.981E+04 Bq/Sample
Total Decayed Activity (582.9 to 1999.2 keV) 3.7099195E+04 Bq/Sample

Second Source Verification

Detecter: Ge 18

Geometry: 1L Marn

Reference date 1/1/2010

Calibration Standard: 81592-334

Standard volume g / vial 1

Standard volume transferred in g / geometry 1

lab ID# of cal standard Rad 10-0030

Isotope	Certified Activity gammas/sec	Geometry Activity gammas/sec	Abundance*	Activity Bq/L	Count Results	%recovery
Am-241	1929	1929	0.359	**5373.3**	5347.2	99.5
Cs-137	1826	1826	0.851	**2145.7**	2103.2	98.0
Co-60	3424	3424	0.99974	**3424.9**	3258.8	95.2
Co-60	3426	3426	0.99986	**3426.5**	3296.2	96.2

Reviewed By: Michaela Korrinhizer

Date: 12/9/2011

Test America Spectrum name: 18_1Lmarn2nd_20111560.An1

Sample description
18_1Lmarn2nd_rad10_120911

Spectrum Filename: C:\User\SPC\Det18\18_1Lmarn2nd_20111560.An1

Acquisition information
Start time:	12/9/2011 12:09:00 PM
Live time:	7200
Real time:	7623
Dead time:	5.55 %
Detector ID:	18

Detector system
Ge18 SN/11164036

Calibration
Filename: 18_1LMarinelli.Clb
18_1Lmarn_83924-334_120711

Energy Calibration
Created:	6/23/2011 2:01:18 PM
Zero offset:	-0.041 keV
Gain:	0.250 keV/channel
Quadratic:	-3.236E-08 keV/channel^2

Efficiency Calibration
Created:	12/8/2011 10:14:04 AM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 2.55 %
Log(Eff):	-1.645931E+00 + (3.227669E-02*Log(E)) + (-6.187585E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.90 %
Log(Eff):	-1.318185E+01 + (4.538566E+00*Log(E)) + (-5.017483E-01*Log(E)^2)

Library Files
Main analysis library:	DET_EnergyStandardMix & Mn, Zn.l
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters
Analysis engine:	Env32 G53W4.25
Start channel:	150 (37.49keV)
Stop channel:	8000 (1999.48keV)
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

Test America Spectrum name: 18_1Lmarn2nd_20111560.An1

Random error:	1.0000000E+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	18_2011-11-25_1217.PBC 11/25/2011 12:17:57 PM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 12 cutoff: 5.00E+01%

Energy Calibration

Normalized diff: 0.0419

***** 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
36.47	2471.	13.33	0.78	3.512E-02				
42.98	689.	51.74	0.22	4.037E-02				
49.62	26270.	2.92	1.78	4.459E-02				
59.50	672785.	0.17	0.96	4.909E-02	59.54	35.700	5.347E+03	AM241
88.00	352095.	0.23	0.97	5.396E-02	88.03	3.610	7.242E+04	CD109
115.50	158.	90.55	0.50	5.264E-02				
122.07	86542.	0.58	1.03	5.191E-02	122.06	85.600	1.642E+03	CO57
136.52	10521.	3.05	1.07	4.998E-02				
165.91	18601.	1.94	1.11	4.516E-02	165.85	79.900	2.519E+03	Ce139
172.02	253.	77.50	0.42	4.419E-02				
187.30	365.	64.85	0.54	4.195E-02				
229.65	548.	32.44	0.85	3.691E-02				
270.35	138.	82.55	0.39	3.319E-02				
281.66	64.	286.79	1.19	3.249E-02	279.17	81.500	HL>Cutoff	Hg203
391.64	7813.	3.58	1.37	2.576E-02	391.69	64.000	4.652E+03	SN113
511.05	2722.	10.06	2.30	2.125E-02				
518.72	52.	164.67	0.43	2.102E-02				
648.97	156.	86.22	0.54	1.775E-02				
661.72	215786.	0.27	1.50	1.749E-02	661.66	85.210	2.103E+03	CS137
732.78	108.	72.27	0.48	1.615E-02				
750.28	485.	45.36	0.29	1.585E-02				
790.10	158.	69.06	1.65	1.522E-02				
795.66	261.	51.74	1.65	1.514E-02				
815.61	111.	73.71	0.41	1.484E-02				
834.93	67637.	0.62	1.60	1.457E-02	834.85	99.980	3.098E+03	Mn54
869.66	308.	49.02	0.32	1.410E-02				
898.19	6530.	3.91	1.68	1.373E-02	898.02	93.700	6.993E+03	Y898
906.05	282.	49.24	0.32	1.364E-02				

941.41	610.	35.08	0.35	1.322E-02				
962.20	354.	58.25	0.45	1.299E-02				
1115.60	24756.	1.53	1.85	1.149E-02	1115.55	50.600	4.396E+03	Zn65
1129.90	232.	50.18	0.34	1.137E-02				
1142.59	109.	50.29	0.41	1.126E-02				
1166.81	691.	17.22	1.94	1.107E-02				
1173.43	195575.	0.24	1.94	1.101E-02	1173.24	99.900	3.184E+03	Co1173
1242.14	105.	67.99	0.49	1.050E-02				
1270.92	61.	53.36	0.54	1.029E-02				
1305.62	31.	86.01	0.37	1.006E-02				
1318.50	46.	71.02	0.54	9.975E-03				
1332.60	181838.	0.25	1.96	9.884E-03	1332.50	99.982	3.296E+03	Co1332
1343.88	102.	66.80	0.27	9.813E-03				
1405.08	76.	48.56	0.63	9.444E-03				
1502.39	79.	45.32	0.54	8.910E-03				
1836.03	4054.	2.42	2.42	7.460E-03	1836.01	99.200	7.550E+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 keV	Suspected Nuclide	
145.93	36.47	37413.	2471.	7.036E+04	13.33	0.781	-	s
171.97	42.98	50556.	689.	1.707E+04	51.74	0.219	-	s

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected
198.49	49.62	161060.	26270.	5.892E+05	2.92	1.776 -	s
461.81	115.50	10156.	158.	3.001E+03	90.55	0.500 -	sc
545.84	136.52	24055.	10521.	2.105E+05	3.05	1.074 -	
687.74	172.02	13499.	253.	5.730E+03	77.50	0.415 -	c
748.82	187.30	17611.	365.	8.709E+03	64.85	0.540 -	s
918.13	229.65	12446.	548.	1.486E+04	32.44	0.848 -	s
1080.87	270.35	6419.	138.	4.158E+03	82.55	0.387 -	sc
2043.28	511.05	14950.	2722.	1.281E+05	10.06	2.299 -	s
2073.97	518.72	3640.	52.	2.474E+03	164.67	0.427 -	sc
2594.87	648.97	5978.	156.	8.789E+03	86.22	0.545 -	sc
2930.07	732.78	2771.	108.	6.697E+03	72.27	0.483 -	sc
3000.06	750.28	9584.	485.	3.059E+04	45.36	0.292 -	s
3159.15	790.05	3241.	132.	8.651E+03	66.62	0.882 -	sc
3181.41	795.62	7044.	352.	2.328E+04	46.94	0.827 -	s
3261.39	815.61	3038.	111.	7.480E+03	73.71	0.415 -	sc
3477.62	869.66	6760.	308.	2.187E+04	49.02	0.325 -	s
3623.20	906.05	6334.	282.	2.068E+04	49.24	0.318 -	s
3764.64	941.41	10858.	610.	4.618E+04	35.08	0.353 -	s
3847.84	962.20	10140.	354.	2.729E+04	58.25	0.451 -	s
4518.81	1129.90	3822.	232.	2.045E+04	50.18	0.341 -	s
4569.61	1142.59	1448.	109.	9.678E+03	50.29	0.405 -	s
4666.52	1166.68	6726.	691.	5.723E+02	17.22	1.939 -	lD
4967.97	1242.14	1248.	105.	1.000E+04	67.99	0.492 -	s
5083.16	1270.92	428.	61.	5.926E+03	53.36	0.535 -	s
5222.01	1305.62	340.	31.	3.082E+03	86.01	0.369 -	sc
5273.57	1318.50	464.	46.	4.578E+03	71.02	0.537 -	sc
5375.15	1343.88	888.	102.	1.045E+04	66.80	0.273 -	s
5620.10	1405.08	362.	76.	7.995E+03	48.56	0.626 -	s
6009.62	1502.39	328.	79.	8.867E+03	45.32	0.538 -	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: DET_EnergyStandardMix & Mn, Zn.l

********** 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	237.99	59.50	143333.	672785.	93.442	0.17	0.964
CD-109	351.90	88.00	68534.	352095.	48.902	0.23	0.974
CO-57	488.07	122.07	35677.	86542.	12.020	0.58	1.029
Ce-139	663.35	165.91	25840.	18601.	2.583	1.94	1.107
Hg-203	1126.08	281.66	16892.	64.	0.009	286.79	1.186
SN-113	1565.81	391.64	16283.	7813.	1.085	3.58	1.368

Test America Spectrum name: 18_1Lmarn2nd_20111560.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
CS-137	2645.83	661.72	18918.	215786.	29.970	0.27	1.498
Mn-54	3338.67	834.93	16218.	67637.	9.394	0.62	1.603
Y-898	3591.76	898.19	12144.	6530.	0.907	3.91	1.683
Zn-65	4461.60	1115.60	14840.	24756.	3.438	1.53	1.848
Co-1173	4692.49	1173.30	9533.	200159.	27.800	0.26	1.861
Co-1332	5330.00	1332.60	4053.	181838.	25.255	0.25	1.962
Y-1836	7345.43	1836.03	627.	4054.	0.563	2.42	2.416s

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	Peak Energy keV	Peak Activity Bq/Sample	Code	MDA Value Bq/Sample	COMMENTS
AM-241		5.3472E+03				1.58E+05	
			59.54	5.347E+03	(	1.404E+01 1.69E-01 3.57E+01	G
CD-109		7.2415E+04				4.63E+02	
			88.03	7.242E+04	(	2.515E+02 2.33E-01 3.61E+00	G
CO-57		1.6416E+03				2.72E+02	
			122.06	1.642E+03	(	1.675E+01 5.81E-01 8.56E+01	G
Ce-139		2.5188E+03				1.38E+02	
			165.85	2.519E+03	(	1.018E+02 1.94E+00 7.99E+01	G
Hg-203		3.3644E-01				4.66E+01	
			279.17	3.364E-01	(	3.191E+00 2.87E+02 8.15E+01	G
SN-113		4.6524E+03				1.15E+02	
			391.69	4.652E+03	(	3.557E+02 3.58E+00 6.40E+01	G
CS-137		2.1032E+03				1.10E+04	
			661.66	2.103E+03	(	6.274E+00 2.73E-01 8.52E+01	G
Mn-54		3.0983E+03				3.12E+02	
			834.85	3.098E+03	(	2.731E+01 6.20E-01 1.00E+02	G
Y-898		6.9925E+03				1.07E+02	
			898.02	6.993E+03	(	5.528E+02 3.91E+00 9.37E+01	G
Zn-65	F	4.3962E+03				2.44E+02	
			1115.55	4.396E+03	(	1.013E+02 1.53E+00 5.06E+01	G

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Co-1173	3.2588E+03					1.93E+03	
		1173.24	3.259E+03	(	7.452E+00	2.61E-01	9.99E+01 G
Co-1332	3.2962E+03					1.93E+03	
		1332.50	3.296E+03	(	5.427E+00	2.55E-01	1.00E+02 G
Y-1836	7.5502E+03					1.07E+02	
		1836.01	7.550E+03	@(	2.223E+02	2.42E+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.
@ - 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	281.66	16892.	64.	0.009	286.79	0.000E+00

P - Peakbackground subtraction

Test America Spectrum name: 18_1Lmarn2nd_20111560.An1

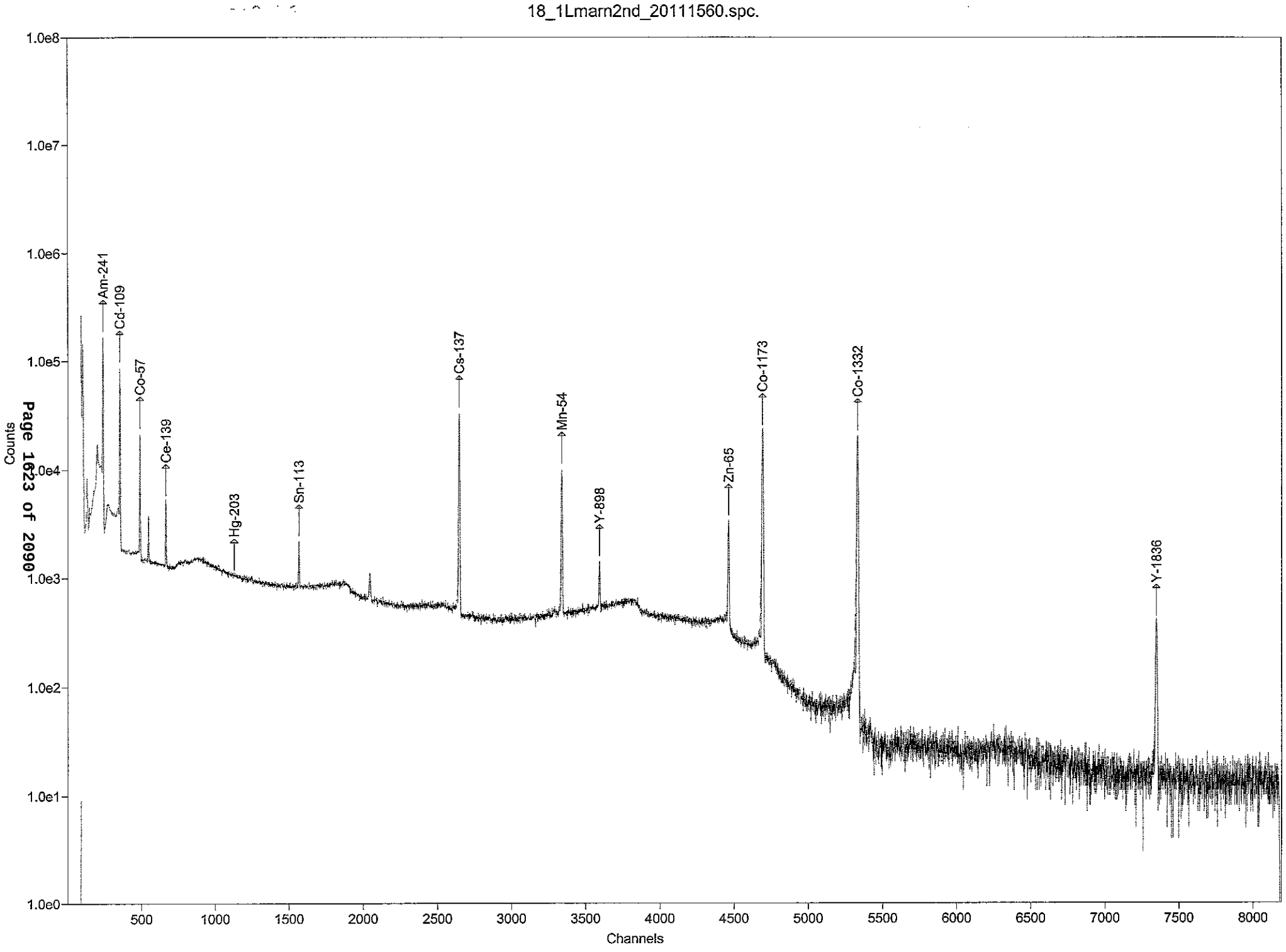
***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count Activity Bq/Sample	Time Corrected Activity Bq/Sample	Uncertainty 1 Sigma Counting		MDA Bq/Sample
AM-241	5.3307E+03	5.3472E+03	1.691E-01%		1.40E+01
CD-109	2.5103E+04	7.2415E+04	2.328E-01%		2.51E+02
CO-57	2.7051E+02	1.6416E+03	5.812E-01%		1.67E+01
Ce-139	7.1585E+01	2.5188E+03	1.943E+00%		1.02E+02
Hg-203 #A	3.3644E-01	>12 Halflives	2.8679E+02%	3.1906E+00	
SN-113	6.5814E+01	4.6524E+03	3.583E+00%		3.56E+02
CS-137	2.0114E+03	2.1032E+03	2.735E-01%		6.27E+00
Mn-54	6.4505E+02	3.0983E+03	6.198E-01%		2.73E+01
Y-898	7.0467E+01	6.9925E+03	3.911E+00%		5.53E+02
Zn-65	5.9134E+02	4.3962E+03	1.530E+00%		1.01E+02
Co-1173	2.5264E+03	3.2588E+03	2.612E-01%		7.45E+00
Co-1332	2.5554E+03	3.2962E+03	2.546E-01%		5.43E+00
Y-1836 #	7.6087E+01	7.5502E+03	2.415E+00%		2.22E+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 (37.5 to 1999.5 keV) 3.932E+04 Bq/Sample
Total Decayed Activity (37.5 to 1999.5 keV) 1.1727047E+05 Bq/Sample


18_1Lmarn2nd_20111560.spc.
Counts
Channels
Am-241
Cd-109
Co-57
Ce-139
Hg-203
Sn-113
Cs-137
Mn-54
Y-898
Zn-65
Co-1173
Co-1332
Y-1836

Annual Calibration Verifications

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector # 4**
SpectrumID: 4_20130227011_EffVerif
Analysis Description: ACVTop-91774;Tuna Can 2006
Calibration: 4_Soil_TunaCan_90099_033012
Detector: Ge 4 SN/181

Verification Date: 2013-02-27 16:17
Source Assay Date/Time: 2006-10-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	449	4.48E+02	0.3%
Cs-137	661.66	400	3.83E+02	4.3%
Co-1332	1332.5	777	7.45E+02	4.1%

Comments:

Perform ____KM 2/27/13_____ Reviev ___RM 2/27/13_____

C:\User\CRpt\4_20130227011_EffVerif.xls

Sample Description: ACVTop-91774;Tuna Can 2006
Detector: Ge 4 SN/181
Source Date: 10/1/2006 11:00
Acquired: 2/27/2013 16:17:24
Analyzed: 3/4/2013 09:45

Analyst: Jody Watson

Efficiency: 4_Soil_TunaCan_90099_033012
Library: DET_EfficiencyVerification.lib

Nuclide	Activity uCi/Source	Uncertainty %
AM-241	4.478E+02	0.56
CS-137	3.829E+02	0.86
Co-1332	7.452E+02	1.09
Total	1.576E+03	

TestAmerica Spectrum name: 4_20130227011_EffVerif.An1

Sample description
ACVTop-91774;Tuna Can 2006

Spectrum Filename: C:\User\SPC\Det4\4_20130227011_EffVerif.An1

Acquisition information
Start time: 2/27/2013 4:17:24 PM
Live time: 7200
Real time: 7253
Dead time: 0.72 %
Detector ID: 4

Detector system
Ge 4 SN/181

Calibration
Filename: 4_Soil_TunaCan.Clb
4_Soil_TunaCan_90099_033012

Energy Calibration
Created: 2/28/2012 2:55:17 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.917E-08 keV/channel^2

Efficiency Calibration
Created: 4/2/2012 1:19:41 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.78 %
Log(Eff): -3.983609E-01 + (-5.746278E-01*Log(E)) + (-2.046438E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.80 %
Log(Eff): -2.546791E+01 + (9.285295E+00*Log(E)) + (-9.904428E-01*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 (37.61keV)
Stop channel: 8000 (1999.44keV)
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: 0.1108

***** 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
46.55	47124.	0.63	0.76	1.208E-02				
59.59	54866.	0.56	0.76	1.721E-02	59.54	100.000	4.478E+02	AM241
88.12	3315.	2.53	0.84	2.354E-02				
661.43	16127.	0.86	1.34	6.783E-03	661.66	100.000	3.829E+02	CS137
1173.07	9616.	1.14	1.61	4.163E-03				
1332.31	8608.	1.09	1.83	3.728E-03	1332.50	100.000	7.452E+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	
185.74	46.55	11672.	47124.	3.900E+06	0.63	0.759	-	
351.92	88.08	1814.	3335.	1.417E+05	2.50	0.839	-	D
4691.64	1173.07	330.	9616.	2.310E+06	1.14	1.611	-	

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	237.85	59.59	10017.	54866.	7.620	0.56	0.763
CS-137	2644.55	661.43	602.	16127.	2.240	0.86	1.344
Co-1332	5328.94	1332.31	36.	8608.	1.196	1.09	1.834

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 uCi/Source	Peak Energy keV	Peak Activity uCi/Source	Code	MDA Value uCi/Source		COMMENTS
AM-241		4.4779E+02				1.58E+05		
			59.54	4.478E+02	(	3.829E+00	5.62E-01	1.00E+02 G
CS-137		3.8291E+02				1.10E+04		
			661.66	3.829E+02	(	2.780E+00	8.62E-01	1.00E+02 G
Co-1332		7.4516E+02				1.93E+03		
			1332.50	7.452E+02	(	2.655E+00	1.09E+00	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
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 uCi/Source	Time Corrected Activity uCi/Source	Uncertainty 1 Sigma Counting	MDA
AM-241	4.4322E+02	4.4779E+02	5.616E-01%	3.83E+00
CS-137	3.3031E+02	3.8291E+02	8.623E-01%	2.78E+00
Co-1332	3.2075E+02	7.4516E+02	1.093E+00%	2.65E+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 (92.9 to 1999.4 keV) 1.094E+03 uCi/Source
Total Decayed Activity (92.9 to 1999.4 keV) 1.5758633E+03 uCi/Source

TestAmerica
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ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector # 5**
SpectrumID: 5_20140128003_EffVerif
Analysis Description: ACVTop-259586;TunaCan2006
Calibration: 5_Soil_TunaCan_90099_032612
Detector: Ge 5 SN/157

Verification Date: 2014-01-28 09:57
Source Assay Date/Time: 2006-10-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	449	4.49E+02	0.1%
Cs-137	661.66	400	3.94E+02	1.5%
Co-1332	1332.5	777	7.64E+02	1.7%

Comments:

Perform Justin D Lockhart Reviev 1/28/2014

C:\User\CRpt\5_20140128003_EffVerif.xls

Sample Description: ACVTop-259586;TunaCan2006
Detector: Ge 5 SN/157
Source Date: 10/1/2006 11:00
Acquired: 1/28/2014 09:57:52
Analyzed: 1/28/2014 11:58

Analyst: JustinL

Efficiency: 5_Soil_TunaCan_90099_032612
Library: DET_EfficiencyVerification.lib

Nuclide	Activity GPS/Source	Uncertainty %
AM-241	4.487E+02	0.46
CS-137	3.938E+02	0.71
Co-1332	7.635E+02	0.96
Total	1.606E+03	

TestAmerica Spectrum name: 5_20140128003_EffVerif.An1

Sample description
ACVTop-259586;TunaCan2006

Spectrum Filename: C:\User\SPC\Det5\5_20140128003_EffVerif.An1

Acquisition information
Start time: 1/28/2014 9:57:52 AM
Live time: 7200
Real time: 7241
Dead time: 0.57 %
Detector ID: 5

Detector system
Ge 5 SN/157

Calibration
Filename: 5_Soil_TunaCan.Clb
5_Soil_TunaCan_90099_032612

Energy Calibration
Created: 2/28/2012 7:35:48 PM
Zero offset: 0.158 keV
Gain: 0.250 keV/channel
Quadratic: 3.911E-08 keV/channel^2

Efficiency Calibration
Created: 3/27/2012 5:20:37 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.87 %
Log(Eff): 6.466115E-01 + (-7.830454E-01*Log(E)) +
(-4.117504E-03*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.43 %
Log(Eff): -2.462251E+01 + (9.075211E+00*Log(E)) +
(-9.664422E-01*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 (37.62keV)
Stop channel: 8000 (2000.81keV)
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:       0.1051

*****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
 Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
 Energy                             Factor    Energy   Ratio    GPS/Sour
_____________________________________________________________________________
   36.67     1204.   9.66   0.79  1.141E-02
   46.62    65354.   0.55   0.72  1.793E-02
   59.58    80895.   0.46   0.74  2.535E-02    59.54 100.000  4.487E+02 AM241
   87.90     2852.   4.19   0.80  3.459E-02
  661.53    23767.   0.71   1.33  9.926E-03   661.66 100.000  3.938E+02 CS137
 1172.91    12920.   0.96   1.68  6.139E-03
 1332.18    11567.   0.96   1.84  5.515E-03  1332.50 100.000  7.635E+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 Centroid  Background Net Area  Efficiency  Uncert   FWHM  Suspected
Channel   Energy   Counts     Counts   * Area    1 Sigma %  keV   Nuclide
_____________________________________________________________________________
  146.17    36.67      4104.      1204. 1.055E+05    9.66   0.791  -      s
  186.01    46.62     17227.     65354. 3.644E+06    0.55   0.723  -
  351.27    87.90      3262.      2852. 8.245E+04    4.19   0.801  -
 4691.90  1172.91       391.     12920. 2.104E+06    0.96   1.683  -

  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	237.90	59.58	14402.	80895.	11.235	0.46	0.736
CS-137	2646.84	661.53	875.	23767.	3.301	0.71	1.325
Co-1332	5328.59	1332.18	84.	11567.	1.607	0.96	1.844

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 GPS/Source	Peak Energy keV	Peak Activity GPS/Source	Code	MDA Value GPS/Source	COMMENTS
AM-241		4.4871E+02				1.58E+05	
			59.54	4.487E+02	(	3.117E+00 4.64E-01 1.00E+02 G	
CS-137		3.9381E+02				1.10E+04	
			661.66	3.938E+02	(	2.329E+00 7.15E-01 1.00E+02 G	
Co-1332		7.6351E+02				1.93E+03	
			1332.50	7.635E+02	(	2.998E+00 9.56E-01 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
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 GPS/Source	Time Corrected Activity GPS/Source	Uncertainty 1 Sigma Counting	MDA
AM-241	4.4348E+02	4.4871E+02	4.640E-01%	3.12E+00
CS-137	3.3261E+02	3.9381E+02	7.149E-01%	2.33E+00
Co-1332	2.9133E+02	7.6351E+02	9.564E-01%	3.00E+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 2000.8 keV) 1.067E+03 GPS/Source
Total Decayed Activity (37.6 to 2000.8 keV) 1.6060363E+03 GPS/Source

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector # 7**
SpectrumID: 7_20140127010_EffVerif
Analysis Description: ACVWrap-255911;1LMarn2011
Calibration: 7_1Lmarn_90062_032612
Detector: Ge 7 SN/154

Verification Date: 2014-01-27 15:16
Source Assay Date/Time: 2011-01-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	1830	1.78E+03	2.6%
Cs-137	661.66	1705	1.68E+03	1.7%
Co-1332	1332.5	3294	3.26E+03	1.2%

Comments:

Perform Jody Watson Reviev 1/28/2014

C:\User\CRpt\7_20140127010_EffVerif.xls

Test America St. Louis Spectrum ID: 7_20140127010_EffVerif

Sample Description: ACVWrap-255911;1LMarn2011
Detector: Ge 7 SN/154
Source Date: 1/1/2011 11:00
Acquired: 1/27/2014 15:16:52
Analyzed: 1/27/2014 17:22

Analyst: JustinL

Efficiency: 7_1Lmarn_90062_032612
Library: DET_EfficiencyVerification.lib

Nuclide	Activity GPS/Source	Uncertainty %
AM-241	1.783E+03	0.19
CS-137	1.676E+03	0.31
Co-1332	3.255E+03	0.33
Total	6.714E+03	

TestAmerica Spectrum name: 7_20140127010_EffVerif.An1

Sample description
ACVWrap-255911;1LMarn2011

Spectrum Filename: C:\User\SPC\Det7\7_20140127010_EffVerif.An1

Acquisition information
Start time: 1/27/2014 3:16:52 PM
Live time: 7200
Real time: 7497
Dead time: 3.96 %
Detector ID: 7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Liquid_Marinelli 1L.Clb
7_1Lmarn_90062_032612

Energy Calibration
Created: 2/23/2012 8:40:56 AM
Zero offset: 0.117 keV
Gain: 0.250 keV/channel
Quadratic: 3.508E-09 keV/channel^2

Efficiency Calibration
Created: 3/28/2012 9:18:24 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.42 %
Log(Eff): -7.054602E-01 + (-2.848254E-01*Log(E)) + (-4.423998E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.43 %
Log(Eff): -1.484435E+01 + (5.183775E+00*Log(E)) + (-5.730519E-01*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 (37.61keV)
Stop channel: 8000 (2000.12keV)
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	1/1/2011 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: 0.0341

***** 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. GPS/Sour	Nuc
36.47	2984.	9.01	0.84	2.696E-02				
49.52	17484.	3.50	1.54	3.536E-02				
59.51	505009.	0.19	0.87	3.953E-02	59.54	100.000	1.783E+03	AM241
87.96	149842.	0.37	0.94	4.404E-02				
122.00	24722.	1.42	1.00	4.215E-02				
136.34	2875.	7.64	0.91	4.038E-02				
661.63	135072.	0.31	1.48	1.202E-02	661.66	100.000	1.676E+03	CS137
834.82	17602.	1.34	1.65	9.817E-03				
1115.54	7865.	2.99	1.78	7.578E-03				
1173.18	110828.	0.35	1.91	7.239E-03				
1332.42	100812.	0.33	1.99	6.443E-03	1332.50	100.000	3.255E+03	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 Centroid Channel	Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
145.42	36.47	24446.	2984.	1.107E+05	9.01	0.835	-	
197.63	49.52	112790.	17484.	4.944E+05	3.50	1.541	-	s
351.41	87.96	33638.	149842.	3.402E+06	0.37	0.937	-	
487.58	122.00	21840.	24722.	5.866E+05	1.42	0.997	-	s
544.94	136.34	13594.	2875.	7.120E+04	7.64	0.905	-	
3339.02	834.82	7312.	17602.	1.793E+06	1.34	1.653	-	
4461.89	1115.54	7304.	7865.	1.038E+06	2.99	1.778	-	s
4692.45	1173.18	4893.	110828.	1.531E+07	0.35	1.910	-	

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	237.58	59.51	96922.	505009.	70.140	0.19	0.873
CS-137	2646.23	661.63	7593.	135072.	18.760	0.31	1.478
Co-1332	5329.40	1332.42	1003.	100812.	14.002	0.33	1.993

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 GPS/Source	Peak Energy keV	Peak Activity GPS/Source	Code	MDA Value GPS/Source		COMMENTS
AM-241		1.7827E+03				1.58E+05		
			59.54	1.783E+03	(	5.131E+00	1.89E-01	1.00E+02 G
CS-137		1.6757E+03				1.10E+04		
			661.66	1.676E+03	(	5.071E+00	3.12E-01	1.00E+02 G
Co-1332		3.2553E+03				1.93E+03		
			1332.50	3.255E+03	(	4.852E+00	3.28E-01	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: Peak 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
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

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 GPS/Source	Time Corrected Activity GPS/Source	Uncertainty 1 Sigma Counting	MDA
AM-241	1.7739E+03	1.7827E+03	1.888E-01%	5.13E+00
CS-137	1.5612E+03	1.6757E+03	3.124E-01%	5.07E+00
Co-1332	2.1733E+03	3.2553E+03	3.285E-01%	4.85E+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 2000.1 keV) 5.508E+03 GPS/Source
Total Decayed Activity (37.6 to 2000.1 keV) 6.7136885E+03 GPS/Source

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector # 7**
SpectrumID: 7_20140128004_EffVerif
Analysis Description: ACVTOP-259586;TunaCan2006
Calibration: 7_TunaCan_90099_032712
Detector: Ge 7 SN/154

Verification Date: 2014-01-28 18:43
Source Assay Date/Time: 2006-10-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	449	4.25E+02	5.2%
Cs-137	661.66	400	3.78E+02	5.6%
Co-1332	1332.5	777	7.28E+02	6.2%

Comments:

Perform Jody Watson Reviev 1/28/2014

C:\User\CRpt\7_20140128004_EffVerif.xls

Sample Description: ACVTOP-259586;TunaCan2006
Detector: Ge 7 SN/154
Source Date: 10/1/2006 11:00
Acquired: 1/28/2014 18:43:13
Analyzed: 1/28/2014 20:45

Analyst: Jody Watson

Efficiency: 7_TunaCan_90099_032712
Library: DET_EfficiencyVerification.lib

Nuclide	Activity GPS/Source	Uncertainty %
AM-241	4.255E+02	0.39
CS-137	3.777E+02	0.59
Co-1332	7.285E+02	0.82
Total	1.532E+03	

TestAmerica Spectrum name: 7_20140128004_EffVerif.An1

Sample description
ACVTOP-259586;TunaCan2006

Spectrum Filename: C:\User\SPC\Det7\7_20140128004_EffVerif.An1

Acquisition information
Start time: 1/28/2014 6:43:13 PM
Live time: 7200
Real time: 7330
Dead time: 1.77 %
Detector ID: 7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_Soil_TunaCan.Clb
7_TunaCan_90099_032712

Energy Calibration
Created: 2/23/2012 8:40:56 AM
Zero offset: 0.117 keV
Gain: 0.250 keV/channel
Quadratic: 3.508E-09 keV/channel^2

Efficiency Calibration
Created: 3/16/2012 11:45:14 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.87 %
Log(Eff): 6.716580E-01 + (-6.166540E-01*Log(E)) +
(-2.065917E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.48 %
Log(Eff): -2.689695E+01 + (1.019544E+01*Log(E)) +
(-1.081671E+00*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 (37.61keV)
Stop channel: 8000 (2000.12keV)
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:       0.0148

*****   S U M M A R Y   O F   P E A K S   I N   R A N G E   *****
 Peak       Area   Uncert  FWHM    Corrctn   Nuclide  Brnch.     Act.   Nuc
 Energy                             Factor    Energy   Ratio    GPS/Sour
_____________________________________________________________________________
   36.68     1330.   9.67   1.05  1.489E-02
   46.60    80032.   0.43   0.84  2.484E-02
   59.54   112070.   0.39   0.88  3.701E-02    59.54 100.000  4.255E+02 AM241
   88.01     3908.   2.64   0.88  5.327E-02
  661.64    34273.   0.59   1.49  1.492E-02   661.66 100.000  3.777E+02 CS137
 1173.20    17374.   0.85   1.92  8.929E-03
 1332.45    15910.   0.82   2.01  7.951E-03  1332.50 100.000  7.285E+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 Centroid  Background Net Area  Efficiency  Uncert   FWHM  Suspected
Channel   Energy   Counts     Counts   * Area    1 Sigma %  keV   Nuclide
_____________________________________________________________________________
  146.25    36.68      5068.      1330. 8.929E+04    9.67   1.047  -      s
  185.76    46.55     21357.     85177. 3.429E+06    0.47   0.876  -
  351.61    87.98      3362.      3908. 7.336E+04    2.64   0.881  -       D
 4692.54  1173.20       614.     17374. 1.946E+06    0.85   1.923  -

  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	237.70	59.54	19241.	112070.	15.565	0.39	0.882
CS-137	2646.28	661.64	1145.	34273.	4.760	0.59	1.489
Co-1332	5329.51	1332.45	128.	15910.	2.210	0.82	2.010

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 GPS/Source	Peak Energy keV	Peak Activity GPS/Source	Code	MDA Value GPS/Source	COMMENTS
AM-241		4.2547E+02				1.58E+05	
			59.54	4.255E+02	(	2.464E+00 3.91E-01 1.00E+02 G	
CS-137		3.7766E+02				1.10E+04	
			661.66	3.777E+02	(	1.767E+00 5.92E-01 1.00E+02 G	
Co-1332		7.2849E+02				1.93E+03	
			1332.50	7.285E+02	(	2.533E+00 8.19E-01 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
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 GPS/Source	Time Corrected Activity GPS/Source	Uncertainty 1 Sigma Counting	MDA
AM-241	4.2051E+02	4.2547E+02	3.912E-01%	2.46E+00
CS-137	3.1896E+02	3.7766E+02	5.918E-01%	1.77E+00
Co-1332	2.7793E+02	7.2849E+02	8.193E-01%	2.53E+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 (98.9 to 2000.1 keV) 1.017E+03 GPS/Source
Total Decayed Activity (98.9 to 2000.1 keV) 1.5316135E+03 GPS/Source

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector # 9**
SpectrumID: 9_20140127006_EffVerif
Analysis Description: ACVTop-259586;TunaCan2006
Calibration: 9_Soil_TunaCan_90099_050312
Detector: Ge9 S/N100228730

Verification Date: 2014-01-27 09:57
Source Assay Date/Time: 2006-10-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	449	4.36E+02	2.9%
Cs-137	661.66	400	3.87E+02	3.2%
Co-1332	1332.5	777	7.44E+02	4.3%

Comments:

Perform Justin D Lockhart / Jody Watson Revie 1/27/2014

C:\User\CRpt\9_20140127006_EffVerif.xls

Sample Description: ACVTop-259586;TunaCan2006
Detector: Ge9 S/N100228730
Source Date: 10/1/2006 11:00
Acquired: 1/27/2014 09:57:52
Analyzed: 1/27/2014 11:58

Analyst: Jody Watson

Efficiency: 9_Soil_TunaCan_90099_050312
Library: DET_EfficiencyVerification.lib

Nuclide	Activity GPS/Source	Uncertainty %
AM-241	4.359E+02	0.40
CS-137	3.870E+02	0.53
Co-1332	7.440E+02	0.70
Total	1.567E+03	

TestAmerica, Inc Spectrum name: 9_20140127006_EffVerif.An1

Sample description
ACVTop-259586;TunaCan2006

Spectrum Filename: C:\User\SPC\Det9\9_20140127006_EffVerif.An1

Acquisition information
Start time: 1/27/2014 9:57:52 AM
Live time: 7200
Real time: 7243
Dead time: 0.59 %
Detector ID: 9

Detector system
Ge9 S/N100228730

Calibration
Filename: 9_Soil_TunaCan.Clb
9_Soil_TunaCan_90099_050312

Energy Calibration
Created: 3/1/2012 1:57:17 PM
Zero offset: 0.074 keV
Gain: 0.250 keV/channel
Quadratic: -2.269E-08 keV/channel^2

Efficiency Calibration
Created: 6/14/2012 10:19:51 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.30 %
Log(Eff): -8.079856E-01 + (-2.367265E-01*Log(E)) + (-3.950640E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.42 %
Log(Eff): -2.387916E+01 + (8.875647E+00*Log(E)) + (-9.401100E-01*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 (37.59keV)
Stop channel: 8000 (1999.34keV)
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: 0.0279

***** 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. GPS/Sour	Nuc
36.52	1513.	9.40	0.98	1.632E-02				
46.61	90228.	0.40	1.00	2.579E-02				
59.58	113489.	0.40	0.95	3.662E-02	59.54	100.000	4.359E+02	AM241
88.11	4431.	4.23	1.01	5.052E-02				
661.70	42601.	0.53	1.51	1.810E-02	661.66	100.000	3.870E+02	CS137
1173.28	23445.	0.73	1.93	1.163E-02				
1332.55	21471.	0.70	2.03	1.050E-02	1332.50	100.000	7.439E+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 Centroid Channel	Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide
145.74	36.52	5612.	1513.	9.270E+04	9.40	0.982	-
185.90	46.56	22509.	90806.	3.521E+06	0.47	0.935	-
352.02	88.11	6367.	4431.	8.770E+04	4.23	1.012	-
4693.14	1173.28	793.	23445.	2.016E+06	0.73	1.926	-

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	237.93	59.58	20068.	113489.	15.762	0.40	0.945
CS-137	2646.19	661.70	1349.	42601.	5.917	0.53	1.513
Co-1332	5330.56	1332.55	140.	21471.	2.982	0.70	2.033

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 GPS/Source	Peak Energy keV	Peak Activity GPS/Source	Code	MDA Value GPS/Source	COMMENTS
AM-241		4.3588E+02				1.58E+05	
			59.54	4.359E+02	(	2.546E+00 4.01E-01 1.00E+02 G	
CS-137		3.8704E+02				1.10E+04	
			661.66	3.870E+02	(	1.580E+00 5.31E-01 1.00E+02 G	
Co-1332		7.4395E+02				1.93E+03	
			1332.50	7.439E+02	(	2.004E+00 7.00E-01 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
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 GPS/Source	Time Corrected Activity GPS/Source	Uncertainty 1 Sigma Counting	MDA
AM-241	4.3079E+02	4.3588E+02	4.010E-01%	2.55E+00
CS-137	3.2692E+02	3.8704E+02	5.309E-01%	1.58E+00
Co-1332	2.8397E+02	7.4395E+02	7.000E-01%	2.00E+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 1999.3 keV) 1.042E+03 GPS/Source
Total Decayed Activity (37.6 to 1999.3 keV) 1.5668657E+03 GPS/Source

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #11**
SpectrumID: 11_20140127006_EffVerif
Analysis Description: ACVWrap-255911;1LMarn2011
Calibration: Ge11_1Lmarn_83924_334_101210
Detector: Ge11 S/N09363993

Verification Date: 2014-01-27 09:59
Source Assay Date/Time: 2011-01-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	1830	1.81E+03	1.0%
Cs-137	661.66	1705	1.73E+03	-1.6%
Co-1332	1332.5	3294	3.29E+03	0.2%

Comments:

Perform Jody Watson Revie 1/28/2014

C:\User\CRpt\11_20140127006_EffVerif.xls

Sample Description: ACVWrap-255911;1LMarn2011
Detector: Ge11 S/N09363993
Source Date: 1/1/2011 11:00
Acquired: 1/27/2014 09:59:44
Analyzed: 1/28/2014 07:30

Analyst: Jody Watson

Efficiency: Ge11_1Lmarn_83924_334_101210
Library: DET_EfficiencyVerification.lib

Nuclide	Activity uCi/Source	Uncertainty %
AM-241	1.812E+03	0.17
CS-137	1.733E+03	0.26
Co-1332	3.288E+03	0.26
Total	6.833E+03	

TestAmerica, Inc Spectrum name: 11_20140127006_EffVerif.An1

Sample description
ACVWrap-255911;1LMarn2011

Spectrum Filename: C:\User\SPC\Det11\11_20140127006_EffVerif.An1

Acquisition information
Start time: 1/27/2014 9:59:44 AM
Live time: 7200
Real time: 7497
Dead time: 3.97 %
Detector ID: 11

Detector system
Ge11 S/N09363993

Calibration
Filename: 11_Liquid_Marinelli 1L.Clb
Ge11_1Lmarn_83924_334_101210

Energy Calibration
Created: 2/28/2012 1:09:34 PM
Zero offset: 0.055 keV
Gain: 0.250 keV/channel
Quadratic: -2.946E-08 keV/channel^2

Efficiency Calibration
Created: 11/1/2011 11:27:06 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.69 %
Log(Eff): -1.728738E+00 + (5.998209E-02*Log(E)) + (-6.399241E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.15 %
Log(Eff): -1.340909E+01 + (4.619770E+00*Log(E)) + (-5.089701E-01*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 (1999.47keV)
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	1/1/2011 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: 0.0159

***** 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
36.65	5458.	6.81	0.88	3.429E-02				
49.52	26410.	2.72	1.77	4.363E-02				
59.51	627249.	0.17	0.89	4.831E-02	59.54	100.000	1.812E+03	AM241
84.84	2386.	9.85	0.94	5.335E-02				
88.01	187057.	0.26	0.94	5.351E-02				
122.07	30844.	1.22	0.99	5.171E-02				
136.43	3517.	6.89	0.94	4.986E-02				
661.66	204877.	0.26	1.43	1.762E-02	661.66	100.000	1.733E+03	CS137
834.83	27671.	1.03	1.55	1.468E-02				
1115.50	12772.	2.50	1.80	1.158E-02				
1173.22	173138.	0.26	1.80	1.110E-02				
1332.48	157323.	0.26	1.90	9.954E-03	1332.50	100.000	3.288E+03	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 Centroid Channel	Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
146.27	36.65	37918.	5458.	1.592E+05	6.81	0.875	-	s
197.72	49.52	139925.	26410.	6.053E+05	2.72	1.773	-	s
338.91	84.81	26438.	2386.	8.910E+03	9.85	0.936	-	lD
351.48	87.98	38852.	181420.	3.391E+06	0.33	0.943	-	
487.78	122.07	23932.	30844.	5.965E+05	1.22	0.990	-	
545.16	136.43	15760.	3517.	7.054E+04	6.89	0.941	-	
3338.24	834.83	9539.	27671.	1.885E+06	1.03	1.552	-	
4461.24	1115.50	11378.	12772.	1.103E+06	2.50	1.802	-	
4692.19	1173.22	4971.	173138.	1.560E+07	0.26	1.801	-	

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	237.66	59.51	109066.	627249.	87.118	0.17	0.888
CS-137	2645.55	661.66	11390.	204877.	28.455	0.26	1.430
Co-1332	5329.59	1332.48	1267.	157323.	21.850	0.26	1.903

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 uCi/Source	Peak Energy keV	Peak Activity uCi/Source	Code	MDA Value uCi/Source		COMMENTS
AM-241		1.8118E+03				1.58E+05		
			59.54	1.812E+03	(	4.453E+00	1.66E-01	1.00E+02 G
CS-137		1.7330E+03				1.10E+04		
			661.66	1.733E+03	(	4.230E+00	2.59E-01	1.00E+02 G
Co-1332		3.2877E+03				1.93E+03		
			1332.50	3.288E+03	(	3.523E+00	2.60E-01	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: Peak 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
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

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 uCi/Source	Time Corrected Activity uCi/Source	Uncertainty Counting 1 Sigma	MDA
AM-241	1.8029E+03	1.8118E+03	1.658E-01%	4.45E+00
CS-137	1.6146E+03	1.7330E+03	2.587E-01%	4.23E+00
Co-1332	2.1951E+03	3.2877E+03	2.598E-01%	3.52E+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 1999.5 keV) 5.613E+03 uCi/Source
Total Decayed Activity (37.6 to 1999.5 keV) 6.8324727E+03 uCi/Source

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #12**
SpectrumID: 12_20140127003_EffVerif
Analysis Description: ACVWrap-255911;1LMarn2011
Calibration: Ge12_Marn1LCal_90062_032612
Detector: Ge12 S/N10034336

Verification Date: 2014-01-27 12:08
Source Assay Date/Time: 2011-01-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	1830	1.78E+03	2.8%
Cs-137	661.66	1705	1.67E+03	2.2%
Co-1332	1332.5	3294	3.17E+03	3.6%

Comments:

Perform Jody Watson Revie 1/28/2014

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Sample Description: ACVWrap-255911;1LMarn2011
Detector: Ge12 S/N10034336
Source Date: 1/1/2011 11:00
Acquired: 1/27/2014 12:08:56
Analyzed: 1/28/2014 13:33

Analyst: Jody Watson

Efficiency: Ge12_Marn1LCal_90062_032612
Library: DET_EfficiencyVerification.lib

Nuclide	Activity uCi/Source	Uncertainty %
AM-241	1.779E+03	0.17
CS-137	1.668E+03	0.25
Co-1332	3.174E+03	0.26
Total	6.622E+03	

TestAmerica, Inc Spectrum name: 12_20140127003_EffVerif.An1

Sample description
ACVWrap-255911;1LMarn2011

Spectrum Filename: C:\User\SPC\Det12\12_20140127003_EffVerif.An1

Acquisition information
Start time: 1/27/2014 12:08:56 PM
Live time: 7200
Real time: 7491
Dead time: 3.89 %
Detector ID: 12

Detector system
Ge12 S/N10034336

Calibration
Filename: 12_Liquid_Marinelli 1L.Clb
Ge12_Marn1LCal_90062_032612

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: 4/2/2012 5:17:10 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 2.18 %
Log(Eff): -2.771167E+00 + (4.009767E-01*Log(E)) + (-8.911171E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 0.25 %
Log(Eff): -1.324587E+01 + (4.570937E+00*Log(E)) + (-5.039442E-01*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	1/1/2011 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: 0.0523

***** 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
36.53	4866.	7.29	1.24	3.604E-02				
49.58	26778.	2.72	1.92	4.587E-02				
59.52	645957.	0.17	1.13	5.067E-02	59.54	100.000	1.779E+03	AM241
88.03	188796.	0.32	1.14	5.599E-02				
122.12	31879.	1.26	1.21	5.406E-02				
136.52	4186.	6.57	1.22	5.212E-02				
661.61	220744.	0.25	1.58	1.973E-02	661.66	100.000	1.668E+03	CS137
834.78	29837.	1.10	1.73	1.647E-02				
1115.38	13865.	2.44	1.87	1.297E-02				
1173.10	187375.	0.26	1.95	1.242E-02				
1332.36	169671.	0.26	2.05	1.112E-02	1332.50	100.000	3.174E+03	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 Centroid Channel	Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
145.81	36.53	36239.	4866.	1.350E+05	7.29	1.240	-	s
197.93	49.58	143815.	26778.	5.838E+05	2.72	1.924	-	s
351.62	88.03	39886.	188796.	3.372E+06	0.32	1.143	-	s
487.87	122.12	27010.	31879.	5.897E+05	1.26	1.214	-	s
545.42	136.52	18649.	4186.	8.031E+04	6.57	1.223	-	s
3337.61	834.78	12304.	29837.	1.812E+06	1.10	1.734	-	
4460.38	1115.38	12355.	13865.	1.069E+06	2.44	1.874	-	s
4691.37	1173.10	7815.	187375.	1.508E+07	0.26	1.947	-	

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	237.69	59.52	121203.	645957.	89.716	0.17	1.128s
CS-137	2644.92	661.61	11970.	220744.	30.659	0.25	1.581
Co-1332	5328.84	1332.36	3327.	169671.	23.565	0.26	2.046

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 uCi/Source	Peak Energy keV	Peak Activity uCi/Source	Code	MDA Value uCi/Source	COMMENTS
AM-241		1.7791E+03				1.58E+05	
			59.54	1.779E+03	*(	4.476E+00 1.68E-01 1.00E+02	G
CS-137		1.6683E+03				1.10E+04	
			661.66	1.668E+03	(	3.874E+00 2.45E-01 1.00E+02	G
Co-1332		3.1744E+03				1.93E+03	
			1332.50	3.174E+03	(	5.080E+00 2.63E-01 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: Peak 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
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

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 uCi/Source	Time Corrected Activity uCi/Source	Uncertainty 1 Sigma Counting	MDA
AM-241 #	1.7703E+03	1.7791E+03	1.675E-01%	4.48E+00
CS-137	1.5542E+03	1.6683E+03	2.450E-01%	3.87E+00
Co-1332	2.1194E+03	3.1744E+03	2.626E-01%	5.08E+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) 5.444E+03 uCi/Source
Total Decayed Activity (37.6 to 1999.4 keV) 6.6217651E+03 uCi/Source

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #12**
SpectrumID: 12_20140128004_EffVerif
Analysis Description: ACVTop-259586;TunaCan2006
Calibration: 12_TunaCanCal_90099_100212
Detector: Ge12 S/N10034336

Verification Date: 2014-01-28 14:18
Source Assay Date/Time: 2006-10-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	449	4.47E+02	0.4%
Cs-137	661.66	400	3.94E+02	1.6%
Co-1332	1332.5	777	7.55E+02	2.8%

Comments:

Perform Jody Watson Revie 1/28/2014

C:\User\CRpt\12_20140128004_EffVerif.xls

Sample Description: ACVTop-259586;TunaCan2006
Detector: Ge12 S/N10034336
Source Date: 10/1/2006 11:00
Acquired: 1/28/2014 14:18:05
Analyzed: 1/28/2014 16:18

Analyst: Jody Watson

Efficiency: 12_TunaCanCal_90099_100212
Library: DET_EfficiencyVerification.lib

Nuclide	Activity GPS/Source	Uncertainty %
AM-241	4.471E+02	0.42
CS-137	3.935E+02	0.58
Co-1332	7.554E+02	0.77
Total	1.596E+03	

TestAmerica, Inc Spectrum name: 12_20140128004_EffVerif.An1

Sample description
ACVTop-259586;TunaCan2006

Spectrum Filename: C:\User\SPC\Det12\12_20140128004_EffVerif.An1

Acquisition information
Start time:	1/28/2014 2:18:05 PM
Live time:	7200
Real time:	7246
Dead time:	0.63 %
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*Log(E)) + (-3.369562E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.96 %
Log(Eff):	-2.288409E+01 + (8.352717E+00*Log(E)) + (-8.812368E-01*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: 0.0087

***** 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. GPS/Sour	Nuc
36.55	1480.	9.57	0.89	1.444E-02				
46.52	77370.	0.54	1.12	2.228E-02				
59.52	99318.	0.42	1.11	3.121E-02	59.54	100.000	4.471E+02	AM241
87.99	3561.	4.10	1.18	4.277E-02				
661.67	37598.	0.58	1.62	1.571E-02	661.66	100.000	3.935E+02	CS137
1173.21	20770.	0.79	1.92	1.018E-02				
1332.49	19132.	0.77	2.06	9.220E-03	1332.50	100.000	7.554E+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	
145.89	36.55	5572.	1480.	1.025E+05	9.57	0.886	-	s
185.74	46.52	24066.	77370.	3.473E+06	0.54	1.118	-	s
351.46	87.99	4624.	3561.	8.326E+04	4.10	1.175	-	s
4691.80	1173.21	827.	20770.	2.040E+06	0.79	1.915	-	

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	237.67	59.52	17591.	99318.	13.794	0.42	1.110s
CS-137	2645.17	661.67	1535.	37598.	5.222	0.58	1.616
Co-1332	5329.33	1332.49	294.	19132.	2.657	0.77	2.055

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 GPS/Source	Peak Energy keV	Peak Activity GPS/Source	Code	MDA Value GPS/Source	COMMENTS
AM-241		4.4707E+02				1.58E+05	
			59.54	4.471E+02	*(	2.794E+00 4.18E-01 1.00E+02	G
CS-137		3.9351E+02				1.10E+04	
			661.66	3.935E+02	(	1.939E+00 5.75E-01 1.00E+02	G
Co-1332		7.5535E+02				1.93E+03	
			1332.50	7.554E+02	(	3.261E+00 7.65E-01 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
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 GPS/Source	Time Corrected Activity GPS/Source	Uncertainty 1 Sigma Counting	MDA
AM-241 #	4.4186E+02	4.4707E+02	4.183E-01%	2.79E+00
CS-137	3.3236E+02	3.9351E+02	5.754E-01%	1.94E+00
Co-1332	2.8820E+02	7.5535E+02	7.652E-01%	3.26E+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) 1.062E+03 GPS/Source
Total Decayed Activity (37.6 to 1999.4 keV) 1.5959352E+03 GPS/Source

TestAmerica
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ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #15**
SpectrumID: 15_20140124007_EffVerif
Analysis Description: ACVTop-259586;TunaCan2006
Calibration: 15_TunaCan_90099_032212
Detector: Ge15 SN/11012216

Verification Date: 2014-01-24 15:13
Source Assay Date/Time: 2006-10-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	449	4.42E+02	1.5%
Cs-137	661.66	400	3.86E+02	3.5%
Co-1332	1332.5	777	7.51E+02	3.3%

Comments:

Perform ____Jody Watson_____ Revie 1/24/2014

C:\User\CRpt\15_20140124007_EffVerif.xls

Sample Description: ACVTop-259586;TunaCan2006
Detector: Ge15 SN/11012216
Source Date: 10/1/2006 11:00
Acquired: 1/24/2014 15:13:10
Analyzed: 1/24/2014 17:13

Analyst: Jody Watson

Efficiency: 15_TunaCan_90099_032212
Library: DET_EfficiencyVerification.lib

Nuclide	Activity GPS/Source	Uncertainty %
AM-241	4.423E+02	0.46
CS-137	3.861E+02	0.67
Co-1332	7.514E+02	0.92
Total	1.580E+03	

TestAmerica, Inc. Spectrum name: 15_20140124007_EffVerif.An1

Sample description
ACVTop-259586;TunaCan2006

Spectrum Filename: C:\User\SPC\Det15\15_20140124007_EffVerif.An1

Acquisition information
Start time: 1/24/2014 3:13:10 PM
Live time: 7200
Real time: 7227
Dead time: 0.37 %
Detector ID: 15

Detector system
Ge15 SN/11012216

Calibration
Filename: 15_Soil_TunaCan.Clb
15_TunaCan_90099_032212

Energy Calibration
Created: 2/28/2012 4:29:17 PM
Zero offset: 0.044 keV
Gain: 0.250 keV/channel
Quadratic: -3.267E-08 keV/channel^2

Efficiency Calibration
Created: 3/22/2012 1:03:01 PM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 1.00 %
Log(Eff): -6.894897E-01 + (-3.290613E-01*Log(E)) + (-3.875629E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.13 %
Log(Eff): -2.362677E+01 + (8.666669E+00*Log(E)) + (-9.214638E-01*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 (1999.52keV)
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: 0.0029

***** 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. GPS/Sour	Nuc
46.55	63242.	0.50	0.95	1.954E-02				
59.54	86146.	0.46	1.02	2.737E-02	59.54	100.000	4.423E+02	AM241
88.03	3254.	4.88	1.09	3.706E-02				
661.65	27112.	0.67	1.55	1.155E-02	661.66	100.000	3.861E+02	CS137
1173.21	14966.	0.95	1.84	7.076E-03				
1332.50	13074.	0.92	1.94	6.325E-03	1332.50	100.000	7.514E+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
185.66	46.49	20160.	68291.	3.495E+06	0.57	1.022	-
351.69	88.03	4872.	3254.	8.780E+04	4.88	1.089	-
4691.88	1173.21	622.	14966.	2.115E+06	0.95	1.839	-

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	237.80	59.54	15953.	86146.	11.965	0.46	1.023
CS-137	2645.26	661.65	1040.	27112.	3.766	0.67	1.551
Co-1332	5329.37	1332.50	161.	13074.	1.816	0.92	1.937

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 GPS/Source	Peak Energy keV	Peak Activity GPS/Source	Code	MDA Value GPS/Source	COMMENTS
AM-241		4.4227E+02				1.58E+05	
			59.54	4.423E+02	(	3.036E+00 4.61E-01 1.00E+02 G	
CS-137		3.8607E+02				1.10E+04	
			661.66	3.861E+02	(	2.179E+00 6.74E-01 1.00E+02 G	
Co-1332		7.5135E+02				1.93E+03	
			1332.50	7.514E+02	(	3.557E+00 9.18E-01 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
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 GPS/Source	Time Corrected Activity GPS/Source	Uncertainty 1 Sigma Counting	MDA
AM-241	4.3711E+02	4.4227E+02	4.613E-01%	3.04E+00
CS-137	3.2615E+02	3.8607E+02	6.736E-01%	2.18E+00
Co-1332	2.8708E+02	7.5135E+02	9.185E-01%	3.56E+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 1999.5 keV) 1.050E+03 GPS/Source
Total Decayed Activity (37.6 to 1999.5 keV) 1.5796848E+03 GPS/Source

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #17**
SpectrumID: 17_20140123005_EffVerif
Analysis Description: ACVTop-259586;TunaCan2006
Calibration: 17_TunaCan_90099_032612
Detector: Ge17 SN/11080671

Verification Date: 2014-01-23 11:17
Source Assay Date/Time: 2006-10-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	449	4.37E+02	2.6%
Cs-137	661.66	400	3.87E+02	3.3%
Co-1332	1332.5	777	7.33E+02	5.6%

Comments:

Perform Jody Watson Revie 1/23/2014

C:\User\CRpt\17_20140123005_EffVerif.xls

Sample Description: ACVTop-259586;TunaCan2006
Detector: Ge17 SN/11080671
Source Date: 10/1/2006 11:00
Acquired: 1/23/2014 11:17:37
Analyzed: 1/23/2014 13:18

Analyst: JustinL

Efficiency: 17_TunaCan_90099_032612
Library: DET_EfficiencyVerification.lib

Nuclide	Activity GPS/Source	Uncertainty %
AM-241	4.371E+02	0.43
CS-137	3.868E+02	0.60
Co-1332	7.334E+02	0.79
Total	1.557E+03	

TestAmerica, Inc. Spectrum name: 17_20140123005_EffVerif.An1

Sample description
ACVTop-259586;TunaCan2006

Spectrum Filename: C:\User\SPC\Det17\17_20140123005_EffVerif.An1

Acquisition information
Start time: 1/23/2014 11:17:37 AM
Live time: 7200
Real time: 7248
Dead time: 0.66 %
Detector ID: 17

Detector system
Ge17 SN/11080671

Calibration
Filename: 17_Soil_TunaCan.Clb
17_TunaCan_90099_032612

Energy Calibration
Created: 2/29/2012 10:33:23 AM
Zero offset: 0.108 keV
Gain: 0.250 keV/channel
Quadratic: -2.584E-08 keV/channel^2

Efficiency Calibration
Created: 4/12/2012 9:28:42 AM
Knee Energy: 165.85 keV
Above the Knee: Quadratic Uncertainty = 0.91 %
Log(Eff): -5.264190E-01 + (-4.024164E-01*Log(E)) + (-2.604461E-02*Log(E)^2)
Below the Knee: Quadratic Uncertainty = 1.00 %
Log(Eff): -2.343889E+01 + (8.582715E+00*Log(E)) + (-9.075430E-01*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 (37.63keV)
Stop channel: 8000 (1999.54keV)
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: 0.0187

***** 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. GPS/Sour	Nuc
46.59	73432.	0.50	0.76	2.104E-02				
59.58	91985.	0.43	0.76	2.959E-02	59.54	100.000	4.371E+02	AM241
88.06	3451.	4.45	0.83	4.060E-02				
661.65	33946.	0.60	1.33	1.443E-02	661.66	100.000	3.868E+02	CS137
1173.26	19157.	0.83	1.72	9.359E-03				
1332.50	17118.	0.79	1.86	8.481E-03	1332.50	100.000	7.334E+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	
185.85	46.59	17888.	73432.	3.489E+06	0.50	0.760	-	
351.64	88.06	4826.	3451.	8.500E+04	4.45	0.825	-	s
4692.35	1173.26	773.	19157.	2.047E+06	0.83	1.724	-	

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	237.75	59.58	15258.	91985.	12.776	0.43	0.764
CS-137	2645.46	661.65	1213.	33946.	4.715	0.60	1.331
Co-1332	5329.63	1332.50	157.	17118.	2.377	0.79	1.865

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 GPS/Source	Peak Energy keV	Peak Activity GPS/Source	Code	MDA Value GPS/Source	COMMENTS
AM-241		4.3712E+02				1.58E+05	
			59.54	4.371E+02	(	2.748E+00 4.25E-01	1.00E+02 G
CS-137		3.8679E+02				1.10E+04	
			661.66	3.868E+02	(	1.880E+00 5.95E-01	1.00E+02 G
Co-1332		7.3337E+02				1.93E+03	
			1332.50	7.334E+02	(	2.619E+00 7.91E-01	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
P - Photon Reaction
C - Charged Particle Reaction
M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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

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 GPS/Source	Time Corrected Activity GPS/Source	Uncertainty 1 Sigma Counting	MDA
AM-241	4.3203E+02	4.3712E+02	4.253E-01%	2.75E+00
CS-137	3.2679E+02	3.8679E+02	5.952E-01%	1.88E+00
Co-1332	2.8033E+02	7.3337E+02	7.913E-01%	2.62E+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 1999.5 keV) 1.039E+03 GPS/Source
Total Decayed Activity (37.6 to 1999.5 keV) 1.5572817E+03 GPS/Source

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANNUAL CALIBRATION VERIFICATION

Detector ID: **Detector #18**
SpectrumID: 18_20140123003_EffVerif
Analysis Description: ACVWrap-255911;1LMarn2011
Calibration: 18_1Lmarn_83924-334_120711
Detector: Ge18 SN/11164036

Verification Date: 2014-01-23 11:19
Source Assay Date/Time: 2011-01-01 11:00

Isotope	Gamma Energy (kev)	Source Emission Rate (GPS) (Assay)	Observed Activity (GPS) (Actual)	Percent Difference (%) Assay-Actual / Assay
Am-241	59.54	1830	1.83E+03	0.0%
Cs-137	661.66	1705	1.72E+03	-0.8%
Co-1332	1332.5	3295	3.22E+03	2.2%

Comments:

Perform ___Jody Watson_____ Reviev _____1/23/14_____

C:\User\CRpt\18_20140123003_EffVerif.xls

Sample Description: ACVWrap-255911;1LMarn2011
Detector: Ge18 SN/11164036
Source Date: 1/1/2011 11:00
Acquired: 1/23/2014 11:19:33
Analyzed: 1/23/2014 13:24

Analyst: JustinL

Efficiency: 18_1Lmarn_83924-334_120711
Library: DET_EfficiencyVerification.lib

Nuclide	Activity GPS/Source	Uncertainty %
AM-241	1.830E+03	0.17
CS-137	1.719E+03	0.27
Co-1332	3.223E+03	0.28
Total	6.771E+03	

Test America Spectrum name: 18_20140123003_EffVerif.An1

Sample description
ACVWrap-255911;1LMarn2011

Spectrum Filename: C:\User\SPC\Det18\18_20140123003_EffVerif.An1

Acquisition information
Start time:	1/23/2014 11:19:33 AM
Live time:	7200
Real time:	7505
Dead time:	4.06 %
Detector ID:	18

Detector system
Ge18 SN/11164036

Calibration
Filename: 18_1LMarinelli.Clb
18_1Lmarn_83924-334_120711

Energy Calibration
Created:	3/1/2012 1:27:55 PM
Zero offset:	0.007 keV
Gain:	0.250 keV/channel
Quadratic:	-3.202E-08 keV/channel^2

Efficiency Calibration
Created:	12/8/2011 10:14:04 AM
Knee Energy:	165.85 keV
Above the Knee:	Quadratic Uncertainty = 2.55 %
Log(Eff):	-1.645931E+00 + (3.227669E-02*Log(E)) + (-6.187585E-02*Log(E)^2)
Below the Knee:	Quadratic Uncertainty = 0.90 %
Log(Eff):	-1.318185E+01 + (4.538566E+00*Log(E)) + (-5.017483E-01*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 (37.54keV)
Stop channel:	8000 (1999.55keV)
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	1/1/2011 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: 0.0532

***** 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. GPS/Sour	Nuc
36.36	4754.	7.02	1.01	3.503E-02				
49.47	27365.	2.65	1.77	4.450E-02				
59.47	643803.	0.17	0.93	4.908E-02	59.54	100.000	1.830E+03	AM241
87.97	188042.	0.33	0.98	5.396E-02				
122.09	31546.	1.22	1.01	5.190E-02				
136.43	3650.	6.77	1.09	4.999E-02				
165.90	2364.	7.36	1.07	4.517E-02				
661.71	201640.	0.27	1.46	1.749E-02	661.66	100.000	1.719E+03	CS137
834.99	27232.	0.76	1.68	1.457E-02				
1115.50	12316.	2.86	1.79	1.149E-02				
1173.31	169390.	0.28	1.81	1.101E-02				
1332.61	153359.	0.28	1.94	9.884E-03	1332.50	100.000	3.223E+03	Co1332

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

Channel	Peak Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
145.31	36.36	33702.	4754.	1.357E+05	7.02	1.006	-	s
197.69	49.47	142605.	27365.	6.149E+05	2.65	1.769	-	s
351.58	87.97	41737.	188042.	3.485E+06	0.33	0.981	-	
487.96	122.09	25197.	31546.	6.078E+05	1.22	1.011	-	
545.31	136.43	16422.	3650.	7.301E+04	6.77	1.086	-	
663.09	165.86	13935.	2364.	5.234E+04	7.36	1.072	-	D
3338.37	834.91	11424.	27675.	1.900E+06	1.14	1.588	-	
4460.99	1115.50	13178.	12316.	1.072E+06	2.86	1.786	-	s
4692.29	1173.31	7137.	169390.	1.538E+07	0.28	1.814	-	

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	237.67	59.47	129081.	643803.	89.417	0.17	0.933
CS-137	2645.60	661.71	14472.	201640.	28.006	0.27	1.458
Co-1332	5329.81	1332.61	3424.	153359.	21.300	0.28	1.936

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 GPS/Source	Peak Energy keV	Peak Activity GPS/Source	Code	MDA Value GPS/Source		COMMENTS
AM-241		1.8300E+03				1.58E+05		
			59.54	1.830E+03	(	4.767E+00	1.73E-01	1.00E+02 G
CS-137		1.7187E+03				1.10E+04		
			661.66	1.719E+03	(	4.801E+00	2.73E-01	1.00E+02 G
Co-1332		3.2227E+03				1.93E+03		
			1332.50	3.223E+03	(	5.787E+00	2.80E-01	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: Peak 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
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

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 GPS/Source	Time Corrected Activity GPS/Source	Uncertainty 1 Sigma Counting	MDA
AM-241	1.8211E+03	1.8300E+03	1.734E-01%	4.77E+00
CS-137	1.6016E+03	1.7187E+03	2.730E-01%	4.80E+00
Co-1332	2.1548E+03	3.2227E+03	2.798E-01%	5.79E+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 (172.4 to 1999.5 keV) 5.577E+03 GPS/Source
Total Decayed Activity (172.4 to 1999.5 keV) 6.7713540E+03 GPS/Source

Monthly Backgrounds

Test America
St. Louis
Background Check

Spectrum: 4_20140502005_BGLong
Acquired: 5/2/2014 5:55:06 PM
Detector: Ge 4 SN/181
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	1.32	1.20	1.24	1.31	1.39	1.43	PASS

Analyst: April Bean Reviewer: Siobhan Perry

TestAmerica Spectrum name: 4_20140502005_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det4\4_20140502005_BGLong.An1

Acquisition information
Start time:	5/2/2014 5:55:06 PM
Live time:	43200
Real time:	43258
Dead time:	0.13 %
Detector ID:	4

Detector system
Ge 4 SN/181

Calibration
Filename: 4_QC.Clb
4_QA-D_Rad11-0018_032612

Energy Calibration
Created:	2/28/2012 2:55:17 PM
Zero offset:	0.091 keV
Gain:	0.250 keV/channel
Quadratic:	-2.917E-08 keV/channel^2

Efficiency Calibration
Created:	3/27/2012 7:34:55 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 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (1999.44keV)
Peak rejection level:	30.000%
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:	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. 14 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1974

***** 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
46.61	361.	9.77	0.81	3.538E-02	46.54	4.250	5.565E+00	PB210
63.35	318.	11.39	0.80	4.647E-02	63.29	3.810	4.165E+00	TH234
92.63	440.	8.26	0.78	6.309E-02	92.59	5.584	2.891E+00	TH234
					93.35	5.561	2.901E+00	AC228
185.54	181.	20.51	0.70	5.803E-02	185.72	54.000	1.335E-01	U235
					185.99	3.280	2.199E+00	Ra226
238.37	170.	16.45	1.06	5.340E-02	238.63	43.300	1.703E-01	PB212
510.64	840.	5.89	1.88	2.895E-02	511.86	20.000	3.374E+00	RH106
1187.94	46.	22.67	0.40	8.696E-03	1189.05	16.200	7.641E-01	Ta182
1460.70	46.	22.92	0.98	7.834E-03	1460.83	10.670	1.274E+00	K40

********** 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	
2041.42	510.64	276.	840.	2.904E+04	5.89	1.875	-	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: 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	185.98	46.61	294.	361.	0.008	9.77	0.811
TH-234	252.87	63.35	299.	318.	0.007	11.39	0.803
TH-234	369.95	92.63	294.	440.	0.010	8.26	0.782
Ra-226	741.37	185.53	312.	176.	0.004	20.19	0.690s
PB-212	952.63	238.37	204.	170.	0.004	16.45	1.059
Ta-182	4751.12	1187.94	12.	46.	0.001	22.67	0.396s
K-40	5842.84	1460.70	17.	46.	0.001	22.92	0.984s

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 DPS	Peak Energy keV	Peak Activity DPS	Peak Code	Peak MDA Value DPS	COMMENTS
K-40	N	1.2739E+00				4.66E+11	
			1460.83	1.274E+00	?(	6.072E-01 2.29E+01 1.07E+01	G
PB-210	N	5.5645E+00				8.14E+03	
			46.54	5.565E+00	(	1.273E+00 9.77E+00 4.25E+00	G
PB-212	N	1.7028E-01				6.98E+02	
			238.63	1.703E-01	(	6.938E-02 1.64E+01 4.33E+01	G
			300.03	0.000E+00	%	6.791E-01 1.92E+02 3.28E+00	GA
TH-234	N	4.1655E+00				1.63E+12	
			63.29	4.165E+00	(	1.089E+00 1.14E+01 3.81E+00	G
			92.59	2.891E+00	-	5.429E-01 8.26E+00 5.58E+00	G
Ra-226		2.1479E+00				5.84E+05	
			185.99	2.148E+00	(	1.035E+00 2.02E+01 3.28E+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:	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
Ta-182	1187.94	12.	46.	0.001	22.67	7.641E-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 *****

Nuclide		Time of Count Activity DPS	Uncertainty 1 Sigma Counting	MDA
BE-7	<	1.8514E-01		
NA-22	<	7.9904E-02		
K-40	#	1.2739E+00	2.2921E+01%	6.072E-01
Sc-46	<	9.4256E-02		
CR-51	<	2.7403E-01		
MN-54	<	7.6077E-02		
FE-59	<	1.1803E-01		
Co-56	<	1.0161E-01		
CO-57	<	3.8848E-02		
CO-58	<	6.9093E-02		
CO-60	<	8.8280E-02		
ZN-65	<	1.8891E-01		
NB-94	<	3.1456E-02		
ZR-95	<	6.5411E-02		
NB-95	<	7.5421E-02		
RU-103	<	3.4924E-02		
RH-106	<	7.4678E-01		
AG-108M	<	2.6460E-02		

AG-110M	<	1.2771E-01		
SN-113	<	5.2742E-02		
SB-124	<	4.3326E-02		
SB-125	<	1.5113E-01		
I-131	<	3.8458E-02		
BA-133	<	3.7301E-02		
CS-134	<	5.8008E-02		
CS-137	<	1.0304E-01		
CE-139	<	2.3564E-02		
Ba-140	<	1.8163E-01		
La-140	<	6.9663E-02		
CE-141	<	5.8617E-02		
CE-144	<	3.1117E-01		
PM-144	<	8.3660E-02		
EU-152	<	1.3525E-01		
EU-154	<	6.1325E-01		
EU-155	<	1.3757E-01		
HF-181	<	4.3149E-02		
Ta-182	<	1.8676E-01		
Hg-203	<	2.8130E-02		
TL-208	<	7.5432E-02		
pm-146	<	2.1231E-01		
y-88	<	1.0294E-01		
PB-210		5.5645E+00	9.7663E+00%	1.273E+00
PB-212		1.7028E-01	1.6450E+01%	6.938E-02
PB-214	<	8.7402E-02		
BI-207	<	5.9119E-02		
BI-212	<	4.6519E-01		
BI-214	<	1.6958E-01		
BI-210M	<	6.6773E-02		
RA-224	<	7.1627E-01		
AC-228	<	3.3278E-01		
TH-227	<	2.9382E-01		
TH-229	<	6.8594E-01		
TH-234		4.1655E+00	1.1387E+01%	1.089E+00
PA-231	<	1.0501E+00		
PA-233	<	9.2410E-02		
PA-234	<	1.5356E-01		
PA-234M	<	1.4297E+01		
Ra-226		2.1479E+00	2.0193E+01%	1.035E+00
U-235	<	2.7072E-01		
AM-241	<	1.2299E-01		
Np-237	<	1.5966E-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	1999.4 keV)	1.332E+01 DPS

Test America
St. Louis
Background Check

Spectrum: 5_20140502005_BGLong
Acquired: 5/2/2014 5:56:09 PM
Detector: Ge 5 SN/157
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	1.45	1.30	1.35	1.47	1.55	1.60	PASS

Analyst: April Bean Reviewer: Siobhan Perry

TestAmerica Spectrum name: 5_20140502005_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det5\5_20140502005_BGLong.An1

Acquisition information
Start time:	5/2/2014 5:56:09 PM
Live time:	43200
Real time:	43327
Dead time:	0.29 %
Detector ID:	5

Detector system
Ge 5 SN/157

Calibration
Filename: 5_QC.Clb
Ge5_QC

Energy Calibration
Created:	2/28/2012 7:35:48 PM
Zero offset:	0.158 keV
Gain:	0.250 keV/channel
Quadratic:	3.911E-08 keV/channel^2

Efficiency Calibration
Created:	1/6/2011 8:03:22 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 G53W4.25
Start channel:	150 (37.62keV)
Stop channel:	8000 (2000.81keV)
Peak rejection level:	30.000%
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:	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. 21 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1229

***** 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
46.60	342.	11.09	0.71	5.684E-02	46.54	4.250	3.285E+00	PB210
59.68	114.	22.53	0.60	7.439E-02	59.54	35.900	9.950E-02	AM241
63.37	364.	10.89	0.62	7.934E-02	63.29	3.810	2.791E+00	TH234
74.92	139.	20.36	0.81	9.479E-02				
77.16	129.	19.76	0.82	9.781E-02				
92.56	494.	9.25	1.11	1.129E-01	92.59	5.584	1.815E+00	TH234
					93.35	5.561	1.822E+00	AC228
143.94	111.	29.76	0.48	1.085E-01	143.79	10.960	2.160E-01	U235
185.82	240.	17.56	0.87	9.605E-02	185.72	54.000	1.071E-01	U235
					185.99	3.280	1.764E+00	Ra226
238.47	139.	23.67	1.09	8.327E-02	238.63	43.300	8.949E-02	PB212
295.14	126.	22.65	1.01	6.952E-02	295.09	19.300	2.179E-01	PB214
351.96	145.	25.61	0.73	5.573E-02	351.93	37.600	1.598E-01	PB214
608.89	155.	17.94	1.47	3.199E-02	609.31	46.090	2.436E-01	BI214
					610.30	5.750	1.956E+00	RU103
661.57	78.	24.26	0.79	2.860E-02	661.66	85.210	7.408E-02	CS137
1120.39	73.	23.20	0.54	1.646E-02	1120.29	15.100	6.766E-01	BI214
1460.95	74.	19.77	0.30	1.300E-02	1460.83	10.670	1.235E+00	K40
1764.63	40.	22.51	1.26	1.105E-02	1764.49	15.400	5.372E-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 keV	Suspected Nuclide	
299.16	74.88	330.	139.	1.466E+03	23.58	0.632	-	M
308.14	77.13	236.	116.	1.181E+03	22.98	0.871	-	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: 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	185.95	46.60	347.	342.	0.008	11.09	0.710
AM-241	238.30	59.68	220.	114.	0.003	22.53	0.598
TH-234	253.07	63.37	345.	364.	0.008	10.89	0.617
TH-234	369.94	92.56	416.	494.	0.011	9.25	1.114s
U-235	575.63	143.94	294.	111.	0.003	29.76	0.476s
U-235	742.85	185.72	313.	228.	0.005	12.09	0.925D
PB-212	953.98	238.47	259.	139.	0.003	23.67	1.088
PB-214	1180.81	295.14	208.	126.	0.003	22.65	1.007
PB-214	1408.19	351.96	283.	145.	0.003	25.61	0.732s
BI-214	2436.27	608.89	149.	155.	0.004	17.94	1.467s
CS-137	2647.00	661.57	80.	78.	0.002	24.26	0.788s
BI-214	4481.92	1120.39	37.	73.	0.002	23.20	0.542s
K-40	5843.24	1460.95	28.	74.	0.002	19.77	0.296s
BI-214	7056.65	1764.63	10.	40.	0.001	22.51	1.265s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS		COMMENTS
K-40	N	1.2351E+00				4.66E+11		
			1460.83	1.235E+00	?(	4.568E-01	1.98E+01 1.07E+01	G
CS-137	I	7.4079E-02				1.10E+04		
			661.66	7.408E-02	(	4.216E-02	2.43E+01 8.52E+01	G
PB-210	N	3.2853E+00				8.14E+03		
			46.54	3.285E+00	(	8.587E-01	1.11E+01 4.25E+00	G

Nuclide		Ave activity	Energy		Activity	Code	Peak	MDA	Comments
PB-212	N	8.9494E-02						6.98E+02	
			238.63	8.949E-02	(	4.988E-02	2.37E+01	4.33E+01	G
			300.03	0.000E+00		7.612E-02	0.00E+00	3.28E+00	GA
PB-214	N	1.7952E-01						5.84E+05	
			351.93	1.598E-01	(	8.964E-02	2.56E+01	3.76E+01	G
			295.09	2.179E-01	(	1.205E-01	2.26E+01	1.93E+01	G
			242.00	0.000E+00	%	2.355E-01	6.28E+01	7.43E+00	GA
BI-214	N	2.4358E-01						5.84E+05	
			609.31	2.436E-01	*(	9.350E-02	1.79E+01	4.61E+01	G
			1120.29	6.766E-01	+	2.904E-01	2.32E+01	1.51E+01	G
			1764.49	5.372E-01	+	2.322E-01	2.25E+01	1.54E+01	G
TH-234	N	2.7912E+00						1.63E+12	
			63.29	2.791E+00	(	6.845E-01	1.09E+01	3.81E+00	G
			92.59	1.815E+00	-	3.591E-01	9.25E+00	5.58E+00	G
U-235	N	2.1605E-01						2.57E+11	
			185.72	1.016E-01	}	3.799E-02	1.21E+01	5.40E+01	GA
			143.79	2.160E-01	*(	1.608E-01	2.98E+01	1.10E+01	G
			205.33	0.000E+00		3.729E-02	0.00E+00	5.01E+00	G
			163.38	0.000E+00		3.301E-02	0.00E+00	5.08E+00	G
AM-241	T	9.9502E-02						1.58E+05	
			59.54	9.950E-02	?(	6.249E-02	2.25E+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.
+ - 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

Peak Codes:
G - Gamma Ray

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
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

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 1 Sigma Counting	MDA
BE-7	<	3.5041E-01		
NA-22	<	5.6681E-02		
K-40	#	1.2351E+00	1.9769E+01%	4.568E-01
Sc-46	<	2.0271E-02		
CR-51	<	1.4129E-01		
MN-54	<	3.9710E-02		
FE-59	<	4.2444E-02		
Co-56	<	4.7094E-02		
CO-57	<	1.4836E-02		
CO-58	<	1.8024E-02		
CO-60	<	4.8356E-02		
ZN-65	<	6.7915E-02		
NB-94	<	4.3284E-02		
ZR-95	<	3.1645E-02		
NB-95	<	5.3655E-02		
RU-103	<	3.1372E-02		
RH-106	<	4.0354E-01		
AG-108M	<	2.4609E-02		
AG-110M	<	5.9120E-02		
SN-113	<	1.9667E-02		
SB-124	<	3.8283E-02		
SB-125	<	4.8930E-02		
I-131	<	1.7306E-02		
BA-133	<	3.4847E-02		
CS-134	<	3.5518E-02		
CS-137		7.4079E-02	2.4258E+01%	4.216E-02
CE-139	<	2.2229E-02		
Ba-140	<	1.6888E-01		
La-140	<	2.1565E-02		

CE-141	<	2.7267E-02		
CE-144	<	1.5985E-01		
PM-144	<	5.0198E-02		
EU-152	<	9.1825E-02		
EU-154	<	3.3832E-01		
EU-155	<	7.4813E-02		
HF-181	<	1.7908E-02		
Ta-182	<	1.2830E-01		
Hg-203	<	2.2247E-02		
TL-208	<	4.5233E-02		
pm-146	<	5.3468E-02		
y-88	<	4.6158E-02		
PB-210		3.2853E+00	1.1085E+01%	8.587E-01
PB-212		8.9494E-02	2.3671E+01%	4.988E-02
PB-214		1.7952E-01	1.7093E+01%	8.964E-02
BI-207	<	4.0047E-02		
BI-212	<	5.0125E-01		
BI-214		2.4358E-01	1.7945E+01%	9.350E-02
BI-210M	<	3.7910E-02		
RA-224	<	2.5669E-01		
AC-228	<	1.4595E-01		
TH-227	<	8.0748E-02		
TH-229	<	3.6918E-01		
TH-234		2.7912E+00	1.0891E+01%	6.845E-01
PA-231	<	7.2765E-01		
PA-233	<	5.5682E-02		
PA-234	<	5.6471E-02		
PA-234M	<	7.8653E+00		
Ra-226	<	7.4283E-01		
U-235		2.1605E-01	2.9757E+01%	1.608E-01
AM-241	#	9.9502E-02	2.2535E+01%	6.249E-02
Np-237	<	1.2579E-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 (205.2 to 2000.8 keV) 8.214E+00 DPS

Test America
St. Louis
Background Check

Spectrum: 7_20140502006_BGLong
Acquired: 5/2/2014 6:11:20 PM
Detector: Ge 7 SN/154
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	1.30	1.16	1.21	1.29	1.40	1.45	PASS

Analyst: April Bean Reviewer: Siobhan Perry

TestAmerica Spectrum name: 7_20140502006_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det7\7_20140502006_BGLong.An1

Acquisition information
Start time:	5/2/2014 6:11:20 PM
Live time:	43200
Real time:	43855
Dead time:	1.49 %
Detector ID:	7

Detector system
Ge 7 SN/154

Calibration
Filename: 7_QC.Clb
Ge7_QC

Energy Calibration
Created:	2/23/2012 8:40:56 AM
Zero offset:	0.117 keV
Gain:	0.250 keV/channel
Quadratic:	3.508E-09 keV/channel^2

Efficiency Calibration
Created:	1/6/2011 8:06:10 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 G53W4.25
Start channel:	150 (37.61keV)
Stop channel:	8000 (2000.12keV)
Peak rejection level:	30.000%
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:	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. 15 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 1.0000

***** 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
46.43	444.	10.60	1.05	8.086E-02	46.54	4.250	2.979E+00	PB210
63.26	466.	9.56	0.94	1.228E-01	63.29	3.810	2.303E+00	TH234
92.58	572.	8.83	1.12	1.861E-01	92.59	5.584	1.274E+00	TH234
					93.35	5.561	1.278E+00	AC228
185.57	348.	12.70	1.24	1.634E-01	185.72	54.000	9.143E-02	U235
					185.99	3.280	1.506E+00	Ra226
238.51	149.	20.02	1.08	1.417E-01	238.63	43.300	5.622E-02	PB212
1001.21	42.	29.41	0.68	2.864E-02	1001.00	0.837	4.104E+00	PA234M
1461.44	83.	20.62	0.31	1.997E-02	1460.83	10.670	9.018E-01	K40

No unknown peaks passed sensitivity test.

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	185.09	46.38	348.	426.	0.010	9.52	1.041s
TH-234	252.59	63.26	413.	466.	0.011	9.56	0.938s
TH-234	369.91	92.58	475.	572.	0.013	8.83	1.115s
Ra-226	741.90	185.57	345.	348.	0.008	12.70	1.245s
PB-212	953.67	238.51	234.	149.	0.003	20.02	1.084s
PA-234M	4004.60	1001.21	32.	42.	0.001	29.41	0.678s
K-40	5845.44	1461.44	30.	83.	0.002	20.62	0.312s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS		COMMENTS
K-40	N	9.0185E-01				4.66E+11		
			1460.83	9.018E-01	@(	3.068E-01	2.06E+01 1.07E+01	G
PB-210	N	2.8569E+00				8.14E+03		
			46.54	2.857E+00	*(	6.015E-01	9.52E+00 4.25E+00	G
PB-212	N	5.6215E-02				6.98E+02		
			238.63	5.622E-02	(	2.792E-02	2.00E+01 4.33E+01	G
			300.03	0.000E+00		4.460E-02	0.00E+00 3.28E+00	GA
TH-234	N	2.3030E+00				1.63E+12		
			63.29	2.303E+00	@(	4.819E-01	9.56E+00 3.81E+00	G
			92.59	1.274E+00	-	2.323E-01	8.83E+00 5.58E+00	G
PA-234M	N	4.1042E+00				1.63E+12		
			1001.00	4.104E+00	?(	2.827E+00	2.94E+01 8.37E-01	G
			766.41	0.000E+00	%	8.021E+00	3.39E+01 2.94E-01	G
Ra-226		1.5063E+00				5.84E+05		
			185.99	1.506E+00	@(	3.858E-01	1.27E+01 3.28E+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

Peak Codes:
G - Gamma Ray
X - X-Ray

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
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

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 1 Sigma Counting	MDA
BE-7	<	7.3545E-02		
NA-22	<	2.7106E-02		
K-40	#	9.0185E-01	2.0623E+01%	3.068E-01
Sc-46	<	3.6147E-02		
CR-51	<	1.5990E-01		
MN-54	<	3.4859E-02		
FE-59	<	4.6546E-02		
Co-56	<	3.2987E-02		
CO-57	<	1.1328E-02		
CO-58	<	9.4277E-03		
CO-60	<	1.7310E-02		
ZN-65	<	1.9340E-02		
NB-94	<	3.2919E-02		
ZR-95	<	4.7239E-02		
NB-95	<	1.7075E-02		
RU-103	<	1.9993E-02		
RH-106	<	1.9219E-01		
AG-108M	<	1.7340E-02		
AG-110M	<	3.8823E-02		
SN-113	<	3.4077E-02		
SB-124	<	1.7987E-02		
SB-125	<	4.3279E-02		
I-131	<	1.6735E-02		
BA-133	<	2.4751E-02		
CS-134	<	2.1276E-02		
CS-137	<	3.6518E-02		
CE-139	<	6.4559E-03		
Ba-140	<	3.2826E-02		
La-140	<	1.2127E-02		
CE-141	<	1.0495E-02		

CE-144	<	7.7800E-02			
PM-144	<	2.8877E-02			
EU-152	<	2.6489E-02			
EU-154	<	2.2479E-01			
EU-155	<	4.1892E-02			
HF-181	<	9.6853E-03			
Ta-182	<	7.1624E-02			
Hg-203	<	1.4292E-02			
TL-208	<	3.2442E-02			
pm-146	<	4.4427E-02			
y-88	<	3.2083E-02			
PB-210	#	2.8569E+00	9.5226E+00%		6.015E-01
PB-212	#	5.6215E-02	2.0022E+01%		2.792E-02
PB-214	<	4.9383E-02			
BI-207	<	2.2698E-02			
BI-212	<	3.2167E-01			
BI-214	<	4.3445E-02			
BI-210M	<	2.5961E-02			
RA-224	<	3.1805E-01			
AC-228	<	1.1526E-01			
TH-227	<	6.0531E-02			
TH-229	<	2.7847E-01			
TH-234	#	2.3030E+00	9.5585E+00%		4.819E-01
PA-231	<	3.7246E-01			
PA-233	<	3.7039E-02			
PA-234	<	5.2512E-02			
PA-234M	#	4.1042E+00	2.9412E+01%		2.827E+00
Ra-226	#	1.5063E+00	1.2699E+01%		3.858E-01
U-235	<	9.1175E-02			
AM-241	<	4.1512E-02			
Np-237	<	8.3673E-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 (37.6 to 2000.1 keV) 1.173E+01 DPS

Test America
St. Louis
Background Check

Spectrum: 9_20140502003_BGLong
Acquired: 5/2/2014 5:57:37 PM
Detector: Ge9 S/N100228730
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	1.89	1.53	1.65	1.82	2.14	2.26	PASS

Analyst: April Bean Reviewer: Siobhan Perry

TestAmerica, Inc Spectrum name: 9_20140502003_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det9\9_20140502003_BGLong.An1

Acquisition information
Start time: 5/2/2014 5:57:37 PM
Live time: 43200
Real time: 43266
Dead time: 0.15 %
Detector ID: 9

Detector system
Ge9 S/N100228730

Calibration
Filename: 9_QC.Clb
9_QC-E_79670-334_060211

Energy Calibration
Created: 3/1/2012 1:57:17 PM
Zero offset: 0.074 keV
Gain: 0.250 keV/channel
Quadratic: -2.269E-08 keV/channel^2

Efficiency Calibration
Created: 6/3/2011 12:03:10 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 G53W4.25
Start channel: 150 (37.59keV)
Stop channel: 8000 (1999.34keV)
Peak rejection level: 30.000%
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:	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. 14 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.3616

***** 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
295.54	136.	25.96	0.73	1.045E-01	295.09	19.300	1.554E-01	PB214
352.03	208.	18.06	1.29	8.640E-02	351.93	37.600	1.481E-01	PB214
510.85	1265.	5.27	2.40	6.210E-02	511.86	20.000	2.362E+00	RH106
609.15	275.	16.38	1.25	5.260E-02	609.31	46.090	2.625E-01	BI214
					610.30	5.750	2.108E+00	RU103
1120.13	63.	25.64	0.57	2.761E-02	1120.29	15.100	3.479E-01	BI214
					1120.55	99.987	5.255E-02	Sc46
1460.82	198.	9.73	2.08	2.339E-02	1460.83	10.670	1.833E+00	K40
1764.17	63.	19.92	1.01	2.159E-02	1764.49	15.400	4.385E-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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
2042.76	510.85	467.	1265.	2.038E+04	5.27	2.403	-	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: 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-214	1181.55	295.54	301.	136.	0.003	25.96	0.731s
PB-214	1407.48	352.03	288.	208.	0.005	18.06	1.288s
BI-214	2435.95	609.15	284.	275.	0.006	16.38	1.254s
BI-214	4480.42	1120.13	53.	63.	0.001	25.64	0.573s
K-40	5843.98	1460.82	33.	198.	0.005	9.73	2.081
BI-214	7058.38	1764.17	21.	63.	0.001	19.92	1.015s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS	COMMENTS
K-40	N	1.8332E+00				4.66E+11	
			1460.83	1.833E+00	(	2.747E-01 9.73E+00 1.07E+01	G
PB-214	N	1.5058E-01				5.84E+05	
			351.93	1.481E-01	*(	5.830E-02 1.81E+01 3.76E+01	G
			295.09	1.554E-01	(	9.578E-02 2.60E+01 1.93E+01	G
			242.00	0.000E+00	%	2.053E-01 1.13E+02 7.43E+00	GA
BI-214	N	2.8359E-01				5.84E+05	
			609.31	2.625E-01	@(	7.762E-02 1.64E+01 4.61E+01	G
			1120.29	3.479E-01	?(	2.040E-01 2.56E+01 1.51E+01	G
			1764.49	4.385E-01	+	1.675E-01 1.99E+01 1.54E+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

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 1 Sigma Counting	MDA
BE-7	< 1.7676E-01		
NA-22	< 3.2890E-02		
K-40	1.8332E+00	9.7298E+00%	2.747E-01
Sc-46	< 2.1852E-02		
CR-51	< 1.6533E-01		
MN-54	< 3.5245E-02		
FE-59	< 3.8142E-02		
Co-56	< 1.4668E-02		
CO-57	< 9.6996E-03		
CO-58	< 1.3011E-02		
CO-60	< 3.1549E-02		
ZN-65	< 9.0564E-02		
NB-94	< 1.3769E-02		
ZR-95	< 2.4476E-02		
NB-95	< 1.2951E-02		
RU-103	< 1.9419E-02		
RH-106	< 2.9448E-01		
AG-108M	< 2.0472E-02		
AG-110M	< 4.6971E-02		
SN-113	< 3.4670E-02		
SB-124	< 3.8674E-02		
SB-125	< 5.7287E-02		
I-131	< 3.5389E-02		
BA-133	< 2.7272E-02		

CS-134	<	1.9498E-02			
CS-137	<	3.9129E-02			
CE-139	<	1.6604E-02			
Ba-140	<	1.2200E-01			
La-140	<	2.5295E-02			
CE-141	<	3.0749E-02			
CE-144	<	1.0448E-01			
PM-144	<	2.4457E-02			
EU-152	<	8.1343E-02			
EU-154	<	1.1947E-01			
EU-155	<	7.0925E-02			
HF-181	<	1.1319E-02			
Ta-182	<	1.2714E-01			
Hg-203	<	1.7629E-02			
TL-208	<	3.6368E-02			
pm-146	<	8.9440E-02			
y-88	<	4.4592E-02			
PB-210	<	6.5643E-01			
PB-212	<	4.5291E-02			
PB-214		1.5058E-01	1.5812E+01%		5.830E-02
BI-207	<	3.1131E-02			
BI-212	<	1.7176E-01			
BI-214	#	2.8359E-01	1.5214E+01%		7.762E-02
BI-210M	<	3.7125E-02			
RA-224	<	4.0281E-01			
AC-228	<	1.8008E-01			
TH-227	<	9.5188E-02			
TH-229	<	3.2053E-01			
TH-234	<	2.7873E-01			
PA-231	<	6.9572E-01			
PA-233	<	2.3943E-02			
PA-234	<	7.1011E-02			
PA-234M	<	4.7374E+00			
Ra-226	<	4.8009E-01			
U-235	<	1.3466E-01			
AM-241	<	4.6593E-02			
Np-237	<	1.0130E-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	1999.3 keV)	2.267E+00 DPS

Test America
St. Louis
Background Check

Spectrum: 11_20140502005_BGLong
Acquired: 5/2/2014 6:15:44 PM
Detector: Ge11 S/N09363993
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	2.13	2.00	2.04	2.18	2.21	2.25	PASS

Analyst: April Bean Reviewer: Siobhan Perry

TestAmerica, Inc Spectrum name: 11_20140502005_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det11\11_20140502005_BGLong.An1

Acquisition information
Start time: 5/2/2014 6:15:44 PM
Live time: 43200
Real time: 46987
Dead time: 8.06 %
Detector ID: 11

Detector system
Ge11 S/N09363993

Calibration
Filename: 11_QC.Clb
11_QC-G_092511

Energy Calibration
Created: 2/28/2012 1:09:34 PM
Zero offset: 0.055 keV
Gain: 0.250 keV/channel
Quadratic: -2.946E-08 keV/channel^2

Efficiency Calibration
Created: 10/4/2011 1:15:19 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 G53W4.25
Start channel: 150 (37.58keV)
Stop channel: 8000 (1999.47keV)
Peak rejection level: 30.000%
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:	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. 24 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0978

***** 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
39.68	178.	24.47	0.99	5.488E-02				
46.65	617.	8.77	0.94	6.417E-02	46.54	4.250	5.246E+00	PB210
63.33	500.	11.65	0.74	8.641E-02	63.29	3.810	3.521E+00	TH234
72.69	147.	25.03	0.92	9.888E-02				
74.98	460.	9.13	0.93	1.019E-01				
77.19	242.	15.83	0.93	1.049E-01				
84.61	259.	13.98	0.94	1.149E-01				
87.41	136.	23.42	0.94	1.187E-01				
92.70	735.	8.07	1.16	1.199E-01	92.59	5.584	2.541E+00	TH234
					93.35	5.561	2.549E+00	AC228
185.76	426.	12.87	1.07	1.054E-01	185.72	54.000	1.733E-01	U235
					185.99	3.280	2.855E+00	Ra226
238.65	332.	12.37	0.91	9.259E-02	238.63	43.300	1.917E-01	PB212
294.93	218.	21.53	1.05	7.891E-02	295.09	19.300	3.315E-01	PB214
351.68	280.	16.11	1.42	6.511E-02	351.93	37.600	2.645E-01	PB214
583.31	171.	15.22	1.49	4.159E-02	583.02	84.500	1.129E-01	TL208
609.42	330.	12.75	1.35	3.969E-02	609.31	46.090	4.175E-01	BI214
					610.30	5.750	3.353E+00	RU103
1120.32	110.	17.87	1.05	2.116E-02	1120.29	15.100	7.944E-01	BI214
					1121.30	34.900	3.440E-01	Ta182
1460.97	265.	10.46	1.74	1.711E-02	1460.83	10.670	3.360E+00	K40
1764.64	117.	14.42	1.56	1.467E-02	1764.49	15.400	1.203E+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 keV		Suspected Nuclide
158.42	39.68	540.	178.	3.234E+03	24.47	0.986	-	
290.35	72.68	608.	147.	1.492E+03	25.03	0.925	-	D
299.50	74.97	651.	460.	4.510E+03	9.13	0.927	-	D
308.36	77.19	610.	242.	2.303E+03	15.83	0.929	-	D
338.50	84.73	533.	291.	2.532E+03	15.29	1.046	-	sM
349.69	87.53	370.	118.	9.901E+02	27.50	0.812	-	M

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 keV
PB-210	186.26	46.65	629.	617.	0.014	8.77	0.944
TH-234	252.93	63.33	756.	500.	0.012	11.65	0.743
TH-234	370.36	92.70	696.	735.	0.017	8.07	1.163s
Ra-226	742.41	185.76	597.	426.	0.010	12.87	1.074s
PB-212	953.87	238.65	406.	332.	0.008	12.37	0.914
PB-214	1180.08	295.23	338.	158.	0.004	23.09	1.014
PB-214	1405.81	351.68	388.	280.	0.006	16.11	1.415s
TL-208	2332.14	583.31	139.	171.	0.004	15.22	1.490
BI-214	2436.56	609.42	288.	330.	0.008	12.75	1.353
BI-214	4480.50	1120.32	63.	110.	0.003	17.87	1.052s
K-40	5843.90	1460.97	72.	265.	0.006	10.46	1.741
BI-214	7059.62	1764.64	27.	117.	0.003	14.42	1.565s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS		COMMENTS
K-40	N	3.3599E+00				4.66E+11		
			1460.83	3.360E+00	(	5.357E-01	1.05E+01	1.07E+01 G
TL-208	N	1.1285E-01				6.98E+02		
			583.02	1.129E-01	(	3.793E-02	1.52E+01	8.45E+01 G
			277.28	0.000E+00		3.250E-02	0.00E+00	6.31E+00 G
			860.56	0.000E+00		5.093E-02	0.00E+00	1.24E+01 G
PB-210	N	5.2464E+00				8.14E+03		
			46.54	5.246E+00	(	1.018E+00	8.77E+00	4.25E+00 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
PB-212	N	1.9168E-01					6.98E+02	
			238.63	1.917E-01	(	5.578E-02	1.24E+01	4.33E+01 G
			300.03	0.000E+00		6.697E-02	0.00E+00	3.28E+00 GA
PB-214	N	2.5656E-01					5.84E+05	
			351.93	2.645E-01	(	8.950E-02	1.61E+01	3.76E+01 G
			295.09	2.410E-01	?(	1.343E-01	2.31E+01	1.93E+01 G
			242.00	0.000E+00	%	3.065E-01	5.83E+01	7.43E+00 GA
BI-214	N	4.1753E-01					5.84E+05	
			609.31	4.175E-01	(	1.035E-01	1.27E+01	4.61E+01 G
			1120.29	7.944E-01	+	2.883E-01	1.79E+01	1.51E+01 G
			1764.49	1.203E+00	+	2.744E-01	1.44E+01	1.54E+01 G
TH-234	N	3.5214E+00					1.63E+12	
			63.29	3.521E+00	(	9.209E-01	1.17E+01	3.81E+00 G
			92.59	2.541E+00	-	4.344E-01	8.07E+00	5.58E+00 G
Ra-226		2.8548E+00					5.84E+05	
			185.99	2.855E+00	*(	7.804E-01	1.29E+01	3.28E+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:	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

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 1 Sigma Counting	MDA
BE-7	<	3.1848E-01		
NA-22	<	6.7477E-02		
K-40		3.3599E+00	1.0464E+01%	5.357E-01
Sc-46	<	4.9040E-02		
CR-51	<	1.4449E-01		
MN-54	<	4.5796E-02		
FE-59	<	1.2065E-01		
Co-56	<	4.5308E-02		
CO-57	<	1.0528E-02		
CO-58	<	3.7964E-02		
CO-60	<	2.0277E-02		
ZN-65	<	7.3129E-02		
NB-94	<	5.9900E-02		
ZR-95	<	2.7061E-02		
NB-95	<	2.3900E-02		
RU-103	<	4.0630E-02		
RH-106	<	3.9723E-01		
AG-108M	<	2.0787E-02		
AG-110M	<	2.2351E-02		
SN-113	<	4.9889E-02		
SB-124	<	1.7987E-02		
SB-125	<	1.0456E-01		
I-131	<	1.8670E-02		
BA-133	<	3.5365E-02		
CS-134	<	4.6034E-02		
CS-137	<	5.4202E-02		
CE-139	<	2.2712E-02		
Ba-140	<	1.1720E-01		
La-140	<	6.0124E-02		
CE-141	<	3.7665E-02		
CE-144	<	1.5000E-01		
PM-144	<	4.3924E-02		
EU-152	<	5.5162E-02		
EU-154	<	3.7801E-01		
EU-155	<	6.0906E-02		

HF-181	<	4.1891E-02			
Ta-182	<	1.1289E-01			
Hg-203	<	2.4509E-02			
TL-208		1.1285E-01	1.5217E+01%		3.793E-02
pm-146	<	9.5325E-02			
y-88	<	5.8781E-02			
PB-210		5.2464E+00	8.7691E+00%		1.018E+00
PB-212		1.9168E-01	1.2365E+01%		5.578E-02
PB-214		2.5656E-01	1.4079E+01%		8.950E-02
BI-207	<	3.6596E-02			
BI-212	<	6.3182E-01			
BI-214		4.1753E-01	1.2749E+01%		1.035E-01
BI-210M	<	4.8132E-02			
RA-224	<	5.7908E-01			
AC-228	<	2.1553E-01			
TH-227	<	1.5389E-01			
TH-229	<	4.5978E-01			
TH-234		3.5214E+00	1.1651E+01%		9.209E-01
PA-231	<	6.9674E-01			
PA-233	<	7.4370E-02			
PA-234	<	1.0047E-01			
PA-234M	<	8.6091E+00			
Ra-226	#	2.8548E+00	1.2873E+01%		7.804E-01
U-235	<	1.6954E-01			
AM-241	<	8.5315E-02			
Np-237	<	1.9954E-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 (84.6 to 1999.5 keV) 1.596E+01 DPS

Test America
St. Louis
Background Check

Spectrum: 12_20140502005_BGLong
Acquired: 5/2/2014 6:16:42 PM
Detector: Ge12 S/N10034336
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	2.16	1.95	2.02	2.14	2.29	2.36	PASS

Analyst: April Bean Reviewer: Siobhan Perry

TestAmerica, Inc Spectrum name: 12_20140502005_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det12\12_20140502005_BGLong.An1

Acquisition information
Start time: 5/2/2014 6:16:42 PM
Live time: 43200
Real time: 43302
Dead time: 0.24 %
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 G53W4.25
Start channel: 150 (37.58keV)
Stop channel: 8000 (1999.36keV)
Peak rejection level: 30.000%
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:	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. 20 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.2053

***** 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
46.56	774.	7.62	1.12	6.300E-02	46.54	4.250	6.699E+00	PB210
63.31	438.	13.37	1.10	8.571E-02	63.29	3.810	3.106E+00	TH234
74.85	183.	20.74	0.92	1.012E-01				
77.29	139.	25.89	0.92	1.045E-01				
92.65	676.	7.34	1.20	1.198E-01	92.59	5.584	2.340E+00	TH234
185.64	444.	13.16	1.25	1.068E-01	185.72	54.000	1.784E-01	U235
					185.99	3.280	2.939E+00	Ra226
238.38	365.	12.89	1.00	9.400E-02	238.63	43.300	2.077E-01	PB212
294.93	212.	21.66	0.86	8.027E-02	295.09	19.300	3.175E-01	PB214
351.89	318.	12.82	1.63	6.651E-02	351.93	37.600	2.944E-01	PB214
510.77	1208.	5.01	2.42	4.821E-02	511.86	20.000	2.906E+00	RH106
583.02	160.	17.60	1.67	4.296E-02	583.02	84.500	1.018E-01	TL208
609.30	213.	20.27	0.78	4.104E-02	609.31	46.090	2.604E-01	BI214
911.04	110.	24.99	1.50	2.567E-02	911.16	29.000	3.420E-01	AC228
1001.14	63.	25.73	0.82	2.403E-02	1001.00	0.837	7.289E+00	PA234M
1119.91	75.	27.50	1.59	2.185E-02	1120.29	15.100	5.274E-01	BI214
1460.36	119.	13.98	2.19	1.768E-02	1460.83	10.670	1.465E+00	K40
1763.90	75.	17.77	0.55	1.522E-02	1764.49	15.400	7.408E-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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
298.50	74.74	730.	208.	2.054E+03	24.15	0.978	-	
308.26	77.18	515.	141.	1.349E+03	27.60	0.730	-	
2041.68	510.77	420.	1208.	2.507E+04	5.01	2.420	-	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: 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	185.86	46.56	706.	774.	0.018	7.62	1.122s
TH-234	252.83	63.31	816.	438.	0.010	13.37	1.104s
TH-234	369.85	92.59	678.	524.	0.012	8.27	0.933D
Ra-226	741.76	185.64	687.	444.	0.010	13.16	1.247s
PB-212	952.61	238.38	504.	365.	0.008	12.89	0.996
PB-214	1178.67	294.93	424.	212.	0.005	21.66	0.861s
PB-214	1406.37	351.89	310.	318.	0.007	12.82	1.633s
TL-208	2330.62	583.02	164.	160.	0.004	17.60	1.668s
BI-214	2435.70	609.30	341.	213.	0.005	20.27	0.780s
AC-228	3642.70	911.04	125.	110.	0.003	24.99	1.496s
PA-234M	4003.19	1001.14	61.	63.	0.001	25.73	0.815s
BI-214	4478.50	1119.91	73.	75.	0.002	27.50	1.588
K-40	5841.24	1460.36	37.	119.	0.003	13.98	2.191
BI-214	7056.77	1763.90	22.	75.	0.002	17.77	0.549s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS		COMMENTS
K-40	N	1.4646E+00				4.66E+11		
			1460.83	1.465E+00 ?(		3.796E-01	1.40E+01 1.07E+01	G
TL-208	N	1.0182E-01				6.98E+02		
			583.02	1.018E-01 (		3.982E-02	1.76E+01 8.45E+01	G
			277.28	0.000E+00		3.197E-02	0.00E+00 6.31E+00	G
			860.56	0.000E+00		4.958E-02	0.00E+00 1.24E+01	G
PB-210	N	6.6986E+00				8.14E+03		
			46.54	6.699E+00 *(		1.094E+00	7.62E+00 4.25E+00	G

Nuclide		Ave activity	Energy		Activity	Code	Peak	MDA	Comments
PB-212	N	2.0772E-01						6.98E+02	
			238.63	2.077E-01	(	6.108E-02	1.29E+01	4.33E+01	G
			300.03	0.000E+00		6.578E-02	0.00E+00	3.28E+00	GA
PB-214	N	3.0222E-01						5.84E+05	
			351.93	2.944E-01	*(	7.846E-02	1.28E+01	3.76E+01	G
			295.09	3.175E-01	(	1.473E-01	2.17E+01	1.93E+01	G
			242.00	0.000E+00	&	2.684E-01	5.80E+01	7.43E+00	GA
BI-214	N	2.6044E-01						5.84E+05	
			609.31	2.604E-01	(	1.086E-01	2.03E+01	4.61E+01	G
			1120.29	5.274E-01	+	2.980E-01	2.75E+01	1.51E+01	G
			1764.49	7.408E-01	+	2.427E-01	1.78E+01	1.54E+01	G
AC-228	N	3.4200E-01						2.10E+03	
			911.16	3.420E-01	@(	1.704E-01	2.50E+01	2.90E+01	G
			968.97	0.000E+00	%	2.746E-01	3.79E+01	1.75E+01	G
			338.32	0.000E+00	%	2.594E-01	3.27E+01	1.20E+01	G
			93.35	0.000E+00	%	5.074E-01	3.20E+01	5.56E+00	XA
TH-234	N	3.1060E+00						1.63E+12	
			63.29	3.106E+00	*(	9.632E-01	1.34E+01	3.81E+00	G
			92.59	1.813E+00	-	4.291E-01	8.27E+00	5.58E+00	G
PA-234M	N	7.2889E+00						1.63E+12	
			1001.00	7.289E+00	?(	4.489E+00	2.57E+01	8.37E-01	G
			766.41	0.000E+00	%	1.362E+01	3.32E+01	2.94E-01	G
Ra-226		2.9393E+00						5.84E+05	
			185.99	2.939E+00	*(	8.257E-01	1.32E+01	3.28E+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

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 1 Sigma Counting	MDA
BE-7	<	1.9179E-01		
NA-22	<	3.1975E-02		
K-40	#	1.4646E+00	1.3978E+01%	3.796E-01
Sc-46	<	2.6273E-02		
CR-51	<	2.2881E-01		
MN-54	<	3.6943E-02		
FE-59	<	8.7804E-02		
Co-56	<	4.4412E-02		
CO-57	<	2.0491E-02		
CO-58	<	2.0824E-02		
CO-60	<	4.5717E-02		
ZN-65	<	1.2308E-01		
NB-94	<	4.0583E-02		
ZR-95	<	3.4429E-02		
NB-95	<	3.6948E-02		
RU-103	<	3.9377E-02		
RH-106	<	4.8622E-01		
AG-108M	<	1.5126E-02		
AG-110M	<	7.0093E-02		
SN-113	<	2.8227E-02		
SB-124	<	1.9274E-02		
SB-125	<	4.5861E-02		
I-131	<	3.7601E-02		
BA-133	<	3.7041E-02		
CS-134	<	4.6637E-02		

CS-137	<	5.1482E-02		
CE-139	<	2.6489E-02		
Ba-140	<	1.6602E-01		
La-140	<	4.2544E-02		
CE-141	<	3.3048E-02		
CE-144	<	1.4650E-01		
PM-144	<	4.1847E-02		
EU-152	<	1.0275E-01		
EU-154	<	4.0406E-01		
EU-155	<	8.8847E-02		
HF-181	<	4.5720E-02		
Ta-182	<	1.0734E-01		
Hg-203	<	2.0829E-02		
TL-208	#	1.0182E-01	1.7599E+01%	3.982E-02
pm-146	<	6.3011E-02		
y-88	<	4.2070E-02		
PB-210	#	6.6986E+00	7.6155E+00%	1.094E+00
PB-212		2.0772E-01	1.2888E+01%	6.108E-02
PB-214	#	3.0222E-01	1.2584E+01%	7.846E-02
BI-207	<	3.3833E-02		
BI-212	<	4.6784E-01		
BI-214		2.6044E-01	2.0273E+01%	1.086E-01
BI-210M	<	4.3277E-02		
RA-224	<	4.5292E-01		
AC-228	#	3.4200E-01	2.4993E+01%	1.704E-01
TH-227	<	1.5433E-01		
TH-229	<	3.0277E-01		
TH-234		3.1060E+00	1.3371E+01%	9.632E-01
PA-231	<	4.2442E-01		
PA-233	<	6.0767E-02		
PA-234	<	1.1552E-01		
PA-234M	#	7.2889E+00	2.5730E+01%	4.489E+00
Ra-226	#	2.9393E+00	1.3161E+01%	8.257E-01
U-235	<	2.0875E-01		
AM-241	<	9.6635E-02		
Np-237	<	1.7369E-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 (133.7 to 1999.4 keV) 2.271E+01 DPS

Test America
St. Louis
Background Check

Spectrum: 15_20140502004_BGLong
Acquired: 5/2/2014 6:12:41 PM
Detector: Ge15 SN/11012216
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	1.72	1.60	1.64	1.71	1.80	1.84	PASS

Analyst: April Bean Reviewer: Siobhan Perry

TestAmerica, Inc. Spectrum name: 15_20140502004_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det15\15_20140502004_BGLong.An1

Acquisition information
Start time: 5/2/2014 6:12:41 PM
Live time: 43200
Real time: 43214
Dead time: 0.03 %
Detector ID: 15

Detector system
Ge15 SN/11012216

Calibration
Filename: 15_20140502004_BGLong.An1
15_QC_83725-334_SOURCE F_2011

Energy Calibration
Created: 2/28/2012 4:29:17 PM
Zero offset: 0.044 keV
Gain: 0.250 keV/channel
Quadratic: -3.267E-08 keV/channel^2

Efficiency Calibration
Created: 8/2/2011 8:55:45 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 G53W4.25
Start channel: 150 (37.57keV)
Stop channel: 8000 (1999.52keV)
Peak rejection level: 30.000%
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:	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. 22 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1841

***** 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
46.03	529.	9.45	0.93	5.991E-02	46.54	4.250	4.761E+00	PB210
62.98	471.	11.64	1.07	8.161E-02	63.29	3.810	3.489E+00	TH234
84.22	121.	29.97	0.98	1.090E-01				
92.35	660.	8.71	1.01	1.141E-01	92.59	5.584	2.395E+00	TH234
					93.35	5.561	2.403E+00	AC228
185.54	371.	13.17	1.04	9.785E-02	185.72	54.000	1.626E-01	U235
					185.99	3.280	2.679E+00	Ra226
238.26	245.	17.09	1.04	8.510E-02	238.63	43.300	1.542E-01	PB212
582.10	150.	19.21	1.32	3.411E-02	583.02	84.500	1.205E-01	TL208
609.36	181.	20.07	1.68	3.220E-02	609.31	46.090	2.826E-01	BI214
					610.30	5.750	2.270E+00	RU103
835.35	62.	28.94	0.44	2.270E-02	834.85	99.980	6.324E-02	MN54
1120.08	62.	26.92	1.40	1.693E-02	1120.29	15.100	5.613E-01	BI214
					1120.55	99.987	8.480E-02	Sc46
					1121.30	34.900	2.431E-01	Ta182
1460.26	75.	19.73	1.21	1.314E-02	1460.83	10.670	1.238E+00	K40
1764.33	69.	18.91	0.52	1.107E-02	1764.49	15.400	9.372E-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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
336.98	84.35	699.	191.	1.756E+03	27.42	0.572	-	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: 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	183.82	46.03	539.	529.	0.012	9.45	0.927
TH-234	251.57	62.98	660.	471.	0.011	11.64	1.071s
TH-234	368.95	92.35	688.	660.	0.015	8.71	1.014s
Ra-226	741.47	185.54	504.	371.	0.009	13.17	1.035s
PB-212	952.23	238.26	394.	245.	0.006	17.09	1.039
TL-208	2327.12	582.10	136.	150.	0.003	19.21	1.319s
BI-214	2436.14	609.36	221.	181.	0.004	20.07	1.675
MN-54	3340.06	835.35	60.	62.	0.001	28.94	0.444s
BI-214	4479.26	1120.08	50.	62.	0.001	26.92	1.397s
K-40	5840.76	1460.26	36.	75.	0.002	19.73	1.209s
BI-214	7058.11	1764.33	16.	69.	0.002	18.91	0.516s

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 DPS	Peak Energy keV	Activity DPS	Code	MDA Value DPS		COMMENTS
K-40	N	1.2384E+00				4.66E+11		
			1460.83	1.238E+00	(	5.064E-01	1.97E+01 1.07E+01	G
MN-54	C	6.3235E-02				3.12E+02		
			834.85	6.324E-02	?(	3.958E-02	2.89E+01 1.00E+02	G
TL-208	N	1.2047E-01				6.98E+02		
			583.02	1.205E-01	&(	4.582E-02	1.92E+01 8.45E+01	G
			277.28	0.000E+00	%	3.684E-01	8.96E+01 6.31E+00	G
			860.56	0.000E+00		6.285E-02	0.00E+00 1.24E+01	G
PB-210	N	4.7613E+00				8.14E+03		
			46.54	4.761E+00	&(	9.972E-01	9.45E+00 4.25E+00	G
PB-212	N	1.5417E-01				6.98E+02		
			238.63	1.542E-01	(	5.986E-02	1.71E+01 4.33E+01	G
			300.03	0.000E+00		7.413E-02	0.00E+00 3.28E+00	GA
BI-214	N	2.8258E-01				5.84E+05		
			609.31	2.826E-01	(	1.122E-01	2.01E+01 4.61E+01	G
			1120.29	5.613E-01	+	3.229E-01	2.69E+01 1.51E+01	G
			1764.49	9.372E-01	+	2.900E-01	1.89E+01 1.54E+01	G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
TH-234	N	3.4886E+00					1.63E+12	
			63.29	3.489E+00	*(	9.072E-01	1.16E+01	3.81E+00 G
			92.59	2.395E+00	-	4.539E-01	8.71E+00	5.58E+00 G
Ra-226		2.6788E+00					5.84E+05	
			185.99	2.679E+00	*(	7.749E-01	1.32E+01	3.28E+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:	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

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		Activity DPS	Time of Count Uncertainty 1 Sigma Counting	MDA
BE-7	<	2.8656E-01		
NA-22	<	4.2261E-02		
K-40		1.2384E+00	1.9732E+01%	5.064E-01
Sc-46	<	4.9437E-02		
CR-51	<	2.4638E-01		
MN-54	#	6.3235E-02	2.8943E+01%	3.958E-02
FE-59	<	3.3487E-02		
Co-56	<	3.7028E-02		
CO-57	<	2.1772E-02		
CO-58	<	3.1516E-02		
CO-60	<	6.2599E-02		
ZN-65	<	8.7378E-02		
NB-94	<	3.2578E-02		
ZR-95	<	9.3583E-02		
NB-95	<	3.8992E-02		
RU-103	<	2.9298E-02		
RH-106	<	4.1152E-01		
AG-108M	<	3.6439E-02		
AG-110M	<	5.6360E-02		
SN-113	<	5.1447E-02		
SB-124	<	4.9820E-02		
SB-125	<	8.9284E-02		
I-131	<	3.5185E-02		
BA-133	<	5.3515E-02		
CS-134	<	4.2875E-02		
CS-137	<	4.4174E-02		
CE-139	<	2.7697E-02		
Ba-140	<	1.5350E-01		
La-140	<	1.8474E-02		
CE-141	<	3.1594E-02		
CE-144	<	1.5405E-01		
PM-144	<	5.3532E-02		
EU-152	<	4.5618E-02		
EU-154	<	2.1619E-01		
EU-155	<	1.1342E-01		
HF-181	<	3.8459E-02		
Ta-182	<	1.1071E-01		
Hg-203	<	2.6963E-02		
TL-208	#	1.2047E-01	1.9206E+01%	4.582E-02
pm-146	<	1.3428E-01		
y-88	<	6.3887E-02		
PB-210		4.7613E+00	9.4542E+00%	9.972E-01
PB-212		1.5417E-01	1.7087E+01%	5.986E-02

PB-214	<	1.1176E-01			
BI-207	<	5.0166E-02			
BI-212	<	6.5481E-01			
BI-214		2.8258E-01	2.0071E+01%		1.122E-01
BI-210M	<	4.7295E-02			
RA-224	<	5.7634E-01			
AC-228	<	2.1195E-01			
TH-227	<	1.7073E-01			
TH-229	<	5.4051E-01			
TH-234	#	3.4886E+00	1.1636E+01%		9.072E-01
PA-231	<	3.8863E-01			
PA-233	<	5.9459E-02			
PA-234	<	1.2323E-01			
PA-234M	<	6.0155E+00			
Ra-226	#	2.6788E+00	1.3169E+01%		7.749E-01
U-235	<	1.9974E-01			
AM-241	<	8.9039E-02			
Np-237	<	1.9437E-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) 1.279E+01 DPS

Test America
St. Louis
Background Check

Spectrum: 17_20140502006_BGLong
Acquired: 5/2/2014 6:13:22 PM
Detector: Ge17 SN/11080671
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	2.47	2.30	2.35	2.39	2.58	2.63	PASS

Analyst: April Bean Reviewer: Siobhan Perry

TestAmerica, Inc. Spectrum name: 17_20140502006_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det17\17_20140502006_BGLong.An1

Acquisition information
Start time: 5/2/2014 6:13:22 PM
Live time: 43200
Real time: 43336
Dead time: 0.31 %
Detector ID: 17

Detector system
Ge17 SN/11080671

Calibration
Filename: 17_QC.Clb
17_QC_83725-334_SOURCE H_042211

Energy Calibration
Created: 2/29/2012 10:33:23 AM
Zero offset: 0.108 keV
Gain: 0.250 keV/channel
Quadratic: -2.584E-08 keV/channel^2

Efficiency Calibration
Created: 5/1/2011 11:17:56 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 G53W4.25
Start channel: 150 (37.63keV)
Stop channel: 8000 (1999.54keV)
Peak rejection level: 30.000%
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:	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. 22 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.1896

***** 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
46.66	834.	5.75	0.76	5.956E-02	46.54	4.250	7.648E+00	PB210
63.33	617.	8.50	0.67	8.042E-02	63.29	3.810	4.665E+00	TH234
75.02	157.	24.91	0.80	9.511E-02				
84.73	188.	22.91	1.29	1.072E-01				
92.63	922.	6.07	1.00	1.119E-01	92.59	5.584	3.417E+00	TH234
					93.35	5.561	3.428E+00	AC228
143.61	178.	19.93	1.36	1.093E-01	143.79	10.960	3.432E-01	U235
163.70	136.	27.65	0.76	1.037E-01	163.38	5.080	5.972E-01	U235
185.55	446.	10.30	0.81	9.860E-02	185.72	54.000	1.942E-01	U235
238.48	289.	16.62	0.95	8.658E-02	238.63	43.300	1.783E-01	PB212
351.91	134.	26.43	0.85	6.081E-02	351.93	37.600	1.352E-01	PB214
510.81	1145.	5.38	2.40	4.374E-02	511.86	20.000	3.034E+00	RH106
583.16	162.	21.61	0.70	3.886E-02	583.02	84.500	1.138E-01	TL208
609.25	126.	22.28	1.10	3.710E-02	609.31	46.090	1.699E-01	BI214
					610.30	5.750	1.364E+00	RU103
1460.54	153.	12.69	1.08	1.608E-02	1460.83	10.670	2.068E+00	K40
1764.05	72.	26.57	1.00	1.381E-02	1764.49	15.400	7.838E-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 Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 1 Sigma %	FWHM keV	Suspected Nuclide	
299.70	75.07	668.	155.	1.626E+03	28.45	0.613	-	
338.30	84.73	625.	188.	1.754E+03	22.91	1.288	-	s
654.05	163.70	426.	136.	1.312E+03	27.65	0.763	-	sM
2042.14	510.81	454.	1145.	2.617E+04	5.38	2.401	-	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 keV
PB-210	186.12	46.66	519.	834.	0.019	5.75	0.764
TH-234	252.77	63.33	712.	617.	0.014	8.50	0.672
TH-234	369.89	92.63	700.	922.	0.021	6.07	0.998s
U-235	573.75	143.61	403.	178.	0.004	19.93	1.358s
U-235	742.10	185.72	526.	448.	0.010	8.40	0.809D
PB-212	953.06	238.48	549.	289.	0.007	16.62	0.946
PB-214	1406.64	351.91	318.	134.	0.003	26.43	0.854s
TL-208	2331.51	583.16	218.	162.	0.004	21.61	0.698s
BI-214	2435.87	609.25	188.	126.	0.003	22.28	1.096s
K-40	5842.08	1460.54	39.	153.	0.004	12.69	1.084s
BI-214	7057.09	1764.05	42.	72.	0.002	26.57	1.001s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS		COMMENTS
K-40	N	2.0681E+00				4.66E+11		
			1460.83	2.068E+00	(	4.274E-01	1.27E+01	1.07E+01 G
TL-208	N	1.1382E-01				6.98E+02		
			583.02	1.138E-01	(	5.045E-02	2.16E+01	8.45E+01 G
			277.28	0.000E+00	%	3.486E-01	8.90E+01	6.31E+00 G
			860.56	0.000E+00		5.423E-02	0.00E+00	1.24E+01 G
PB-210	N	7.6481E+00				8.14E+03		
			46.54	7.648E+00	(	9.980E-01	5.75E+00	4.25E+00 G
PB-212	N	1.7832E-01				6.98E+02		
			238.63	1.783E-01	(	6.914E-02	1.66E+01	4.33E+01 G
			300.03	0.000E+00		7.165E-02	0.00E+00	3.28E+00 GA
PB-214	N	1.3517E-01				5.84E+05		
			351.93	1.352E-01	*(	8.682E-02	2.64E+01	3.76E+01 G
			295.09	0.000E+00	%	1.293E-01	3.14E+01	1.93E+01 G
			242.00	0.000E+00	&	3.364E-01	9.75E+01	7.43E+00 GA

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
BI-214	N 1.6990E-01				5.84E+05	
		609.31	1.699E-01	(	9.005E-02 2.23E+01 4.61E+01	G
		1120.29	0.000E+00		5.680E-02 0.00E+00 1.51E+01	G
		1764.49	7.838E-01	+	3.583E-01 2.66E+01 1.54E+01	G
TH-234	N 4.6646E+00				1.63E+12	
		63.29	4.665E+00	(	9.605E-01 8.50E+00 3.81E+00	G
		92.59	3.417E+00	-	4.668E-01 6.07E+00 5.58E+00	G
U-235	N 3.4320E-01				2.57E+11	
		185.72	1.948E-01	}	4.768E-02 8.40E+00 5.40E+01	GA
		143.79	3.432E-01	(	1.860E-01 1.99E+01 1.10E+01	G
		205.33	0.000E+00	%	4.105E-01 9.77E+01 5.01E+00	G
		163.38	0.000E+00		3.236E-02 0.00E+00 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:	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

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 1 Sigma Counting	MDA
BE-7	<	2.4686E-01		
NA-22	<	5.8952E-02		
K-40		2.0681E+00	1.2695E+01%	4.274E-01
Sc-46	<	1.9908E-02		
CR-51	<	2.7136E-01		
MN-54	<	5.1085E-02		
FE-59	<	4.4337E-02		
Co-56	<	2.0104E-02		
CO-57	<	1.9151E-02		
CO-58	<	4.4761E-02		
CO-60	<	2.7361E-02		
ZN-65	<	7.2001E-02		
NB-94	<	5.7539E-02		
ZR-95	<	5.4355E-02		
NB-95	<	4.0547E-02		
RU-103	<	3.9023E-02		
RH-106	<	3.4158E-01		
AG-108M	<	3.3746E-02		
AG-110M	<	7.4422E-02		
SN-113	<	4.6650E-02		
SB-124	<	4.3158E-02		
SB-125	<	1.2295E-01		
I-131	<	3.3625E-02		
BA-133	<	3.8981E-02		
CS-134	<	4.3596E-02		
CS-137	<	3.5923E-02		
CE-139	<	1.9652E-02		
Ba-140	<	1.8533E-01		
La-140	<	2.8091E-02		
CE-141	<	3.7969E-02		
CE-144	<	2.0113E-01		
PM-144	<	4.9940E-02		
EU-152	<	6.1269E-02		
EU-154	<	3.1501E-01		
EU-155	<	1.2650E-01		
HF-181	<	3.2470E-02		

Ta-182	<	2.4026E-01			
Hg-203	<	3.2619E-02			
TL-208		1.1382E-01	2.1606E+01%		5.045E-02
pm-146	<	1.0749E-01			
y-88	<	5.9896E-02			
PB-210		7.6481E+00	5.7545E+00%		9.980E-01
PB-212		1.7832E-01	1.6624E+01%		6.914E-02
PB-214	#	1.3517E-01	2.6428E+01%		8.682E-02
BI-207	<	3.9359E-02			
BI-212	<	2.7195E-01			
BI-214	#	1.6990E-01	2.2279E+01%		9.005E-02
BI-210M	<	4.3237E-02			
RA-224	<	6.3417E-01			
AC-228	<	1.8508E-01			
TH-227	<	1.7870E-01			
TH-229	<	2.7673E-01			
TH-234		4.6646E+00	8.5039E+00%		9.605E-01
PA-231	<	9.2375E-01			
PA-233	<	8.8369E-02			
PA-234	<	1.3896E-01			
PA-234M	<	8.0093E+00			
Ra-226	<	9.9112E-01			
U-235		3.4320E-01	1.9925E+01%		1.860E-01
AM-241	<	1.0150E-01			
Np-237	<	1.3986E-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 (205.2 to 1999.5 keV) 1.532E+01 DPS

Test America
St. Louis
Background Check

Spectrum: 18_20140502003_BGLong
Acquired: 5/2/2014 5:58:59 PM
Detector: Ge18 SN/11164036
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	2.58	2.45	2.50	2.52	2.66	2.71	PASS

Analyst: April Bean Reviewer: Siobhan Perry

Test America Spectrum name: 18_20140502003_BGLong.An1

Sample description
Background Long PBC Count

Spectrum Filename: C:\User\SPC\Det18\18_20140502003_BGLong.An1

Acquisition information
Start time: 5/2/2014 5:58:59 PM
Live time: 43200
Real time: 43381
Dead time: 0.42 %
Detector ID: 18

Detector system
Ge18 SN/11164036

Calibration
Filename: 18_QC.Clb
Ge18_QA Source E

Energy Calibration
Created: 3/1/2012 1:27:55 PM
Zero offset: 0.007 keV
Gain: 0.250 keV/channel
Quadratic: -3.202E-08 keV/channel^2

Efficiency Calibration
Created: 6/23/2011 2:02:37 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 G53W4.25
Start channel: 150 (37.54keV)
Stop channel: 8000 (1999.55keV)
Peak rejection level: 30.000%
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:	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. 19 cutoff: 5.00E+01%
Energy Calibration
Normalized diff: 0.0855

***** 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
46.68	644.	9.44	0.88	6.084E-02	46.54	4.250	5.783E+00	PB210
63.27	623.	11.70	1.14	8.302E-02	63.29	3.810	4.557E+00	TH234
74.86	166.	23.41	0.98	9.847E-02				
77.18	169.	25.88	0.98	1.016E-01				
92.57	871.	8.20	1.26	1.168E-01	92.59	5.584	3.090E+00	TH234
					93.35	5.561	3.099E+00	AC228
185.82	492.	8.34	1.09	1.039E-01	185.72	54.000	2.030E-01	U235
					185.99	3.280	3.343E+00	Ra226
238.64	370.	9.96	1.15	9.181E-02	238.63	43.300	2.152E-01	PB212
351.94	188.	20.99	0.50	6.597E-02	351.93	37.600	1.754E-01	PB214
582.90	190.	18.75	0.63	4.106E-02	583.02	84.500	1.265E-01	TL208
609.33	212.	16.40	1.19	3.888E-02	609.31	46.090	2.738E-01	BI214
					610.30	5.750	2.200E+00	RU103
1121.48	91.	27.60	1.76	2.107E-02	1120.29	15.100	6.620E-01	BI214
1461.18	167.	13.09	1.06	1.710E-02	1460.83	10.670	2.117E+00	K40
1764.80	83.	18.33	0.72	1.491E-02	1764.49	15.400	8.368E-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 keV	Suspected Nuclide	
299.18	74.84	668.	166.	1.681E+03	23.41	0.977	-	D
308.45	77.15	876.	169.	1.667E+03	25.88	0.980	-	D
1406.86	351.94	357.	188.	2.850E+03	20.99	0.501	-	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: 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	186.54	46.68	832.	644.	0.015	9.44	0.884
TH-234	252.87	63.27	1124.	623.	0.014	11.70	1.143s
TH-234	369.99	92.57	1102.	871.	0.020	8.20	1.258s
Ra-226	742.80	185.84	785.	456.	0.011	12.90	1.053
PB-212	953.81	238.62	615.	352.	0.008	15.06	1.135
TL-208	2330.40	582.90	222.	190.	0.004	18.75	0.631s
BI-214	2436.11	609.33	230.	212.	0.005	16.40	1.192
BI-214	4484.89	1121.48	90.	91.	0.002	27.60	1.760
K-40	5844.43	1461.18	53.	167.	0.004	13.09	1.059s
BI-214	7059.94	1764.80	27.	83.	0.002	18.33	0.716s

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 DPS	Peak Energy keV	Peak Activity DPS	Code	MDA Value DPS		COMMENTS
K-40	N	2.1170E+00				4.66E+11		
			1460.83	2.117E+00	(	4.656E-01	1.31E+01 1.07E+01	G
TL-208	N	1.2655E-01				6.98E+02		
			583.02	1.265E-01	(	4.817E-02	1.87E+01 8.45E+01	G
			277.28	0.000E+00	%	4.531E-01	1.17E+02 6.31E+00	G
			860.56	0.000E+00		5.074E-02	0.00E+00 1.24E+01	G
PB-210	N	5.7826E+00				8.14E+03		
			46.54	5.783E+00	(	1.231E+00	9.44E+00 4.25E+00	G
PB-212	N	2.0496E-01				6.98E+02		
			238.63	2.050E-01	(	6.887E-02	1.51E+01 4.33E+01	G
			300.03	0.000E+00		6.685E-02	0.00E+00 3.28E+00	GA
BI-214	N	2.7384E-01				5.84E+05		
			609.31	2.738E-01	(	9.479E-02	1.64E+01 4.61E+01	G
			1120.29	6.620E-01	&	3.413E-01	2.76E+01 1.51E+01	G
			1764.49	8.368E-01	+	2.714E-01	1.83E+01 1.54E+01	G
TH-234	N	4.5571E+00				1.63E+12		
			63.29	4.557E+00	(	1.163E+00	1.17E+01 3.81E+00	G
			92.59	3.090E+00	-	5.585E-01	8.20E+00 5.58E+00	G

Test America Spectrum name: 18_20140502003_BGLong.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ra-226	3.1010E+00					5.84E+05	
		185.99	3.101E+00	(	9.059E-01	1.29E+01	3.28E+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:	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

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		Activity	Time of Count Uncertainty 1 Sigma Counting	MDA
		DPS		
BE-7	<	2.2201E-01		
NA-22	<	3.9789E-02		
K-40		2.1170E+00	1.3091E+01%	4.656E-01
Sc-46	<	5.7481E-02		

CR-51	<	2.3335E-01		
MN-54	<	5.9055E-02		
FE-59	<	3.5912E-02		
Co-56	<	1.9772E-02		
CO-57	<	1.3163E-02		
CO-58	<	5.8013E-02		
CO-60	<	7.1482E-02		
ZN-65	<	1.3441E-01		
NB-94	<	4.8077E-02		
ZR-95	<	7.7469E-02		
NB-95	<	3.3811E-02		
RU-103	<	4.5839E-02		
RH-106	<	4.3175E-01		
AG-108M	<	3.7709E-02		
AG-110M	<	8.3721E-02		
SN-113	<	2.1371E-02		
SB-124	<	3.9184E-02		
SB-125	<	1.2841E-01		
I-131	<	3.5723E-02		
BA-133	<	4.0746E-02		
CS-134	<	3.5292E-02		
CS-137	<	3.8958E-02		
CE-139	<	2.9231E-02		
Ba-140	<	1.5333E-01		
La-140	<	4.0523E-02		
CE-141	<	4.1308E-02		
CE-144	<	1.5294E-01		
PM-144	<	2.3899E-02		
EU-152	<	8.4596E-02		
EU-154	<	3.1489E-01		
EU-155	<	1.2724E-01		
HF-181	<	2.7582E-02		
Ta-182	<	1.7333E-01		
Hg-203	<	2.8295E-02		
TL-208		1.2655E-01	1.8747E+01%	4.817E-02
pm-146	<	1.5811E-01		
y-88	<	6.1271E-02		
PB-210		5.7826E+00	9.4385E+00%	1.231E+00
PB-212		2.0496E-01	1.5065E+01%	6.887E-02
PB-214	<	1.0405E-01		
BI-207	<	4.4694E-02		
BI-212	<	6.4132E-01		
BI-214		2.7384E-01	1.6399E+01%	9.479E-02
BI-210M	<	4.8478E-02		
RA-224	<	6.8969E-01		
AC-228	<	2.0884E-01		
TH-227	<	2.0184E-01		
TH-229	<	6.8068E-01		
TH-234		4.5571E+00	1.1696E+01%	1.163E+00

PA-231	<	1.0224E+00			
PA-233	<	8.7458E-02			
PA-234	<	1.1691E-01			
PA-234M	<	7.8858E+00			
Ra-226		3.1010E+00	1.2904E+01%		9.059E-01
U-235	<	2.0688E-01			
AM-241	<	9.2390E-02			
Np-237	<	2.3070E-01			

  < - 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 (84.3 to 1999.5 keV) 1.616E+01 DPS

Run Logs

Gamma Spectroscopy Run Log

Detector: GV4

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/30/12 13:58		IC 160-11761/1		11761			JLW
04/02/12 16:50		ICV 160-11761/2		11761			JLW
02/27/13 16:17		ACVTOP 160-38300/1		38300			JLW
05/02/14 17:55		ICB 160-119900/1		119900			SMP
05/21/14 00:00		CCV 160-123327/1		123327			
05/21/14 00:21		CCV 160-123327/2		123327			SMP
05/21/14 00:40		CCB 160-123327/3		123327			SMP
05/21/14 01:49	30	ZZZZZ		123327			
05/21/14 02:30	30	ZZZZZ		123327			
05/21/14 10:51	45	ZZZZZ		123327			
05/21/14 12:20	30	LCS 160-123290/2-A		123327	123290	GA-01-R	SMP
05/21/14 13:07	60	ZZZZZ		123327			
05/21/14 14:20	60	ZZZZZ		123327			
05/21/14 15:46	30	160-6694-5	2222-SD05	123327	123290	GA-01-R	SMP
05/21/14 18:07		TCCLBA 160-123322/1-A		123327			
05/21/14 18:37		TCCLBC 160-123322/3-A		123327			
05/21/14 19:00		TCCLBB 160-123322/2-A		123327			
05/21/14 19:19		ZZZZZ		123327			
05/21/14 19:34		ZZZZZ		123327			
05/21/14 19:45		ZZZZZ		123327			
05/21/14 19:58		ZZZZZ		123327			
05/21/14 20:20		ZZZZZ		123327			
05/21/14 20:34		ZZZZZ		123327			

Detector: GV5

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/26/12 15:05		IC 160-12297/1		12297			JLW
03/27/12 10:12		ICV 160-12297/2		12297			JLW
01/28/14 09:57		ACVTOP 160-101796/1		101796			JLW
05/02/14 17:56		ICB 160-119898/1		119898			SMP
05/21/14 00:00		CCV 160-123298/1		123298			
05/21/14 00:21		CCV 160-123298/2		123298			SMP
05/21/14 00:40		CCB 160-123298/3		123298			SMP
05/21/14 01:49	30	ZZZZZ		123298			
05/21/14 02:30		ZZZZZ		123298			
05/21/14 10:50	45	ZZZZZ		123298			
05/21/14 12:20	30	MB 160-123290/1-A		123298	123290	GA-01-R	SMP
05/21/14 13:07	60	ZZZZZ		123298			
05/21/14 14:57	60	ZZZZZ		123298			
05/21/14 18:07		TCCLBB 160-123322/2-A		123298			
05/21/14 18:36		TCCLBA 160-123322/1-A		123298			
05/21/14 18:59		TCCLBC 160-123322/3-A		123298			
05/21/14 19:17		ZZZZZ		123298			
05/21/14 19:33		ZZZZZ		123298			
05/21/14 19:45		ZZZZZ		123298			
05/21/14 19:57		ZZZZZ		123298			

Gamma Spectroscopy Run Log

Detector: GV5 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/21/14 20:20		ZZZZZ		123298			

Detector: GV7

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/26/12 06:37		IC 160-12306/1		12306			JLW
03/27/12 08:10		IC 160-12302/1		12302			JLW
03/27/12 15:25		ICV 160-12302/2		12302			JLW
04/02/12 14:43		ICV 160-12306/2		12306			JLW
01/27/14 15:16		ACVRAP 160-101588/1		101588			JLW
01/28/14 18:43		ACVTOP 160-101797/1		101797			JLW
05/02/14 18:11		ICB 160-119899/1		119899			SMP
05/20/14 00:01		CCV 160-123127/1		123127			
05/20/14 00:22		CCV 160-123127/2		123127			
05/20/14 00:43		CCB 160-123127/3		123127			SMP
05/20/14 01:24		CCV 160-123127/4		123127			
05/20/14 01:44		CCV 160-123127/5		123127			SMP
05/20/14 09:46	30	ZZZZZ		123127			
05/20/14 10:45	30	ZZZZZ		123127			
05/20/14 11:25	30	ZZZZZ		123127			
05/20/14 12:35	30	ZZZZZ		123127			
05/20/14 13:25	30	ZZZZZ		123127			
05/20/14 14:29	30	ZZZZZ		123127			
05/20/14 15:18	60	MB 160-122895/1-A		123127	122895	GA-01-R	SMP
05/20/14 17:39	60	ZZZZZ		123127			
05/20/14 18:57	60	ZZZZZ		123127			
05/20/14 20:19	60	ZZZZZ		123127			
05/20/14 21:28	30	ZZZZZ		123127			
05/20/14 22:27	45	ZZZZZ		123127			
05/21/14 00:01		CCV 160-123299/1		123299			
05/21/14 00:22		CCV 160-123299/2		123299			SMP
05/21/14 00:40		CCB 160-123299/3		123299			SMP
05/21/14 01:49	30	ZZZZZ		123299			
05/21/14 02:30		ZZZZZ		123299			
05/21/14 10:49	30	ZZZZZ		123299			
05/21/14 12:11	60	ZZZZZ		123299			
05/21/14 13:45	60	ZZZZZ		123299			
05/21/14 15:45	30	160-6694-6	2222-SD06	123299	123290	GA-01-R	SMP
05/21/14 18:08		TCCLBC 160-123322/3-A		123299			
05/21/14 18:38		TCCLBB 160-123322/2-A		123299			
05/21/14 19:00		TCCLBA 160-123322/1-A		123299			
05/21/14 19:18		ZZZZZ		123299			
05/21/14 19:34		ZZZZZ		123299			
05/21/14 19:46		ZZZZZ		123299			
05/21/14 19:58		ZZZZZ		123299			
05/21/14 20:21		ZZZZZ		123299			

Gamma Spectroscopy Run Log

Detector: GV9

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/03/12 13:37		IC 160-12326/1		12326			JLW
06/14/12 10:54		ICV 160-12326/2		12326			JLW
01/27/14 09:57		ACVTOP 160-101591/1		101591			JLW
05/02/14 17:57		ICB 160-119903/1		119903			SMP
05/21/14 00:01		CCV 160-123245/1		123245			
05/21/14 00:24		CCV 160-123245/2		123245			SMP
05/21/14 00:45		CCB 160-123245/3		123245			SMP
05/21/14 01:46		ZZZZZ		123245			
05/21/14 02:26		ZZZZZ		123245			
05/21/14 10:45	30	ZZZZZ		123245			
05/21/14 12:08	45	ZZZZZ		123245			
05/21/14 13:06	60	ZZZZZ		123245			
05/21/14 14:28	30	160-6694-1 DU	2222-SD01 DU	123245	123290	GA-01-R	SMP
05/21/14 19:07	45	ZZZZZ		123245			
05/21/14 20:12	45	ZZZZZ		123245			

Detector: GV11

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
10/31/11 13:03		IC 160-45529/1		45529			JLW
11/10/11 02:13		ICV 160-45529/2		45529			JLW
01/27/14 09:59		ACVRAP 160-101594/1		101594			JLW
05/02/14 18:15		ICB 160-119908/1		119908			SMP
05/20/14 00:02		CCV 160-123145/1		123145			
05/20/14 00:25		CCV 160-123145/2		123145			SMP
05/20/14 00:45		CCB 160-123145/3		123145			SMP
05/20/14 09:56	30	ZZZZZ		123145			
05/20/14 10:42	45	ZZZZZ		123145			
05/20/14 11:46	30	ZZZZZ		123145			
05/20/14 12:31	30	ZZZZZ		123145			
05/20/14 13:40	30	ZZZZZ		123145			
05/20/14 14:26	30	ZZZZZ		123145			
05/20/14 15:11	60	LCS 160-122895/2-A		123145	122895	GA-01-R	SMP
05/20/14 17:38	60	ZZZZZ		123145			
05/20/14 18:54	60	ZZZZZ		123145			
05/20/14 20:16	60	ZZZZZ		123145			
05/20/14 21:25	45	ZZZZZ		123145			
05/20/14 22:22	30	ZZZZZ		123145			

Detector: GV12

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/26/12 11:38		IC 160-12342/1		12342			JLW
04/11/12 22:47		ICV 160-12342/2		12342			JLW
10/02/12 10:16		IC 160-13156/1		13156			JLW
10/04/12 09:10		ICV 160-13156/2		13156			JLW
01/27/14 12:08		ACVRAP 160-101592/1		101592			JLW
01/28/14 14:18		ACVTOP 160-101795/1		101795			JLW
05/02/14 18:16		ICB 160-119909/1		119909			SMP
05/20/14 00:03		CCV 160-123147/1		123147			
05/20/14 00:25		CCV 160-123147/2		123147			SMP
05/20/14 00:44		CCB 160-123147/3		123147			SMP
05/20/14 09:57	30	ZZZZZ		123147			

Gamma Spectroscopy Run Log

Detector: GV12 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/20/14 10:43	45	ZZZZZ		123147			
05/20/14 11:47	30	ZZZZZ		123147			
05/20/14 12:31	30	ZZZZZ		123147			
05/20/14 13:41	30	ZZZZZ		123147			
05/20/14 14:26	30	ZZZZZ		123147			
05/20/14 15:11	60	160-6694-7 DU	2222-RIN-01 DU	123147	122895	GA-01-R	SMP
05/20/14 17:39	60	ZZZZZ		123147			
05/20/14 18:56	60	ZZZZZ		123147			
05/20/14 20:18	60	ZZZZZ		123147			
05/20/14 21:26	45	ZZZZZ		123147			
05/20/14 22:23	45	ZZZZZ		123147			
05/21/14 00:03		CCV 160-123247/1		123247			
05/21/14 00:25		CCV 160-123247/2		123247			SMP
05/21/14 00:47		CCB 160-123247/3		123247			SMP
05/21/14 01:47	30	ZZZZZ		123247			
05/21/14 02:29		ZZZZZ		123247			
05/21/14 10:48	45	ZZZZZ		123247			
05/21/14 12:10	120	ZZZZZ		123247			
05/21/14 14:32	30	160-6694-2	2222-SD02	123247	123290	GA-01-R	SMP
05/21/14 15:55	60	ZZZZZ		123247			
05/21/14 19:09	45	ZZZZZ		123247			
05/21/14 20:14	45	ZZZZZ		123247			
05/21/14 22:41	30	ZZZZZ		123247			

Detector: GV15

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/22/12 11:06		IC 160-12362/1		12362			JLW
03/23/12 06:10		ICV 160-12362/2		12362			JLW
01/24/14 15:13		ACVTOP 160-101162/1		101162			JLW
05/02/14 18:12		ICB 160-119911/1		119911			SMP
05/21/14 00:02		CCB 160-123296/1		123296			SMP
05/21/14 00:45		CCV 160-123296/2		123296			
05/21/14 01:07		CCV 160-123296/3		123296			SMP
05/21/14 01:46		ZZZZZ		123296			
05/21/14 02:27		ZZZZZ		123296			
05/21/14 10:44	45	ZZZZZ		123296			
05/21/14 12:22	30	160-6694-1	2222-SD01	123296	123290	GA-01-R	SMP
05/21/14 13:06	60	ZZZZZ		123296			
05/21/14 14:26	30	160-6694-3	2222-SD03	123296	123290	GA-01-R	SMP
05/21/14 15:53	120	ZZZZZ		123296			
05/21/14 19:08	45	ZZZZZ		123296			
05/21/14 20:13	45	ZZZZZ		123296			
05/21/14 21:15	60	ZZZZZ		123296			

Detector: GV17

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
03/26/12 06:29		IC 160-12390/1		12390			JLW
03/26/12 09:29		ICV 160-12390/2		12390			JLW
01/23/14 11:17		ACVTOP 160-100896/1		100896			JLW
05/02/14 18:13		ICB 160-119912/1		119912			SMP
05/21/14 00:03		CCB 160-123294/1		123294			EMN

Gamma Spectroscopy Run Log

Detector: GV17 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/21/14 00:46		CCV 160-123294/2		123294			
05/21/14 01:08		CCV 160-123294/3		123294			EMN
05/21/14 01:47		ZZZZZ		123294			
05/21/14 02:28		ZZZZZ		123294			
05/21/14 10:42		ZZZZZ		123294			
05/21/14 12:07	60	ZZZZZ		123294			
05/21/14 14:27	30	160-6694-4	2222-SD04	123294	123290	GA-01-R	EMN
05/21/14 15:54	120	ZZZZZ		123294			
05/21/14 19:09	45	ZZZZZ		123294			
05/21/14 20:14	60	ZZZZZ		123294			
05/21/14 21:16	120	ZZZZZ		123294			

Detector: GV18

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
12/07/11 13:13		IC 160-47625/1		47625			JLW
12/09/11 12:09		ICV 160-47625/2		47625			JLW
01/23/14 11:19		ACVRAP 160-100898/1		100898			JLW
05/02/14 17:58		ICB 160-119914/1		119914			SMP
05/20/14 00:03		CCB 160-123230/1		123230			SMP
05/20/14 01:25		CCV 160-123230/2		123230			
05/20/14 01:45		CCV 160-123230/3		123230			SMP
05/20/14 13:46	60	160-6694-7	2222-RIN-01	123230	122895	GA-01-R	SMP
05/20/14 15:17	60	ZZZZZ		123230			
05/20/14 17:34	60	ZZZZZ		123230			
05/20/14 18:55	60	ZZZZZ		123230			
05/20/14 20:17	60	ZZZZZ		123230			
05/20/14 22:25	60	ZZZZZ		123230			

GAS FLOW PROPORTIONAL COUNTER

Method 9315

Total Apha Radium (GFPC) by Method 9315

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

Prep Batch: 122912

Preparation, Precipitate Separation

Gas Flow Proportional Counter Analysis Detail Report
Prep Batch: 122912

Lab ID: MB 160-122912/1-A | Analyzed: 05/21/14 16:15 | Decay Corrected: No | Ts: 200
Client ID: | Detector: Orange0 | Yield Truncated: No | Tb: 1000
Sigma: 2 | Dil Fac: 1 | Calibration Type: 2

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Cs	Cb	CPMs	CPMb	Eff	Anly Batch
Total Alpha Radium	0.01052	0.0992	0.0992	U	pCi/L	1.00	0.198	12	56	0.060	0.056	0.18158	123289

Carrier	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Ba Carrier	0.02920				g		0.0339	86.1	40 - 110

Lab ID: LCS 160-122912/2-A | Analyzed: 05/21/14 16:15 | Decay Corrected: No | Ts: 200
Client ID: | Detector: Orange1 | Yield Truncated: No | Tb: 1000
Sigma: 2 | Dil Fac: 1 | Calibration Type: 2

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Cs	Cb	CPMs	CPMb	Eff	Anly Batch
Total Alpha Radium	11.86	0.805	1.34		pCi/L	1.00	0.235	905	82	4.525	0.082	0.17947	123289

Carrier	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Ba Carrier	0.02910				g		0.0339	85.8	40 - 110

Lab ID: LCSD 160-122912/3-A | Analyzed: 05/21/14 16:16 | Decay Corrected: No | Ts: 200
Client ID: | Detector: Orange2 | Yield Truncated: No | Tb: 1000
Sigma: 2 | Dil Fac: 1 | Calibration Type: 2

Analyte	LCSD Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Cs	Cb	CPMs	CPMb	Eff	Anly Batch
Total Alpha Radium	11.62	0.790	1.31		pCi/L	1.00	0.346	964	228	4.820	0.228	0.17544	123289

Carrier	LCSD Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Ba Carrier	0.03140				g		0.0339	92.6	40 - 110

Lab ID: 160-6694-7 | Analyzed: 05/21/14 16:16 | Decay Corrected: No | Ts: 200
Client ID: 2222-RIN-01 | Detector: Orange3 | Yield Truncated: No | Tb: 1000
Sigma: 2 | Dil Fac: 1 | Calibration Type: 2

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Cs	Cb	CPMs	CPMb	Eff	Anly Batch
Total Alpha Radium	0.0991	0.130	0.130	U	pCi/L	1.00	0.217	22	72	0.110	0.072	0.17454	123289

Carrier	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Ba Carrier	0.0310				g		0.0339	91.4	40 - 110

Gas Flow Proportional Counter Analysis Detail Report
Prep Batch: 122912

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 160-122912/1-A	Total Alpha Radium			0.01052	U	pCi/L							

Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-122912/2-A	Total Alpha Radium		11.2	11.86		pCi/L	106	67 - 133	2				

Lab Control Sample Duplicate ID:	Analyte	Parent Result	Spike Added	LCSD Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCSD 160-122912/3-A	Total Alpha Radium		11.2	11.62		pCi/L	103	67 - 133	2	0.09	0.26	1	

Glossary:

Ts = Count Duration, Sample

Tb = Count Duration, Background

Cs = Total Counts, Sample

Cb = Total Counts, Background

CPMs = Counts Per Minute, Sample

CPMb = Counts Per Minute, Background

Eff = Efficiency

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID MB 160-122912/1-A

Repeat 1

Carrier No. 0

Batch ID 122912

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 5/21/2014 4:15:54 PM

Count Ended 5/21/2014 7:36:05 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 200.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.056	12	0.060	0.004
sd	0.000			0.007	3.464	0.017	0.019
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.378	90	0.450	0.072
sd	0.000			0.019	9.487	0.047	0.051

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID LCS 160-122912/2-A

Repeat 1

Carrier No. 0

Batch ID 122912

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 5/21/2014 4:15:57 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 5/21/2014 7:36:10 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 200.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.082	905	4.525	4.443
sd	0.000			0.009	30.083	0.150	0.151
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.302	158	0.790	0.488
sd	0.000			0.017	12.570	0.063	0.065

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID LCSD 160-122912/3-A

Repeat 1

Carrier No. 0

Batch ID 122912

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 5/21/2014 4:16:00 PM

Count Ended 5/21/2014 7:36:13 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 200.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.228	964	4.820	4.592
sd	0.000			0.015	31.048	0.155	0.156
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.567	266	1.330	0.763
sd	0.000			0.024	16.310	0.082	0.085

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID 160-6694-D-7-A

Repeat 1

Carrier No. 0

Batch ID 122912

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 5/21/2014 4:16:03 PM

Count Ended 5/21/2014 7:36:15 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 200.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.072	22	0.110	0.038
sd	0.000			0.008	4.690	0.023	0.025
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.484	107	0.535	0.051
sd	0.000			0.022	10.344	0.052	0.056

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122912 Batch Start Date: 05/19/14 13:41 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/21/14 14:54

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	IngDecDate1	IngDecDate2
MB 160-122912/1		PrecSep_0, 9315		1000.00 mL	8.6069 g	8.6361 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCS 160-122912/2		PrecSep_0, 9315		1000.00 mL	8.5878 g	8.6169 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
LCSD 160-122912/3		PrecSep_0, 9315		1000.00 mL	8.6159 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	988.31 mL	8.6163 g	8.6473 g	0.0339 g	5/21/14 11:20	5/21/14 13:40

Lab Sample ID	Client Sample ID	Method Chain	Basis	NativeMassBa	Ba Carrier 00008	RA22609A120 00003			
MB 160-122912/1		PrecSep_0, 9315		0 g	1 mL				
LCS 160-122912/2		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
LCSD 160-122912/3		PrecSep_0, 9315		0 g	1 mL	0.25 mL			
160-6694-D-7	2222-RIN-01	PrecSep_0, 9315	T	0 g	1 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0040

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.

Method 9320

Radium-228 (GFPC) by Method 9320

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

Prep Batch: 122913

Preparation, Precipitate Separation

Gas Flow Proportional Counter Analysis Detail Report
Prep Batch: 122913

Lab ID: MB 160-122913/1-A | Analyzed: 05/23/14 09:50 | Decay Corrected: No | Ts: 200
Client ID: | Detector: Orange4 | Yield Truncated: No | Tb: 1000
Sigma: 2 | Dil Fac: 1 | Calibration Type: 1

Analyte	MB Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Cs	Cb	CPMs	CPMb	Eff	Anly Batch
Radium-228	0.2086	0.162	0.163	U	pCi/L	1.00	0.254	97	349	0.485	0.349	0.44188	123737

Carrier	MB Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Ba Carrier	0.03870			X	g		0.0339	114	40 - 110
Y Carrier	0.02320				g		0.0268	86.7	40 - 110

Lab ID: LCS 160-122913/2-A | Analyzed: 05/23/14 09:50 | Decay Corrected: No | Ts: 200
Client ID: | Detector: Orange6 | Yield Truncated: No | Tb: 1000
Sigma: 2 | Dil Fac: 1 | Calibration Type: 1

Analyte	LCS Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Cs	Cb	CPMs	CPMb	Eff	Anly Batch
Radium-228	3.751	0.389	0.520		pCi/L	1.00	0.312	564	492	2.820	0.492	0.44107	123737

Carrier	LCS Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Ba Carrier	0.03660				g		0.0339	108	40 - 110
Y Carrier	0.02340				g		0.0268	87.5	40 - 110

Lab ID: LCSD 160-122913/3-A | Analyzed: 05/23/14 09:50 | Decay Corrected: No | Ts: 200
Client ID: | Detector: Orange8 | Yield Truncated: No | Tb: 1000
Sigma: 2 | Dil Fac: 1 | Calibration Type: 1

Analyte	LCSD Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Cs	Cb	CPMs	CPMb	Eff	Anly Batch
Radium-228	3.208	0.356	0.462		pCi/L	1.00	0.276	474	376	2.370	0.376	0.44551	123737

Carrier	LCSD Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Ba Carrier	0.03510				g		0.0339	104	40 - 110
Y Carrier	0.02420				g		0.0268	90.5	40 - 110

Lab ID: 160-6694-7 | Analyzed: 05/23/14 09:50 | Decay Corrected: No | Ts: 200
Client ID: 2222-RIN-01 | Detector: Orange9 | Yield Truncated: No | Tb: 1000
Sigma: 2 | Dil Fac: 1 | Calibration Type: 1

Analyte	Result	Count Unc	Total Unc	Qualifier	Unit	RL	MDC	Cs	Cb	CPMs	CPMb	Eff	Anly Batch
Radium-228	0.0584	0.181	0.181	U	pCi/L	1.00	0.314	88	407	0.440	0.407	0.44430	123737

Carrier	Result	Count Unc	Total Unc	Qualifier	Unit	MDC	Spike Added	% Rec	% Rec Limits
Ba Carrier	0.0333				g		0.0339	98.2	40 - 110
Y Carrier	0.0236				g		0.0268	88.2	40 - 110

Gas Flow Proportional Counter Analysis Detail Report
Prep Batch: 122913

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 160-122913/1-A	Radium-228			0.2086	U	pCi/L							

Lab Control Sample ID:	Analyte	Parent Result	Spike Added	LCS Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCS 160-122913/2-A	Radium-228		3.85	3.751		pCi/L	97	56 - 140	16				

Lab Control Sample Duplicate ID:	Analyte	Parent Result	Spike Added	LCSD Result	Qualifier	Unit	% Rec	% Rec Limits	RPD	RER	DER	RER Limit	Z Factor
LCSD 160-122913/3-A	Radium-228		3.85	3.208		pCi/L	83	56 - 140	16	0.55	1.56	1	

Glossary:

Ts = Count Duration, Sample

Tb = Count Duration, Background

Cs = Total Counts, Sample

Cb = Total Counts, Background

CPMs = Counts Per Minute, Sample

CPMb = Counts Per Minute, Background

Eff = Efficiency

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID MB 160-122913/1-A

Repeat 1

Carrier No. 0

Batch ID 122913

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 5/23/2014 9:50:09 AM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 5/23/2014 1:10:20 PM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 200.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.072	21	0.105	0.033
sd	0.000			0.008	4.583	0.023	0.024
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.349	97	0.485	0.136
sd	0.000			0.019	9.849	0.049	0.053

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID LCS 160-122913/2-A

Repeat 1

Carrier No. 0

Batch ID 122913

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 5/23/2014 9:50:15 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 5/23/2014 1:10:25 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 200.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.106	31	0.155	0.049
sd	0.000			0.010	5.568	0.028	0.030
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.492	564	2.820	2.328
sd	0.000			0.022	23.749	0.119	0.121

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID LCSD 160-122913/3-A

Repeat 1

Carrier No. 0

Batch ID 122913

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 5/23/2014 9:50:18 AM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 5/23/2014 1:10:30 PM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 200.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.045	17	0.085	0.040
sd	0.000			0.007	4.123	0.021	0.022
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.376	474	2.370	1.994
sd	0.000			0.019	21.772	0.109	0.111

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID 160-6694-E-7-A

Repeat 1

Carrier No. 0

Batch ID 122913

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 5/23/2014 9:50:22 AM

Count Ended 5/23/2014 1:10:32 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 200.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.122	26	0.130	0.008
sd	0.000			0.011	5.099	0.025	0.028
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.407	88	0.440	0.033
sd	0.000			0.020	9.381	0.047	0.051

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

Lab Sample ID	Client Sample ID	Method Chain	Basis	InitialAmount	Ba_TareWt	Ba_GrossWt	Ba_Mass	Y_TareWt	Y_GrossWt
MB 160-122913/1		PrecSep_0, 9320		1000.00 mL	8.6503 g	8.6890 g	0.0339 g	8.6245 g	8.6477 g
LCS 160-122913/2		PrecSep_0, 9320		1000.00 mL	8.5885 g	8.6251 g	0.0339 g	8.6415 g	8.6649 g
LCSD 160-122913/3		PrecSep_0, 9320		1000.00 mL	8.5894 g	8.6245 g	0.0339 g	8.5947 g	8.6189 g
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	985.17 mL	8.5752 g	8.6085 g	0.0339 g	8.6119 g	8.6355 g

Lab Sample ID	Client Sample ID	Method Chain	Basis	Y_Mass	IngDecDate1	IngDecDate2	NativeMassBa	NativeMassY	Ba Carrier 00008
MB 160-122913/1		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCS 160-122913/2		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
LCSD 160-122913/3		PrecSep_0, 9320		0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T	0.02675 g	5/20/14 12:23	5/23/14 7:55	0 g	0 g	1 mL

Lab Sample ID	Client Sample ID	Method Chain	Basis	Ra-228 00007	Y Carrier 00008				
MB 160-122913/1		PrecSep_0, 9320			0.2 mL				
LCS 160-122913/2		PrecSep_0, 9320		1 mL	0.2 mL				
LCSD 160-122913/3		PrecSep_0, 9320		1 mL	0.2 mL				
160-6694-E-7	2222-RIN-01	PrecSep_0, 9320	T		0.2 mL				

Batch Notes	
Balance ID	1125330898, 1122021820
Person's name who witnessed reagent drop	TAG
Analyst who added reagent	LEM
SOP Number	ST-RC-0002, ST-RC-0041

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GAS FLOW PROPORTIONAL COUNTER BATCH WORKSHEET

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG No.:

Batch Number: 122913 Batch Start Date: 05/19/14 13:43 Batch Analyst: Mewes, Leah E

Batch Method: PrecSep_0 Batch End Date: 05/23/14 09:21

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.

Daily Checks

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

APPROVED
By Siobhan Perry at 10:02 pm, May 21, 2014

Wednesday, May 21, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
Detector 0											
12:13 AM	**Efficiency**	10735.11	10961.91	328.86	-226.80	**Pass**					
	Background										
	Crosstalk	3362.500	3302.588	96.137	59.912	**Pass**					
12:17 AM	**Efficiency**						33720.25	33739.55	1012.19	-19.30	**Pass**
	Background										
	Crosstalk						89.932	237.400	143.963	-147.468	**Pass**
3:52 AM	**Efficiency**										
	Background	0.050	0.134	0.042	-0.084	**Pass**	0.535	0.474	0.121	0.061	**Pass**
	Crosstalk										
Detector 1											
12:14 AM	**Efficiency**	10146.30	10173.40	305.20	-27.10	**Pass**					
	Background										
	Crosstalk	3006.500	3028.900	109.715	-22.400	**Pass**					
12:17 AM	**Efficiency**						33385.95	33478.80	1004.36	-92.85	**Pass**
	Background										
	Crosstalk						16.083	42.975	30.711	-26.892	**Pass**
3:52 AM	**Efficiency**										
	Background	0.085	0.142	0.063	-0.057	**Pass**	0.415	0.416	0.134	-0.001	**Pass**
	Crosstalk										
Detector 2											
12:14 AM	**Efficiency**	10913.47	10972.86	329.19	-59.39	**Pass**					
	Background										
	Crosstalk	3362.000	3366.220	137.933	-4.220	**Pass**					
12:17 AM	**Efficiency**						23227.19	23193.20	695.80	33.99	**Pass**
	Background										
	Crosstalk						15.580	37.375	27.717	-21.795	**Pass**

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Wednesday, May 21, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
3:52 AM	**Efficiency**										
	Background	0.245	0.165	0.116	0.080	**Pass**	0.620	0.686	0.494	-0.066	**Pass**
	Crosstalk										
Detector 3											
12:14 AM	**Efficiency**	10539.16	10703.24	321.10	-164.08	**Pass**					
	Background										
	Crosstalk	3482.500	3488.780	118.326	-6.280	**Pass**					
12:17 AM	**Efficiency**						30319.58	30620.69	918.62	-301.11	**Pass**
	Background										
	Crosstalk						14.072	43.524	34.997	-29.452	**Pass**
3:52 AM	**Efficiency**										
	Background	0.070	0.136	0.041	-0.066	**Pass**	0.480	0.553	0.099	-0.073	**Pass**
	Crosstalk										
Detector 4											
12:14 AM	**Efficiency**	10480.61	10616.58	318.50	-135.97	**Pass**					
	Background										
	Crosstalk	4068.500	4041.960	93.896	26.540	**Pass**					
12:17 AM	**Efficiency**						26090.12	26048.10	781.44	42.02	**Pass**
	Background										
	Crosstalk						8.041	8.525	2.042	-0.484	**Pass**
3:52 AM	**Efficiency**										
	Background	0.090	0.105	0.031	-0.015	**Pass**	0.505	0.386	0.065	0.119	**Pass**
	Crosstalk										
Detector 5											
12:14 AM	**Efficiency**	10762.86	10779.16	323.37	-16.30	**Pass**					
	Background										
	Crosstalk	3983.500	3963.700	62.110	19.800	**Pass**					

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Gas Proportional Counter Daily Quality Control Checks

Wednesday, May 21, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:17 AM	**Efficiency**						21570.59	21843.90	655.32	-273.32	**Pass**
	Background										
	Crosstalk						5.528	5.095	1.480	0.433	**Pass**
3:52 AM	**Efficiency**										
	Background	0.175	0.169	0.053	0.006	**Pass**	0.400	0.448	0.102	-0.048	**Pass**
	Crosstalk										
Detector 6											
12:14 AM	**Efficiency**	10632.75	10768.46	323.05	-135.71	**Pass**					
	Background										
	Crosstalk	3902.500	3929.080	151.831	-26.580	**Pass**					
12:17 AM	**Efficiency**						29099.14	29157.55	874.73	-58.41	**Pass**
	Background										
	Crosstalk						4.523	5.750	1.400	-1.227	**Pass**
3:52 AM	**Efficiency**										
	Background	0.130	0.107	0.023	0.023	**Pass**	0.585	0.498	0.080	0.087	**Pass**
	Crosstalk										
Detector 7											
12:14 AM	**Efficiency**	11679.66	11415.50	342.47	264.16	**Pass**					
	Background										
	Crosstalk	4356.500	4055.000	78.818	301.500	**DOEF**					
12:17 AM	**Efficiency**						27867.91	27782.35	833.47	85.56	**Pass**
	Background										
	Crosstalk						3.015	4.600	1.392	-1.585	**Pass**
3:52 AM	**Efficiency**										
	Background	0.075	0.102	0.037	-0.027	**Pass**	0.405	0.391	0.058	0.014	**Pass**
	Crosstalk										
Detector 8											

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Wednesday, May 21, 2014

Instrument: Orange

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:14 AM	**Efficiency**						33492.42	33564.38	1006.93	-71.96	**Pass**
	Background										
	Crosstalk						18.596	16.400	3.440	2.196	**Pass**
12:17 AM	**Efficiency**	10769.86	10932.62	327.98	-162.76	**Pass**					
	Background										
	Crosstalk	3515.000	3644.120	113.075	-129.120	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.075	0.096	0.039	-0.021	**Pass**	0.490	0.411	0.066	0.079	**Pass**
	Crosstalk										
Detector 9											
12:14 AM	**Efficiency**						33973.44	33894.25	1016.83	79.19	**Pass**
	Background										
	Crosstalk						19.098	14.000	4.085	5.098	**Pass**
12:17 AM	**Efficiency**	9963.15	10270.92	308.13	-307.77	**Pass**					
	Background										
	Crosstalk	3287.000	3336.480	71.578	-49.480	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.080	0.141	0.053	-0.061	**Pass**	0.435	0.454	0.117	-0.019	**Pass**
	Crosstalk										
Detector 10											
12:14 AM	**Efficiency**						23247.61	23268.15	698.04	-20.54	**Pass**
	Background										
	Crosstalk						9.549	5.525	1.626	4.024	**WARNING**
12:17 AM	**Efficiency**	9051.87	9314.42	279.43	-262.55	**Pass**					
	Background										
	Crosstalk	5569.000	5412.260	206.903	156.740	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.110	0.117	0.045	-0.007	**Pass**	0.395	0.469	0.118	-0.074	**Pass**
	Crosstalk										

TestAmerica
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Gas Proportional Counter Daily Quality Control Checks

Wednesday, May 21, 2014

Instrument: Orange

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
Detector 11											
12:14 AM	**Efficiency**						30731.73	29987.20	899.62	744.53	**Pass**
	Background										
	Crosstalk						12.565	15.700	2.687	-3.135	**Pass**
12:17 AM	**Efficiency**	10871.94	10755.42	322.66	116.52	**Pass**					
	Background										
	Crosstalk	3368.500	3246.680	84.085	121.820	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.085	0.122	0.042	-0.037	**Pass**	0.700	0.532	0.085	0.168	**Pass**
	Crosstalk										
Detector 12											
12:14 AM	**Efficiency**						25699.07	25927.73	777.83	-228.65	**Pass**
	Background										
	Crosstalk						12.062	12.950	1.629	-0.888	**Pass**
12:17 AM	**Efficiency**	11019.03	11039.74	331.19	-20.71	**Pass**					
	Background										
	Crosstalk	3697.000	3628.500	68.433	68.500	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.135	0.119	0.050	0.016	**Pass**	0.515	0.498	0.092	0.017	**Pass**
	Crosstalk										
Detector 13											
12:14 AM	**Efficiency**						22110.85	22266.53	668.00	-155.68	**Pass**
	Background										
	Crosstalk						15.580	14.975	3.432	0.605	**Pass**
12:17 AM	**Efficiency**	12387.72	11233.00	336.99	1154.72	**FAIL**					
	Background										
	Crosstalk	4229.500	3521.820	75.777	707.680	**DOEF**					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Wednesday, May 21, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:30 AM	**Efficiency**	11233.22	11233.00	336.99	0.22	**Pass**					
	Background										
	Crosstalk	3532.500	3521.820	75.777	10.680	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.150	0.163	0.058	-0.013	**Pass**	0.550	0.499	0.101	0.051	**Pass**
	Crosstalk										
Detector 14											
3:52 AM	**Efficiency**										
	Background	0.000	0.138	0.037	-0.138	**FAIL**	0.000	0.432	0.047	-0.432	**FAIL**
	Crosstalk										
Detector 15											
12:14 AM	**Efficiency**						27629.25	27467.78	824.03	161.47	**Pass**
	Background										
	Crosstalk						27.139	21.400	5.218	5.739	**Pass**
12:18 AM	**Efficiency**	11714.68	11797.00	353.91	-82.32	**Pass**					
	Background										
	Crosstalk	3566.500	3542.000	85.963	24.500	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.125	0.137	0.054	-0.012	**Pass**	0.470	0.437	0.083	0.033	**Pass**
	Crosstalk										
Detector 16											
12:20 AM	**Efficiency**						33580.17	33491.33	1004.74	88.84	**Pass**
	Background										
	Crosstalk						25.129	32.800	8.069	-7.671	**Pass**
12:24 AM	**Efficiency**	10702.78	10824.14	324.72	-121.36	**Pass**					
	Background										
	Crosstalk	3427.500	3496.320	67.571	-68.820	**Pass**					

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Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
3:52 AM	**Efficiency**										
	Background	0.150	0.128	0.037	0.022	**Pass**	0.595	0.442	0.061	0.153	**Pass**
	Crosstalk										
Detector 17											
12:20 AM	**Efficiency**						33314.43	33457.18	1003.72	-142.75	**Pass**
	Background										
	Crosstalk						13.570	13.975	2.967	-0.405	**Pass**
12:24 AM	**Efficiency**	10043.22	10056.48	301.69	-13.26	**Pass**					
	Background										
	Crosstalk	3459.500	3425.740	60.289	33.760	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.110	0.151	0.048	-0.041	**Pass**	0.440	0.438	0.089	0.002	**Pass**
	Crosstalk										
Detector 18											
12:20 AM	**Efficiency**						23274.71	23209.68	696.29	65.04	**Pass**
	Background										
	Crosstalk						14.575	16.100	4.093	-1.525	**Pass**
12:24 AM	**Efficiency**	10968.51	11053.86	331.62	-85.35	**Pass**					
	Background										
	Crosstalk	3624.500	3611.520	52.801	12.980	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.105	0.109	0.050	-0.004	**Pass**	0.505	0.426	0.077	0.079	**Pass**
	Crosstalk										
Detector 19											
12:21 AM	**Efficiency**						31249.47	30982.63	929.48	266.85	**Pass**
	Background										
	Crosstalk						15.580	16.650	4.107	-1.070	**Pass**

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Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:24 AM	**Efficiency**	10937.91	11009.96	330.30	-72.05	**Pass**					
	Background										
	Crosstalk	3770.500	3716.300	50.984	54.200	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.130	0.092	0.031	0.038	**Pass**	0.600	0.380	0.083	0.221	**Pass**
	Crosstalk										
Detector 20											
12:21 AM	**Efficiency**						25728.87	25820.98	774.63	-92.11	**Pass**
	Background										
	Crosstalk						22.114	20.300	5.444	1.814	**Pass**
12:24 AM	**Efficiency**	10663.25	10934.68	328.04	-271.43	**Pass**					
	Background										
	Crosstalk	3583.500	3574.300	107.105	9.200	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.105	0.097	0.035	0.008	**Pass**	0.340	0.375	0.071	-0.035	**Pass**
	Crosstalk										
Detector 21											
12:21 AM	**Efficiency**						22001.66	22199.20	665.98	-197.54	**Pass**
	Background										
	Crosstalk						13.570	13.000	2.763	0.570	**Pass**
12:24 AM	**Efficiency**	11044.10	11170.12	335.10	-126.02	**Pass**					
	Background										
	Crosstalk	3694.500	3672.660	78.069	21.840	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.130	0.101	0.032	0.029	**Pass**	0.410	0.325	0.064	0.085	**Pass**
	Crosstalk										
Detector 22											

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Wednesday, May 21, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:21 AM	**Efficiency**						29049.76	29331.13	879.93	-281.37	**Pass**
	Background										
	Crosstalk						14.575	13.075	3.867	1.500	**Pass**
12:24 AM	**Efficiency**	10909.99	10918.70	327.56	-8.71	**Pass**					
	Background										
	Crosstalk	3563.000	3612.240	230.452	-49.240	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.100	0.100	0.032	0.001	**Pass**	0.465	0.381	0.079	0.084	**Pass**
	Crosstalk										
Detector 23											
12:21 AM	**Efficiency**						27484.72	27644.68	829.34	-159.95	**Pass**
	Background										
	Crosstalk						7.036	13.125	3.128	-6.089	**Pass**
12:24 AM	**Efficiency**	11493.61	11544.58	346.34	-50.96	**Pass**					
	Background										
	Crosstalk	3684.000	3809.981	484.264	-125.981	**Pass**					
3:52 AM	**Efficiency**										
	Background	0.130	0.105	0.049	0.026	**Pass**	0.505	0.446	0.115	0.059	**Pass**
	Crosstalk										

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APPROVED
By Jody Watson at 6:34 am, May 23, 2014

Friday, May 23, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
Detector 0											
12:15 AM	**Efficiency**	10733.20	10961.91	328.86	-228.71	**Pass**					
	Background										
	Crosstalk	3445.000	3302.588	96.137	142.413	**Pass**					
12:19 AM	**Efficiency**						33419.16	33739.55	1012.19	-320.39	**Pass**
	Background										
	Crosstalk						76.377	237.400	143.963	-161.023	**Pass**
3:54 AM	**Efficiency**										
	Background	0.090	0.134	0.042	-0.044	**Pass**	0.375	0.474	0.121	-0.099	**Pass**
	Crosstalk										
Detector 1											
12:15 AM	**Efficiency**	10189.92	10173.40	305.20	16.52	**Pass**					
	Background										
	Crosstalk	3022.500	3028.900	109.715	-6.400	**Pass**					
12:19 AM	**Efficiency**						33253.02	33478.80	1004.36	-225.78	**Pass**
	Background										
	Crosstalk						12.064	42.975	30.711	-30.911	**Pass**
3:54 AM	**Efficiency**										
	Background	0.125	0.142	0.063	-0.017	**Pass**	0.375	0.416	0.134	-0.041	**Pass**
	Crosstalk										
Detector 2											
12:15 AM	**Efficiency**	10877.04	10972.86	329.19	-95.82	**Pass**					
	Background										
	Crosstalk	3382.500	3366.220	137.933	16.280	**Pass**					
12:19 AM	**Efficiency**						23045.60	23193.20	695.80	-147.60	**Pass**
	Background										
	Crosstalk						14.577	37.375	27.717	-22.798	**Pass**

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Friday, May 23, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
3:54 AM	**Efficiency**										
	Background	0.200	0.165	0.116	0.035	**Pass**	0.490	0.686	0.494	-0.196	**Pass**
	Crosstalk										
Detector 3											
12:15 AM	**Efficiency**	10617.33	10703.24	321.10	-85.91	**Pass**					
	Background										
	Crosstalk	3490.500	3488.780	118.326	1.720	**Pass**					
12:19 AM	**Efficiency**						30560.47	30620.69	918.62	-60.22	**Pass**
	Background										
	Crosstalk						9.550	43.524	34.997	-33.973	**Pass**
3:54 AM	**Efficiency**										
	Background	0.090	0.136	0.041	-0.046	**Pass**	0.610	0.553	0.099	0.058	**Pass**
	Crosstalk										
Detector 4											
12:16 AM	**Efficiency**	10510.73	10616.58	318.50	-105.85	**Pass**					
	Background										
	Crosstalk	3991.000	4041.960	93.896	-50.960	**Pass**					
12:19 AM	**Efficiency**						26182.56	26048.10	781.44	134.46	**Pass**
	Background										
	Crosstalk						9.048	8.525	2.042	0.523	**Pass**
3:54 AM	**Efficiency**										
	Background	0.120	0.105	0.031	0.016	**Pass**	0.435	0.386	0.065	0.049	**Pass**
	Crosstalk										
Detector 5											
12:16 AM	**Efficiency**	10674.38	10779.16	323.37	-104.78	**Pass**					
	Background										
	Crosstalk	4099.000	3963.700	62.110	135.300	**WARNING**					

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Instrument: Orange

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:19 AM	**Efficiency**						21538.41	21843.90	655.32	-305.49	**Pass**
	Background										
	Crosstalk						1.508	5.095	1.480	-3.587	**WARNING**
3:54 AM	**Efficiency**										
	Background	0.160	0.169	0.053	-0.009	**Pass**	0.455	0.448	0.102	0.007	**Pass**
	Crosstalk										
Detector 6											
12:16 AM	**Efficiency**	10535.75	10768.46	323.05	-232.71	**Pass**					
	Background										
	Crosstalk	3922.500	3929.080	151.831	-6.580	**Pass**					
12:19 AM	**Efficiency**						29118.42	29157.55	874.73	-39.13	**Pass**
	Background										
	Crosstalk						5.529	5.750	1.400	-0.221	**Pass**
3:54 AM	**Efficiency**										
	Background	0.110	0.107	0.023	0.003	**Pass**	0.620	0.498	0.080	0.122	**Pass**
	Crosstalk										
Detector 7											
12:16 AM	**Efficiency**	11595.18	11415.50	342.47	179.68	**Pass**					
	Background										
	Crosstalk	4206.500	4055.000	78.818	151.500	**Pass**					
12:19 AM	**Efficiency**						27844.84	27782.35	833.47	62.49	**Pass**
	Background										
	Crosstalk						6.534	4.600	1.392	1.934	**Pass**
3:54 AM	**Efficiency**										
	Background	0.085	0.102	0.037	-0.017	**Pass**	0.345	0.391	0.058	-0.046	**Pass**
	Crosstalk										
Detector 8											

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Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:16 AM	**Efficiency**						33689.73	33564.38	1006.93	125.36	**Pass**
	Background										
	Crosstalk						16.587	16.400	3.440	0.187	**Pass**
12:19 AM	**Efficiency**	10739.43	10932.62	327.98	-193.19	**Pass**					
	Background										
	Crosstalk	3565.500	3644.120	113.075	-78.620	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.135	0.096	0.039	0.039	**Pass**	0.385	0.411	0.066	-0.026	**Pass**
	Crosstalk										
Detector 9											
12:16 AM	**Efficiency**						33772.71	33894.25	1016.83	-121.54	**Pass**
	Background										
	Crosstalk						12.064	14.000	4.085	-1.936	**Pass**
12:19 AM	**Efficiency**	10124.88	10270.92	308.13	-146.04	**Pass**					
	Background										
	Crosstalk	3331.500	3336.480	71.578	-4.980	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.150	0.141	0.053	0.009	**Pass**	0.470	0.454	0.117	0.016	**Pass**
	Crosstalk										
Detector 10											
12:16 AM	**Efficiency**						23229.07	23268.15	698.04	-39.08	**Pass**
	Background										
	Crosstalk						6.032	5.525	1.626	0.507	**Pass**
12:19 AM	**Efficiency**	8968.88	9314.42	279.43	-345.54	**FAIL**					
	Background										
	Crosstalk	5573.500	5412.260	206.903	161.240	**Pass**					
12:32 AM	**Efficiency**	8973.38	9314.42	279.43	-341.04	**FAIL**					
	Background										
	Crosstalk	5659.000	5412.260	206.903	246.740	**Pass**					

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Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
3:54 AM	**Efficiency**										
	Background	0.100	0.117	0.045	-0.017	**Pass**	0.450	0.469	0.118	-0.019	**Pass**
	Crosstalk										
Detector 11											
12:16 AM	**Efficiency**						30557.74	29987.20	899.62	570.54	**Pass**
	Background										
	Crosstalk						10.053	15.700	2.687	-5.647	**WARNING**
12:19 AM	**Efficiency**	10777.45	10755.42	322.66	22.03	**Pass**					
	Background										
	Crosstalk	3335.000	3246.680	84.085	88.320	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.160	0.122	0.042	0.038	**Pass**	0.505	0.532	0.085	-0.027	**Pass**
	Crosstalk										
Detector 12											
12:16 AM	**Efficiency**						25920.56	25927.73	777.83	-7.16	**Pass**
	Background										
	Crosstalk						14.577	12.950	1.629	1.627	**Pass**
12:19 AM	**Efficiency**	10838.47	11039.74	331.19	-201.27	**Pass**					
	Background										
	Crosstalk	3574.500	3628.500	68.433	-54.000	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.100	0.119	0.050	-0.019	**Pass**	0.515	0.498	0.092	0.017	**Pass**
	Crosstalk										
Detector 13											
12:16 AM	**Efficiency**						22071.08	22266.53	668.00	-195.45	**Pass**
	Background										
	Crosstalk						13.069	14.975	3.432	-1.906	**Pass**

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Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:19 AM	**Efficiency**	11077.18	11233.00	336.99	-155.82	**Pass**					
	Background										
	Crosstalk	3561.500	3521.820	75.777	39.680	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.155	0.163	0.058	-0.008	**Pass**	0.520	0.499	0.101	0.021	**Pass**
	Crosstalk										
Detector 15											
12:16 AM	**Efficiency**						27359.25	27467.78	824.03	-108.53	**Pass**
	Background										
	Crosstalk						17.090	21.400	5.218	-4.310	**Pass**
12:19 AM	**Efficiency**	11678.25	11797.00	353.91	-118.75	**Pass**					
	Background										
	Crosstalk	3487.500	3542.000	85.963	-54.500	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.135	0.137	0.054	-0.002	**Pass**	0.555	0.437	0.083	0.118	**Pass**
	Crosstalk										
Detector 16											
12:22 AM	**Efficiency**						33549.11	33491.33	1004.74	57.79	**Pass**
	Background										
	Crosstalk						22.619	32.800	8.069	-10.181	**Pass**
12:26 AM	**Efficiency**	10599.79	10824.14	324.72	-224.35	**Pass**					
	Background										
	Crosstalk	3427.500	3496.320	67.571	-68.820	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.130	0.128	0.037	0.002	**Pass**	0.555	0.442	0.061	0.113	**Pass**
	Crosstalk										
Detector 17											

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Instrument: Orange

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:22 AM	**Efficiency**						33190.23	33457.18	1003.72	-266.94	**Pass**
	Background										
	Crosstalk						15.079	13.975	2.967	1.104	**Pass**
12:26 AM	**Efficiency**	10003.78	10056.48	301.69	-52.70	**Pass**					
	Background										
	Crosstalk	3420.500	3425.740	60.289	-5.240	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.130	0.151	0.048	-0.021	**Pass**	0.360	0.438	0.089	-0.078	**Pass**
	Crosstalk										
Detector 18											
12:22 AM	**Efficiency**						23119.88	23209.68	696.29	-89.79	**Pass**
	Background										
	Crosstalk						12.566	16.100	4.093	-3.534	**Pass**
12:26 AM	**Efficiency**	10836.49	11053.86	331.62	-217.37	**Pass**					
	Background										
	Crosstalk	3613.000	3611.520	52.801	1.480	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.095	0.109	0.050	-0.014	**Pass**	0.355	0.426	0.077	-0.071	**Pass**
	Crosstalk										
Detector 19											
12:22 AM	**Efficiency**						31034.99	30982.63	929.48	52.36	**Pass**
	Background										
	Crosstalk						13.572	16.650	4.107	-3.078	**Pass**
12:26 AM	**Efficiency**	10948.02	11009.96	330.30	-61.94	**Pass**					
	Background										
	Crosstalk	3753.500	3716.300	50.984	37.200	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.055	0.092	0.031	-0.037	**Pass**	0.335	0.380	0.083	-0.045	**Pass**
	Crosstalk										

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Instrument: Orange

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
Detector 20											
12:22 AM	**Efficiency**						25842.34	25820.98	774.63	21.37	**Pass**
	Background										
	Crosstalk						15.079	20.300	5.444	-5.221	**Pass**
12:26 AM	**Efficiency**	10789.45	10934.68	328.04	-145.23	**Pass**					
	Background										
	Crosstalk	3616.000	3574.300	107.105	41.700	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.085	0.097	0.035	-0.012	**Pass**	0.380	0.375	0.071	0.005	**Pass**
	Crosstalk										
Detector 21											
12:22 AM	**Efficiency**						22051.38	22199.20	665.98	-147.82	**Pass**
	Background										
	Crosstalk						10.556	13.000	2.763	-2.444	**Pass**
12:26 AM	**Efficiency**	11067.22	11170.12	335.10	-102.90	**Pass**					
	Background										
	Crosstalk	3762.500	3672.660	78.069	89.840	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.070	0.101	0.032	-0.031	**Pass**	0.350	0.325	0.064	0.025	**Pass**
	Crosstalk										
Detector 22											
12:22 AM	**Efficiency**						29118.92	29331.13	879.93	-212.20	**Pass**
	Background										
	Crosstalk						10.053	13.075	3.867	-3.022	**Pass**
12:26 AM	**Efficiency**	10748.94	10918.70	327.56	-169.76	**Pass**					
	Background										
	Crosstalk	3536.000	3612.240	230.452	-76.240	**Pass**					

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Friday, May 23, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
3:54 AM	**Efficiency**										
	Background	0.125	0.100	0.032	0.026	**Pass**	0.355	0.381	0.079	-0.026	**Pass**
	Crosstalk										
Detector 23											
12:22 AM	**Efficiency**						27563.97	27644.68	829.34	-80.71	**Pass**
	Background										
	Crosstalk						4.021	13.125	3.128	-9.104	**WARNING**
12:26 AM	**Efficiency**	11544.76	11544.58	346.34	0.19	**Pass**					
	Background										
	Crosstalk	3663.500	3809.981	484.264	-146.481	**Pass**					
3:54 AM	**Efficiency**										
	Background	0.120	0.105	0.049	0.016	**Pass**	0.505	0.446	0.115	0.059	**Pass**
	Crosstalk										

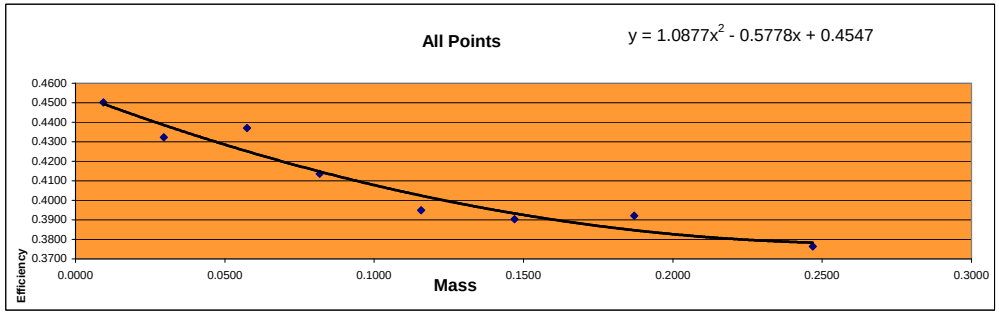
Alpha Beta Calibrations

Curve is for Gross Beta
Strontium 90
and
Total Strontium

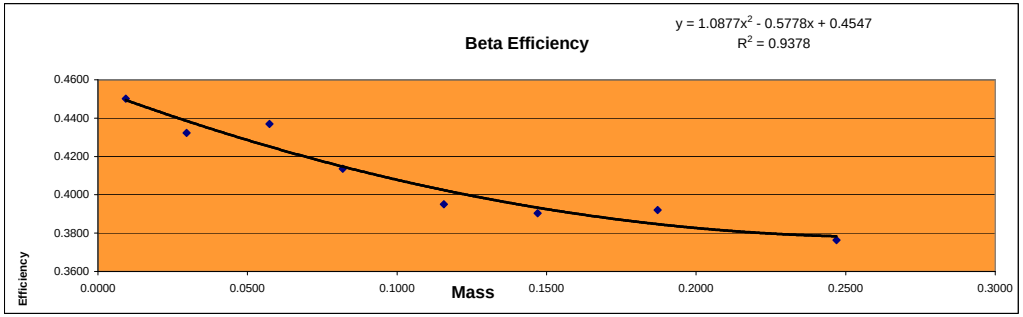
Orange 4

Detector ID	Std ID	Count Date	Sample Wt	Count Time	Beta Counts	DPM 41588.469 CPM	Sr-90 Eff	Standard Aliquot
4	B1	1/23/2013 15:18	0.0093	5	93592	18718.400	0.4501	1mL
4	B2	1/23/2013 15:09	0.0296	5	89877	17975.400	0.4322	1mL
4	B3	1/23/2013 15:00	0.0574	5	90869	18173.800	0.4370	1mL
4	B4	1/23/2013 14:53	0.0818	5	86007	17201.400	0.4136	1mL
4	B5	1/23/2013 14:45	0.1157	5	82135	16427.000	0.3950	1mL
4	B6	1/23/2013 15:46	0.1470	5	81161	16232.200	0.3903	1mL
4	B7	1/23/2013 15:37	0.1871	5	81527	16305.400	0.3921	1mL
4	B8	1/23/2013 15:27	0.2469	5	78270	15654.000	0.3764	1mL

Mass	Measured Efficiency	Theoretical Efficiency	Percent Δ Efficiency
0.0093	0.4501	0.4494	0.15%
0.0296	0.4322	0.4386	-1.44%
0.0574	0.4370	0.4251	2.79%
0.0818	0.4136	0.4147	-0.27%
0.1157	0.3950	0.4024	-1.84%
0.1470	0.3903	0.3933	-0.75%
0.1871	0.3921	0.3847	1.92%
0.2469	0.3764	0.3783	-0.51%



Mass	Efficiency
0.0093	0.4501
0.0296	0.4322
0.0574	0.4370
0.0818	0.4136
0.1157	0.3950
0.1470	0.3903
0.1871	0.3921
0.2469	0.3764



Standard ID
Strontium 90
Sr-90_00004 #6322
Cert# 80573-334 Ref. date 9/172009

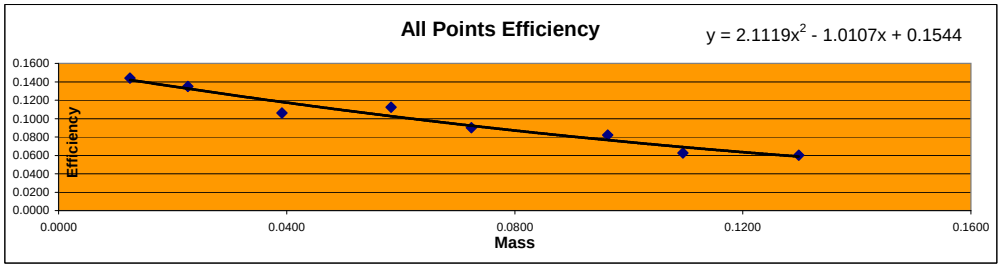
Initial Activity:	22560	dpm/mL
Reference Date:	9/17/2009	
Count Date:	1/23/2013	
Elapsed Time:	1224.000	days
Half Life:	10409.625	days
Exponential Term:	0.921730256	
Corrected Activity:	20794.23458	dpm/mL
Decay Activity (Sr/Y-90)	41588.46916	dpm

Curve is for Gross Alpha

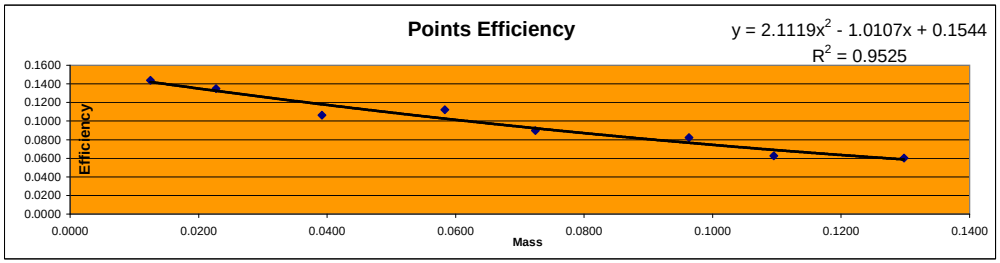
Orange 4

Detector ID	Sample ID	Count Date	Mass	Count Time	Alpha Counts	Net CPM	DPM	Th-230 Efficiency	Standard Aliquot
4	A1	7/18/2013 19:58	0.0125	40	13668	341.700	2374.5	0.1439	1mL
4	A2	7/18/2013 18:30	0.0227	40	12813	320.325	2374.5	0.1349	1mL
4	A3	7/18/2013 17:29	0.0392	40	10088	252.200	2374.5	0.1062	1mL
4	A4	7/23/2013 16:41	0.0583	50	13318	266.360	2374.5	0.1122	1mL
4	A5	7/18/2013 15:43	0.0724	40	17085	427.125	4749.0	0.0899	2mL
4	A6	7/18/2013 22:47	0.0963	40	15616	390.400	4749.0	0.0822	2mL
4	A7	7/18/2013 21:52	0.1095	40	11874	296.850	4749.0	0.0625	2mL
4	A8	7/18/2013 21:01	0.1298	40	11426	285.650	4749.0	0.0601	2mL

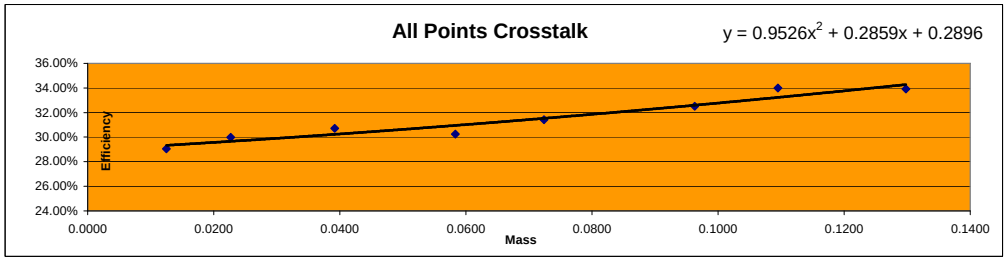
Mass	Measured Efficiency	Theoretical Efficiency	Percent Δ Efficiency
0.0125	0.1439	0.1421	1.27%
0.0227	0.1349	0.1325	1.78%
0.0392	0.1062	0.1180	-10.01%
0.0583	0.1122	0.1027	9.28%
0.0724	0.0899	0.0923	-2.55%
0.0963	0.0822	0.0766	7.25%
0.1095	0.0625	0.0690	-9.46%
0.1298	0.0601	0.0588	2.33%



Mass	Efficiency
0.0125	0.1439
0.0227	0.1349
0.0392	0.1062
0.0583	0.1122
0.0724	0.0899
0.0963	0.0822
0.1095	0.0625
0.1298	0.0601



Detector ID	Sample ID	Mass	Count Time	Alpha Counts	Beta Counts	Alpha CPM	Beta CPM	% α into β	
4	A1	0.0125	40.00	13668	5598	341.70	139.95	29.06%	Min
4	A2	0.0227	40.00	12813	5488	320.33	137.20	29.99%	29.06%
4	A3	0.0392	40.00	10088	4470	252.20	111.75	30.70%	
4	A4	0.0583	40.00	13318	5772	332.95	144.30	30.24%	Max
4	A5	0.0724	40.00	17085	7826	427.13	195.65	31.42%	34.00%
4	A6	0.0963	40.00	15616	7519	390.40	187.98	32.50%	
4	A7	0.1095	40.00	11874	6117	296.85	152.93	34.00%	Mean
4	A8	0.1298	40.00	11426	5864	285.65	146.60	33.92%	31.48%



Standard ID
Thorium-230
Th-230_00016 #51465
Cert # 92523 Ref. date 11/29/2012
Activity 2374.5 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-6322;B5 **Repeat** 39

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 2:45:11 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 2:50:20 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	0	0.000	-0.049
sd	0.000			0.007	0.000	0.000	0.140
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	82,135	16,427.000	16,426.620
sd	0.000			0.019	286.592	57.318	57.318

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-6322;B4

Repeat 41

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 2:53:19 PM

Count Ended 1/23/2013 2:58:29 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	0	0.000	-0.049
sd	0.000			0.007	0.000	0.000	0.140
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	86,007	17,201.400	17,201.020
sd	0.000			0.019	293.270	58.654	58.654

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-6322;B3 **Repeat** 42

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 3:00:53 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 3:06:03 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	3	0.600	0.551
sd	0.000			0.007	1.732	0.346	0.346
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	90,869	18,173.800	18,173.420
sd	0.000			0.019	301.445	60.289	60.289

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-6322;B2

Repeat 43

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 3:09:08 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 3:14:17 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	1	0.200	0.151
sd	0.000			0.007	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	89,877	17,975.400	17,975.020
sd	0.000			0.019	299.795	59.959	59.959

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-6322;B1 **Repeat** 44

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 3:18:54 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/23/2013 3:24:03 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	3	0.600	0.551
sd	0.000			0.007	1.732	0.346	0.346
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	93,592	18,718.400	18,718.020
sd	0.000			0.019	305.928	61.186	61.186

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-6322;B8 **Repeat** 44

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 3:27:10 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 3:32:17 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	1	0.200	0.151
sd	0.000			0.007	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	78,270	15,654.000	15,653.620
sd	0.000			0.019	279.768	55.954	55.954

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-6322;B7 **Repeat** 45

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 3:37:27 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 3:42:36 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	1	0.200	0.151
sd	0.000			0.007	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	81,527	16,305.400	16,305.020
sd	0.000			0.019	285.529	57.106	57.106

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-6322;B6 **Repeat** 46

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 3:46:21 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/23/2013 3:51:30 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	1	0.200	0.151
sd	0.000			0.007	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	81,161	16,232.200	16,231.820
sd	0.000			0.019	284.888	56.978	56.978

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-51465;A5 **Repeat** 9

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 3:43:52 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/18/2013 4:23:58 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	17,085	427.125	427.057
sd	0.000			0.008	130.710	3.268	3.268
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	7,826	195.650	195.264
sd	0.000			0.020	88.465	2.212	2.212

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-51465;A3 **Repeat** 11

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/18/2013 5:29:23 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 7/18/2013 6:09:28 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	10,088	252.200	252.132
sd	0.000			0.008	100.439	2.511	2.511
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	4,470	111.750	111.364
sd	0.000			0.020	66.858	1.671	1.672

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-51465;A2 **Repeat** 12

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/18/2013 6:30:54 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 7/18/2013 7:10:59 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	12,813	320.325	320.257
sd	0.000			0.008	113.195	2.830	2.830
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	5,488	137.200	136.814
sd	0.000			0.020	74.081	1.852	1.852

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-51465;A1 **Repeat** 13

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 7:58:42 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/18/2013 8:38:46 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	13,668	341.700	341.632
sd	0.000			0.008	116.910	2.923	2.923
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	5,598	139.950	139.564
sd	0.000			0.020	74.820	1.870	1.871

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-51465;A8

Repeat 14

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 9:01:01 PM

Count Ended 7/18/2013 9:41:05 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 40.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	11,426	285.650	285.582
sd	0.000			0.008	106.892	2.672	2.672
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	5,864	146.600	146.214
sd	0.000			0.020	76.577	1.914	1.915

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-51465;A7

Repeat 15

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/18/2013 9:52:28 PM

Count Ended 7/18/2013 10:32:33 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 40.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	11,874	296.850	296.782
sd	0.000			0.008	108.968	2.724	2.724
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	6,117	152.925	152.539
sd	0.000			0.020	78.211	1.955	1.955

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-51465;A6 **Repeat** 16

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/18/2013 10:47:01 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 7/18/2013 11:27:07 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	15,616	390.400	390.332
sd	0.000			0.008	124.964	3.124	3.124
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	7,519	187.975	187.589
sd	0.000			0.020	86.712	2.168	2.168

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICABT-51465;A4 **Repeat** 18

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/23/2013 4:41:18 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/23/2013 5:31:23 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 50.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	13,318	266.360	266.292
sd	0.000			0.008	115.404	2.308	2.308
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	5,772	115.440	115.054
sd	0.000			0.020	75.974	1.519	1.520

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

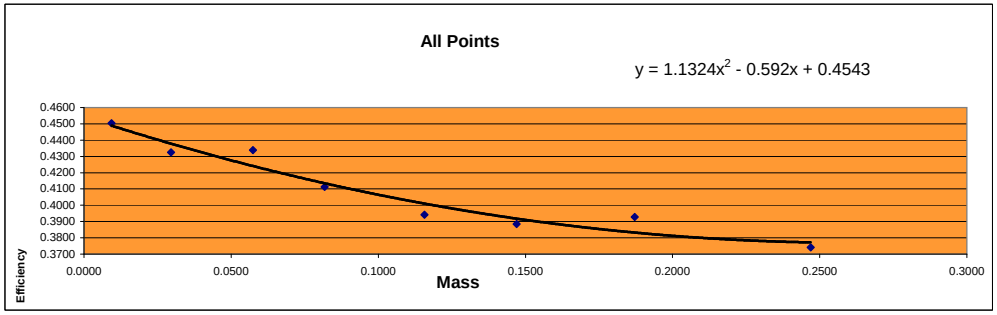
*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Curve is for Gross Beta
Strontium 90
and
Total Strontium

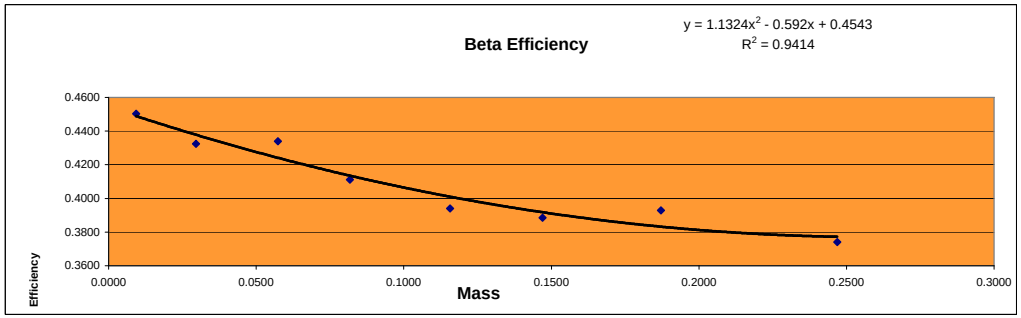
Orange 6

Detector ID	Std ID	Count Date	Sample Wt	Count Time	Beta Counts	DPM 41588.469 CPM	Sr-90 Eff	Standard Aliquot
6	B1	1/23/2013 15:37	0.0093	5	93641	18728.200	0.4503	1mL
6	B2	1/23/2013 15:26	0.0296	5	89937	17987.400	0.4325	1mL
6	B3	1/23/2013 15:19	0.0574	5	90226	18045.200	0.4339	1mL
6	B4	1/23/2013 15:09	0.0818	5	85509	17101.800	0.4112	1mL
6	B5	1/23/2013 15:01	0.1157	5	81949	16389.800	0.3941	1mL
6	B6	1/23/2013 14:53	0.1470	5	80794	16158.800	0.3885	1mL
6	B7	1/23/2013 14:45	0.1871	5	81699	16339.800	0.3929	1mL
6	B8	1/23/2013 15:46	0.2469	5	77798	15559.600	0.3741	1mL

Mass	Measured Efficiency	Theoretical Efficiency	Percent Δ Efficiency
0.0093	0.4503	0.4489	0.32%
0.0296	0.4325	0.4378	-1.20%
0.0574	0.4339	0.4241	2.32%
0.0818	0.4112	0.4135	-0.54%
0.1157	0.3941	0.4010	-1.71%
0.1470	0.3885	0.3917	-0.82%
0.1871	0.3929	0.3832	2.54%
0.2469	0.3741	0.3772	-0.80%



Mass	Efficiency
0.0093	0.4503
0.0296	0.4325
0.0574	0.4339
0.0818	0.4112
0.1157	0.3941
0.1470	0.3885
0.1871	0.3929
0.2469	0.3741



Standard ID
Strontium 90
Sr-90_00004 #6322
Cert# 80573-334 Ref. date 9/172009

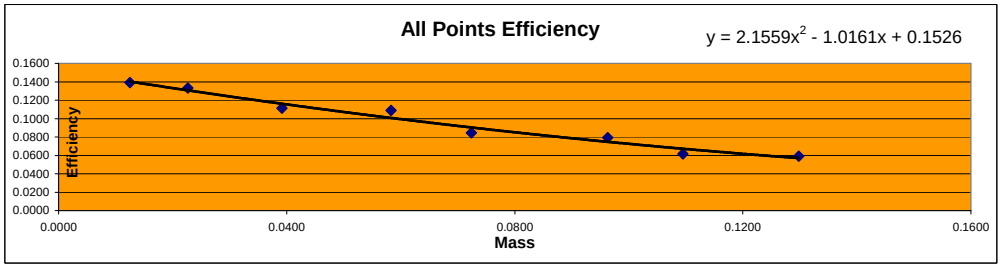
Initial Activity:	22560 dpm/mL
Reference Date:	9/17/2009
Count Date:	1/23/2013
Elapsed Time:	1224.000 days
Half Life:	10409.625 days
Exponential Term:	0.921730256
Corrected Activity:	20794.23458 dpm/mL
Decay Activity (Sr/Y-90)	41588.46916 dpm

Curve is for Gross Alpha

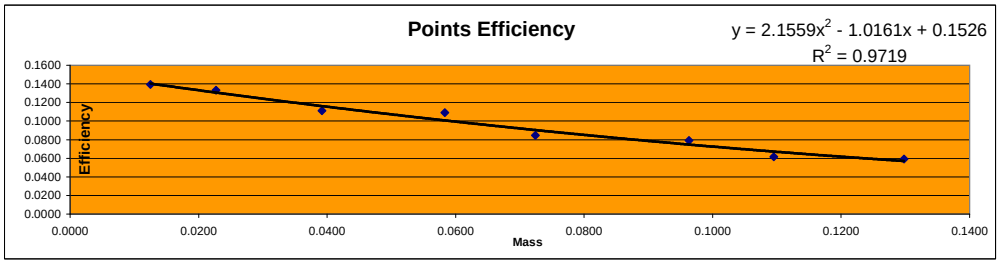
Orange 6

Detector ID	Sample ID	Count Date	Mass	Count Time	Alpha Counts	Net CPM	DPM	Th-230 Efficiency	Standard Aliquot
6	A1	7/18/2013 21:52	0.0125	40	13222	330.550	2374.5	0.1392	1mL
6	A2	7/18/2013 21:01	0.0227	40	12646	316.150	2374.5	0.1331	1mL
6	A3	7/23/2013 16:41	0.0392	50	13208	264.160	2374.5	0.1112	1mL
6	A4	7/23/2013 18:58	0.0583	50	12933	258.660	2374.5	0.1089	1mL
6	A5	7/18/2013 17:29	0.0724	40	16087	402.175	4749.0	0.0847	2mL
6	A6	7/18/2013 16:37	0.0963	40	15054	376.350	4749.0	0.0792	2mL
6	A7	7/18/2013 15:44	0.1095	40	11713	292.825	4749.0	0.0617	2mL
6	A8	7/18/2013 22:47	0.1298	40	11212	280.300	4749.0	0.0590	2mL

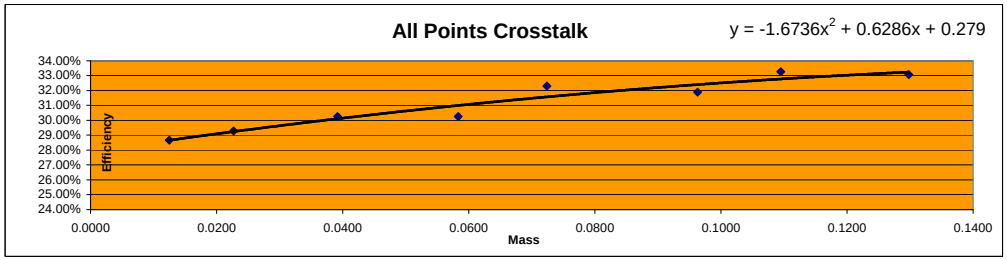
Mass	Measured Efficiency	Theoretical Efficiency	Percent Δ Efficiency
0.0125	0.1392	0.1402	-0.73%
0.0227	0.1331	0.1306	1.91%
0.0392	0.1112	0.1161	-4.16%
0.0583	0.1089	0.1007	8.19%
0.0724	0.0847	0.0903	-6.25%
0.0963	0.0792	0.0747	6.03%
0.1095	0.0617	0.0672	-8.23%
0.1298	0.0590	0.0570	3.49%



Mass	Efficiency
0.0125	0.1392
0.0227	0.1331
0.0392	0.1112
0.0583	0.1089
0.0724	0.0847
0.0963	0.0792
0.1095	0.0617
0.1298	0.0590



Detector ID	Sample ID	Mass	Count Time	Alpha Counts	Beta Counts	Alpha CPM	Beta CPM	% α into β	
6	A1	0.0125	40.00	13222	5313	330.55	132.83	28.66%	Min
6	A2	0.0227	40.00	12646	5241	316.15	131.03	29.30%	28.66%
6	A3	0.0392	40.00	13208	5728	330.20	143.20	30.25%	
6	A4	0.0583	40.00	12933	5609	323.33	140.23	30.25%	Max
6	A5	0.0724	40.00	16087	7677	402.18	191.93	32.31%	33.28%
6	A6	0.0963	40.00	15054	7051	376.35	176.28	31.90%	
6	A7	0.1095	40.00	11713	5842	292.83	146.05	33.28%	Mean
6	A8	0.1298	40.00	11212	5542	280.30	138.55	33.08%	31.13%



Standard ID
Thorium-230
Th-230_00016 #51465
Cert # 92523 Ref. date 11/29/2012
Activity 2374.5 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-6322;B7

Repeat 39

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 2:45:20 PM

Count Ended 1/23/2013 2:50:29 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	0	0.000	-0.073
sd	0.000			0.009	0.000	0.000	0.171
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	81,699	16,339.800	16,339.454
sd	0.000			0.019	285.830	57.166	57.166

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-6322;B6

Repeat 40

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 2:53:29 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 2:58:38 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	1	0.200	0.127
sd	0.000			0.009	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	80,794	16,158.800	16,158.454
sd	0.000			0.019	284.243	56.849	56.849

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-6322;B5

Repeat 41

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 3:01:02 PM

Count Ended 1/23/2013 3:06:12 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	2	0.400	0.327
sd	0.000			0.009	1.414	0.283	0.283
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	81,949	16,389.800	16,389.454
sd	0.000			0.019	286.267	57.253	57.253

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-6322;B4

Repeat 43

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 3:09:16 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 3:14:26 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	4	0.800	0.727
sd	0.000			0.009	2.000	0.400	0.400
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	85,509	17,101.800	17,101.454
sd	0.000			0.019	292.419	58.484	58.484

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-6322;B3 **Repeat** 44

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 3:19:05 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 3:24:15 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	2	0.400	0.327
sd	0.000			0.009	1.414	0.283	0.283
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	90,226	18,045.200	18,044.854
sd	0.000			0.019	300.376	60.075	60.075

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-6322;B2

Repeat 45

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 3:26:42 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 3:31:52 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	1	0.200	0.127
sd	0.000			0.009	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	89,937	17,987.400	17,987.054
sd	0.000			0.019	299.895	59.979	59.979

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-6322;B1 **Repeat** 46

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 3:37:38 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 3:42:48 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	0	0.000	-0.073
sd	0.000			0.009	0.000	0.000	0.171
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	93,641	18,728.200	18,727.854
sd	0.000			0.019	306.008	61.202	61.202

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-6322;B8

Repeat 46

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 3:46:31 PM

Count Ended 1/23/2013 3:51:39 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	1	0.200	0.127
sd	0.000			0.009	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	77,798	15,559.600	15,559.254
sd	0.000			0.019	278.923	55.785	55.785

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-51465;A7

Repeat 9

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 3:44:02 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/18/2013 4:24:07 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	11,713	292.825	292.744
sd	0.000			0.009	108.227	2.706	2.706
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	5,842	146.050	145.589
sd	0.000			0.021	76.433	1.911	1.911

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-51465;A6

Repeat 10

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 4:37:49 PM

Count Ended 7/18/2013 5:17:54 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 40.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	15,054	376.350	376.269
sd	0.000			0.009	122.695	3.067	3.067
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	7,051	176.275	175.814
sd	0.000			0.021	83.970	2.099	2.099

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-51465;A5 **Repeat** 11

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 5:29:34 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/18/2013 6:09:40 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	16,087	402.175	402.094
sd	0.000			0.009	126.835	3.171	3.171
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	7,677	191.925	191.464
sd	0.000			0.021	87.618	2.190	2.191

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-51465;A2

Repeat 14

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 9:01:09 PM

Count Ended 7/18/2013 9:41:14 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 40.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	12,646	316.150	316.069
sd	0.000			0.009	112.454	2.811	2.811
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	5,241	131.025	130.564
sd	0.000			0.021	72.395	1.810	1.810

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-51465;A1

Repeat 15

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 9:52:37 PM

Count Ended 7/18/2013 10:32:42 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 40.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	13,222	330.550	330.469
sd	0.000			0.009	114.987	2.875	2.875
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	5,313	132.825	132.364
sd	0.000			0.021	72.890	1.822	1.822

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-51465;A8

Repeat 16

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/18/2013 10:47:10 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/18/2013 11:27:14 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	11,212	280.300	280.219
sd	0.000			0.009	105.887	2.647	2.647
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	5,542	138.550	138.089
sd	0.000			0.021	74.445	1.861	1.861

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-51465;A3

Repeat 18

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/23/2013 4:41:28 PM

Count Ended 7/23/2013 5:31:33 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 50.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	13,208	264.160	264.079
sd	0.000			0.009	114.926	2.299	2.299
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	5,728	114.560	114.099
sd	0.000			0.021	75.684	1.514	1.514

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICABT-51465;A4

Repeat 20

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/23/2013 6:58:19 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/23/2013 7:48:24 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 50.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	12,933	258.660	258.579
sd	0.000			0.009	113.723	2.274	2.274
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	5,609	112.180	111.719
sd	0.000			0.021	74.893	1.498	1.498

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

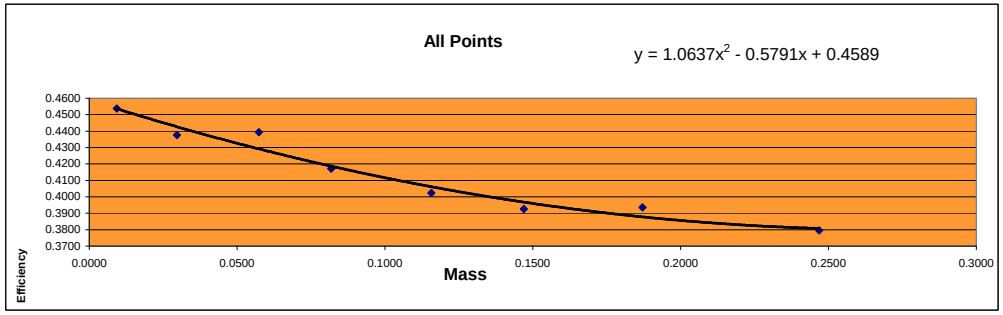
*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Curve is for Gross Beta
Strontium 90
and
Total Strontium

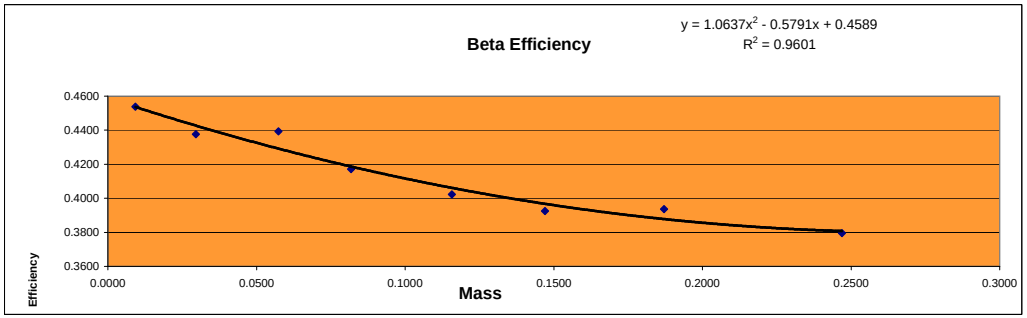
Orange 8

Detector ID	Std ID	Count Date	Sample Wt	Count Time	Beta Counts	DPM 41588.469 CPM	Sr-90 Eff	Standard Aliquot
8	B1	1/23/2013 14:27	0.0093	5	94371	18874.200	0.4538	1mL
8	B2	1/23/2013 17:27	0.0296	5	90984	18196.800	0.4375	1mL
8	B3	1/23/2013 17:19	0.0574	5	91341	18268.200	0.4393	1mL
8	B4	1/23/2013 17:12	0.0818	5	86724	17344.800	0.4171	1mL
8	B5	1/23/2013 17:05	0.1157	5	83645	16729.000	0.4023	1mL
8	B6	1/23/2013 16:58	0.1470	5	81633	16326.600	0.3926	1mL
8	B7	1/23/2013 16:47	0.1871	5	81845	16369.000	0.3936	1mL
8	B8	1/23/2013 14:37	0.2469	5	78908	15781.600	0.3795	1mL

Mass	Measured Efficiency	Theoretical Efficiency	Percent Δ Efficiency
0.0093	0.4538	0.4536	0.05%
0.0296	0.4375	0.4427	-1.16%
0.0574	0.4393	0.4292	2.35%
0.0818	0.4171	0.4186	-0.38%
0.1157	0.4023	0.4061	-0.96%
0.1470	0.3926	0.3968	-1.05%
0.1871	0.3936	0.3878	1.50%
0.2469	0.3795	0.3808	-0.34%



Mass	Efficiency
0.0093	0.4538
0.0296	0.4375
0.0574	0.4393
0.0818	0.4171
0.1157	0.4023
0.1470	0.3926
0.1871	0.3936
0.2469	0.3795



Standard ID
Strontium 90
Sr-90_00004 #6322
Cert# 80573-334 Ref. date 9/172009

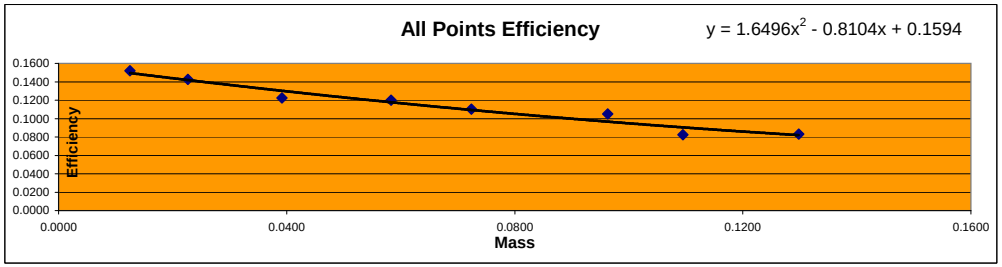
Initial Activity:	22560 dpm/mL
Reference Date:	9/17/2009
Count Date:	1/23/2013
Elapsed Time:	1224.000 days
Half Life:	10409.625 days
Exponential Term:	0.921730256
Corrected Activity:	20794.23458 dpm/mL
Decay Activity (Sr/Y-90)	41588.46916 dpm

Curve is for Gross Alpha

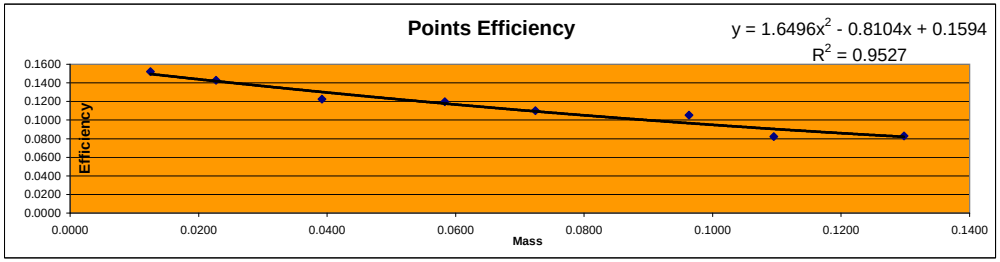
Orange 8

Detector ID	Sample ID	Count Date	Mass	Count Time	Alpha Counts	Net CPM	DPM	Th-230 Efficiency	Standard Aliquot
8	A1	7/24/2013 8:46	0.0125	50	18041	360.820	2374.5	0.1520	1mL
8	A2	7/24/2013 18:31	0.0227	50	16948	338.960	2374.5	0.1428	1mL
8	A3	7/24/2013 17:29	0.0392	50	14549	290.980	2374.5	0.1225	1mL
8	A4	7/24/2013 16:36	0.0583	50	14235	284.700	2374.5	0.1199	1mL
8	A5	7/24/2013 15:14	0.0724	50	26144	522.880	4749.0	0.1101	2mL
8	A6	7/24/2013 11:45	0.0963	50	24983	499.660	4749.0	0.1052	2mL
8	A7	7/24/2013 10:46	0.1095	50	19565	391.300	4749.0	0.0824	2mL
8	A8	7/24/2013 9:53	0.1298	50	19719	394.380	4749.0	0.0830	2mL

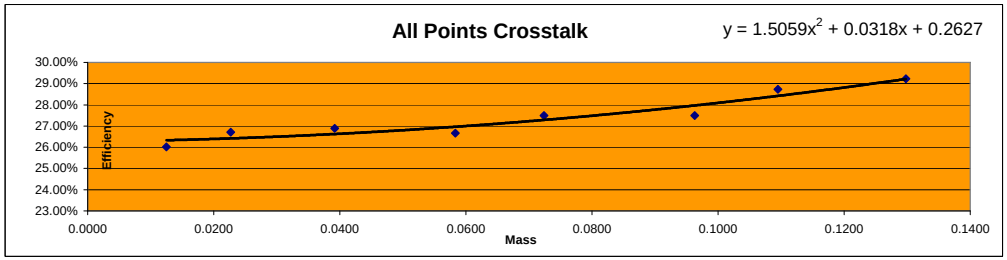
Mass	Measured Efficiency	Theoretical Efficiency	Percent Δ Efficiency
0.0125	0.1520	0.1495	1.62%
0.0227	0.1428	0.1419	0.63%
0.0392	0.1225	0.1302	-5.86%
0.0583	0.1199	0.1178	1.82%
0.0724	0.1101	0.1094	0.67%
0.0963	0.1052	0.0967	8.85%
0.1095	0.0824	0.0904	-8.89%
0.1298	0.0830	0.0820	1.27%



Mass	Efficiency
0.0125	0.1520
0.0227	0.1428
0.0392	0.1225
0.0583	0.1199
0.0724	0.1101
0.0963	0.1052
0.1095	0.0824
0.1298	0.0830



Detector ID	Sample ID	Mass	Count Time	Alpha Counts	Beta Counts	Alpha CPM	Beta CPM	% α into β	
8	A1	0.0125	40.00	18041	6343	451.03	158.58	26.01%	Min
8	A2	0.0227	40.00	16948	6179	423.70	154.48	26.72%	26.01%
8	A3	0.0392	40.00	14549	5352	363.73	133.80	26.89%	
8	A4	0.0583	40.00	14235	5176	355.88	129.40	26.67%	Max
8	A5	0.0724	40.00	26144	9918	653.60	247.95	27.50%	29.22%
8	A6	0.0963	40.00	24983	9474	624.58	236.85	27.50%	
8	A7	0.1095	40.00	19565	7888	489.13	197.20	28.73%	Mean
8	A8	0.1298	40.00	19719	8142	492.98	203.55	29.22%	27.41%



Standard ID
Thorium-230
Th-230_00016 #51465
Cert # 92523 Ref. date 11/29/2012
Activity 2374.5 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-6322;B1

Repeat 38

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 2:27:39 PM

Count Ended 1/23/2013 2:32:50 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	16	3.200	3.170
sd	0.000			0.005	4.000	0.800	0.800
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	94,371	18,874.200	18,873.885
sd	0.000			0.018	307.199	61.440	61.440

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-6322;B8

Repeat 38

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 2:37:24 PM

Count Ended 1/23/2013 2:42:33 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	11	2.200	2.170
sd	0.000			0.005	3.317	0.663	0.663
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	78,908	15,781.600	15,781.285
sd	0.000			0.018	280.906	56.181	56.181

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-6322;B7

Repeat 47

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 4:47:23 PM

Count Ended 1/23/2013 4:52:32 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	16	3.200	3.170
sd	0.000			0.005	4.000	0.800	0.800
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	81,845	16,369.000	16,368.685
sd	0.000			0.018	286.086	57.217	57.217

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-6322;B6

Repeat 48

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 4:58:41 PM

Count Ended 1/23/2013 5:03:49 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	18	3.600	3.570
sd	0.000			0.005	4.243	0.849	0.849
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	81,633	16,326.600	16,326.285
sd	0.000			0.018	285.715	57.143	57.143

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-6322;B5

Repeat 49

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 5:05:41 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 5:10:50 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	20	4.000	3.970
sd	0.000			0.005	4.472	0.894	0.894
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	83,645	16,729.000	16,728.685
sd	0.000			0.018	289.214	57.843	57.843

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-6322;B4

Repeat 51

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 5:12:28 PM

Count Ended 1/23/2013 5:17:39 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	10	2.000	1.970
sd	0.000			0.005	3.162	0.632	0.632
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	86,724	17,344.800	17,344.485
sd	0.000			0.018	294.489	58.898	58.898

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-6322;B3

Repeat 52

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 5:19:14 PM

Count Ended 1/23/2013 5:24:23 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	8	1.600	1.570
sd	0.000			0.005	2.828	0.566	0.566
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	91,341	18,268.200	18,267.885
sd	0.000			0.018	302.227	60.445	60.445

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-6322;B2

Repeat 53

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 5:27:46 PM

Count Ended 1/23/2013 5:32:58 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	18	3.600	3.570
sd	0.000			0.005	4.243	0.849	0.849
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	90,984	18,196.800	18,196.485
sd	0.000			0.018	301.636	60.327	60.327

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-51465;A1

Repeat 17

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 8:46:46 AM

Count Ended 7/24/2013 9:36:52 AM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 50.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	18,041	360.820	360.786
sd	0.000			0.006	134.317	2.686	2.686
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	6,343	126.860	126.516
sd	0.000			0.019	79.643	1.593	1.593

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-51465;A8

Repeat 18

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 9:53:57 AM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 7/24/2013 10:44:03 AM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 50.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	19,719	394.380	394.346
sd	0.000			0.006	140.424	2.808	2.808
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	8,142	162.840	162.496
sd	0.000			0.019	90.233	1.805	1.805

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-51465;A7

Repeat 19

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 10:46:00 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 7/24/2013 11:36:05 AM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 50.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	19,565	391.300	391.266
sd	0.000			0.006	139.875	2.797	2.798
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	7,888	157.760	157.416
sd	0.000			0.019	88.814	1.776	1.776

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-51465;A6

Repeat 20

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 11:45:59 AM

Count Ended 7/24/2013 12:36:06 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 50.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	24,983	499.660	499.626
sd	0.000			0.006	158.060	3.161	3.161
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	9,474	189.480	189.136
sd	0.000			0.019	97.334	1.947	1.947

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-51465;A5

Repeat 21

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 3:14:15 PM

Count Ended 7/24/2013 4:04:22 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 50.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	26,144	522.880	522.846
sd	0.000			0.006	161.691	3.234	3.234
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	9,918	198.360	198.016
sd	0.000			0.019	99.589	1.992	1.992

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-51465;A4

Repeat 27

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 4:36:56 PM

Count Ended 7/24/2013 5:27:03 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 50.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	14,235	284.700	284.666
sd	0.000			0.006	119.311	2.386	2.386
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	5,176	103.520	103.176
sd	0.000			0.019	71.944	1.439	1.439

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-51465;A3

Repeat 26

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 5:29:38 PM

Count Ended 7/24/2013 6:19:42 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 50.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	14,549	290.980	290.946
sd	0.000			0.006	120.619	2.412	2.412
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	5,352	107.040	106.696
sd	0.000			0.019	73.157	1.463	1.463

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICABT-51465;A2

Repeat 24

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 6:31:42 PM

Count Ended 7/24/2013 7:21:47 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 50.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	16,948	338.960	338.926
sd	0.000			0.006	130.184	2.604	2.604
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	6,179	123.580	123.236
sd	0.000			0.019	78.607	1.572	1.572

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

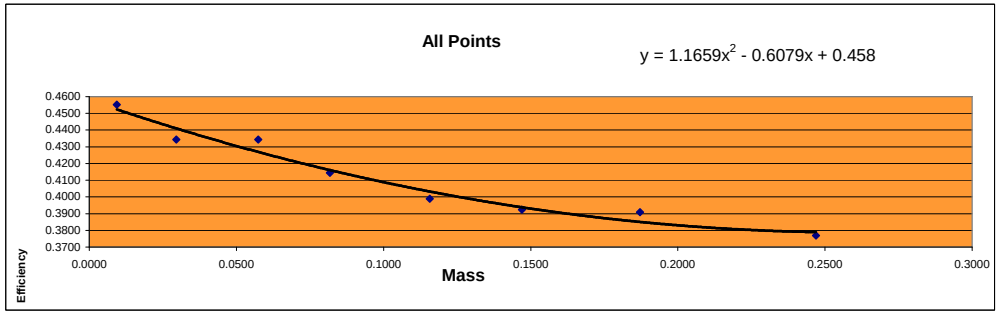
Error = .00 **x sd**

Curve is for Gross Beta
Strontium 90
and
Total Strontium

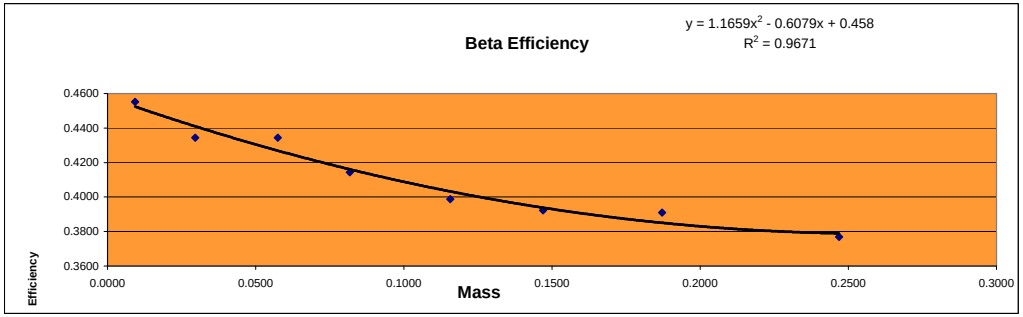
Orange 9

Detector ID	Std ID	Count Date	Sample Wt	Count Time	Beta Counts	DPM 41588.469 CPM	Sr-90 Eff	Standard Aliquot
9	B1	1/23/2013 14:36	0.0093	5	94656	18931.200	0.4552	1mL
9	B2	1/23/2013 14:27	0.0296	5	90334	18066.800	0.4344	1mL
9	B3	1/23/2013 17:27	0.0574	5	90313	18062.600	0.4343	1mL
9	B4	1/23/2013 17:19	0.0818	5	86182	17236.400	0.4145	1mL
9	B5	1/23/2013 17:12	0.1157	5	82941	16588.200	0.3989	1mL
9	B6	1/23/2013 17:05	0.1470	5	81581	16316.200	0.3923	1mL
9	B7	1/23/2013 16:58	0.1871	5	81283	16256.600	0.3909	1mL
9	B8	1/23/2013 16:47	0.2469	5	78385	15677.000	0.3770	1mL

Mass	Measured Efficiency	Theoretical Efficiency	Percent Δ Efficiency
0.0093	0.4552	0.4524	0.61%
0.0296	0.4344	0.4410	-1.50%
0.0574	0.4343	0.4269	1.73%
0.0818	0.4145	0.4161	-0.39%
0.1157	0.3989	0.4033	-1.09%
0.1470	0.3923	0.3938	-0.38%
0.1871	0.3909	0.3851	1.51%
0.2469	0.3770	0.3790	-0.53%



Mass	Efficiency
0.0093	0.4552
0.0296	0.4344
0.0574	0.4343
0.0818	0.4145
0.1157	0.3989
0.1470	0.3923
0.1871	0.3909
0.2469	0.3770



Standard ID
Strontium 90
Sr-90_00004 #6322
Cert# 80573-334 Ref. date 9/172009

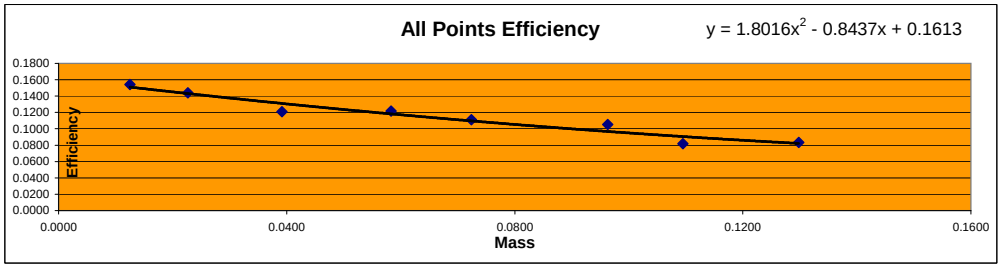
Initial Activity:	22560	dpm/mL
Reference Date:	9/17/2009	
Count Date:	1/23/2013	
Elapsed Time:	1224.000	days
Half Life:	10409.625	days
Exponential Term:	0.921730256	
Corrected Activity:	20794.23458	dpm/mL
Decay Activity (Sr/Y-90)	41588.46916	dpm

Curve is for Gross Alpha

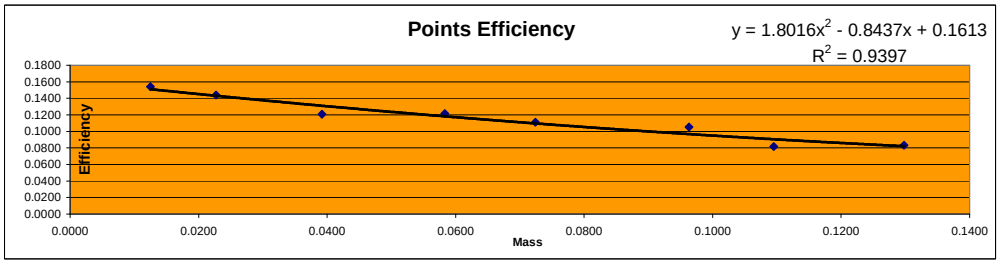
Orange 9

Detector ID	Sample ID	Count Date	Mass	Count Time	Alpha Counts	Net CPM	DPM	Th-230 Efficiency	Standard Aliquot
9	A1	7/24/2013 9:53	0.0125	50	18299	365.980	2374.5	0.1541	1mL
9	A2	7/24/2013 8:46	0.0227	50	17114	342.280	2374.5	0.1441	1mL
9	A3	7/24/2013 18:31	0.0392	50	14351	287.020	2374.5	0.1209	1mL
9	A4	7/24/2013 17:29	0.0583	50	14446	288.920	2374.5	0.1217	1mL
9	A5	7/24/2013 16:37	0.0724	50	26402	528.040	4749.0	0.1112	2mL
9	A6	7/24/2013 15:14	0.0963	50	25033	500.660	4749.0	0.1054	2mL
9	A7	7/24/2013 11:46	0.1095	50	19397	387.940	4749.0	0.0817	2mL
9	A8	7/24/2013 10:46	0.1298	50	19797	395.940	4749.0	0.0834	2mL

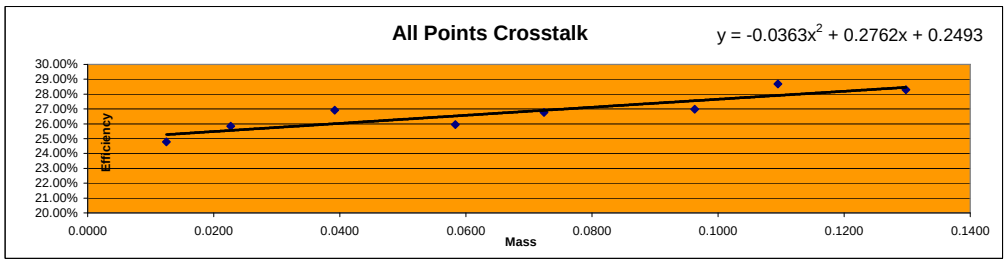
Mass	Measured Efficiency	Theoretical Efficiency	Percent Δ Efficiency
0.0125	0.1541	0.1510	2.05%
0.0227	0.1441	0.1431	0.75%
0.0392	0.1209	0.1310	-7.73%
0.0583	0.1217	0.1182	2.91%
0.0724	0.1112	0.1097	1.40%
0.0963	0.1054	0.0968	8.96%
0.1095	0.0817	0.0905	-9.75%
0.1298	0.0834	0.0821	1.50%



Mass	Efficiency
0.0125	0.1541
0.0227	0.1441
0.0392	0.1209
0.0583	0.1217
0.0724	0.1112
0.0963	0.1054
0.1095	0.0817
0.1298	0.0834



Detector ID	Sample ID	Mass	Count Time	Alpha Counts	Beta Counts	Alpha CPM	Beta CPM	% α into β	
9	A1	0.0125	40.00	18299	6027	457.48	150.68	24.78%	Min
9	A2	0.0227	40.00	17114	5961	427.85	149.03	25.83%	24.78%
9	A3	0.0392	40.00	14351	5286	358.78	132.15	26.92%	
9	A4	0.0583	40.00	14446	5062	361.15	126.55	25.95%	Max
9	A5	0.0724	40.00	26402	9646	660.05	241.15	26.76%	28.68%
9	A6	0.0963	40.00	25033	9253	625.83	231.33	26.99%	
9	A7	0.1095	40.00	19397	7800	484.93	195.00	28.68%	Mean
9	A8	0.1298	40.00	19797	7813	494.93	195.33	28.30%	26.77%



Standard ID
Thorium-230
Th-230_00016 #51465
Cert # 92523 Ref. date 11/29/2012
Activity 2374.5 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-6322;B2

Repeat 38

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 2:27:43 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 2:32:52 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	17	3.400	3.325
sd	0.000			0.009	4.123	0.825	0.825
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	90,334	18,066.800	18,066.437
sd	0.000			0.019	300.556	60.111	60.111

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-6322;B1

Repeat 39

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 2:36:41 PM

Count Ended 1/23/2013 2:41:50 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	17	3.400	3.325
sd	0.000			0.009	4.123	0.825	0.825
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	94,656	18,931.200	18,930.837
sd	0.000			0.019	307.662	61.532	61.532

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-6322;B8

Repeat 47

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 4:47:27 PM

Count Ended 1/23/2013 4:52:37 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	13	2.600	2.525
sd	0.000			0.009	3.606	0.721	0.721
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	78,385	15,677.000	15,676.637
sd	0.000			0.019	279.973	55.995	55.995

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-6322;B7

Repeat 48

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 4:58:46 PM

Count Ended 1/23/2013 5:03:54 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	17	3.400	3.325
sd	0.000			0.009	4.123	0.825	0.825
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	81,283	16,256.600	16,256.237
sd	0.000			0.019	285.102	57.020	57.020

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-6322;B6 **Repeat** 49

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 ***l*** **sd** 0 ***l***

Residual Wt 0 ***mg*** **sd** 0 ***mg***

Count Began 1/23/2013 5:05:46 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/23/2013 5:10:56 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	15	3.000	2.925
sd	0.000			0.009	3.873	0.775	0.775
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	81,581	16,316.200	16,315.837
sd	0.000			0.019	285.624	57.125	57.125

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-6322;B5

Repeat 50

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 5:12:35 PM

Count Ended 1/23/2013 5:17:44 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	16	3.200	3.125
sd	0.000			0.009	4.000	0.800	0.800
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	82,941	16,588.200	16,587.837
sd	0.000			0.019	287.995	57.599	57.599

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-6322;B4

Repeat 52

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 5:19:19 PM

Count Ended 1/23/2013 5:24:29 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	21	4.200	4.125
sd	0.000			0.009	4.583	0.917	0.917
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	86,182	17,236.400	17,236.037
sd	0.000			0.019	293.568	58.714	58.714

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-6322;B3

Repeat 53

Carrier No. 0

Batch ID m122627

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 5:27:50 PM

Count Ended 1/23/2013 5:33:01 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	13	2.600	2.525
sd	0.000			0.009	3.606	0.721	0.721
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	90,313	18,062.600	18,062.237
sd	0.000			0.019	300.521	60.104	60.104

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-51465;A2

Repeat 17

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 8:46:52 AM

Count Ended 7/24/2013 9:36:59 AM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 50.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	17,114	342.280	342.206
sd	0.000			0.009	130.820	2.616	2.616
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	5,961	119.220	118.823
sd	0.000			0.020	77.208	1.544	1.544

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-51465;A1

Repeat 18

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 9:53:20 AM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 7/24/2013 10:43:26 AM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 50.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	18,299	365.980	365.906
sd	0.000			0.009	135.274	2.705	2.705
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	6,027	120.540	120.143
sd	0.000			0.020	77.634	1.553	1.553

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-51465;A8

Repeat 19

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 10:46:04 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/24/2013 11:36:10 AM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 50.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	19,797	395.940	395.866
sd	0.000			0.009	140.702	2.814	2.814
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	7,813	156.260	155.863
sd	0.000			0.020	88.391	1.768	1.768

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-51465;A7

Repeat 20

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 11:46:03 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 7/24/2013 12:36:08 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 50.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	19,397	387.940	387.866
sd	0.000			0.009	139.273	2.785	2.785
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	7,800	156.000	155.603
sd	0.000			0.020	88.318	1.766	1.766

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-51465;A6

Repeat 21

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 3:14:19 PM

Count Ended 7/24/2013 4:04:25 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 50.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	25,033	500.660	500.586
sd	0.000			0.009	158.218	3.164	3.164
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	9,253	185.060	184.663
sd	0.000			0.020	96.193	1.924	1.924

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-51465;A5

Repeat 22

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 4:37:01 PM

Count Ended 7/24/2013 5:27:07 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 50.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	26,402	528.040	527.966
sd	0.000			0.009	162.487	3.250	3.250
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	9,646	192.920	192.523
sd	0.000			0.020	98.214	1.964	1.964

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-51465;A4 **Repeat** 28

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 5:29:43 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/24/2013 6:19:49 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 50.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	14,446	288.920	288.846
sd	0.000			0.009	120.192	2.404	2.404
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	5,062	101.240	100.843
sd	0.000			0.020	71.148	1.423	1.423

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICABT-51465;A3 **Repeat** 27

Carrier No. 0

Batch ID M132731

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 6:31:50 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 7/24/2013 7:21:56 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 50.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	14,351	287.020	286.946
sd	0.000			0.009	119.796	2.396	2.396
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	5,286	105.720	105.323
sd	0.000			0.020	72.705	1.454	1.454

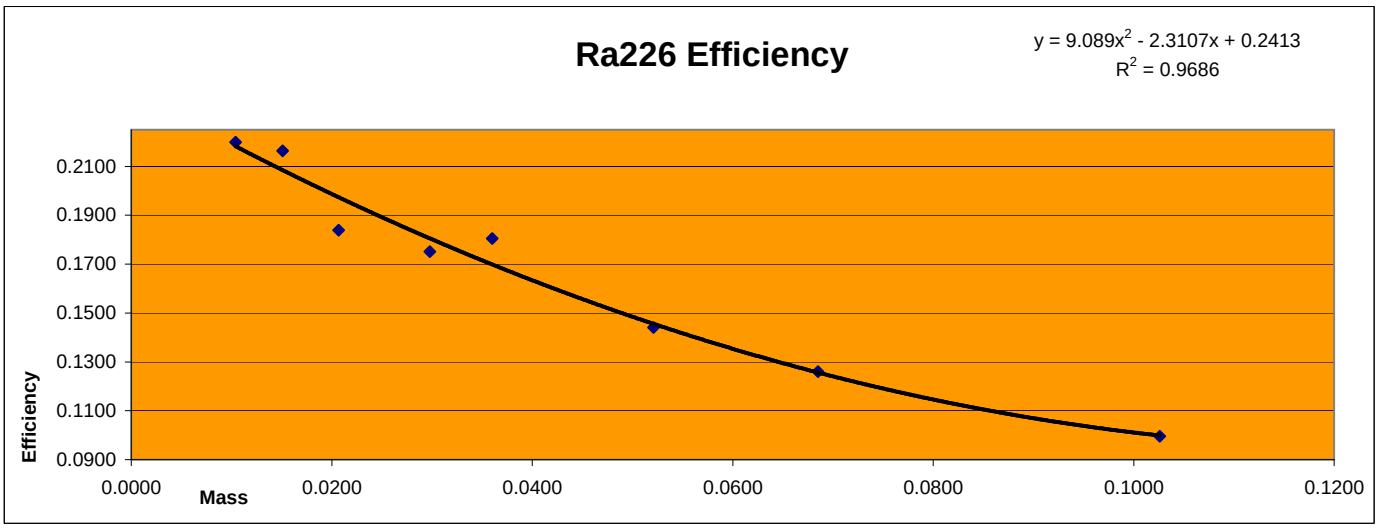
	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Ra-226 Calibrations

Orange 0

Std #	Mass	Count Time	Sample Time	Alpha Counts	DPM	CPM	Efficiency
T11	0.0104	40.00	1/23/2013 16:47	40185	4567.9	1004.6250	0.2199
T12	0.0151	40.00	1/23/2013 22:27	39540	4567.9	988.5000	0.2164
T13	0.0207	40.00	1/23/2013 21:28	33589	4567.9	839.7250	0.1838
T14	0.0298	40.00	1/23/2013 20:30	32005	4567.9	800.1250	0.1752
T15	0.0360	40.00	1/23/2013 19:45	32984	4567.9	824.6000	0.1805
T16	0.0521	40.00	1/23/2013 19:04	26314	4567.9	657.8500	0.1440
T17	0.0685	40.00	1/23/2013 18:18	23031	4567.9	575.7750	0.1260
T18	0.1026	40.00	1/23/2013 17:29	18200	4567.9	455.0000	0.0996



Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICRA6-10734;T1 **Repeat** 28

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 4:47:37 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 5:27:45 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	40,185	1,004.625	1,004.547
sd	0.000			0.009	200.462	5.012	5.012
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	11,638	290.950	290.547
sd	0.000			0.020	107.880	2.697	2.697

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICRA6-10734;T8 **Repeat** 29

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 5:29:59 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 6:10:04 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	18,200	455.000	454.922
sd	0.000			0.009	134.907	3.373	3.373
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	5,899	147.475	147.072
sd	0.000			0.020	76.805	1.920	1.920

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICRA6-10734;T7

Repeat 30

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 6:18:38 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 6:58:43 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	23,031	575.775	575.697
sd	0.000			0.009	151.760	3.794	3.794
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	7,277	181.925	181.522
sd	0.000			0.020	85.305	2.133	2.133

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICRA6-10734;T6 **Repeat** 31

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 7:04:03 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 7:44:10 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	26,314	657.850	657.772
sd	0.000			0.009	162.216	4.055	4.055
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	8,076	201.900	201.497
sd	0.000			0.020	89.867	2.247	2.247

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICRA6-10734;T5

Repeat 32

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 7:45:34 PM

Count Ended 1/23/2013 8:25:41 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 40.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	32,984	824.600	824.522
sd	0.000			0.009	181.615	4.540	4.540
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	9,559	238.975	238.572
sd	0.000			0.020	97.770	2.444	2.444

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICRA6-10734;T4 **Repeat** 33

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 8:30:26 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 9:10:33 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	32,005	800.125	800.047
sd	0.000			0.009	178.899	4.472	4.472
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	9,460	236.500	236.097
sd	0.000			0.020	97.263	2.432	2.432

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICRA6-10734;T3

Repeat 34

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 9:28:47 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 10:08:55 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	33,589	839.725	839.647
sd	0.000			0.009	183.273	4.582	4.582
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	10,170	254.250	253.847
sd	0.000			0.020	100.846	2.521	2.521

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICRA6-10734;T2

Repeat 35

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 10:27:18 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 11:07:26 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

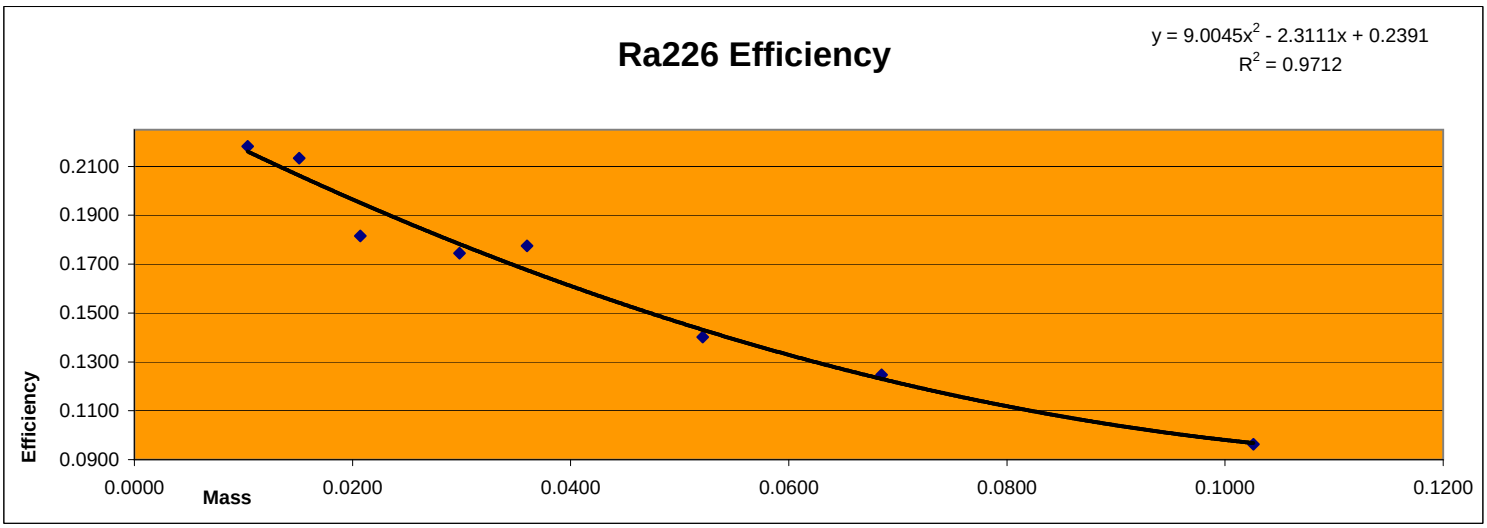
	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	39,540	988.500	988.422
sd	0.000			0.009	198.847	4.971	4.971
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	11,625	290.625	290.222
sd	0.000			0.020	107.819	2.695	2.696

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Orange 1

Std #	Mass	Count Time	Sample Time	Alpha Counts	DPM	CPM	Efficiency
T11	0.0104	40.00	1/23/2013 17:29	39871	4567.9	996.7750	0.2182
T12	0.0151	40.00	1/23/2013 16:47	38981	4567.9	974.5250	0.2133
T13	0.0207	40.00	1/23/2013 22:27	33172	4567.9	829.3000	0.1815
T14	0.0298	40.00	1/23/2013 21:28	31881	4567.9	797.0250	0.1745
T15	0.0360	40.00	1/23/2013 20:30	32438	4567.9	810.9500	0.1775
T16	0.0521	40.00	1/23/2013 19:45	25605	4567.9	640.1250	0.1401
T17	0.0685	40.00	1/23/2013 19:04	22779	4567.9	569.4750	0.1247
T18	0.1026	40.00	1/23/2013 18:18	17596	4567.9	439.9000	0.0963



Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICRA6-10734;T2 **Repeat** 28

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 4:47:40 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 5:27:47 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	38,981	974.525	974.468
sd	0.000			0.008	197.436	4.936	4.936
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	11,203	280.075	279.776
sd	0.000			0.017	105.844	2.646	2.646

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICRA6-10734;T1 **Repeat** 29

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 5:29:35 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 6:09:42 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	39,871	996.775	996.718
sd	0.000			0.008	199.677	4.992	4.992
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	11,562	289.050	288.751
sd	0.000			0.017	107.527	2.688	2.688

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICRA6-10734;T8 **Repeat** 30

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 6:18:41 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 6:58:48 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	17,596	439.900	439.843
sd	0.000			0.008	132.650	3.316	3.316
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	5,936	148.400	148.101
sd	0.000			0.017	77.045	1.926	1.926

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICRA6-10734;T7 **Repeat** 31

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/23/2013 7:04:06 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/23/2013 7:44:13 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	22,779	569.475	569.418
sd	0.000			0.008	150.927	3.773	3.773
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	7,272	181.800	181.501
sd	0.000			0.017	85.276	2.132	2.132

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICRA6-10734;T6 **Repeat** 32

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 7:45:37 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 8:25:43 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	25,605	640.125	640.068
sd	0.000			0.008	160.016	4.000	4.000
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	7,867	196.675	196.376
sd	0.000			0.017	88.696	2.217	2.217

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICRA6-10734;T5 **Repeat** 33

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 8:30:30 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 9:10:38 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	32,438	810.950	810.893
sd	0.000			0.008	180.106	4.503	4.503
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	9,280	232.000	231.701
sd	0.000			0.017	96.333	2.408	2.408

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICRA6-10734;T4 **Repeat** 34

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 9:28:50 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 10:08:58 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	31,881	797.025	796.968
sd	0.000			0.008	178.553	4.464	4.464
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	9,018	225.450	225.151
sd	0.000			0.017	94.963	2.374	2.374

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICRA6-10734;T3 **Repeat** 35

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 10:27:22 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 11:07:29 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

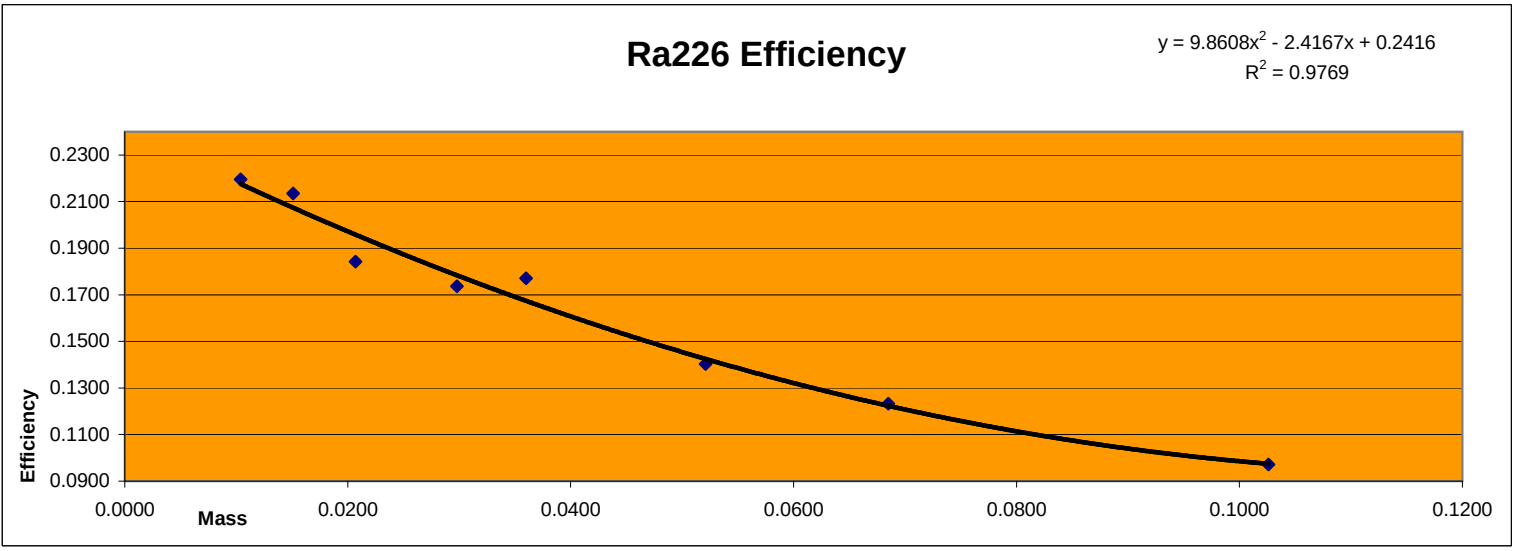
	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	33,172	829.300	829.243
sd	0.000			0.008	182.132	4.553	4.553
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	9,775	244.375	244.076
sd	0.000			0.017	98.869	2.472	2.472

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Orange 2

Std #	Mass	Count Time	Sample Time	Alpha Counts	DPM	CPM	Efficiency
T11	0.0104	40.00	1/23/2013 18:18	40109	4567.9	1002.7250	0.2195
T12	0.0151	40.00	1/23/2013 17:29	39008	4567.9	975.2000	0.2135
T13	0.0207	40.00	1/23/2013 16:47	33673	4567.9	841.8250	0.1843
T14	0.0298	40.00	1/23/2013 22:27	31731	4567.9	793.2750	0.1737
T15	0.0360	40.00	1/23/2013 21:28	32364	4567.9	809.1000	0.1771
T16	0.0521	40.00	1/23/2013 20:30	25630	4567.9	640.7500	0.1403
T17	0.0685	40.00	1/23/2013 19:45	22527	4567.9	563.1750	0.1233
T18	0.1026	40.00	1/23/2013 19:04	17746	4567.9	443.6500	0.0971



Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICRA6-10734;T3 **Repeat** 28

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 4:47:43 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 5:27:51 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	33,673	841.825	841.755
sd	0.000			0.008	183.502	4.588	4.588
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	10,101	252.525	252.239
sd	0.000			0.017	100.504	2.513	2.513

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICRA6-10734;T2 **Repeat** 29

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 5:29:39 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 6:09:47 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	39,008	975.200	975.130
sd	0.000			0.008	197.504	4.938	4.938
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	11,392	284.800	284.514
sd	0.000			0.017	106.733	2.668	2.668

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICRA6-10734;T1 **Repeat** 30

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 6:18:45 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 6:58:53 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	40,109	1,002.725	1,002.655
sd	0.000			0.008	200.272	5.007	5.007
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	12,086	302.150	301.864
sd	0.000			0.017	109.936	2.748	2.748

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICRA6-10734;T8 **Repeat** 31

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 7:04:09 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 7:44:15 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	17,746	443.650	443.580
sd	0.000			0.008	133.214	3.330	3.330
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	6,098	152.450	152.164
sd	0.000			0.017	78.090	1.952	1.952

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICRA6-10734;T7 **Repeat** 32

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 7:45:53 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 8:25:59 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	22,527	563.175	563.105
sd	0.000			0.008	150.090	3.752	3.752
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	7,347	183.675	183.389
sd	0.000			0.017	85.715	2.143	2.143

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICRA6-10734;T6 **Repeat** 33

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 8:30:33 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 9:10:40 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	25,630	640.750	640.680
sd	0.000			0.008	160.094	4.002	4.002
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	8,200	205.000	204.714
sd	0.000			0.017	90.554	2.264	2.264

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICRA6-10734;T5 **Repeat** 34

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 9:28:54 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 10:09:02 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	32,364	809.100	809.030
sd	0.000			0.008	179.900	4.497	4.498
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	9,713	242.825	242.539
sd	0.000			0.017	98.555	2.464	2.464

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICRA6-10734;T4 **Repeat** 35

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 10:27:25 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 11:07:33 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

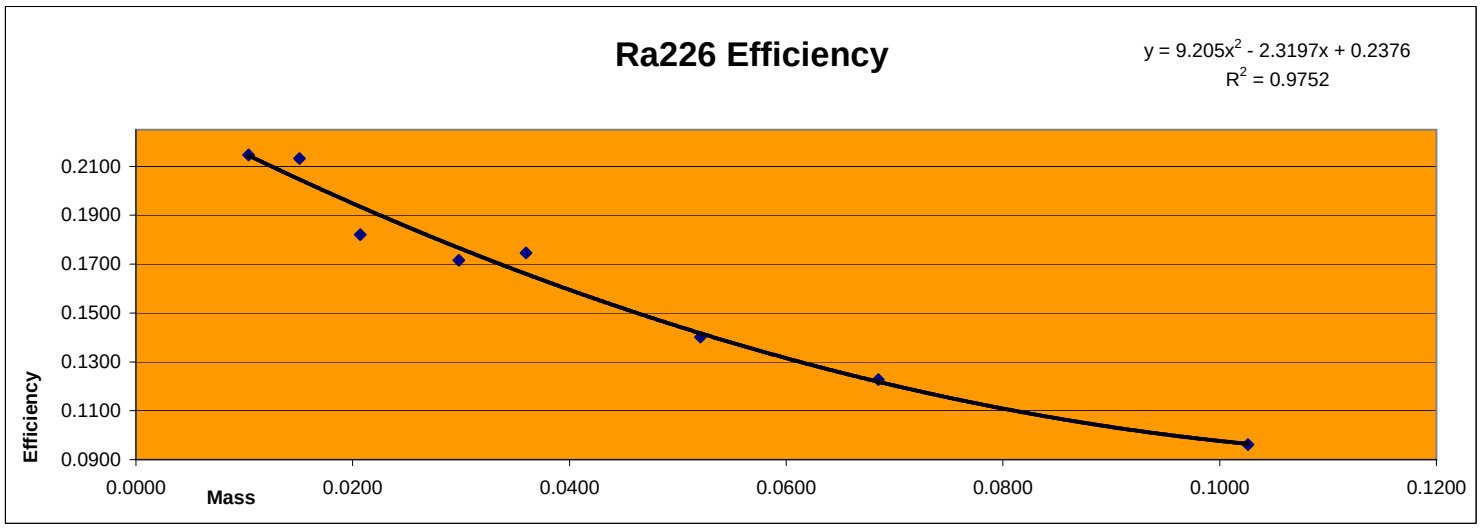
	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	31,731	793.275	793.205
sd	0.000			0.008	178.132	4.453	4.453
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	9,480	237.000	236.714
sd	0.000			0.017	97.365	2.434	2.434

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Orange 3

Std #	Mass	Count Time	Sample Time	Alpha Counts	DPM	CPM	Efficiency
T11	0.0104	40.00	1/23/2013 19:04	39224	4567.9	980.6000	0.2147
T12	0.0151	40.00	1/23/2013 18:18	38959	4567.9	973.9750	0.2132
T13	0.0207	40.00	1/23/2013 17:29	33274	4567.9	831.8500	0.1821
T14	0.0298	40.00	1/23/2013 16:47	31347	4567.9	783.6750	0.1716
T15	0.0360	40.00	1/23/2013 22:27	31907	4567.9	797.6750	0.1746
T16	0.0521	40.00	1/23/2013 21:28	25614	4567.9	640.3500	0.1402
T17	0.0685	40.00	1/23/2013 20:30	22419	4567.9	560.4750	0.1227
T18	0.1026	40.00	1/23/2013 19:45	17562	4567.9	439.0500	0.0961



Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICRA6-10734;T4 **Repeat** 28

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 4:47:47 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 5:27:53 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	31,347	783.675	783.610
sd	0.000			0.008	177.051	4.426	4.426
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	9,967	249.175	248.819
sd	0.000			0.019	99.835	2.496	2.496

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICRA6-10734;T3

Repeat 29

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 5:29:42 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 6:09:49 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	33,274	831.850	831.785
sd	0.000			0.008	182.412	4.560	4.560
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	10,508	262.700	262.344
sd	0.000			0.019	102.509	2.563	2.563

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICRA6-10734;T2

Repeat 30

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 6:18:48 PM

Count Ended 1/23/2013 6:58:57 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 40.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	38,959	973.975	973.910
sd	0.000			0.008	197.380	4.935	4.935
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	12,088	302.200	301.844
sd	0.000			0.019	109.945	2.749	2.749

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICRA6-10734;T1 **Repeat** 31

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 7:04:13 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 7:44:20 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	39,224	980.600	980.535
sd	0.000			0.008	198.050	4.951	4.951
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	12,381	309.525	309.169
sd	0.000			0.019	111.270	2.782	2.782

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICRA6-10734;T8

Repeat 32

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 7:45:56 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 8:26:01 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	17,562	439.050	438.985
sd	0.000			0.008	132.522	3.313	3.313
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	6,327	158.175	157.819
sd	0.000			0.019	79.542	1.989	1.989

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICRA6-10734;T7 **Repeat** 33

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 8:30:36 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 9:10:43 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	22,419	560.475	560.410
sd	0.000			0.008	149.730	3.743	3.743
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	7,700	192.500	192.144
sd	0.000			0.019	87.750	2.194	2.194

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICRA6-10734;T6 **Repeat** 34

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 9:28:57 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 10:09:03 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	25,614	640.350	640.285
sd	0.000			0.008	160.044	4.001	4.001
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	8,644	216.100	215.744
sd	0.000			0.019	92.973	2.324	2.324

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICRA6-10734;T5 **Repeat** 35

Carrier No. 0

Batch ID m122573

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/23/2013 10:27:28 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/23/2013 11:07:36 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 40.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	31,907	797.675	797.610
sd	0.000			0.008	178.625	4.466	4.466
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	10,067	251.675	251.319
sd	0.000			0.019	100.334	2.508	2.508

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha Beta Calibration Verifications

ICV is for Gross Beta
Strontium 90
and
Total Strontium

Orange Beta ICV 2013						
Detector	Low Mass Recovery	Medium Mass Recovery	High Mass Recovery	Mean Recovery	Beta Activity	2009.34 pCi
4	99.78%	99.98%	101.63%	100.46%		

Standard ID

Strontium 90
Sr-90_00018 #51512 (Rad12-0043)
Cert# 92352 Ref. date 11/29/12

Initial Activity:	2238.7	dpm	
Reference Date:	11/29/2012		
Current Date:	1/24/2013		(or date at which you wish to determine activity)
Elapsed Time:	56.000	days	
Half Life:	10409.625	days	
Exponential Term:	0.996278064		
Corrected Activity:	2230.367701	dpm	
Decay Activity (Sr/Y-90)	4460.735402	dpm	2009.34 pCi

ICV is for Gross Alpha

Orange Alpha ICV 2013				
	Low	Medium	High	Mean
	Mass	Mass	Mass	Recovery
Detector	Recovery	Recovery	Recovery	
4	120.12%	102.53%	87.34%	103.33%

Standard ID

Thorium-230
Th-230_00003 #6340
Cert # 84460-334 Ref. date 4/11/11
Activity 1079.73 pCi/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICV-51512;Beta 1 **Repeat** 1

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 6:10:26 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/24/2013 6:15:29 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	4	0.800	0.751
sd	0.000			0.007	2.000	0.400	0.400
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	9,525	1,905.000	1,904.620
sd	0.000			0.019	97.596	19.519	19.519

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICV-51512;Beta 3 **Repeat** 3

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 6:25:15 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/24/2013 6:30:18 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	2	0.400	0.351
sd	0.000			0.007	1.414	0.283	0.283
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	8,745	1,749.000	1,748.620
sd	0.000			0.019	93.515	18.703	18.703

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICV-51512;Beta 2

Repeat 4

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 6:33:12 PM

Count Ended 1/24/2013 6:38:15 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.049	1	0.200	0.151
sd	0.000			0.007	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.380	9,009	1,801.800	1,801.420
sd	0.000			0.019	94.916	18.983	18.983

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICVABT-6340;A2 **Repeat** 9

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 8:56:57 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/24/2013 9:27:00 AM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 30.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	7,806	260.200	260.132
sd	0.000			0.008	88.352	2.945	2.945
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	3,455	115.167	114.781
sd	0.000			0.020	58.779	1.959	1.959

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICVABT-6340;A1 **Repeat** 10

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 9:49:41 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/24/2013 10:19:46 AM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 30.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	11,505	383.500	383.432
sd	0.000			0.008	107.261	3.575	3.575
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	4,581	152.700	152.314
sd	0.000			0.020	67.683	2.256	2.256

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ICVABT-6340;A3 **Repeat** 11

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 10:43:44 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 7/24/2013 11:13:47 AM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 30.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.068	5,825	194.167	194.099
sd	0.000			0.008	76.322	2.544	2.544
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.386	2,933	97.767	97.381
sd	0.000			0.020	54.157	1.805	1.805

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

ICV is for Gross Beta
Strontium 90
and
Total Strontium

Orange Beta ICV 2013						
Detector	Low Mass Recovery	Medium Mass Recovery	High Mass Recovery	Mean Recovery	Beta Activity	2009.34 pCi
6	97.99%	98.74%	99.88%	98.87%		

Standard ID

Strontium 90
Sr-90_00018 #51512 (Rad12-0043)
Cert# 92352 Ref. date 11/29/12

Initial Activity:	2238.7	dpm	
Reference Date:	11/29/2012		
Current Date:	1/24/2013		(or date at which you wish to determine activity)
Elapsed Time:	56.000	days	
Half Life:	10409.625	days	
Exponential Term:	0.996278064		
Corrected Activity:	2230.367701	dpm	
Decay Activity (Sr/Y-90)	4460.735402	dpm	2009.34 pCi

ICV is for Gross Alpha

Orange Alpha ICV 2013				
	Low	Medium	High	Mean
	Mass	Mass	Mass	Recovery
Detector	Recovery	Recovery	Recovery	
6	118.18%	101.41%	84.66%	101.42%

Standard ID

Thorium-230
Th-230_00003 #6340
Cert # 84460-334 Ref. date 4/11/11
Activity 1079.73 pCi/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICV-51512;Beta 3 **Repeat** 1

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 6:10:34 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/24/2013 6:15:36 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	1	0.200	0.127
sd	0.000			0.009	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	8,560	1,712.000	1,711.654
sd	0.000			0.019	92.520	18.504	18.504

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICV-51512;Beta 2 **Repeat** 2

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/24/2013 6:16:59 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/24/2013 6:22:02 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	0	0.000	-0.073
sd	0.000			0.009	0.000	0.000	0.171
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	8,863	1,772.600	1,772.254
sd	0.000			0.019	94.144	18.829	18.829

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICV-51512;Beta 1 **Repeat** 3

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 6:25:24 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/24/2013 6:30:26 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.073	1	0.200	0.127
sd	0.000			0.009	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.346	9,330	1,866.000	1,865.654
sd	0.000			0.019	96.592	19.318	19.318

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICVABT-6340;A1 **Repeat** 12

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 11:45:14 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/24/2013 12:15:19 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 30.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	11,162	372.067	371.986
sd	0.000			0.009	105.650	3.522	3.522
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	4,391	146.367	145.906
sd	0.000			0.021	66.265	2.209	2.209

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICVABT-6340;A2 **Repeat** 12

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 3:13:39 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 7/24/2013 3:43:42 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 30.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	7,577	252.567	252.486
sd	0.000			0.009	87.046	2.902	2.902
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	3,454	115.133	114.672
sd	0.000			0.021	58.771	1.959	1.959

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ICVABT-6340;A3 **Repeat** 13

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 3:46:36 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 7/24/2013 4:16:39 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 30.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.081	5,528	184.267	184.186
sd	0.000			0.009	74.351	2.478	2.478
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.461	2,829	94.300	93.839
sd	0.000			0.021	53.188	1.773	1.773

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

ICV is for Gross Beta
Strontium 90
and
Total Strontium

Orange Beta ICV 2013						
Detector	Low Mass Recovery	Medium Mass Recovery	High Mass Recovery	Mean Recovery	Beta Activity	2009.34 pCi
8	96.30%	98.79%	100.83%	98.64%		

Standard ID

Strontium 90
Sr-90_00018 #51512 (Rad12-0043)
Cert# 92352 Ref. date 11/29/12

Initial Activity:	2238.7	dpm	
Reference Date:	11/29/2012		
Current Date:	1/24/2013		(or date at which you wish to determine activity)
Elapsed Time:	56.000	days	
Half Life:	10409.625	days	
Exponential Term:	0.996278064		
Corrected Activity:	2230.367701	dpm	
Decay Activity (Sr/Y-90)	4460.735402	dpm	2009.34 pCi

ICV is for Gross Alpha

Orange Alpha ICV 2013				
	Low	Medium	High	Mean
	Mass	Mass	Mass	Recovery
Detector	Recovery	Recovery	Recovery	
8	117.44%	96.51%	82.72%	98.89%

Standard ID

Thorium-230
Th-230_00003 #6340
Cert # 84460-334 Ref. date 4/11/11
Activity 1079.73 pCi/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICV-51512;Beta 1

Repeat 10

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 7:31:58 PM

Count Ended 1/24/2013 7:37:01 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	3	0.600	0.570
sd	0.000			0.005	1.732	0.346	0.346
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	9,278	1,855.600	1,855.285
sd	0.000			0.018	96.322	19.264	19.264

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICV-51512;Beta 3 **Repeat** 11

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 7:38:23 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/24/2013 7:43:27 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	2	0.400	0.370
sd	0.000			0.005	1.414	0.283	0.283
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	8,746	1,749.200	1,748.885
sd	0.000			0.018	93.520	18.704	18.704

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICV-51512;Beta 2

Repeat 12

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 7:49:41 PM

Count Ended 1/24/2013 7:54:44 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.030	1	0.200	0.170
sd	0.000			0.005	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.315	8,980	1,796.000	1,795.685
sd	0.000			0.018	94.763	18.953	18.953

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICVABT-6340;A1

Repeat 14

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 7:26:15 PM

Count Ended 7/24/2013 7:56:20 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	12,028	400.933	400.899
sd	0.000			0.006	109.672	3.656	3.656
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	4,093	136.433	136.089
sd	0.000			0.019	63.977	2.133	2.133

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICVABT-6340;A3

Repeat 20

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 11:21:48 PM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 7/24/2013 11:51:51 PM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	6,528	217.600	217.566
sd	0.000			0.006	80.796	2.693	2.693
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	2,682	89.400	89.056
sd	0.000			0.019	51.788	1.726	1.726

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ICVABT-6340;A2

Repeat 21

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 11:54:33 PM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 7/25/2013 12:24:37 AM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.034	8,355	278.500	278.466
sd	0.000			0.006	91.406	3.047	3.047
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.344	3,035	101.167	100.823
sd	0.000			0.019	55.091	1.836	1.836

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

ICV is for Gross Beta
Strontium 90
and
Total Strontium

Orange Beta ICV 2013						
Detector	Low Mass Recovery	Medium Mass Recovery	High Mass Recovery	Mean Recovery	Beta Activity	2009.34 pCi
9	98.49%	100.38%	98.79%	99.22%		

Standard ID

Strontium 90
Sr-90_00018 #51512 (Rad12-0043)
Cert# 92352 Ref. date 11/29/12

Initial Activity:	2238.7	dpm	
Reference Date:	11/29/2012		
Current Date:	1/24/2013		(or date at which you wish to determine activity)
Elapsed Time:	56.000	days	
Half Life:	10409.625	days	
Exponential Term:	0.996278064		
Corrected Activity:	2230.367701	dpm	
Decay Activity (Sr/Y-90)	4460.735402	dpm	2009.34 pCi

ICV is for Gross Alpha

Orange Alpha ICV 2013				
	Low	Medium	High	Mean
	Mass	Mass	Mass	Recovery
Detector	Recovery	Recovery	Recovery	
9	118.46%	97.52%	81.39%	99.12%

Standard ID

Thorium-230
Th-230_00003 #6340
Cert # 84460-334 Ref. date 4/11/11
Activity 1079.73 pCi/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICV-51512;Beta 2 **Repeat** 10

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 7:32:03 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/24/2013 7:37:06 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	1	0.200	0.125
sd	0.000			0.009	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	9,062	1,812.400	1,812.037
sd	0.000			0.019	95.195	19.039	19.039

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICV-51512;Beta 1 **Repeat** 11

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/24/2013 7:38:33 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/24/2013 7:43:35 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	2	0.400	0.325
sd	0.000			0.009	1.414	0.283	0.283
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	9,446	1,889.200	1,888.837
sd	0.000			0.019	97.191	19.438	19.438

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICV-51512;Beta 3 **Repeat** 12

Carrier No. 0

Batch ID m122640

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/24/2013 7:50:14 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 1/24/2013 7:55:17 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.075	0	0.000	-0.075
sd	0.000			0.009	0.000	0.000	0.173
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.363	8,509	1,701.800	1,701.437
sd	0.000			0.019	92.244	18.449	18.449

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICVABT-6340;A2

Repeat 14

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 7/24/2013 7:26:21 PM

Count Ended 7/24/2013 7:56:26 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 30.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	8,476	282.533	282.459
sd	0.000			0.009	92.065	3.069	3.069
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	2,993	99.767	99.370
sd	0.000			0.020	54.708	1.824	1.824

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICVABT-6340;A1

Repeat 15

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 8:19:10 PM

Count Ended 7/24/2013 8:49:15 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	12,239	407.967	407.893
sd	0.000			0.009	110.630	3.688	3.688
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	3,997	133.233	132.836
sd	0.000			0.020	63.222	2.107	2.107

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ICVABT-6340;A3

Repeat 21

Carrier No. 0

Batch ID m132736

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 7/24/2013 11:54:38 PM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 7/25/2013 12:24:41 AM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.074	6,441	214.700	214.626
sd	0.000			0.009	80.256	2.675	2.675
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.397	2,504	83.467	83.070
sd	0.000			0.020	50.040	1.668	1.668

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Ra-226 Calibration Verifications

Radium-226 Verification Orange 2013

Detector	Barium Yield	Results of Calibration
0	99.12%	105.46%

Standard ID

Radium 226
Ra-226_00008 #34981
Cert # SRM 4967 Ref. date 9/9/1991
Activity 25.018 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ICVRA6-34981;045C

Repeat 1

Carrier No. 0

Batch ID 2335045

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/27/2013 5:37:16 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/27/2013 11:37:39 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 360.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.078	6,561	18.225	18.147
sd	0.000			0.009	81.000	0.225	0.225
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.403	8,882	24.672	24.269
sd	0.000			0.020	94.244	0.262	0.263

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Radium-226 Verification Orange 2013

Detector	Barium Yield	Results of Calibration
1	100.59%	97.48%

Standard ID

Radium 226
Ra-226_00008 #34981
Cert # SRM 4967 Ref. date 9/9/1991
Activity 25.018 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ICVRA6-34981;029C

Repeat 2

Carrier No. 0

Batch ID 2341029

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 1/27/2013 5:37:44 PM

Count Ended 1/27/2013 11:38:08 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 360.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.057	6,042	16.783	16.726
sd	0.000			0.008	77.730	0.216	0.216
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.299	8,508	23.633	23.334
sd	0.000			0.017	92.239	0.256	0.257

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Radium-226 Verification Orange 2013

Detector	Barium Yield	Results of Calibration
2	101.18%	97.63%

Standard ID

Radium 226
Ra-226_00008 #34981
Cert # SRM 4967 Ref. date 9/9/1991
Activity 25.018 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ICVRA6-34981;018C

Repeat 2

Carrier No. 0

Batch ID 2342018

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/27/2013 5:38:22 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/27/2013 11:38:44 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 360.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.070	6,077	16.881	16.811
sd	0.000			0.008	77.955	0.217	0.217
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.286	8,646	24.017	23.731
sd	0.000			0.017	92.984	0.258	0.259

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Radium-226 Verification Orange 2013

Detector	Barium Yield	Results of Calibration
3	100.88%	97.31%

Standard ID

Radium 226
Ra-226_00008 #34981
Cert # SRM 4967 Ref. date 9/9/1991
Activity 25.018 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ICVRA6-34981;054C

Repeat 2

Carrier No. 0

Batch ID 2345054

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 1/27/2013 5:38:51 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 1/27/2013 11:39:14 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 360.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.065	5,980	16.611	16.546
sd	0.000			0.008	77.330	0.215	0.215
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.356	8,576	23.822	23.466
sd	0.000			0.019	92.607	0.257	0.258

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha Beta Annual Calibration Verifications

Orange Alpha ACV 2014				
	Low	Medium	High	Mean
	Mass	Mass	Mass	Recovery
Detector	Recovery	Recovery	Recovery	
4	122.44%	107.34%	94.84%	108.21%

Standard ID

Thorium-230

Th-230_00003 #6340

Cert # 84460-334 Ref. date 4/11/11

Activity 1079.73 pCi/mL

Orange Beta ACV 2014

Detector	Low Mass Recovery	Medium Mass Recovery	High Mass Recovery	Mean Recovery
4	96.85%	99.40%	97.66%	97.97%

Beta Activity 1958.744 pCi

Standard ID

Strontium 90
Sr-90_00018 #51512
Cert# 92352 Ref. date 11/29/12

Initial Activity:	2238.7	dpm	
Reference Date:	11/29/2012		
Current Date:	2/11/2014		(or date at which you wish to determine activity)
Elapsed Time:	439.000	days	
Half Life:	10409.625	days	
Exponential Term:	0.971191359		
Corrected Activity:	2174.206097	dpm	
Decay Activity (Sr/Y-90)	4348.412193	dpm	1958.744 pCi

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ACVABT-51512;B3 **Repeat** 3

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 5:41:21 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 2/11/2014 5:46:24 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.067	0	0.000	-0.067
sd	0.000			0.008	0.000	0.000	0.164
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.357	8,191	1,638.200	1,637.843
sd	0.000			0.019	90.504	18.101	18.101

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ACVABT-51512;B2

Repeat 4

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/11/2014 5:47:26 PM

Count Ended 2/11/2014 5:52:27 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.067	0	0.000	-0.067
sd	0.000			0.008	0.000	0.000	0.164
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.357	8,730	1,746.000	1,745.643
sd	0.000			0.019	93.434	18.687	18.687

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ACVABT-51512;B1 **Repeat** 5

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 5:54:45 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 2/11/2014 5:59:47 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.067	0	0.000	-0.067
sd	0.000			0.008	0.000	0.000	0.164
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.357	9,013	1,802.600	1,802.243
sd	0.000			0.019	94.937	18.987	18.987

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ACVABT-6340;A3

Repeat 3

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 7:39:44 PM

Count Ended 2/11/2014 8:09:47 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.067	6,326	210.867	210.800
sd	0.000			0.008	79.536	2.651	2.651
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.357	3,274	109.133	108.776
sd	0.000			0.019	57.219	1.907	1.907

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ACVABT-6340;A2

Repeat 4

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 8:19:19 PM

Count Ended 2/11/2014 8:49:22 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.067	8,171	272.367	272.300
sd	0.000			0.008	90.394	3.013	3.013
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.357	3,801	126.700	126.343
sd	0.000			0.019	61.652	2.055	2.055

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - A

Addr: 4

Sample ID ACVABT-6340;A1

Repeat 5

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 8:51:32 PM

Count Ended 2/11/2014 9:21:36 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.067	11,727	390.900	390.833
sd	0.000			0.008	108.291	3.610	3.610
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.357	4,709	156.967	156.610
sd	0.000			0.019	68.622	2.287	2.287

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Orange Alpha ACV 2014				
	Low	Medium	High	Mean
	Mass	Mass	Mass	Recovery
Detector	Recovery	Recovery	Recovery	
6	121.88%	107.43%	95.02%	108.11%

Standard ID

Thorium-230

Th-230_00003 #6340

Cert # 84460-334 Ref. date 4/11/11

Activity 1079.73 pCi/mL

Orange Beta ACV 2014

Detector	Low Mass Recovery	Medium Mass Recovery	High Mass Recovery	Mean Recovery
6	97.66%	95.01%	96.64%	96.44%

Beta Activity 1958.744 pCi

Standard ID

Strontium 90
Sr-90_00018 #51512
Cert# 92352 Ref. date 11/29/12

Initial Activity:	2238.7	dpm	
Reference Date:	11/29/2012		
Current Date:	2/11/2014		(or date at which you wish to determine activity)
Elapsed Time:	439.000	days	
Half Life:	10409.625	days	
Exponential Term:	0.971191359		
Corrected Activity:	2174.206097	dpm	
Decay Activity (Sr/Y-90)	4348.412193	dpm	1958.744 pCi

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ACVABT-51512;B3

Repeat 5

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/11/2014 5:54:54 PM

Count Ended 2/11/2014 5:59:57 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.095	1	0.200	0.105
sd	0.000			0.010	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.466	8,073	1,614.600	1,614.134
sd	0.000			0.022	89.850	17.970	17.970

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ACVABT-51512;B2

Repeat 6

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/11/2014 6:01:08 PM

Count Ended 2/11/2014 6:06:09 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 *days*

Decay Factor 1.000

Sample Count Time 5.00 *mins*

Background Count Time 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.095	0	0.000	-0.095
sd	0.000			0.010	0.000	0.000	0.195
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.466	8,316	1,663.200	1,662.734
sd	0.000			0.022	91.192	18.238	18.238

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ACVABT-51512;B1 **Repeat** 7

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/11/2014 6:09:32 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 2/11/2014 6:14:35 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.095	1	0.200	0.105
sd	0.000			0.010	1.000	0.200	0.200
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.466	9,069	1,813.800	1,813.334
sd	0.000			0.022	95.231	19.046	19.046

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ACVABT-6340;A3

Repeat 5

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 8:51:42 PM

Count Ended 2/11/2014 9:21:45 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.095	6,203	206.767	206.672
sd	0.000			0.010	78.759	2.625	2.625
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.466	3,126	104.200	103.734
sd	0.000			0.022	55.911	1.864	1.864

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ACVABT-6340;A2

Repeat 6

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 9:24:12 PM

Count Ended 2/11/2014 9:54:16 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.095	8,026	267.533	267.438
sd	0.000			0.010	89.588	2.986	2.986
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.466	3,737	124.567	124.101
sd	0.000			0.022	61.131	2.038	2.038

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 4-7 - C

Addr: 6

Sample ID ACVABT-6340;A1 **Repeat** 7

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/11/2014 9:55:17 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 2/11/2014 10:25:21 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 30.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.095	11,513	383.767	383.672
sd	0.000			0.010	107.299	3.577	3.577
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.466	4,587	152.900	152.434
sd	0.000			0.022	67.727	2.258	2.258

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Orange Alpha ACV 2014				
	Low	Medium	High	Mean
	Mass	Mass	Mass	Recovery
Detector	Recovery	Recovery	Recovery	
8	118.92%	103.54%	90.81%	104.42%

Standard ID

Thorium-230

Th-230_00003 #6340

Cert # 84460-334 Ref. date 4/11/11

Activity 1079.73 pCi/mL

Orange Beta ACV 2014

Detector	Low Mass Recovery	Medium Mass Recovery	High Mass Recovery	Mean Recovery
8	96.59%	95.88%	98.02%	96.83%

Beta Activity 1958.744 pCi

Standard ID

Strontium 90
Sr-90_00018 #51512
Cert# 92352 Ref. date 11/29/12

Initial Activity:	2238.7	dpm	
Reference Date:	11/29/2012		
Current Date:	2/11/2014		(or date at which you wish to determine activity)
Elapsed Time:	439.000	days	
Half Life:	10409.625	days	
Exponential Term:	0.971191359		
Corrected Activity:	2174.206097	dpm	
Decay Activity (Sr/Y-90)	4348.412193	dpm	1958.744 pCi

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ACVABT-51512;B1

Repeat 9

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 6:29:08 PM

Count Ended 2/11/2014 6:34:10 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.045	2	0.400	0.355
sd	0.000			0.007	1.414	0.283	0.283
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.381	9,076	1,815.200	1,814.819
sd	0.000			0.020	95.268	19.054	19.054

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ACVABT-51512;B3 **Repeat** 15

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/11/2014 7:38:40 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 2/11/2014 7:43:43 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 5.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.045	0	0.000	-0.045
sd	0.000			0.007	0.000	0.000	0.134
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.381	8,290	1,658.000	1,657.619
sd	0.000			0.020	91.049	18.210	18.210

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ACVABT-51512;B2

Repeat 16

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 7:46:12 PM

Count Ended 2/11/2014 7:51:14 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.045	5	1.000	0.955
sd	0.000			0.007	2.236	0.447	0.447
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.381	8,500	1,700.000	1,699.619
sd	0.000			0.020	92.195	18.439	18.439

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ACVABT-6340;A1

Repeat 9

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 10:58:50 PM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 2/11/2014 11:28:54 PM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.045	12,177	405.900	405.855
sd	0.000			0.007	110.349	3.678	3.678
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.381	4,303	143.433	143.052
sd	0.000			0.020	65.597	2.187	2.187

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ACVABT-6340;A2

Repeat 11

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/12/2014 9:26:33 AM

Count Ended 2/12/2014 9:56:36 AM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.045	8,962	298.733	298.688
sd	0.000			0.007	94.668	3.156	3.156
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.381	3,274	109.133	108.752
sd	0.000			0.020	57.219	1.907	1.907

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - A

Addr: 8

Sample ID ACVABT-6340;A3

Repeat 12

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/12/2014 11:36:39 AM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 2/12/2014 12:06:44 PM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.045	12,472	415.733	415.688
sd	0.000			0.007	111.678	3.723	3.723
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.381	4,247	141.567	141.186
sd	0.000			0.020	65.169	2.172	2.172

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Orange Alpha ACV 2014				
	Low	Medium	High	Mean
	Mass	Mass	Mass	Recovery
Detector	Recovery	Recovery	Recovery	
9	121.05%	101.41%	89.24%	103.90%

Standard ID

Thorium-230

Th-230_00003 #6340

Cert # 84460-334 Ref. date 4/11/11

Activity 1079.73 pCi/mL

Orange Beta ACV 2014						
Detector	Low Mass Recovery	Medium Mass Recovery	High Mass Recovery	Mean Recovery	Beta Activity	1958.744 pCi
9	97.05%	96.80%	95.98%	96.61%		

Standard ID

Strontium 90
Sr-90_00018 #51512
Cert# 92352 Ref. date 11/29/12

Initial Activity:	2238.7	dpm	
Reference Date:	11/29/2012		
Current Date:	2/11/2014		(or date at which you wish to determine activity)
Elapsed Time:	439.000	days	
Half Life:	10409.625	days	
Exponential Term:	0.971191359		
Corrected Activity:	2174.206097	dpm	
Decay Activity (Sr/Y-90)	4348.412193	dpm	1958.744 pCi

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ACVABT-51512;B2

Repeat 9

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 6:29:13 PM

Count Ended 2/11/2014 6:34:14 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.090	2	0.400	0.310
sd	0.000			0.009	1.414	0.283	0.283
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.427	8,519	1,703.800	1,703.373
sd	0.000			0.021	92.298	18.460	18.460

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ACVABT-51512;B1

Repeat 10

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 6:35:24 PM

Count Ended 2/11/2014 6:40:26 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.090	4	0.800	0.710
sd	0.000			0.009	2.000	0.400	0.400
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.427	9,075	1,815.000	1,814.573
sd	0.000			0.021	95.263	19.053	19.053

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ACVABT-51512;B3

Repeat 16

Carrier No. 0

Batch ID M142810

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 7:46:20 PM

Count Ended 2/11/2014 7:51:22 PM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 5.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.090	4	0.800	0.710
sd	0.000			0.009	2.000	0.400	0.400
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.427	8,059	1,611.800	1,611.373
sd	0.000			0.021	89.772	17.954	17.954

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ACVABT-6340;A2

Repeat 9

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 10:58:54 PM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 2/11/2014 11:28:58 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 30.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.090	8,820	294.000	293.910
sd	0.000			0.009	93.915	3.130	3.131
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.427	3,263	108.767	108.340
sd	0.000			0.021	57.123	1.904	1.904

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ACVABT-6340;A1

Repeat 10

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/11/2014 11:29:57 PM

Collection Date 1 1/1/1900

Half Life 0.00 ***days***

Count Ended 2/12/2014 12:00:02 AM

Collection Date 2 1/1/1900

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.090	12,507	416.900	416.810
sd	0.000			0.009	111.835	3.728	3.728
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.427	4,287	142.900	142.473
sd	0.000			0.021	65.475	2.183	2.183

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Alpha/Beta Count Results

Sample Activity Report

Orange 8-11 - B

Addr: 9

Sample ID ACVABT-6340;A3

Repeat 11

Carrier No. 0

Batch ID M142808

Count Method Gross Alpha Beta

Detector Volts 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/12/2014 9:26:43 AM

Count Ended 2/12/2014 9:56:47 AM

Collection Date 1 1/1/1900

Collection Date 2 1/1/1900

Half Life 0.00 ***days***

Decay Factor 1.000

Sample Count Time 30.00 ***mins***

Background Count Time 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.090	7,062	235.400	235.310
sd	0.000			0.009	84.036	2.801	2.801
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.427	2,763	92.100	91.673
sd	0.000			0.021	52.564	1.752	1.752

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected**

MDC Method Tb = Ts < 10

Error = .00 **x sd**

Ra-226 Annual Calibration Verifications

Orange Radium-226 ACV 2014

Detector	Barium Yield	Results of Calibration
0	95.87%	113.70%

Standard ID

Radium 226

Ra-226_00008 #34981

Cert # SRM 4967 Ref. date 9/9/1991

Activity 25.018 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - A

Addr: 0

Sample ID ACVRA6-228337;LCS5 **Repeat** 1

Carrier No. 0

Batch ID 100681

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/13/2014 4:03:41 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 2/13/2014 2:37:15 PM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 360.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.130	6,643	18.453	18.323
sd	0.000			0.011	81.505	0.226	0.227
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.451	7,246	20.128	19.677
sd	0.000			0.021	85.123	0.236	0.237

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Orange Radium-226 ACV 2014

Detector	Barium Yield	Results of Calibration
1	79.35%	114.96%

Standard ID

Radium 226
Ra-226_00008 #34981
Cert # SRM 4967 Ref. date 9/9/1991
Activity 25.018 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - B

Addr: 1

Sample ID ACVRA6-228337;LCS4 **Repeat** 1

Carrier No. 0

Batch ID 97902

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty	0 ***l***	**sd**	0 ***l***
Residual Wt	0 ***mg***	**sd**	0 ***mg***

Count Began 2/13/2014 4:03:49 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 ***days***

Count Ended 2/13/2014 10:04:11 AM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 360.00 ***mins*** **Background Count Time** 1,000.00 ***mins***

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.112	5,933	16.481	16.369
sd	0.000			0.011	77.026	0.214	0.214
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.296	5,867	16.297	16.001
sd	0.000			0.017	76.596	0.213	0.213

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Orange Radium-226 ACV 2014

Detector	Barium Yield	Results of Calibration
2	88.50%	121.84%

Standard ID

Radium 226
Ra-226_00008 #34981
Cert # SRM 4967 Ref. date 9/9/1991
Activity 25.018 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - C

Addr: 2

Sample ID ACVRA6-228337;LCS1 **Repeat** 1

Carrier No. 0

Batch ID 98098

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/13/2014 4:03:54 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 2/13/2014 10:04:16 AM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 360.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.275	6,878	19.106	18.831
sd	0.000			0.017	82.934	0.230	0.231
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.571	6,574	18.261	17.690
sd	0.000			0.024	81.080	0.225	0.226

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Orange Radium-226 ACV 2014

Detector	Barium Yield	Results of Calibration
3	84.37%	105.37%

Standard ID

Radium 226

Ra-226_00008 #34981

Cert # SRM 4967 Ref. date 9/9/1991

Activity 25.018 dpm/mL

Alpha/Beta Count Results

Sample Activity Report

Orange 0-3 - D

Addr: 3

Sample ID ACVRA6-228337;LCSD1 **Repeat** 1

Carrier No. 0

Batch ID 98098

Count Method Gross Alpha Beta **Detector Volts** 1515

Sample Qty 0 *l* **sd** 0 *l*

Residual Wt 0 *mg* **sd** 0 *mg*

Count Began 2/13/2014 4:04:00 AM **Collection Date 1** 1/1/1900 **Half Life** 0.00 *days*

Count Ended 2/13/2014 10:04:23 AM **Collection Date 2** 1/1/1900 **Decay Factor** 1.000

Sample Count Time 360.00 *mins* **Background Count Time** 1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	0.000	1.000	1.000	0.107	5,653	15.703	15.596
sd	0.000			0.010	75.186	0.209	0.209
A to B	0.000	1.000				0.000	
sd	0.000					0.000	
Beta	0.000	1.000	1.000	0.487	6,025	16.736	16.249
sd	0.000			0.022	77.621	0.216	0.217

	Net Activity dpm	LLD dpm	MDC pCi/l	MPC pCi/l	Net Concentration * pCi/l	Conc / MPC Ratio
Alpha	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	
Beta	0.000	0.000	0.000	1.000	0.000 ± 0.000	0.000
sd	0.000				0.000	

*** Note: Decay Corrected** **MDC Method** Tb = Ts < 10 **Error =** .00 **x sd**

Monthly Backgrounds

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
Detector 0											
12:13 AM	**Efficiency**	10715.66	10961.91	328.86	-246.25	**Pass**					
	Background										
	Crosstalk	3360.000	3302.588	96.137	57.412	**Pass**					
12:20 AM	**Efficiency**						33733.11	33739.55	1012.19	-6.44	**Pass**
	Background										
	Crosstalk						76.824	237.400	143.963	-160.576	**Pass**
3:56 AM	**Efficiency**										
	Background	0.070	0.134	0.042	-0.064	**Pass**	0.340	0.474	0.121	-0.134	**Pass**
	Crosstalk										
Detector 1											
12:13 AM	**Efficiency**	9956.24	10173.40	305.20	-217.16	**Pass**					
	Background										
	Crosstalk	3083.000	3028.900	109.715	54.100	**Pass**					
12:20 AM	**Efficiency**						33315.74	33478.80	1004.36	-163.06	**Pass**
	Background										
	Crosstalk						10.548	42.975	30.711	-32.427	**Pass**
3:56 AM	**Efficiency**										
	Background	0.120	0.142	0.063	-0.022	**Pass**	0.260	0.416	0.134	-0.156	**Pass**
	Crosstalk										
Detector 2											
12:13 AM	**Efficiency**	11061.16	10972.86	329.19	88.30	**Pass**					
	Background										
	Crosstalk	3461.500	3366.220	137.933	95.280	**Pass**					
12:20 AM	**Efficiency**						23150.17	23193.20	695.80	-43.03	**Pass**
	Background										
	Crosstalk						16.073	37.375	27.717	-21.302	**Pass**

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
3:56 AM	**Efficiency**										
	Background	0.345	0.165	0.116	0.180	**Pass**	0.480	0.686	0.494	-0.206	**Pass**
	Crosstalk										
Detector 3											
12:13 AM	**Efficiency**	10544.75	10703.24	321.10	-158.49	**Pass**					
	Background										
	Crosstalk	3489.000	3488.780	118.326	0.220	**Pass**					
12:20 AM	**Efficiency**						30326.26	30620.69	918.62	-294.43	**Pass**
	Background										
	Crosstalk						14.566	43.524	34.997	-28.958	**Pass**
3:56 AM	**Efficiency**										
	Background	0.075	0.136	0.041	-0.061	**Pass**	0.505	0.553	0.099	-0.048	**Pass**
	Crosstalk										
Detector 4											
12:13 AM	**Efficiency**	10623.32	10616.58	318.50	6.74	**Pass**					
	Background										
	Crosstalk	4096.000	4041.960	93.896	54.040	**Pass**					
12:20 AM	**Efficiency**						25905.00	26048.10	781.44	-143.10	**Pass**
	Background										
	Crosstalk						7.032	8.525	2.042	-1.493	**Pass**
3:56 AM	**Efficiency**										
	Background	0.105	0.105	0.031	0.000	**Pass**	0.540	0.386	0.065	0.154	**Pass**
	Crosstalk										
Detector 5											
12:13 AM	**Efficiency**	10707.89	10779.16	323.37	-71.27	**Pass**					
	Background										
	Crosstalk	3996.500	3963.700	62.110	32.800	**Pass**					

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THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: Orange

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:20 AM	**Efficiency**						21619.54	21843.90	655.32	-224.36	**Pass**
	Background										
	Crosstalk						8.539	5.095	1.480	3.444	**WARNING**
3:56 AM	**Efficiency**										
	Background	0.140	0.169	0.053	-0.029	**Pass**	0.465	0.448	0.102	0.017	**Pass**
	Crosstalk										
Detector 6											
12:13 AM	**Efficiency**	10686.37	10768.46	323.05	-82.09	**Pass**					
	Background										
	Crosstalk	3959.000	3929.080	151.831	29.920	**Pass**					
12:20 AM	**Efficiency**						28932.79	29157.55	874.73	-224.76	**Pass**
	Background										
	Crosstalk						10.046	5.750	1.400	4.296	**DOEF**
3:56 AM	**Efficiency**										
	Background	0.115	0.107	0.023	0.008	**Pass**	0.595	0.498	0.080	0.097	**Pass**
	Crosstalk										
Detector 7											
12:13 AM	**Efficiency**	11678.69	11415.50	342.47	263.19	**Pass**					
	Background										
	Crosstalk	4297.500	4055.000	78.818	242.500	**DOEF**					
12:20 AM	**Efficiency**						27769.11	27782.35	833.47	-13.24	**Pass**
	Background										
	Crosstalk						5.525	4.600	1.392	0.925	**Pass**
3:56 AM	**Efficiency**										
	Background	0.030	0.102	0.037	-0.072	**Pass**	0.460	0.391	0.058	0.069	**Pass**
	Crosstalk										
Detector 8											

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:13 AM	**Efficiency**						33390.79	33564.38	1006.93	-173.58	**Pass**
	Background										
	Crosstalk						15.571	16.400	3.440	-0.829	**Pass**
12:19 AM	**Efficiency**	10724.40	10932.62	327.98	-208.22	**Pass**					
	Background										
	Crosstalk	3623.500	3644.120	113.075	-20.620	**Pass**					
3:56 AM	**Efficiency**										
	Background	0.085	0.096	0.039	-0.011	**Pass**	0.325	0.411	0.066	-0.086	**Pass**
	Crosstalk										
Detector 9											
12:13 AM	**Efficiency**						33864.85	33894.25	1016.83	-29.40	**Pass**
	Background										
	Crosstalk						13.562	14.000	4.085	-0.438	**Pass**
12:19 AM	**Efficiency**	10088.36	10270.92	308.13	-182.56	**Pass**					
	Background										
	Crosstalk	3249.500	3336.480	71.578	-86.980	**Pass**					
3:56 AM	**Efficiency**										
	Background	0.085	0.141	0.053	-0.056	**Pass**	0.510	0.454	0.117	0.056	**Pass**
	Crosstalk										
Detector 10											
12:13 AM	**Efficiency**						23287.76	23268.15	698.04	19.61	**Pass**
	Background										
	Crosstalk						5.023	5.525	1.626	-0.502	**Pass**
12:19 AM	**Efficiency**	9144.09	9314.42	279.43	-170.33	**Pass**					
	Background										
	Crosstalk	5559.000	5412.260	206.903	146.740	**Pass**					
3:56 AM	**Efficiency**										
	Background	0.090	0.117	0.045	-0.027	**Pass**	0.550	0.469	0.118	0.081	**Pass**
	Crosstalk										

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Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: Orange

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
Detector 11											
12:14 AM	**Efficiency**						30522.66	29987.20	899.62	535.46	**Pass**
	Background										
	Crosstalk						11.050	15.700	2.687	-4.650	**Pass**
12:19 AM	**Efficiency**	10823.47	10755.42	322.66	68.05	**Pass**					
	Background										
	Crosstalk	3278.500	3246.680	84.085	31.820	**Pass**					
3:56 AM	**Efficiency**										
	Background	0.075	0.122	0.042	-0.047	**Pass**	0.645	0.532	0.085	0.113	**Pass**
	Crosstalk										
Detector 12											
12:14 AM	**Efficiency**						25905.85	25927.73	777.83	-21.87	**Pass**
	Background										
	Crosstalk						17.078	12.950	1.629	4.128	**WARNING**
12:19 AM	**Efficiency**	10940.03	11039.74	331.19	-99.71	**Pass**					
	Background										
	Crosstalk	3571.000	3628.500	68.433	-57.500	**Pass**					
3:56 AM	**Efficiency**										
	Background	0.100	0.119	0.050	-0.019	**Pass**	0.455	0.498	0.092	-0.043	**Pass**
	Crosstalk										
Detector 13											
12:14 AM	**Efficiency**						22127.01	22266.53	668.00	-139.51	**Pass**
	Background										
	Crosstalk						16.073	14.975	3.432	1.098	**Pass**
12:19 AM	**Efficiency**	11120.18	11233.00	336.99	-112.82	**Pass**					
	Background										
	Crosstalk	3492.000	3521.820	75.777	-29.820	**Pass**					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
3:56 AM	**Efficiency**										
	Background	0.125	0.163	0.058	-0.038	**Pass**	0.525	0.499	0.101	0.026	**Pass**
	Crosstalk										
Detector 14											
12:14 AM	**Efficiency**						29032.00	29008.58	870.26	23.42	**Pass**
	Background										
	Crosstalk						45.205	36.750	9.105	8.455	**Pass**
12:19 AM	**Efficiency**	10970.60	11064.70	331.94	-94.10	**Pass**					
	Background										
	Crosstalk	3541.000	3646.460	71.414	-105.460	**Pass**					
3:56 AM	**Efficiency**										
	Background	0.065	0.138	0.037	-0.073	**Pass**	0.515	0.432	0.047	0.083	**Pass**
	Crosstalk										
Detector 15											
12:14 AM	**Efficiency**						27477.13	27467.78	824.03	9.36	**Pass**
	Background										
	Crosstalk						18.584	21.400	5.218	-2.816	**Pass**
12:19 AM	**Efficiency**	11698.20	11797.00	353.91	-98.80	**Pass**					
	Background										
	Crosstalk	3514.000	3542.000	85.963	-28.000	**Pass**					
3:56 AM	**Efficiency**										
	Background	0.115	0.137	0.054	-0.022	**Pass**	0.475	0.437	0.083	0.038	**Pass**
	Crosstalk										
Detector 16											
12:22 AM	**Efficiency**	10563.75	10824.14	324.72	-260.39	**Pass**					
	Background										
	Crosstalk	3415.000	3496.320	67.571	-81.320	**Pass**					

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: Orange

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:26 AM	**Efficiency**						33479.01	33491.33	1004.74	-12.32	**Pass**
	Background										
	Crosstalk						32.146	32.800	8.069	-0.654	**Pass**
3:56 AM	**Efficiency**										
	Background	0.100	0.128	0.037	-0.028	**Pass**	0.475	0.442	0.061	0.033	**Pass**
	Crosstalk										
Detector 17											
12:22 AM	**Efficiency**	10137.41	10056.48	301.69	80.93	**Pass**					
	Background										
	Crosstalk	3378.500	3425.740	60.289	-47.240	**Pass**					
12:27 AM	**Efficiency**						33458.09	33457.18	1003.72	0.91	**Pass**
	Background										
	Crosstalk						13.562	13.975	2.967	-0.413	**Pass**
3:56 AM	**Efficiency**										
	Background	0.130	0.151	0.048	-0.021	**Pass**	0.350	0.438	0.089	-0.088	**Pass**
	Crosstalk										
Detector 18											
12:22 AM	**Efficiency**	10880.50	11053.86	331.62	-173.36	**Pass**					
	Background										
	Crosstalk	3660.500	3611.520	52.801	48.980	**Pass**					
12:27 AM	**Efficiency**						23451.57	23209.68	696.29	241.90	**Pass**
	Background										
	Crosstalk						20.594	16.100	4.093	4.494	**Pass**
3:56 AM	**Efficiency**										
	Background	0.120	0.109	0.050	0.011	**Pass**	0.375	0.426	0.077	-0.051	**Pass**
	Crosstalk										
Detector 19											

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
12:22 AM	**Efficiency**	10985.52	11009.96	330.30	-24.44	**Pass**					
	Background										
	Crosstalk	3643.000	3716.300	50.984	-73.300	**Pass**					
12:27 AM	**Efficiency**						31251.47	30982.63	929.48	268.84	**Pass**
	Background										
	Crosstalk						21.096	16.650	4.107	4.446	**Pass**
3:56 AM	**Efficiency**										
	Background	0.065	0.092	0.031	-0.027	**Pass**	0.325	0.380	0.083	-0.055	**Pass**
	Crosstalk										
Detector 20											
12:23 AM	**Efficiency**	10901.03	10934.68	328.04	-33.65	**Pass**					
	Background										
	Crosstalk	3529.500	3574.300	107.105	-44.800	**Pass**					
12:27 AM	**Efficiency**						25657.56	25820.98	774.63	-163.42	**Pass**
	Background										
	Crosstalk						21.096	20.300	5.444	0.796	**Pass**
3:57 AM	**Efficiency**										
	Background	0.105	0.097	0.035	0.008	**Pass**	0.335	0.375	0.071	-0.040	**Pass**
	Crosstalk										
Detector 21											
12:23 AM	**Efficiency**	10975.61	11170.12	335.10	-194.51	**Pass**					
	Background										
	Crosstalk	3585.500	3672.660	78.069	-87.160	**Pass**					
12:27 AM	**Efficiency**						21871.91	22199.20	665.98	-327.29	**Pass**
	Background										
	Crosstalk						12.557	13.000	2.763	-0.443	**Pass**
3:57 AM	**Efficiency**										
	Background	0.060	0.101	0.032	-0.041	**Pass**	0.320	0.325	0.064	-0.005	**Pass**
	Crosstalk										

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Gas Proportional Counter Daily Quality Control Checks

Monday, May 12, 2014

Instrument: ***Orange***

Detector ID	Check Type	Alpha CPM	Alpha Mean	Alpha +/- limit	Alpha Deviation	Alpha Flag	Beta CPM	Beta Mean	Beta +/- limit	Beta Deviation	Beta Flag
Detector 22											
12:23 AM	**Efficiency**	10816.98	10918.70	327.56	-101.72	**Pass**					
	Background										
	Crosstalk	3624.500	3612.240	230.452	12.260	**Pass**					
12:27 AM	**Efficiency**						29260.20	29331.13	879.93	-70.92	**Pass**
	Background										
	Crosstalk						8.539	13.075	3.867	-4.536	**Pass**
3:57 AM	**Efficiency**										
	Background	0.075	0.100	0.032	-0.025	**Pass**	0.435	0.381	0.079	0.054	**Pass**
	Crosstalk										
Detector 23											
12:23 AM	**Efficiency**	11327.51	11544.58	346.34	-217.07	**Pass**					
	Background										
	Crosstalk	3685.000	3809.981	484.264	-124.981	**Pass**					
12:27 AM	**Efficiency**						27437.04	27644.68	829.34	-207.64	**Pass**
	Background										
	Crosstalk						8.539	13.125	3.128	-4.586	**Pass**
3:57 AM	**Efficiency**										
	Background	0.075	0.105	0.049	-0.030	**Pass**	0.440	0.446	0.115	-0.006	**Pass**
	Crosstalk										

Alpha/Beta Count Results

Source Count Report

Orange 0-3 - A

Addr: 0

Sample ID ICB
ICB;Monthly Background Check

Repeat 605

Carrier No. 0

Batch ID ICB;Monthly Background

Detector Volts 1515

Residual Wt 0 ***mg***

Half Life 0.00 ***Years***

Count Began 5/9/2014 11:07:40 AM

Calibration Date 8/4/2012 9:20:16 AM

Decay Factor 1.000

Count Ended 5/10/2014 3:48:36 AM

Backgrounds From

Sample Count Time 1,000.00 ***mins***

Background Count Time 0.00

	Gross counts	Gross cpm	Background cpm	Net cpm
Alpha	56	0.056	0.000	0.056
sd	7.483	0.007	0.000	0.007
Beta	378	0.378	0.000	0.378
sd	19.442	0.019	0.000	0.019

	Uncorrected DPM	Corrected DPM	Corrected dpm	Efficiency %
Alpha	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000
Alpha to Beta				0.000
sd				0.000
Beta	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000

Alpha/Beta Count Results

Source Count Report

Orange 0-3 - B

Addr: 1

Sample ID ICB
ICB;Monthly Background Check

Repeat 606
Carrier No. 0

Batch ID ICB;Monthly Background

Detector Volts 1515

Residual Wt 0 ***mg***
Count Began 5/9/2014 11:07:42 AM
Count Ended 5/10/2014 3:48:38 AM

Calibration Date 8/4/2012 9:20:16 AM
Backgrounds From

Half Life 0.00 ***Years***
Decay Factor 1.000

Sample Count Time 1,000.00 ***mins***
Background Count Time 0.00

	Gross counts	Gross cpm	Background cpm	Net cpm
Alpha	82	0.082	0.000	0.082
sd	9.055	0.009	0.000	0.009
Beta	302	0.302	0.000	0.302
sd	17.378	0.017	0.000	0.017

	Uncorrected DPM	Corrected DPM	Corrected dpm	Efficiency %
Alpha	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000
Alpha to Beta				0.000
sd				0.000
Beta	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000

Alpha/Beta Count Results

Source Count Report

Orange 0-3 - C

Addr: 2

Sample ID ICB
ICB;Monthly Background Check

Repeat 607
Carrier No. 0

Batch ID ICB;Monthly Background

Detector Volts 1515

Residual Wt 0 ***mg***
Count Began 5/9/2014 11:07:50 AM
Count Ended 5/10/2014 3:48:47 AM

Calibration Date 8/4/2012 9:20:16 AM
Backgrounds From

Half Life 0.00 ***Years***
Decay Factor 1.000

Sample Count Time 1,000.00 ***mins***
Background Count Time 0.00

	Gross counts	Gross cpm	Background cpm	Net cpm
Alpha	228	0.228	0.000	0.228
sd	15.100	0.015	0.000	0.015
Beta	567	0.567	0.000	0.567
sd	23.812	0.024	0.000	0.024

	Uncorrected DPM	Corrected DPM	Corrected dpm	Efficiency %
Alpha	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000
Alpha to Beta				0.000
sd				0.000
Beta	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000

Alpha/Beta Count Results

Source Count Report

Orange 0-3 - D

Addr: 3

Sample ID ICB
ICB;Monthly Background Check

Repeat 608

Carrier No. 0

Batch ID ICB;Monthly Background

Detector Volts 1515

Residual Wt 0 *mg*

Half Life 0.00 *Years*

Count Began 5/9/2014 11:07:53 AM

Calibration Date 8/4/2012 9:20:16 AM

Decay Factor 1.000

Count Ended 5/10/2014 3:48:50 AM

Backgrounds From

Sample Count Time 1,000.00 *mins*

Background Count Time 0.00

	Gross counts	Gross cpm	Background cpm	Net cpm
Alpha	72	0.072	0.000	0.072
sd	8.485	0.008	0.000	0.008
Beta	484	0.484	0.000	0.484
sd	22.000	0.022	0.000	0.022

	Uncorrected DPM	Corrected DPM	Corrected dpm	Efficiency %
Alpha	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000
Alpha to Beta				0.000
sd				0.000
Beta	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000

Alpha/Beta Count Results

Source Count Report

Orange 4-7 - A

Addr: 4

Sample ID ICB
ICB;Monthly Background Check

Repeat 609
Carrier No. 0

Batch ID ICB;Monthly Background

Detector Volts 1515

Residual Wt 0 ***mg***
Half Life 0.00 ***Years***
Count Began 5/9/2014 11:08:27 AM
Calibration Date 8/4/2012 9:20:16 AM
Decay Factor 1.000
Count Ended 5/10/2014 3:49:22 AM
Backgrounds From

Sample Count Time 1,000.00 ***mins***
Background Count Time 0.00

	Gross counts	Gross cpm	Background cpm	Net cpm
Alpha	72	0.072	0.000	0.072
sd	8.485	0.008	0.000	0.008
Beta	349	0.349	0.000	0.349
sd	18.682	0.019	0.000	0.019

	Uncorrected DPM	Corrected DPM	Corrected dpm	Efficiency %
Alpha	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000
Alpha to Beta				0.000
sd				0.000
Beta	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000

Alpha/Beta Count Results

Source Count Report

Orange 4-7 - C

Addr: 6

Sample ID ICB
ICB;Monthly Background Check

Repeat 611

Carrier No. 0

Batch ID ICB;Monthly Background

Detector Volts 1515

Residual Wt 0 ***mg***

Half Life 0.00 ***Years***

Count Began 5/9/2014 11:08:39 AM

Calibration Date 8/4/2012 9:20:16 AM

Decay Factor 1.000

Count Ended 5/10/2014 3:49:34 AM

Backgrounds From

Sample Count Time 1,000.00 ***mins***

Background Count Time 0.00

	Gross counts	Gross cpm	Background cpm	Net cpm
Alpha	106	0.106	0.000	0.106
sd	10.296	0.010	0.000	0.010
Beta	492	0.492	0.000	0.492
sd	22.181	0.022	0.000	0.022

	Uncorrected DPM	Corrected DPM	Corrected dpm	Efficiency %
Alpha	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000
Alpha to Beta				0.000
sd				0.000
Beta	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000

Alpha/Beta Count Results

Source Count Report

Orange 8-11 - A

Addr: 8

Sample ID ICB
ICB;Monthly Background Check

Batch ID ICB;Monthly Background

Repeat 625
Carrier No. 0
Detector Volts 1515

Residual Wt 0 ***mg***
Count Began 5/9/2014 11:09:36 AM
Count Ended 5/10/2014 3:50:29 AM
Calibration Date 8/4/2012 9:20:16 AM
Backgrounds From
Half Life 0.00 ***Years***
Decay Factor 1.000

Sample Count Time 1,000.00 ***mins***
Background Count Time 0.00

	Gross counts	Gross cpm	Background cpm	Net cpm
Alpha	45	0.045	0.000	0.045
sd	6.708	0.007	0.000	0.007
Beta	376	0.376	0.000	0.376
sd	19.391	0.019	0.000	0.019

	Uncorrected DPM	Corrected DPM	Corrected dpm	Efficiency %
Alpha	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000
Alpha to Beta				0.000
sd				0.000
Beta	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000

Alpha/Beta Count Results

Source Count Report

Orange 8-11 - B

Addr: 9

Sample ID ICB
ICB;Monthly Background Check

Repeat 628

Carrier No. 0

Batch ID ICB;Monthly Background

Detector Volts 1515

Residual Wt 0 ***mg***

Half Life 0.00 ***Years***

Count Began 5/12/2014 6:30:06 PM

Calibration Date 8/4/2012 9:20:16 AM

Decay Factor 1.000

Count Ended 5/13/2014 11:11:03 AM

Backgrounds From

Sample Count Time 1,000.00 ***mins***

Background Count Time 0.00

	Gross counts	Gross cpm	Background cpm	Net cpm
Alpha	122	0.122	0.000	0.122
sd	11.045	0.011	0.000	0.011
Beta	407	0.407	0.000	0.407
sd	20.174	0.020	0.000	0.020

	Uncorrected DPM	Corrected DPM	Corrected dpm	Efficiency %
Alpha	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000
Alpha to Beta				0.000
sd				0.000
Beta	0.000	0.000	0.000	0.000
sd	0.000	0.000	0.000	0.000

Run Logs

Gas Flow Proportional Counter Run Log

Detector: Orange0

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
01/23/13 16:47	40	ICRA6 160-30868/1		30868			JLW
01/23/13 17:29	40	ICRA6 160-30868/8		30868			JLW
01/23/13 18:18	40	ICRA6 160-30868/7		30868			JLW
01/23/13 19:04	40	ICRA6 160-30868/6		30868			JLW
01/23/13 19:45	40	ICRA6 160-30868/5		30868			JLW
01/23/13 20:30	40	ICRA6 160-30868/4		30868			JLW
01/23/13 21:28	40	ICRA6 160-30868/3		30868			JLW
01/23/13 22:27	40	ICRA6 160-30868/2		30868			JLW
01/27/13 17:37	360	ICVRA6 160-30868/9		30868			JLW
02/13/14 04:03	360	ACVRA6 160-106547/1		106547			LES
05/09/14 11:07	1000	ICB 160-121359/1		121359			PS
05/21/14 00:11	2	CCVA 160-123289/1		123289			MLK
05/21/14 00:15	2	CCVB 160-123289/16		123289			MLK
05/21/14 00:32	200	CCB 160-123289/48		123289			MLK
05/21/14 11:28	60	ZZZZZ		123289			
05/21/14 16:15	200	MB 160-122912/1-A		123289	122912	9315	MLK

Detector: Orange1

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
01/23/13 16:47	40	ICRA6 160-30875/2		30875			JLW
01/23/13 17:29	40	ICRA6 160-30875/1		30875			JLW
01/23/13 18:18	40	ICRA6 160-30875/8		30875			JLW
01/23/13 19:04	40	ICRA6 160-30875/7		30875			JLW
01/23/13 19:45	40	ICRA6 160-30875/6		30875			JLW
01/23/13 20:30	40	ICRA6 160-30875/5		30875			JLW
01/23/13 21:28	40	ICRA6 160-30875/4		30875			JLW
01/23/13 22:27	40	ICRA6 160-30875/3		30875			JLW
01/27/13 17:37	360	ICVRA6 160-30875/9		30875			JLW
02/13/14 04:03	360	ACVRA6 160-106548/1		106548			LES
05/09/14 11:07	1000	ICB 160-121359/2		121359			PS
05/21/14 00:11	2	CCVA 160-123289/2		123289			MLK
05/21/14 00:15	2	CCVB 160-123289/17		123289			MLK
05/21/14 00:32	200	CCB 160-123289/49		123289			MLK
05/21/14 11:28	60	ZZZZZ		123289			
05/21/14 16:15	200	LCS 160-122912/2-A		123289	122912	9315	MLK

Detector: Orange2

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
01/23/13 16:47	40	ICRA6 160-30876/3		30876			JLW
01/23/13 17:29	40	ICRA6 160-30876/2		30876			JLW
01/23/13 18:18	40	ICRA6 160-30876/1		30876			JLW
01/23/13 19:04	40	ICRA6 160-30876/8		30876			JLW
01/23/13 19:45	40	ICRA6 160-30876/7		30876			JLW
01/23/13 20:30	40	ICRA6 160-30876/6		30876			JLW
01/23/13 21:28	40	ICRA6 160-30876/5		30876			JLW
01/23/13 22:27	40	ICRA6 160-30876/4		30876			JLW
01/27/13 17:38	360	ICVRA6 160-30876/9		30876			JLW
02/13/14 04:03	360	ACVRA6 160-106549/1		106549			LES
05/09/14 11:07	1000	ICB 160-121359/3		121359			PS
05/21/14 00:11	2	CCVA 160-123289/3		123289			MLK
05/21/14 00:15	2	CCVB 160-123289/18		123289			MLK

Gas Flow Proportional Counter Run Log

Detector: Orange2 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
05/21/14 00:32	200	CCB 160-123289/50		123289			MLK
05/21/14 11:28	60	ZZZZZ		123289			
05/21/14 12:40	60	ZZZZZ		123289			
05/21/14 16:16	200	LCSD 160-122912/3-A		123289	122912	9315	MLK

Detector: Orange3

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
01/23/13 16:47	40	ICRA6 160-30877/4		30877			JLW
01/23/13 17:29	40	ICRA6 160-30877/3		30877			JLW
01/23/13 18:18	40	ICRA6 160-30877/2		30877			JLW
01/23/13 19:04	40	ICRA6 160-30877/1		30877			JLW
01/23/13 19:45	40	ICRA6 160-30877/8		30877			JLW
01/23/13 20:30	40	ICRA6 160-30877/7		30877			JLW
01/23/13 21:28	40	ICRA6 160-30877/6		30877			JLW
01/23/13 22:27	40	ICRA6 160-30877/5		30877			JLW
01/27/13 17:38	360	ICVRA6 160-30877/9		30877			JLW
02/13/14 04:04	360	ACVRA6 160-106550/1		106550			LES
05/09/14 11:07	1000	ICB 160-121359/4		121359			PS
05/21/14 00:12	2	CCVA 160-123289/4		123289			MLK
05/21/14 00:15	2	CCVB 160-123289/19		123289			MLK
05/21/14 00:32	200	CCB 160-123289/51		123289			MLK
05/21/14 11:30	60	ZZZZZ		123289			
05/21/14 16:16	200	160-6694-7	2222-RIN-01	123289	122912	9315	MLK

Detector: Orange4

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
01/23/13 14:45	5	ICABT 160-63209/15		63209			JLW
01/23/13 14:53	5	ICABT 160-63209/16		63209			JLW
01/23/13 15:00	5	ICABT 160-63209/17		63209			JLW
01/23/13 15:09	5	ICABT 160-63209/18		63209			JLW
01/23/13 15:18	5	ICABT 160-63209/19		63209			JLW
01/23/13 15:27	5	ICABT 160-63209/20		63209			JLW
01/23/13 15:37	5	ICABT 160-63209/21		63209			JLW
01/23/13 15:46	5	ICABT 160-63209/22		63209			JLW
01/24/13 18:10	5	ICVABT 160-63209/23		63209			JLW
01/24/13 18:25	5	ICVABT 160-63209/24		63209			JLW
01/24/13 18:33	5	ICVABT 160-63209/25		63209			JLW
07/18/13 07:30	40	ZZZZZ		63209			
07/18/13 09:23	40	ZZZZZ		63209			
07/18/13 15:43	40	ICABT 160-63209/3		63209			JLW
07/18/13 16:37	40	ZZZZZ		63209			
07/18/13 17:29	40	ICABT 160-63209/5		63209			JLW
07/18/13 18:30	40	ICABT 160-63209/6		63209			JLW
07/18/13 19:58	40	ICABT 160-63209/7		63209			JLW
07/18/13 21:01	40	ICABT 160-63209/8		63209			JLW
07/18/13 21:52	40	ICABT 160-63209/9		63209			JLW
07/18/13 22:47	40	ICABT 160-63209/10		63209			JLW
07/23/13 16:41	50	ICABT 160-63209/11		63209			JLW
07/24/13 08:56	30	ICVABT 160-63209/12		63209			JLW
07/24/13 09:49	30	ICVABT 160-63209/13		63209			JLW
07/24/13 10:43	30	ICVABT 160-63209/14		63209			JLW

Gas Flow Proportional Counter Run Log

Detector: Orange4 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
02/11/14 17:41	5	ACVABT 160-106019/1		106019			LES
02/11/14 17:47	5	ACVABT 160-106019/2		106019			LES
02/11/14 17:54	5	ACVABT 160-106019/3		106019			LES
02/11/14 19:39	30	ACVABT 160-106019/4		106019			LES
02/11/14 20:19	30	ACVABT 160-106019/5		106019			LES
02/11/14 20:51	30	ACVABT 160-106019/6		106019			LES
05/09/14 11:08	1000	ICB 160-121359/5		121359			PS
05/23/14 00:13	2	CCVA 160-123737/5		123737			SMP
05/23/14 00:17	2	CCVB 160-123737/20		123737			SMP
05/23/14 00:34	200	CCB 160-123737/52		123737			SMP
05/23/14 09:50	200	MB 160-122913/1-A		123737	122913	9320	SMP

Detector: Orange6

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
01/23/13 14:45	5	ICABT 160-63211/16		63211			JLW
01/23/13 14:53	5	ICABT 160-63211/17		63211			JLW
01/23/13 15:01	5	ICABT 160-63211/18		63211			JLW
01/23/13 15:09	5	ICABT 160-63211/19		63211			JLW
01/23/13 15:19	5	ICABT 160-63211/20		63211			JLW
01/23/13 15:26	5	ICABT 160-63211/21		63211			JLW
01/23/13 15:37	5	ICABT 160-63211/22		63211			JLW
01/23/13 15:46	5	ICABT 160-63211/23		63211			JLW
01/24/13 18:10	5	ICVABT 160-63211/24		63211			JLW
01/24/13 18:16	5	ICVABT 160-63211/25		63211			JLW
01/24/13 18:25	5	ICVABT 160-63211/26		63211			JLW
07/18/13 07:30	40	ZZZZZ		63211			
07/18/13 09:23	40	ZZZZZ		63211			
07/18/13 15:44	40	ICABT 160-63211/3		63211			JLW
07/18/13 16:37	40	ICABT 160-63211/4		63211			JLW
07/18/13 17:29	40	ICABT 160-63211/5		63211			JLW
07/18/13 18:31	40	ZZZZZ		63211			
07/18/13 19:58	40	ZZZZZ		63211			
07/18/13 21:01	40	ICABT 160-63211/8		63211			JLW
07/18/13 21:52	40	ICABT 160-63211/9		63211			JLW
07/18/13 22:47	40	ICABT 160-63211/10		63211			JLW
07/23/13 16:41	50	ICABT 160-63211/11		63211			JLW
07/23/13 18:58	50	ICABT 160-63211/12		63211			JLW
07/24/13 11:45	30	ICVABT 160-63211/13		63211			JLW
07/24/13 15:13	30	ICVABT 160-63211/14		63211			JLW
07/24/13 15:46	30	ICVABT 160-63211/15		63211			JLW
02/11/14 17:54	5	ACVABT 160-106021/1		106021			LES
02/11/14 18:01	5	ACVABT 160-106021/2		106021			LES
02/11/14 18:09	5	ACVABT 160-106021/3		106021			LES
02/11/14 20:51	30	ACVABT 160-106021/4		106021			LES
02/11/14 21:24	30	ACVABT 160-106021/5		106021			LES
02/11/14 21:55	30	ACVABT 160-106021/6		106021			LES
05/09/14 11:08	1000	ICB 160-121359/7		121359			PS
05/23/14 00:14	2	CCVA 160-123737/7		123737			SMP
05/23/14 00:17	2	CCVB 160-123737/22		123737			SMP
05/23/14 00:34	200	CCB 160-123737/54		123737			SMP
05/23/14 09:50	200	LCS 160-122913/2-A		123737	122913	9320	SMP

Gas Flow Proportional Counter Run Log

Detector: Orange8

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
01/23/13 14:27	5	ICABT 160-63213/12		63213			JLW
01/23/13 14:37	5	ICABT 160-63213/13		63213			JLW
01/23/13 16:47	5	ICABT 160-63213/14		63213			JLW
01/23/13 16:58	5	ICABT 160-63213/15		63213			JLW
01/23/13 17:05	5	ICABT 160-63213/16		63213			JLW
01/23/13 17:12	5	ICABT 160-63213/17		63213			JLW
01/23/13 17:19	5	ICABT 160-63213/18		63213			JLW
01/23/13 17:27	5	ICABT 160-63213/19		63213			JLW
01/24/13 19:31	5	ICVABT 160-63213/20		63213			JLW
01/24/13 19:38	5	ICVABT 160-63213/21		63213			JLW
01/24/13 19:49	5	ICVABT 160-63213/22		63213			JLW
07/24/13 08:46	50	ICABT 160-63213/1		63213			JLW
07/24/13 09:53	50	ICABT 160-63213/2		63213			JLW
07/24/13 10:46	50	ICABT 160-63213/3		63213			JLW
07/24/13 11:45	50	ICABT 160-63213/4		63213			JLW
07/24/13 15:14	50	ICABT 160-63213/5		63213			JLW
07/24/13 16:36	50	ICABT 160-63213/6		63213			JLW
07/24/13 17:29	50	ICABT 160-63213/7		63213			JLW
07/24/13 18:31	50	ICABT 160-63213/8		63213			JLW
07/24/13 19:26	30	ICVABT 160-63213/9		63213			JLW
07/24/13 23:21	30	ICVABT 160-63213/10		63213			JLW
07/24/13 23:54	30	ICVABT 160-63213/11		63213			JLW
02/11/14 18:29	5	ACVABT 160-106023/1		106023			LES
02/11/14 19:38	5	ACVABT 160-106023/2		106023			LES
02/11/14 19:46	5	ACVABT 160-106023/3		106023			LES
02/11/14 22:58	30	ACVABT 160-106023/4		106023			LES
02/12/14 09:26	30	ACVABT 160-106023/5		106023			LES
02/12/14 11:36	30	ACVABT 160-106023/6		106023			LES
05/09/14 11:09	1000	ICB 160-121359/21		121359			PS
05/23/14 00:14	2	CCVB 160-123737/9		123737			SMP
05/23/14 00:17	2	CCVA 160-123737/24		123737			SMP
05/23/14 00:34	200	CCB 160-123737/56		123737			SMP
05/23/14 09:50	200	LCSD 160-122913/3-A		123737	122913	9320	SMP

Detector: Orange9

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
01/23/13 14:27	5	ICABT 160-63214/12		63214			JLW
01/23/13 14:36	5	ICABT 160-63214/13		63214			JLW
01/23/13 16:47	5	ICABT 160-63214/14		63214			JLW
01/23/13 16:58	5	ICABT 160-63214/15		63214			JLW
01/23/13 17:05	5	ICABT 160-63214/16		63214			JLW
01/23/13 17:12	5	ICABT 160-63214/17		63214			JLW
01/23/13 17:19	5	ICABT 160-63214/18		63214			JLW
01/23/13 17:27	5	ICABT 160-63214/19		63214			JLW
01/24/13 19:32	5	ICVABT 160-63214/20		63214			JLW
01/24/13 19:38	5	ICVABT 160-63214/21		63214			JLW
01/24/13 19:50	5	ICVABT 160-63214/22		63214			JLW
07/24/13 08:46	50	ICABT 160-63214/1		63214			JLW
07/24/13 09:53	50	ICABT 160-63214/2		63214			JLW
07/24/13 10:46	50	ICABT 160-63214/3		63214			JLW
07/24/13 11:46	50	ICABT 160-63214/4		63214			JLW
07/24/13 15:14	50	ICABT 160-63214/5		63214			JLW

Gas Flow Proportional Counter Run Log

Detector: Orange9 (Continued)

Analysis Date	Count Minutes	Lab Sample ID	Client Sample ID	Analysis Batch	Prep Batch	Method	Analyst Initials
07/24/13 16:37	50	ICABT 160-63214/6		63214			JLW
07/24/13 17:29	50	ICABT 160-63214/7		63214			JLW
07/24/13 18:31	50	ICABT 160-63214/8		63214			JLW
07/24/13 19:26	30	ICVABT 160-63214/9		63214			JLW
07/24/13 20:19	30	ICVABT 160-63214/10		63214			JLW
07/24/13 23:54	30	ICVABT 160-63214/11		63214			JLW
02/11/14 18:29	5	ACVABT 160-106025/1		106025			LES
02/11/14 18:35	5	ACVABT 160-106025/2		106025			LES
02/11/14 19:46	5	ACVABT 160-106025/3		106025			LES
02/11/14 22:58	30	ACVABT 160-106025/4		106025			LES
02/11/14 23:29	30	ACVABT 160-106025/5		106025			LES
02/12/14 09:26	30	ACVABT 160-106025/6		106025			LES
05/12/14 00:11	2	CCVB 160-121498/10		121498			
05/12/14 00:17	2	CCVA 160-121498/18		121498			
05/12/14 00:36	200	CCB 160-121498/58		121498			
05/12/14 07:13	200	ZZZZZ		121498			
05/12/14 11:52	200	ZZZZZ		121498			
05/12/14 18:30	0	ICB 160-121498/108		121498			MLK
05/12/14 18:30	1000	ICB 160-121981/1		121981			PS
05/23/14 00:14	2	CCVB 160-123737/10		123737			SMP
05/23/14 00:17	2	CCVA 160-123737/25		123737			SMP
05/23/14 00:34	200	CCB 160-123737/57		123737			SMP
05/23/14 09:50	200	160-6694-7	2222-RIN-01	123737	122913	9320	SMP

Subcontract Data

MCLinc Project No. TAM002845A
May 20, 2014 Sample Delivery
Isotopic Lead Analysis

CERTIFICATE OF ANALYSIS

May 28, 2014

Erika K. Gish
Test America
St. Louis

Certificate of Analysis
MCLinc Project No. TAM002845A
Analysis of Samples for Isotopic Lead

On May 20, 2014, Materials and Chemistry Laboratory, Inc. (MCLinc) received six solid samples and one water sample in good condition for isotopic lead analysis. Upon receipt, sample 2222-SD03 (160-6694-3) had a loose lid and leaked onto the other five samples it was packaged with. The client was contacted, and we proceeded with the analysis. The sampling date was identified as May 15, 2014.

The samples were prepared by acid digestion using MCLinc SOP-7746 and then analyzed by Inductively Coupled Plasma Mass Spectroscopy using MCLinc SOP MCL-7768. The results are including QC are presented in the attached tables.

All QC was acceptable.

Thank you for choosing MCLinc. This report reviewed and approved by:

Jack Hall
Quality Assurance Manager

Mike Tutor
Senior Chemist

Materials and Chemistry Laboratory, Inc.
East Tennessee Technology Park, Building K-1006
2010 Highway 58, Suite 1000
Oak Ridge, Tennessee 37830-1702
Telephone: (865) 576-4138 Fax: (865) 576-8558
www.MCL-inc.com

Metal Analysis of Solid/Liquid Samples by ICP-MS
Analysis Date: 05/27/2014
MCL Project ID: TAM002845A

	Metal:	*Pb Total*			*Pb 204*	*Pb 206*	*Pb 207*	*Pb 208*
Client Sample ID	**MCL Sample ID**	**Concentration**	**Qualifier**	**Units**	**Mass %**	**Mass %**	**Mass %**	**Mass %**
2222-SD01 (160-6694-1)	14-0922	66	D	mg/Kg	1.3223	25.4754	21.3582	51.8441
2222-SD02 (160-6694-2)	14-0923	26	D	mg/Kg	1.3308	25.3594	21.5656	51.7442
2222-SD03 (160-6694-3)	14-0924	120	D	mg/Kg	1.3372	25.4202	21.5542	51.6883
2222-SD04 (160-6694-4)	14-0925	20	D	mg/Kg	1.3273	25.3967	21.4878	51.7882
2222-SD05 (160-6694-5)	14-0926	110	D	mg/Kg	1.3175	25.8765	21.2824	51.5236
2222-SD06 (160-6694-6)	14-0927	96	D	mg/Kg	1.3321	25.3774	21.4585	51.8321
2222-RIN-01 (160-6694-7)	14-0928	0.0035	U	mg/L	NA	NA	NA	NA

Notes:

-U qualifier indicates no analytes above the reported values were detected in the sample

- D qualifier indicates dilution of sample was necessary to remain within the calibration range; concentration calculation includes dilution factor.

- NA = The measured concentration was below the reporting level. No Mass % can be calculated.

Analysis Date: 05/27/2014
MCL Project ID: TAM002845A
QC Data Table

Metal:	*Pb 204*	*Pb 206*	*Pb 207*	*Pb 208*	
QC Sample ID	Result	Result	Result	Result	Units
CCV-1	105	104	106	104	%R
CCV-2	106	105	106	105	%R
CCV-3	104	102	104	101	%R
Blank 1	<0.0393	<0.672	<0.618	<1.47	µg/L
Blank 2	<0.0393	<0.672	<0.618	<1.47	µg/L
Blank 3	<0.0393	<0.672	<0.618	<1.47	µg/L
LCS052314N-2	102	103	104	101	%R
MB052314	<0.00098	<0.017	<0.015	<0.037	mg/Kg

Materials and Chemistry Laboratory, Inc.
East Tennessee Technology Park, Building K-1006
2010 Highway 58, Suite 1000
Oak Ridge, Tennessee 37830-1702
Telephone: (865) 576-4138 Fax: (865) 576-8558
www.MCL-inc.com

METALS PREP SHEET

METALS DIGESTION SAMPLE PREPARATION for ICP or ICP/MS ICP MS Page 8

Procedure: MCL-7746 or Be MCL-7756, App. UU Sample Type: Air Filters, Wipes, Solids, Soils, Oils

Date: 05-23-14 Prepared By: RJJ Project ID: TAM002845A

Spike ID(s): A Pb Iso 052214 B _____ C _____ D _____

Used (check one): Class A Glass Pipets? ☐ Autopipet? ☐ Autopipet #: _____ Verification Wt. (DI H_2O) (g) _____

QA/QC Information

QC Sample ID	Matrix (soil, wipe, filter, DI H_2O)	Aliquot (g) or (mL)	Volume (mL) & Spike ID	Final Vol. (mL)	Comments
MB 052314-2	DI H_2O	2g		50ml	
LCS052314N-2			A: 0.6ml	↓	

Sample Information

MCL Sample ID	Matrix (soil, wipe, filter, etc.)	Aliquot (g) or (mL)	Final Vol. (mL)	Digestion Temp (°C)	Comments	Chemicals Used (include Manufacturer and Lot #)
14-0922	SOIL	2.3645g	50 ml	96	very wet	HCl - 1ml
0923	↓	2.8759g	↓	↓	↓	BDH
0924		2.1827g				4112120
0925		2.6682g				
0926		2.2051g				HNO_3 - 3 ml
0927	↓	2.6698g			↓	EMD
0928	WATER	40 ml	↓	↓		53157

Balance ID	AF 260	Weight (g)	10.0000	5.0000	0.1000	0.0500
Calibration ID	94-060733	Actual (g)	10.0004	5.0010	0.0999	0.0500
Weight Set ID	130124	Actual (g)	10.0001	5.0010	0.1000	0.0500
		Avg (g)	10.00025	5.0010	0.09995	0.0508

Hot Block Used (circle one): A B C (D)

Temp. Blank Location: D 8 Signature RJJ

SAMPLE/QC DATA

Metal Analysis of Solid/Liquid Samples by ICP-MS
Analysis Date: 05/27/2014
MCL Project ID: TAM002845A

	Metal:	Pb Total			Pb 204	Pb 206	Pb 207	Pb 208
Client Sample ID	MCL Sample ID	Concentration	Qualifier	Units	Mass %	Mass %	Mass %	Mass %
2222-SD01 (160-6694-1)	14-0922	66	D	mg/Kg	1.3223	25.4754	21.3582	51.8441
2222-SD02 (160-6694-2)	14-0923	26	D	mg/Kg	1.3308	25.3594	21.5656	51.7442
2222-SD03 (160-6694-3)	14-0924	120	D	mg/Kg	1.3372	25.4202	21.5542	51.6883
2222-SD04 (160-6694-4)	14-0925	20	D	mg/Kg	1.3273	25.3967	21.4878	51.7882
2222-SD05 (160-6694-5)	14-0926	110	D	mg/Kg	1.3175	25.8765	21.2824	51.5236
2222-SD06 (160-6694-6)	14-0927	96	D	mg/Kg	1.3321	25.3774	21.4585	51.8321
2222-RIN-01 (160-6694-7)	14-0928	0.0035	U	mg/L	NA	NA	NA	NA

Notes:

-U qualifier indicates no analytes above the reported values were detected in the sample

- D qualifier indicates dilution of sample was necessary to remain within the calibration range; concentration calculation includes dilution factor.

- NA = The measured concentration was below the reporting level. No Mass % can be calculated.

Analysis Date: 05/27/2014
MCL Project ID: TAM002845A
QC Data Table

Metal:	*Pb 204*	*Pb 206*	*Pb 207*	*Pb 208*	
QC Sample ID	Result	Result	Result	Result	Units
CCV-1	105	104	106	104	%R
CCV-2	106	105	106	105	%R
CCV-3	104	102	104	101	%R
Blank 1	<0.0393	<0.672	<0.618	<1.47	µg/L
Blank 2	<0.0393	<0.672	<0.618	<1.47	µg/L
Blank 3	<0.0393	<0.672	<0.618	<1.47	µg/L
LCS052314N-2	102	103	104	101	%R
MB052314	<0.00098	<0.017	<0.015	<0.037	mg/Kg

	Pb 204 measured conc	Pb 206 measured conc	Pb 207 measured conc	Pb 208 measured conc	Pb Total measured conc	sample wt (g or ml)	Pb Tot mg/Kg	Pb 204 Mass %	Pb 206 Mass %	Pb 207 Mass %	Pb 208 Mass %
14-0922	8.2858	159.6354	133.8361	324.8689	626.6262	2.3645	66.3	1.3223	25.4754	21.3582	51.8441
14-0923	4.0006	76.2335	64.829	155.5495	300.5126	2.8759	26.1	1.3308	25.3594	21.5656	51.7442
14-0924	7.1488	135.8966	115.229	276.326	534.6004	2.1827	122.5	1.3372	25.4202	21.5542	51.6883
14-0925	2.7705	53.0113	44.8521	108.099	208.7329	2.6682	19.6	1.3273	25.3967	21.4878	51.7882
14-0926	6.2411	122.5789	100.8166	244.0714	473.708	2.2051	107.4	1.3175	25.8765	21.2824	51.5236
14-0927	6.8489	130.4799	110.3308	266.4992	514.1588	2.6698	96.3	1.3321	25.3774	21.4585	51.8321
14-0928	<	<	<	<	0	40	<0.0035	NA	NA	NA	NA
lowest std	0.0393	0.6725	0.6181	1.4723	2.8022						

REVIEWED AND APPROVED

5/28/04

Sample Report

Sample ID: 14-922-X5

Sample Date/Time: Tuesday, May 27, 2014 13:31:02
Sample Type: Sample
Sample Description:
Batch ID: 052714_TAM2845A
Autosampler Position: 14
Dataset File: C:\Elandata\Dataset\052714-01\14-922-X5.014
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		4644.9	1126.4	3.2
	Pb	204	8.2858	ug/L	2.2	570843.9	448.4	1.3
	Pb	206	159.6354	ug/L	2.0	11101136.5	7642.2	1.9
	Pb	207	133.8361	ug/L	1.7	9260689.3	6372.9	2.2
	Pb	208	324.8689	ug/L	1.5	22904449.1	16135.3	2.2
>	Bi	209		ug/L		1345230.1	1376714.5	2.2

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204		
	Pb	206		
	Pb	207		
	Pb	208		
>	Bi	209		97.7

Sample Report

Sample ID: 14-923-X5

Sample Date/Time: Tuesday, May 27, 2014 13:34:09
Sample Type: Sample
Sample Description:
Batch ID: 052714_TAM2845A
Autosampler Position: 15
Dataset File: C:\Elandata\Dataset\052714-01\14-923-X5.015
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		2183.3	1126.4	2.8
	Pb	204	4.0006	ug/L	1.0	259578.5	448.4	1.1
	Pb	206	76.2335	ug/L	1.3	4991544.9	7642.2	1.0
	Pb	207	64.8290	ug/L	2.0	4223691.6	6372.9	2.4
	Pb	208	155.5495	ug/L	1.1	10326016.4	16135.3	1.7
>	Bi	209		ug/L		1265630.4	1376714.5	1.7

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204		
	Pb	206		
	Pb	207		
	Pb	208		
>	Bi	209		91.9

Sample Report

Sample ID: 14-0924-X10

Sample Date/Time: Tuesday, May 27, 2014 14:13:46
Sample Type: Sample
Sample Description:
Batch ID: 052714_TAM2845A
Autosampler Position: 21
Dataset File: C:\Elandata\Dataset\052714-01\14-0924-X10.026
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
⌜	Hg	202		ug/L		3056.8	1126.4	3.0
|	Pb	204	7.1488	ug/L	1.9	506579.2	448.4	1.6
|	Pb	206	135.8966	ug/L	3.4	9718697.5	7642.2	3.2
|	Pb	207	115.2290	ug/L	2.4	8199123.5	6372.9	2.3
|	Pb	208	276.3260	ug/L	1.2	20034617.1	16135.3	1.4
⌞>	Bi	209		ug/L		1383112.5	1376714.5	1.0

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
⌜	Hg	202		
|	Pb	204		
|	Pb	206		
|	Pb	207		
|	Pb	208		
⌞>	Bi	209		100.5

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Sample Report

Sample ID: 14-925-X5

Sample Date/Time: Tuesday, May 27, 2014 13:40:21
Sample Type: Sample
Sample Description:
Batch ID: 052714_TAM2845A
Autosampler Position: 17
Dataset File: C:\Elandata\Dataset\052714-01\14-925-X5.017
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		1366.8	1126.4	5.0
	Pb	204	2.7705	ug/L	1.5	167325.6	448.4	1.0
	Pb	206	53.0113	ug/L	1.1	3230760.6	7642.2	0.8
	Pb	207	44.8521	ug/L	1.5	2719635.7	6372.9	1.4
	Pb	208	108.0990	ug/L	0.5	6679193.2	16135.3	1.1
>	Bi	209		ug/L		1177194.7	1376714.5	1.1

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204		
	Pb	206		
	Pb	207		
	Pb	208		
>	Bi	209		85.5

Sample Report

Sample ID: 14-0926-X10

Sample Date/Time: Tuesday, May 27, 2014 14:16:53
Sample Type: Sample
Sample Description:
Batch ID: 052714_TAM2845A
Autosampler Position: 22
Dataset File: C:\Elandata\Dataset\052714-01\14-0926-X10.027
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Callbration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
⌜	Hg	202		ug/L		3133.9	1126.4	3.1
|	Pb	204	6.2411	ug/L	1.7	469417.4	448.4	1.3
|	Pb	206	122.5789	ug/L	2.1	9305233.8	7642.2	2.3
|	Pb	207	100.8166	ug/L	2.1	7615658.3	6372.9	2.9
|	Pb	208	244.0714	ug/L	1.9	18785313.1	16135.3	2.7
⌞>	Bi	209		ug/L		1467938.9	1376714.5	1.4

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
⌜	Hg	202		
|	Pb	204		
|	Pb	206		
|	Pb	207		
|	Pb	208		
⌞>	Bi	209		106.6

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Sample Report

Sample ID: 14-0927-X10

Sample Date/Time: Tuesday, May 27, 2014 14:20:01
Sample Type: Sample
Sample Description:
Batch ID: 052714_TAM2845A
Autosampler Position: 23
Dataset File: C:\Elandata\Dataset\052714-01\14-0927-X10.028
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
[	Hg	202		ug/L		3354.0	1126.4	2.2
|	Pb	204	6.8489	ug/L	3.3	494137.2	448.4	3.0
|	Pb	206	130.4799	ug/L	2.1	9501190.3	7642.2	1.8
|	Pb	207	110.3308	ug/L	1.8	7993968.8	6372.9	2.0
|	Pb	208	266.4992	ug/L	1.6	19672659.4	16135.3	1.3
[>	Bi	209		ug/L		1408528.8	1376714.5	2.4

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
[	Hg	202		
|	Pb	204		
|	Pb	206		
|	Pb	207		
|	Pb	208		
[>	Bi	209		102.3

Sample Report

Sample ID: 14-0928-X1

Sample Date/Time: Tuesday, May 27, 2014 14:02:36
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 20
Dataset File: C:\Elandata\Dataset\052714-01\14-0928-X1.024
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
Hg	202		ug/L		281.7	1126.4	9.8
Pb	204	0.0057	ug/L	33.2	851.6	448.4	16.0
Pb	206	0.1106	ug/L	22.6	15570.5	7642.2	12.1
Pb	207	0.1113	ug/L	25.7	14308.5	6372.9	15.0
Pb	208	0.2396	ug/L	27.5	33545.6	16135.3	14.7
> Bi	209		ug/L		1381623.5	1376714.5	3.7

QC Calculated Values

Analyte	Mass	QC Std % Recovery	Int Std % Recovery
Hg	202		
Pb	204		
Pb	206		
Pb	207		
Pb	208		
> Bi	209		100.4

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Sample Report

Sample ID: CCV_052714

Sample Date/Time: Tuesday, May 27, 2014 13:11:47
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 6
Dataset File: C:\Elandata\Dataset\052714-01\CCV_052714.008
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File:
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
[	Hg	202		ug/L		1070.7	1126.4	5.5
|	Pb	204	3.4321	ug/L	2.2	236622.1	448.4	1.4
|	Pb	206	58.5081	ug/L	1.9	4071672.4	7642.2	1.5
|	Pb	207	54.5036	ug/L	2.5	3772611.8	6372.9	1.3
|	Pb	208	127.7075	ug/L	2.2	9008245.6	16135.3	1.7
[>	Bi	209		ug/L		1344579.0	1376714.5	1.5

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
[	Hg	202		
|	Pb	204	104.7	
|	Pb	206	104.4	
|	Pb	207	105.8	
|	Pb	208	104.1	
[>	Bi	209		97.7

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Sample Report

Sample ID: Inst_Blk

Sample Date/Time: Tuesday, May 27, 2014 13:15:23
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 1
Dataset File: C:\Elandata\Dataset\052714-01\Inst_Blk.009
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		869.4	1126.4	9.1
	Pb	204	0.0016	ug/L	54.6	536.3	448.4	11.7
	Pb	206	0.0247	ug/L	40.6	9042.5	7642.2	9.1
	Pb	207	0.0258	ug/L	39.9	7884.1	6372.9	9.8
	Pb	208	0.0634	ug/L	33.7	19922.3	16135.3	9.5
>	Bi	209		ug/L		1323757.1	1376714.5	3.8

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204	3.9	
	Pb	206	3.7	
	Pb	207	4.2	
	Pb	208	4.3	
>	Bi	209		96.2

Sample Report

Sample ID: CCV_052714

Sample Date/Time: Tuesday, May 27, 2014 13:49:41
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 6
Dataset File: C:\Elandata\Dataset\052714-01\CCV_052714.020
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
[	Hg	202		ug/L		307.0	1126.4	14.2
|	Pb	204	3.4659	ug/L	4.6	245898.3	448.4	2.4
|	Pb	206	58.9147	ug/L	5.9	4216733.3	7642.2	2.5
|	Pb	207	54.7723	ug/L	3.8	3901897.2	6372.9	0.8
|	Pb	208	128.9839	ug/L	5.3	9359296.7	16135.3	2.1
[>	Bi	209		ug/L		1384984.8	1376714.5	3.6

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
[	Hg	202		
|	Pb	204	105.8	
|	Pb	206	105.1	
|	Pb	207	106.3	
|	Pb	208	105.1	
[>	Bi	209		100.6

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Sample Report

Sample ID: Inst_Blk

Sample Date/Time: Tuesday, May 27, 2014 13:53:17
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 1
Dataset File: C:\Elandata\Dataset\052714-01\Inst_Blk.021
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		273.0	1126.4	9.7
	Pb	204	0.0020	ug/L	36.1	592.7	448.4	7.9
	Pb	206	0.0362	ug/L	24.3	10290.2	7642.2	5.5
	Pb	207	0.0354	ug/L	28.7	8936.1	6372.9	7.2
	Pb	208	0.0746	ug/L	31.5	21655.5	16135.3	6.9
>	Bi	209		ug/L		1386752.2	1376714.5	1.3

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204	5.1	
	Pb	206	5.4	
	Pb	207	5.7	
	Pb	208	5.1	
>	Bi	209		100.7

Sample Report

Sample ID: CCV_052714

Sample Date/Time: Tuesday, May 27, 2014 14:23:08
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 6
Dataset File: C:\Elandata\Dataset\052714-01\CCV_052714.029
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		217.7	1126.4	8.5
	Pb	204	3.3958	ug/L	2.1	244579.5	448.4	1.4
	Pb	206	57.3332	ug/L	2.1	4168118.8	7642.2	1.6
	Pb	207	53.4593	ug/L	0.7	3866887.0	6372.9	1.9
	Pb	208	124.4210	ug/L	1.7	9170392.8	16135.3	2.3
>	Bi	209		ug/L		1404684.3	1376714.5	1.9

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204	103.6	
	Pb	206	102.3	
	Pb	207	103.8	
	Pb	208	101.4	
>	Bi	209		102.0

Sample Report

Sample ID: Inst_Blk

Sample Date/Time: Tuesday, May 27, 2014 14:26:44
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 1
Dataset File: C:\Elandata\Dataset\052714-01\Inst_Blk.030
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		210.0	1126.4	21.3
	Pb	204	0.0009	ug/L	87.2	524.0	448.4	16.8
	Pb	206	0.0215	ug/L	42.3	9415.3	7642.2	12.1
	Pb	207	0.0208	ug/L	25.1	8045.6	6372.9	10.2
	Pb	208	0.0422	ug/L	33.7	19666.8	16135.3	9.9
>	Bi	209		ug/L		1413982.2	1376714.5	9.9

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204	2.2	
	Pb	206	3.2	
	Pb	207	3.4	
	Pb	208	2.9	
>	Bi	209		102.7

Sample Report

Sample ID: LCS052314N-2

Sample Date/Time: Tuesday, May 27, 2014 13:18:30
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 9
Dataset File: C:\Elandata\Dataset\052714-01\LCS052314N-2.010
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		848.7	1126.4	3.5
	Pb	204	3.9965	ug/L	1.8	281073.0	448.4	1.6
	Pb	206	69.2157	ug/L	2.5	4912748.2	7642.2	2.0
	Pb	207	64.4988	ug/L	1.7	4554557.8	6372.9	1.7
	Pb	208	149.3942	ug/L	1.6	10750354.1	16135.3	2.0
>	Bi	209		ug/L		1371760.6	1376714.5	1.2

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204	101.6	
	Pb	206	102.9	
	Pb	207	104.3	
	Pb	208	101.5	
>	Bi	209		99.6

Sample Report

Sample ID: MB052314-2

Sample Date/Time: Tuesday, May 27, 2014 13:21:37
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 10
Dataset File: C:\Elandata\Dataset\052714-01\MB052314-2.011
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		776.4	1126.4	11.6
	Pb	204	0.0015	ug/L	55.6	557.9	448.4	9.5
	Pb	206	0.0306	ug/L	15.6	9859.3	7642.2	3.0
	Pb	207	0.0284	ug/L	18.2	8420.2	6372.9	4.0
	Pb	208	0.0591	ug/L	13.9	20477.0	16135.3	1.8
>	Bi	209		ug/L		1382998.6	1376714.5	2.6

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204	3.9	
	Pb	206	4.5	
	Pb	207	4.6	
	Pb	208	4.0	
>	Bi	209		100.5

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Sample Report

Sample ID: 052714 Pb-Iso-CCV2

Sample Date/Time: Tuesday, May 27, 2014 13:56:23
Sample Type: Sample
Sample Description:
Batch ID: 052714_TAM2845A
Autosampler Position: 7
Dataset File: C:\Elandata\Dataset\052714-01\052714 Pb-Iso-CCV2.022
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
[	Hg	202		ug/L		255.7	1126.4	19.9
|	Pb	204	0.0019	ug/L	52.4	574.2	448.4	16.3
|	Pb	206	2.2889	ug/L	17.2	165829.6	7642.2	6.0
|	Pb	207	44.1876	ug/L	17.7	3042597.4	6372.9	5.5
|	Pb	208	0.4332	ug/L	22.8	46267.2	16135.3	8.8
[>	Bi	209		ug/L		1368954.9	1376714.5	17.0

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
[	Hg	202		
|	Pb	204		
|	Pb	206	114%R	
|	Pb	207	110%R	
|	Pb	208		
[>	Bi	209		99.4

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Sample Report

Sample ID: 052714 Pb-Tot CCV

Sample Date/Time: Tuesday, May 27, 2014 13:59:29
Sample Type: Sample
Sample Description:
Batch ID: 052714_TAM2845A
Autosampler Position: 8
Dataset File: C:\Elandata\Dataset\052714-01\052714 Pb-Tot CCV.023
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File: C:\Elandata\Calibration\052714-01.cal
Current Dead Time (ns): 55

Concentration Results

Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
Hg	202		ug/L		249.0	1126.4	4.8
Pb	204	5.5472	ug/L	4.1	371188.6	448.4	2.7
Pb	206	98.4922	ug/L	4.1	6652419.3	7642.2	3.1
Pb	207	88.2792	ug/L	3.9	5932238.1	6372.9	3.1
Pb	208	210.9317	ug/L	2.0	14447167.1	16135.3	2.4
Bi	209	4032	ug/L		1306415.5	1376714.5	2.2

QC Calculated Values

Analyte	Mass	QC Std % Recovery	Int Std % Recovery
Hg	202		
Pb	204		
Pb	206		
Pb	207		
Pb	208		
Bi	209		94.9

Pb tot : $\frac{4032}{400} \times 100 = 101\%$ R

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Calibration Report

Analyte	Mass	Curve Type	Slope	Intercept	Corr Coeff
Hg	201.971	Linear Thru Zero	0.000000	0.000	0.000000
Pb	203.973	Linear Thru Zero	0.051192	0.000	1.000000
Pb	205.975	Linear Thru Zero	0.051670	0.000	0.999999
Pb	206.976	Linear Thru Zero	0.051409	0.000	1.000000
Pb	207.977	Linear Thru Zero	0.052379	0.000	1.000000
Bi	208.980	Linear Thru Zero	0.000000	0.000	0.000000

Method File Name

File Name 052714-01.mth

Tuning File Name

Tuning File Name default.tun

Calibration File Name

File Name 052714-01.cal

Optimization File Name

File Name c:\elandata\optimize\default.dac

Sample Report

Sample ID: Calibration Blank

Sample Date/Time: Tuesday, May 27, 2014 12:57:18
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 1
Dataset File: C:\Elandata\Dataset\052714-01\Calibration Blank.003
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File:
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		1126.4		3.3
	Pb	204		ug/L		448.4		3.9
	Pb	206		ug/L		7642.2		2.9
	Pb	207		ug/L		6372.9		2.5
	Pb	208		ug/L		16135.3		2.3
>	Bi	209		ug/L		1376714.5		1.4

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204		
	Pb	206		
	Pb	207		
	Pb	208		
>	Bi	209		

Sample Report

Sample ID: 052714-01

Sample Date/Time: Tuesday, May 27, 2014 12:59:16
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 2
Dataset File: C:\Elandata\Dataset\052714-01\052714-01 .004
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File:
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		1303.4	1126.4	4.2
	Pb	204	0.0393	ug/L	3.9	3280.3	448.4	2.5
	Pb	206	0.6725	ug/L	4.7	56192.2	7642.2	2.1
	Pb	207	0.6181	ug/L	3.6	51478.4	6372.9	1.9
	Pb	208	1.4723	ug/L	1.4	124312.7	16135.3	1.6
>	Bi	209		ug/L		1409536.1	1376714.5	2.3

QC Calculated Values

Analyte	Mass	QC Std % Recovery	Int Std % Recovery
Hg	202		
Pb	204		
Pb	206		
Pb	207		
Pb	208		
> Bi	209		

Sample Report

Sample ID: 052714-02

Sample Date/Time: Tuesday, May 27, 2014 13:02:23
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 3
Dataset File: C:\Elandata\Dataset\052714-01\052714-02.005
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File:
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
[	Hg	202		ug/L		1454.8	1126.4	4.9
|	Pb	204	0.0787	ug/L	1.5	6574.8	448.4	2.1
|	Pb	206	1.3445	ug/L	1.2	111745.4	7642.2	1.8
|	Pb	207	1.2359	ug/L	1.9	103163.0	6372.9	2.5
|	Pb	208	2.9476	ug/L	1.3	249430.2	16135.3	2.5
[>	Bi	209		ug/L		1507943.5	1376714.5	1.3

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
[	Hg	202		
|	Pb	204		
|	Pb	206		
|	Pb	207		
|	Pb	208		
[>	Bi	209		

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Sample Report

Sample ID: 052714-03

Sample Date/Time: Tuesday, May 27, 2014 13:05:31
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 4
Dataset File: C:\Elandata\Dataset\052714-01\052714-03 .006
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File:
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		1261.8	1126.4	8.3
	Pb	204	0.7863	ug/L	1.9	59011.6	448.4	2.5
	Pb	206	13.4511	ug/L	2.1	1012703.5	7642.2	2.4
	Pb	207	12.3616	ug/L	3.1	932370.7	6372.9	3.3
	Pb	208	29.4534	ug/L	2.9	2285102.5	16135.3	2.7
>	Bi	209		ug/L		1463778.4	1376714.5	2.0

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204		
	Pb	206		
	Pb	207		
	Pb	208		
>	Bi	209		

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Sample Report

Sample ID: 052714-04

Sample Date/Time: Tuesday, May 27, 2014 13:08:40
Sample Type: Sample
Sample Description:
Batch ID:
Autosampler Position: 5
Dataset File: C:\Elandata\Dataset\052714-01\052714-04 .007
Sample File: C:\Elandata\Sample\052714-01.sam
Method File: C:\Elandata\Method\052714-01.mth
Calibration File:
Current Dead Time (ns): 55

Concentration Results

	Analyte	Mass	Conc. Mean	Units	Conc. RSD	Intens. Mean	Blank Intensity	Intens. RSD
	Hg	202		ug/L		1196.1	1126.4	2.6
	Pb	204	9.8314	ug/L	1.9	715644.0	448.4	2.2
	Pb	206	168.1536	ug/L	2.9	12351943.3	7642.2	2.1
	Pb	207	154.5349	ug/L	4.3	11291174.0	6372.9	3.1
	Pb	208	368.0892	ug/L	3.1	27406523.2	16135.3	2.1
>	Bi	209		ug/L		1421316.3	1376714.5	2.5

QC Calculated Values

	Analyte	Mass	QC Std % Recovery	Int Std % Recovery
	Hg	202		
	Pb	204		
	Pb	206		
	Pb	207		
	Pb	208		
>	Bi	209		

COC(S)

TAM002845A

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Gish, Erika K	Carrier Tracking No(s):	COC No: 160-30207.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: erika.gish@testamericainc.com		Page: Page 1 of 1
Company: Materials and Chemistry Laboratory Inc				Job #: 160-6694-1
Address: PO BOX 5808, ,	Due Date Requested: 5/30/2014			
City: Oak Ridge	TAT Requested (days):			
State, Zip: TN, 37831				
Phone:	PO #:			
Email:	WO #:			
Project Name: EPA Region 5 START 3 Contract	Project #: 16002800			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUB (Stable Isotopic Lead)/ Lead to MCL	SUB (Stable Isotopic Lead)/ Lead sub to MCL	Total Number of containers	Special Instructions/Note:
			Preservation Code:							
2222-SD01 (160-6694-1) 14-0922	5/15/14	08:25 Eastern		Solid			X		1	
2222-SD02 (160-6694-2) 14-0923	5/15/14	09:45 Eastern		Solid			X		1	
2222-SD03 (160-6694-3) 14-0924	5/15/14	08:50 Eastern		Solid			X		1	
2222-SD04 (160-6694-4) 14-0925	5/15/14	09:05 Eastern		Solid			X		1	
2222-SD05 (160-6694-5) 14-0926	5/15/14	09:15 Eastern		Solid			X		1	
2222-SD06 (160-6694-6) 14-0927	5/15/14	08:45 Eastern		Solid			X		1	
2222-RIN-01 (160-6694-7) 14-0928	5/15/14	08:10 Eastern		Water				X	1	

Sample # 2222-SD03 (160-6694-3) was received with a loose lid and leaked onto the other 5 samples it was packaged with. ag 5/20/14.

Possible Hazard Identification	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Unconfirmed	☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months
Deliverable Requested: I, II, III, IV, Other (specify)	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by: Jeff Clarke	Date/Time: 5.19.14 1430	Company TA STL	Received by:	Date/Time:	Company
Relinquished by: Angela Grainger	Date/Time: 5-20-14 1137	Company MCL	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Shipping and Receiving Documents

USEPA CLP COC (LAB COPY)
DateShipped: 05/15/14
CarrierName: FedEx
AirbillNo: 803786477258

CHAIN OF CUSTODY RECORD

Case #:
Cooler #: 1

160-6694 Chain of Custody

?-051514-121625-0003
Lab: TestAmerica Inc.
Lab Contact: Erika Gish
Lab Phone: 314-298-8566

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
2222- SD01		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD01	05/15/2014 08:25	
2222-SD02		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD02	05/15/2014 09:45	
2222-SD03		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD03	05/15/2014 08:50	
2222-SD04		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD04	05/15/2014 09:05	

Sample(s) to be used for Lab QC: 2222- SD01 Tag A, 2222- SD01 Tag B, 2222- SD01 Tag C, 2222- SD01 Tag D - Special Instructions: 10-day TAT
Sample 2222-SD01 MS/MSD

Shipment for Case Complete? N

Samples Transferred From Chain of Custody #

Analysis Key

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
Sampling	Jennifer Green (Weston)	5/15/14 13:00	FedEx		
	Fed EX	5-16-14 0645	Jill Clarke TASTL		

USEPA CLP COC (LAB COPY)

DateShipped: 05/15/14
CarrierName: FedEx
AirbillNo: 803786477258

CHAIN OF CUSTODY RECORD

Case #:
Cooler #: 1

No: 2-051514-121625-0003

Lab: TestAmerica Inc.
Lab Contact: Erika Gish
Lab Phone: 314-298-8566

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
2222-SD05		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD05	05/15/2014 09:15	
2222-SD06		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD06	05/15/2014 08:45	

Special Instructions: 10-day TAT
Sample 2222-SD01 MS/MSD

Shipment for Case Complete? N

Samples Transferred From Chain of Custody #

Analysis Key

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
Sampling	Denise Breen (Weston)	5/15/14 13:00	Fed Ex		
	Fed Ex	5-16-14 0645	Jill Clarke TA STL		

USEPA CLP COC (LAB COPY)

DateShipped: 05/15/14
CarrierName: FedEx
AirbillNo: 803786477258

CHAIN OF CUSTODY RECORD

Case #:
Cooler #: 2

No: 2-051514-122735-0004

Lab: TestAmerica Inc.
Lab Contact: Erika Gish
Lab Phone: 314-298-8566

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
2222-RIN-01		Water/ Weston	Grab	TAL Metals + Hg, Ra 228, Stable Isotopic Lead, Radioisotopes by Gamma spectroscopy, Iso U, Iso Th, Total Alpha Radium	A (HNO3 pH<2), B (HNO3 pH<2), C (HNO3 pH<2), D (HNO3 pH<2), E (HNO3 pH<2), F (HNO3 pH<2), G (HNO3 pH<2) (7)	Rinsate Blank	05/15/2014 08:10	

Sample(s) to be used for Lab QC: 2222-RIN-01 Tag A, 2222-RIN-01 Tag B, 2222-RIN-01 Tag C, 2222-RIN-01 Tag D, 2222-RIN-01 Tag E, 2222-RIN-01 Tag F, 2222-RIN-01 Tag G

Shipment for Case Complete? N

Samples Transferred From Chain of Custody #

Analysis Key

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
Sampling	Denise Breen (Weston)	5/15/14 13:00	FedEx		
	FedEx	5-16-14 0645	Jill Clarke TASTL		

Login Sample Receipt Checklist

Client: Weston Solutions, Inc.

Job Number: 160-6694-1

Login Number: 6694

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
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.	True	
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?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	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 <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

DATA ASSESSMENT

Lab Job No.: 160-6694-1
Laboratory: Test America-St. Louis
Site: Canadian Radium & Uranium (2222)

No. of Samples/Matrix: 6/sediment; 1/aqueous

Analysis: Metals and Mercury

Contractor: SAT 2

The following table summarizes the analytical methods used for the requested analyses and the USEPA Region 2 data validation standard operating procedures (SOPs) used for data validation.

Analysis	Analytical Method	Data Validation SOP No.
Metals	SW-846 Method 6010C	No. HW-2a (Revision 15), December 2012
Mercury	SW-846 Method 7470A	No. HW-2c (Revision 15), December 2012

The following definitions provide brief explanations of the national qualifiers assigned to results during the data review process.

U: The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.

J: The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J+: The result is an estimated quantity, but the result may be biased high.

J-: The result is an estimated quantity, but the result may be biased low.

R: The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.

UJ: The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

Reviewer's Signature: Yunru Yang **Date:** 6/2/14

DATA ASSESSMENT

On May 15, 2014, USEPA Region II SAT 2 personnel collected six sediment samples, including one field duplicate, and one rinse blank for metal and mercury analyses from the Canadian Radium & Uranium (2222) site, 105 Kisco Avenue, The Village of Mount Kisco, New York. These samples were shipped under Chain of Custody for the requested analysis to Test America-St. Louis, 13715 Rider Trail North, Earth City, MO. The laboratory verified that samples were received intact, properly sealed, and refrigerated. Sample cooler temperature was recorded at 1.1°C and 1.3°C.

Field Sample ID	Lab Sample ID	Matrix	Analysis	Sampling Date
2222-SD01	160-6694-1	Sediment	Metals, Mercury	5/15/2014
2222-SD02	160-6694-2	Sediment	Metals, Mercury	5/15/2014
2222-SD03	160-6694-3	Sediment	Metals, Mercury	5/15/2014
2222-SD04	160-6694-4	Sediment	Metals, Mercury	5/15/2014
2222-SD05	160-6694-5	Sediment	Metals, Mercury	5/15/2014
2222-SD06*	160-6694-6	Sediment	Metals, Mercury	5/15/2014
2222-RIN-01	160-6694-7	Aqueous	Metals, Mercury	5/15/2014

* A field duplicate of 2222-SD03

The following quality control (QC) parameters were evaluated. However, only data qualifications warranted by a specific QC non-conformance are summarized in this Data Assessment Report.

- Sample Receipt Conditions
- Preservation and Holding Times
- Calibration
- Initial and Continuing Calibration Verification
- Initial and Continuing Calibration Blanks
- Preparation Blanks
- Inductively Coupled Plasma (ICP) Interference Check
- Contract Required Quantitation Limit Check
- Linear Range Check
- Matrix Spike (MS) Recovery
- Laboratory Duplicate Analysis
- Laboratory Control Sample (LCS)
- ICP Serial Dilution
- Field Duplicate
- Field/Rinse Blank

Metals

Calibration Blanks

Trace levels of lead were detected in initial calibration blank (ICV) and all continuing calibration blanks (CCBs) associated with field rinse blank and sediment sample analyses. Since lead was not detected in the field rinse blank and lead concentrations in all sediment samples were greater than reporting limits, no action was required.

DATA ASSESSMENT

Trace levels of cadmium were detected in sample 2222-SD01 and its associated CCB. The presence of cadmium in sample 222-SD01 was qualified as non-detect (U) because its concentration was similar to that in the CCB.

Preparation Blank

Trace level of zinc was detected in the preparation blank associated with the sediment samples. Since zinc concentrations in all sediment samples were greater than reporting limits and greater than 10 times the blank concentration, no action was required.

Matrix Spike/Matrix Spike Duplicate

Sample 2222-SD01 was used for matrix spike (MS) and matrix spike duplicate (MSD) analyses for metals except for mercury. The recoveries of aluminum, calcium, iron, and magnesium were outside the control limits of 75% to 125%; however, since their concentrations in sample 2222-SD01 were greater than four times the spiked concentrations, no action was required.

The antimony and barium recoveries were <75% but >30%; antimony and barium results were estimated (J/UJ) in all sediment samples for potential low bias.

Instead of a sample duplicate analysis, the lab analyzed a matrix spike duplicate. The relative percent differences (RPD) between the MS and MSD concentrations were less than 30% for all analytes; no action was required.

Field Duplicate

Sample 2222-SD06 is field duplicate of 2222-SD03. The calcium results were estimated (J) in both samples for its RPD >50%.

Rinse Blank

Trace level of zinc was detected in rinse blank 2222-RIN-01. The zinc concentrations in all sediment samples were greater than 10 times the rinse blank concentration; no action was required.

Mercury

All QCs were within control limits. Data qualifications were not required.

Others

The solid content of sample 2222-SD04 was <50%; all results were estimated (J/UJ).

CASE NARRATIVE

Client: Weston Solutions, Inc.

Project: EPA Region 5 START 3 Contract

Report Number: 160-6694-1

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.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

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.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT
The samples were received on 5/16/2014 6:45 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were 1.1° C and 1.3° C.

TOTAL METALS (ICP)
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for total metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 05/19/2014 and analyzed on 05/22/2014.

Analytical Batch 123642
The following sample(s) was diluted due to the presence of iron which interferes with arsenic, chromium, lead, antimony, selenium, zinc. : (160-6694-1 MS), (160-6694-1 MSD), (160-6694-1 SD), 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5), 2222-SD06 (160-6694-6). Elevated reporting limits (RLs) are provided.

Zinc was detected in method blank MB 160-122752/1-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.

The matrix spike and/or matrix spike duplicate (MS/MSD) recoveries for calcium, antimony, and barium were outside control limits. Sample matrix interference are suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

Due to the high concentration of aluminum, iron, calcium, and magnesium the matrix spike / matrix spike duplicate (MS/MSD) could not be evaluated for accuracy and precision. The presence of the '4' qualifier in the data indicates analytes where the concentration in the unspiked sample exceeded four times the spiking amount. The associated laboratory control sample (LCS) met acceptance criteria.

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

TOTAL METALS (ICP)
Sample 2222-RIN-01 (160-6694-7) was analyzed for total metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 05/19/2014 and analyzed on 05/22/2014.

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

TOTAL MERCURY
Sample 2222-RIN-01 (160-6694-7) was analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 05/22/2014 and analyzed on 05/27/2014.

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

MERCURY
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for mercury in accordance with EPA SW-846 Method 7471B. The samples were prepared on 05/27/2014 and analyzed on 05/28/2014.

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

PERCENT SOLIDS
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 05/17/2014.

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

TOTAL ALPHA RADIUM (GFPC)
Sample 2222-RIN-01 (160-6694-7) was analyzed for Total Alpha Radium (GFPC) in accordance with SW-846 Method 9315. The samples were prepared on 05/19/2014 and analyzed on 05/21/2014.

Insufficient volume of sample 2222-RIN-01 (160-6694-7) was available to perform a sample duplicate associated with total alpha radium batch 122912. A LCSD was performed.

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

RADIUM-228 (GFPC)
Sample 2222-RIN-01 (160-6694-7) was analyzed for Radium-228 (GFPC) in accordance with SW-846 Method 9320. The samples were prepared on 05/19/2014 and analyzed on 05/23/2014.

Insufficient volume of sample 2222-RIN-01 (160-6694-7) was available to perform a sample duplicate associated with radium-228 batch 122913. A LCSD was performed.

The barium carrier recovery was outside the upper control limit of 110% (114%). The blank activity is less than the MDC. The LCS/LCSD recoveries are within limits and all other carrier recoveries are acceptable. The laboratory believes this anomaly to be isolated to the blank and not indicative of the batch.

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

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 05/19/2014, prepared on 05/21/2014 and analyzed on 05/23/2014.

Samples contain rocks and are not homogeneous. Possible matrix interference: 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5), 2222-SD06 (160-6694-6).

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

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)
Sample 2222-RIN-01 (160-6694-7) was analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE. The samples were prepared on 05/20/2014 and analyzed on 05/21/2014.

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

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with DOE. The samples were dried on 05/19/2014, prepared on 05/21/2014 and analyzed on 05/23/2014.

Samples contain rocks and are not homogeneous. Possible matrix interference: 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5), 2222-SD06 (160-6694-6).

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

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)
Sample 2222-RIN-01 (160-6694-7) was analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with DOE. The samples were prepared on 05/20/2014 and analyzed on 05/21/2014.

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

CESIUM-137 & OTHER GAMMA EMITTERS (GS)
Sample 2222-RIN-01 (160-6694-7) was analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE. The samples were prepared on 05/19/2014 and analyzed on 05/20/2014.

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

RADIUM 226 (NO INGROWTH)
Samples 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5) and 2222-SD06 (160-6694-6) were analyzed for Radium 226 (No ingrowth) in accordance with GA-01-R. The samples were dried on 05/19/2014, and prepared and analyzed on 05/21/2014.

Radium-226 by gamma spectroscopy is typically determined by inference from daughters (e.g. bismuth-214) after sealing the sample in an appropriate counting geometry/container and waiting 21 days to allow the radium-226 decay chain through radon-222 to reach secular equilibrium. Such an approach is considered to be the most reliable and representative means for establishing the true radium-226 concentration in the sample. The method requested by the client to report radium-226, using its own 186 keV gamma-ray emission, is subject to interference and potential bias due to the 185.7 keV uranium-235 gamma ray. Experience also indicates gamma spectroscopy software does not consistently assign accurate peak areas to radium-226 (186 keV), with the problem compounded by slight drift of the instrumentation. The laboratory considers radium-226 reported based upon the 186 keV gamma-ray emission to be best used by the client in a qualitative fashion.

The reporting limit for radium-226 analyzed by gamma spectroscopy was not met. The data is reported: (160-6694-1 DU), (MB 160-123290/1-A), 2222-SD01 (160-6694-1), 2222-SD02 (160-6694-2), 2222-SD03 (160-6694-3), 2222-SD04 (160-6694-4), 2222-SD05 (160-6694-5), 2222-SD06 (160-6694-6).

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

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD01 Lab Sample ID: 160-6694-1

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 08:25

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 72.3

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	10000	270	57	mg/Kg			10	6010C
7440-36-0	Antimony	4.1	13	4.1	mg/Kg	U	J	10	6010C
7440-38-2	Arsenic	4.2	13	3.1	mg/Kg	J		10	6010C
7440-39-3	Barium	150	66	1.5	mg/Kg		J	10	6010C
7440-41-7	Beryllium	1.0	6.6	1.0	mg/Kg	U		10	6010C
7440-43-9	Cadmium	0.80	6.6	0.45	mg/Kg	J → U		10	6010C
7440-70-2	Calcium	5200	3300	89	mg/Kg			10	6010C
7440-47-3	Chromium	44	13	1.8	mg/Kg			10	6010C
7440-48-4	Cobalt	10	66	1.9	mg/Kg	J		10	6010C
7440-50-8	Copper	41	33	3.3	mg/Kg			10	6010C
7439-89-6	Iron	16000	130	26	mg/Kg			10	6010C
7439-92-1	Lead	120	13	1.7	mg/Kg			10	6010C
7439-95-4	Magnesium	5000	1300	42	mg/Kg			10	6010C
7439-96-5	Manganese	220	13	1.1	mg/Kg			10	6010C
7440-02-0	Nickel	20	53	1.5	mg/Kg	J		10	6010C
7440-09-7	Potassium	1100	6600	960	mg/Kg	J		10	6010C
7782-49-2	Selenium	2.7	20	2.7	mg/Kg	U		10	6010C
7440-22-4	Silver	0.93	13	0.93	mg/Kg	U		10	6010C
7440-23-5	Sodium	150	1300	100	mg/Kg	J		10	6010C
7440-28-0	Thallium	2.5	27	2.5	mg/Kg	U		10	6010C
7440-62-2	Vanadium	24	66	6.7	mg/Kg	J		10	6010C
7440-66-6	Zinc	170	66	7.5	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.097	0.041	0.014	mg/Kg			1	7471B

44 6/2/14

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD02 | Lab Sample ID: 160-6694-2

Lab Name: TestAmerica St. Louis | Job No.: 160-6694-1

SDG ID.:

Matrix: Solid | Date Sampled: 05/15/2014 09:45

Reporting Basis: DRY | Date Received: 05/16/2014 06:45

% Solids: 71.9

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	5000	240	51	mg/Kg			10	6010C
7440-36-0	Antimony	3.7	12	3.7	mg/Kg	U	J	10	6010C
7440-38-2	Arsenic	2.8	12	2.8	mg/Kg	U		10	6010C
7440-39-3	Barium	41	60	1.3	mg/Kg	J		10	6010C
7440-41-7	Beryllium	0.89	6.0	0.89	mg/Kg	U		10	6010C
7440-43-9	Cadmium	0.40	6.0	0.40	mg/Kg	U		10	6010C
7440-70-2	Calcium	26000	3000	80	mg/Kg			10	6010C
7440-47-3	Chromium	26	12	1.6	mg/Kg			10	6010C
7440-48-4	Cobalt	8.3	60	1.7	mg/Kg	J		10	6010C
7440-50-8	Copper	42	30	2.9	mg/Kg			10	6010C
7439-89-6	Iron	12000	120	24	mg/Kg			10	6010C
7439-92-1	Lead	71	12	1.5	mg/Kg			10	6010C
7439-95-4	Magnesium	10000	1200	38	mg/Kg			10	6010C
7439-96-5	Manganese	150	12	0.95	mg/Kg			10	6010C
7440-02-0	Nickel	16	48	1.4	mg/Kg	J		10	6010C
7440-09-7	Potassium	1000	6000	860	mg/Kg	J		10	6010C
7782-49-2	Selenium	2.5	18	2.5	mg/Kg	U		10	6010C
7440-22-4	Silver	0.83	12	0.83	mg/Kg	U		10	6010C
7440-23-5	Sodium	140	1200	91	mg/Kg	J		10	6010C
7440-28-0	Thallium	2.3	24	2.3	mg/Kg	U		10	6010C
7440-62-2	Vanadium	14	60	6.0	mg/Kg	J		10	6010C
7440-66-6	Zinc	140	60	6.7	mg/Kg		F	10	6010C
7439-97-6	Mercury	0.043	0.050	0.017	mg/Kg	J		1	7471B

YY 6/2/14

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD03 Lab Sample ID: 160-6694-3

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 08:50

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 52.4

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	11000	350	76	mg/Kg			10	6010C
7440-36-0	Antimony	5.7	18	5.5	mg/Kg	J		10	6010C
7440-38-2	Arsenic	5.7	18	4.2	mg/Kg	J		10	6010C
7440-39-3	Barium	100	89	1.9	mg/Kg		J	10	6010C
7440-41-7	Beryllium	1.3	8.9	1.3	mg/Kg	U		10	6010C
7440-43-9	Cadmium	1.2	8.9	0.60	mg/Kg	J		10	6010C
7440-70-2	Calcium	17000	4400	120	mg/Kg		J	10	6010C
7440-47-3	Chromium	610	18	2.4	mg/Kg			10	6010C
7440-48-4	Cobalt	16	89	2.6	mg/Kg	J		10	6010C
7440-50-8	Copper	140	44	4.3	mg/Kg			10	6010C
7439-89-6	Iron	23000	180	35	mg/Kg			10	6010C
7439-92-1	Lead	290	18	2.3	mg/Kg			10	6010C
7439-95-4	Magnesium	7900	1800	56	mg/Kg			10	6010C
7439-96-5	Manganese	300	18	1.4	mg/Kg			10	6010C
7440-02-0	Nickel	40	71	2.1	mg/Kg	J		10	6010C
7440-09-7	Potassium	1800	8900	1300	mg/Kg	J		10	6010C
7782-49-2	Selenium	3.7	27	3.7	mg/Kg	U		10	6010C
7440-22-4	Silver	1.2	18	1.2	mg/Kg	U		10	6010C
7440-23-5	Sodium	180	1800	140	mg/Kg	J		10	6010C
7440-28-0	Thallium	3.4	35	3.4	mg/Kg	U		10	6010C
7440-62-2	Vanadium	33	89	9.0	mg/Kg	J		10	6010C
7440-66-6	Zinc	430	89	10	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.18	0.061	0.020	mg/Kg			1	7471B

YY 6/2/14

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD04 Lab Sample ID: 160-6694-4

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 09:05

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 28.6

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	9100	690	150	mg/Kg		J	10	6010C
7440-36-0	Antimony	11	35	11	mg/Kg	U	J	10	6010C
7440-38-2	Arsenic	26	35	8.2	mg/Kg	J		10	6010C
7440-39-3	Barium	100	170	3.8	mg/Kg	J		10	6010C
7440-41-7	Beryllium	2.6	17	2.6	mg/Kg	U	J	10	6010C
7440-43-9	Cadmium	3.5	17	1.2	mg/Kg	J		10	6010C
7440-70-2	Calcium	17000	8600	230	mg/Kg		J	10	6010C
7440-47-3	Chromium	70	35	4.8	mg/Kg		J	10	6010C
7440-48-4	Cobalt	19	170	5.0	mg/Kg	J		10	6010C
7440-50-8	Copper	210	86	8.5	mg/Kg		J	10	6010C
7439-89-6	Iron	28000	350	69	mg/Kg			10	6010C
7439-92-1	Lead	520	35	4.5	mg/Kg			10	6010C
7439-95-4	Magnesium	7000	3500	110	mg/Kg			10	6010C
7439-96-5	Manganese	320	35	2.8	mg/Kg			10	6010C
7440-02-0	Nickel	58	140	4.0	mg/Kg	J		10	6010C
7440-09-7	Potassium	2500	17000	2500	mg/Kg	U	J	10	6010C
7782-49-2	Selenium	7.1	52	7.1	mg/Kg	U		10	6010C
7440-22-4	Silver	2.4	35	2.4	mg/Kg	U		10	6010C
7440-23-5	Sodium	900	3500	260	mg/Kg	J		10	6010C
7440-28-0	Thallium	6.6	69	6.6	mg/Kg	U	J	10	6010C
7440-62-2	Vanadium	23	170	18	mg/Kg	J		10	6010C
7440-66-6	Zinc	760	170	19	mg/Kg		B J	10	6010C
7439-97-6	Mercury	0.045	0.10	0.035	mg/Kg	J		1	7471B

YY 6/2/14

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD05 Lab Sample ID: 160-6694-5

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Solid Date Sampled: 05/15/2014 09:15

Reporting Basis: DRY Date Received: 05/16/2014 06:45

% Solids: 76.9

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	4200	260	55	mg/Kg			10	6010C
7440-36-0	Antimony	4.0	13	4.0	mg/Kg	U	J	10	6010C
7440-38-2	Arsenic	3.1	13	3.1	mg/Kg	U		10	6010C
7440-39-3	Barium	16	65	1.4	mg/Kg	J		10	6010C
7440-41-7	Beryllium	0.97	6.5	0.97	mg/Kg	U		10	6010C
7440-43-9	Cadmium	0.44	6.5	0.44	mg/Kg	U		10	6010C
7440-70-2	Calcium	16000	3200	87	mg/Kg			10	6010C
7440-47-3	Chromium	18	13	1.8	mg/Kg			10	6010C
7440-48-4	Cobalt	9.0	65	1.9	mg/Kg	J		10	6010C
7440-50-8	Copper	38	32	3.2	mg/Kg			10	6010C
7439-89-6	Iron	15000	130	26	mg/Kg			10	6010C
7439-92-1	Lead	42	13	1.7	mg/Kg			10	6010C
7439-95-4	Magnesium	6500	1300	41	mg/Kg			10	6010C
7439-96-5	Manganese	130	13	1.0	mg/Kg			10	6010C
7440-02-0	Nickel	17	52	1.5	mg/Kg	J		10	6010C
7440-09-7	Potassium	940	6500	940	mg/Kg	U		10	6010C
7782-49-2	Selenium	2.7	19	2.7	mg/Kg	U		10	6010C
7440-22-4	Silver	0.91	13	0.91	mg/Kg	U		10	6010C
7440-23-5	Sodium	110	1300	99	mg/Kg	J		10	6010C
7440-28-0	Thallium	2.5	26	2.5	mg/Kg	U		10	6010C
7440-62-2	Vanadium	13	65	6.6	mg/Kg	J		10	6010C
7440-66-6	Zinc	130	65	7.3	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.11	0.038	0.013	mg/Kg			1	7471B

YY 6/2/14

1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-SD06 | Lab Sample ID: 160-6694-6

Lab Name: TestAmerica St. Louis | Job No.: 160-6694-1

SDG ID.:

Matrix: Solid | Date Sampled: 05/15/2014 08:45

Reporting Basis: DRY | Date Received: 05/16/2014 06:45

% Solids: 54.9

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	10000	310	66	mg/Kg			10	6010C
7440-36-0	Antimony	5.3	15	4.8	mg/Kg	J		10	6010C
7440-38-2	Arsenic	5.6	15	3.6	mg/Kg	J		10	6010C
7440-39-3	Barium	99	77	1.7	mg/Kg		J	10	6010C
7440-41-7	Beryllium	1.2	7.7	1.2	mg/Kg	U		10	6010C
7440-43-9	Cadmium	2.0	7.7	0.53	mg/Kg	J		10	6010C
7440-70-2	Calcium	29000	3900	100	mg/Kg		J	10	6010C
7440-47-3	Chromium	510	15	2.1	mg/Kg			10	6010C
7440-48-4	Cobalt	18	77	2.2	mg/Kg	J		10	6010C
7440-50-8	Copper	180	39	3.8	mg/Kg			10	6010C
7439-89-6	Iron	22000	150	31	mg/Kg			10	6010C
7439-92-1	Lead	390	15	2.0	mg/Kg			10	6010C
7439-95-4	Magnesium	8500	1500	49	mg/Kg			10	6010C
7439-96-5	Manganese	260	15	1.2	mg/Kg			10	6010C
7440-02-0	Nickel	38	62	1.8	mg/Kg	J		10	6010C
7440-09-7	Potassium	1600	7700	1100	mg/Kg	J		10	6010C
7782-49-2	Selenium	3.2	23	3.2	mg/Kg	U		10	6010C
7440-22-4	Silver	1.1	15	1.1	mg/Kg	U		10	6010C
7440-23-5	Sodium	170	1500	120	mg/Kg	J		10	6010C
7440-28-0	Thallium	2.9	31	2.9	mg/Kg	U		10	6010C
7440-62-2	Vanadium	31	77	7.8	mg/Kg	J		10	6010C
7440-66-6	Zinc	550	77	8.7	mg/Kg		B	10	6010C
7439-97-6	Mercury	0.24	0.056	0.019	mg/Kg			1	7471B

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1A-IN
INORGANIC ANALYSIS DATA SHEET
METALS

Client Sample ID: 2222-RIN-01 Lab Sample ID: 160-6694-7

Lab Name: TestAmerica St. Louis Job No.: 160-6694-1

SDG ID.:

Matrix: Water Date Sampled: 05/15/2014 08:10

Reporting Basis: WET Date Received: 05/16/2014 06:45

CAS No.	Analyte	Result	RL	MDL	Units	C	Q	DIL	Method
7429-90-5	Aluminum	22	200	22	ug/L	U		1	6010C
7440-36-0	Antimony	3.7	10	3.7	ug/L	U		1	6010C
7440-38-2	Arsenic	1.8	10	1.8	ug/L	U		1	6010C
7440-39-3	Barium	2.1	50	2.1	ug/L	U		1	6010C
7440-41-7	Beryllium	0.28	5.0	0.28	ug/L	U		1	6010C
7440-43-9	Cadmium	0.34	5.0	0.34	ug/L	U		1	6010C
7440-70-2	Calcium	54	1000	54	ug/L	U		1	6010C
7440-47-3	Chromium	3.4	10	3.4	ug/L	U		1	6010C
7440-48-4	Cobalt	2.7	50	2.7	ug/L	U		1	6010C
7440-50-8	Copper	2.1	25	2.1	ug/L	U		1	6010C
7439-89-6	Iron	13	100	13	ug/L	U		1	6010C
7439-92-1	Lead	0.60	10	0.60	ug/L	U		1	6010C
7439-95-4	Magnesium	51	1000	51	ug/L	U		1	6010C
7439-96-5	Manganese	1.0	15	1.0	ug/L	U		1	6010C
7440-02-0	Nickel	2.6	40	2.6	ug/L	U		1	6010C
7440-09-7	Potassium	460	5000	460	ug/L	U		1	6010C
7782-49-2	Selenium	2.1	15	2.1	ug/L	U		1	6010C
7440-22-4	Silver	0.99	10	0.99	ug/L	U		1	6010C
7440-23-5	Sodium	110	1000	110	ug/L	U		1	6010C
7440-28-0	Thallium	2.4	20	2.4	ug/L	U		1	6010C
7440-62-2	Vanadium	4.4	50	4.4	ug/L	U		1	6010C
7440-66-6	Zinc	9.2	20	8.3	ug/L	J		1	6010C
7439-97-6	Mercury	0.060	0.20	0.060	ug/L	U		1	7470A

Yy 6/2/14

PROJECT NOTE WESTON SOLUTIONS, INC.

To: Canadian Radium & Uranium Corp. Site File

Date: June 5, 2014

W.O. No.: 20405.012.013.2222.00

From: Nels R. Johnson, CHP, and Denise Breen, Weston Solutions, Inc.

Subject: Review of Test America Analytical Report for the Canadian Radium and Uranium Site - Sediment

1. Data Verification

The subject data package was reviewed and the data appear valid. The data package contained analytical results for six sediment samples, one rinsate water sample, and appropriate laboratory control samples (LCS). Analytical methods employed are alpha spectrometry for isotopic thorium, isotopic uranium, and isotopic lead for sediment and water samples. Gamma spectrometry for Ra-226 and -228 was used for sediment samples, and gas flow proportional counting for Ra-226 and -228 on the water sample.

The analytical methods cited are generally accepted industry methods for the requested radioisotopes. Appropriate tracers for isotopic thorium and isotopic uranium were used and percent recoveries were within tolerances. The suite of LCS included blanks, duplicates, and spikes for all lab methods and most were within tolerances. The minimum detectable concentration (MDC) for each result was acceptable, with the exception of Ra-226. Analytical data complied with the requested detection limits (RL) of 1.0 picocurie per gram (pCi/g) for sediment, again with the exception of Ra-226, and 1.0 pCi/L for water.

Due to a contractual need to expedite these analyses, gamma spectrometry was performed on each sample within two days of drying and homogenization. The laboratory then quantified the Ra-226 activity in each sample based upon the 186 keV gamma line from Ra-226. This technique is generally considered inferior and results in a large relative counting error estimate and a large MDC. The performing laboratory provided the following additional clarification in the case narrative:

> Radium-226 by gamma spectroscopy is typically determined by inference from daughters (e.g., bismuth-214) after sealing the sample in an appropriate counting geometry/container and waiting 21 days to allow the radium-226 decay chain through radon-222 to reach secular equilibrium. Such an approach is considered to be the most reliable and representative means for establishing the true radium-226 concentration in the sample. The method requested by the client to report radium-226, using its own 186 keV gamma-ray emission, is subject to interference and potential bias due to the 185.7 keV uranium-235 gamma ray. Experience also indicates gamma spectroscopy software does not consistently assign accurate peak areas to radium-226 (186 keV), with the problem compounded by slight drift of the instrumentation. The laboratory considers radium-226 reported based upon the 186 keV gamma-ray emission to be best used by the client in a qualitative fashion.

2. Data Interpretation

2.1 Preliminary Interpretation

2.1.1 Sediment Samples

Two samples (2222-SD02 and -SD05) were collected upstream from the site and are considered to be background (i.e., not impacted by potential migration of contaminants from the site). One sample (2222-SD04) was collected at the probable point of entry (PPE) and two samples (2222-SD03 and -SD01) were collected downstream of the PPE; all three samples are considered to be potentially impacted by migration of contaminants from the site. One sample (2222-SD06) was collected as a field duplicate to 2222-SD03.

The sediment data as reported by the laboratory was first grouped into the radioisotopes included in the U-238 decay series (U-238, Th-230, U-233/234, Ra-226, Pb-210, and Pb-214) and the Th-232 decay series (Th-232, Ra-228, Th-228, and Pb-212). In typical sediment in the eastern U.S., the concentrations of the individual radioisotopes of the Th-232 and U-238 decay series range from approximately 0.5 to 1.5 pCi/g. These concentrations are considered to be general background values for these isotopes.

All analytical results reported for the Th-232 decay series ranged from 0.32 to 1.07 pCi/g, and are therefore considered to be at general regional background levels. In addition, all of the individual radioisotopes were observed to be in equilibrium in each sample. The maximum concentrations observed for each radionuclide in this decay series are:
Th-232: 0.604 +/- 0.181 (pCi/g) (2222-SD03)
Ra-228: 0.913 +/- 0.326 pCi/g (2222-SD03)
Th-228: 1.07 +/- 0.251 pCi/g (2222-SD03)
Pb-212 0.811 +/- 0.229 pCi/g (2222-SD06)

All analytical results reported for U-238, Th-230, U-233/234, and Pb-214 of the U-238 decay chain appeared to be consistent with general regional background levels ranging from 0.35 to 1.15 pCi/g. The maximum concentrations observed these radionuclides are:
U-238 1.08 +/- 0.244 pCi/g (2222-SD04)
Th-230 0.745 +/- 0.204 pCi/g (2222-SD03)
U-233/234 1.15 +/- 0.253 pCi/g (2222-SD04)
Pb-214 0.754 +/- 0.200 pCi/g (2222-SD03)

Analytical results reported for Ra-226 and Pb-210 are negatively impacted by large counting errors and MDCs. This is not a reflection on the laboratory's performance but on the limitations of the analytical technique contractually required for a short turn-around time by the client. Due to the large relative counting errors and large MDCs these data are inconclusive after the preliminary interpretation. Field duplicate samples (2222-SD03 and SD06) analytical results compared favorably.

2.1.2 Water Sample

The one water sample is the rinsate blank. Most of the analytical results were below the detection level for the method. The three positive results were for Th-230, U-234, and U-238. All three results are slightly above their respective minimum detectable concentrations, and therefore appear positive. However, the concentrations are very low and are not considered to be a significant contributor to the sediment analytical results.

2.2 Secondary Interpretation

The Hazard Ranking System (HRS) states that in order to establish observed release for a site-attributable

radionuclide: 1) value equals or exceeds a value 2 standard deviations above the mean site-specific background concentration for that radionuclide in that type of sample, or 2) value exceeds the upper-limit value of the range of regional background concentrations for that radionuclide in that type of sample.

In order to examine the data from the most conservative or stringent perspective, WESTON held to both criteria listed above and applied the total uncertainty value to each result. The total uncertainty was added to the results for background samples (2222-SD02 and -SD05), and the total uncertainty was subtracted from the release samples (2222-SD01, -SD03, -SD04, and -SD06). These adjusted results are presented in the attached Table 1. Next, in order to calculate the mean site-specific background concentration: the standard deviation was calculated for each adjusted background sample value. The standard deviation was then multiplied by two and added to the adjusted mean site-specific value for each specific radionuclide. This value was then compared to each adjusted analytical result for the release samples in order to determine if any result qualifies as an observed release.

To compare which values exceed the upper-limit value of the range of regional background concentrations, a range of approximately 0.5 pCi/g to 1.5 pCi/g was used to evaluate individual analytical results within each radionuclide. In typical soil in the eastern U.S., the concentration of the individual radioisotopes of the Th-232 and U-238 decay series range from approximately 0.5 to 1.5 pCi/g. These concentrations are considered to be general background values for these isotopes.

Employing the aforementioned criteria, significant values were established for the site.

One sample location (2222-SD04) exhibits a concentration of Ra-226 that meets the criteria listed above for establishing observed release. Adjusted Ra-226 concentration in sample 2222-SD04 exhibited a significantly elevated concentration of 2.74 pCi/g. The reported Ra-226 concentrations for duplicate samples 2222-SD03 and –SD06 also appeared to be elevated, but the adjusted concentrations did not meet the criteria for observed release due to high uncertainty. The adjusted concentrations of Pb-210 were also elevated in samples 2222-SD03, -SD04 and -SD06 (2.00 pCi/g, 1.38 pCi/g, and 2.01 pCi/g, respectively), but were slightly below criteria for establishing observed release. This elevation in Pb-210, a daughter product of Ra-226, further supports the presence of Ra-226 in the surface water pathway.

Field duplicate samples (2222-SD03 and -SD06) were collected and the adjusted analytical results compared favorably.

The maximum adjusted concentrations (results minus total uncertainty) were detected as follows:
U-238 at 0.836 pCi/g (2222-SD04)
Th-230 at 0.541 pCi/g (2222-SD03)
U-233/234 at 0.897 pCi/g (2222-SD04)
Ra-226 at 2.74 pCi/g (2222-SD04)
Pb-210 at 2.01 pCi/g (2222-SD06)
Pb-214 at 0.554 pCi/g (2222-SD03)
Th-232 at 0.423 pCi/g (2222-SD03)
Ra-228 at 0.597 pCi/g (2222-SD03)
Th-228 at 0.819 pCi/g (2222-SD03)
Pb-212 at 0.582 pCi/g (2222-SD06)
U-235/236 at 0.0128 pCi/g (2222-SD04)

Complete validated analytical data and adjusted concentrations for radionuclides can be found on Table 1 of this Project Note. Significant adjusted analytical results, established in accordance with the aforementioned criteria, can be found on Table 2 of this Project Note as well as on Figure 5, included in the report.

Nels R. Johnson, CHP
Certified Health Physicist

Denise Breen
Assistant Project Scientist

Canadian Radium Uranium Corp. site - May 2014

Table 1. Complete Analytical Results for Sediment Samples

Location ID	SD01					SD02 Background					SD03				
	Result	Total Uncertainty	**Adjusted Result**	Qualifier	Unit	Result	Total Uncertainty	**Adjusted Result**	Qualifier	Unit	Result	Total Uncertainty	**Adjusted Result**	Qualifier	Unit
Uranium-238	0.352	+/- 0.156	**0.196**	V	pCi/g	0.459	+/- 0.151	**0.61**	V	pCi/g	0.591	+/- 0.169	**0.422**	V	pCi/g
Thorium-230	0.578	+/- 0.176	**0.402**	V	pCi/g	0.417	+/- 0.143	**0.56**	V	pCi/g	0.745	+/- 0.204	**0.541**	V	pCi/g
Uranium-233/234	0.585	+/- 0.205	**0.38**	V	pCi/g	0.369	+/- 0.134	**0.503**	V	pCi/g	0.666	+/- 0.181	**0.485**	V	pCi/g
Radium-226	0.780	+/- 1.08	**-0.3**	UV	pCi/g	0.231	+/- 0.800	**1.031**	UV	pCi/g	2.86	+/- 2.07	**0.79**	V	pCi/g
Lead-210	0.877	+/- 1.35	**-0.473**	UV	pCi/g	-0.270	+/- 1.54	**1.27**	UV	pCi/g	4.29	+/- 2.29	**2**	V	pCi/g
Lead-214	0.451	+/- 0.150	**0.301**	V	pCi/g	0.45	+/- 0.125	**0.575**	V	pCi/g	0.754	+/- 0.200	**0.554**	V	pCi/g
Location ID	SD01					SD02 Background					SD03				
Thorium-232	0.333	+/- 0.130	**0.203**	V	pCi/g	0.321	+/- 0.125	**0.446**	V	pCi/g	0.604	+/- 0.181	**0.423**	V	pCi/g
Radium-228	0.628	+/- 0.199	**0.429**	V	pCi/g	0.647	+/- 0.173	**0.82**	V	pCi/g	0.913	+/- 0.316	**0.597**	V	pCi/g
Thorium-228	0.320	+/- 0.136	**0.184**	V	pCi/g	0.314	+/- 0.126	**0.44**	V	pCi/g	1.07	+/- 0.251	**0.819**	V	pCi/g
Lead-212	0.586	+/- 0.176	**0.41**	V	pCi/g	0.472	+/- 0.126	**0.598**	V	pCi/g	0.619	+/- 0.213	**0.406**	V	pCi/g
Location ID	SD01					SD02 Background					SD03				
Uranium-235/236	0.0165	+/- 0.0413	**-0.0248**	UV	pCi/g	0.0230	+/- 0.0408	**0.0638**	UV	pCi/g	0.0110	+/- 0.0276	**-0.0166**	UV	pCi/g
Uranium-232	60.1			V	%	81.5			V	%	88.0			V	%
Thorium-229	78.2			V	%	83.0			V	%	72.2			V	%
Reference 42	p. 12, 13					p. 13-14					p. 15				

Location ID	SD04					SD05 Background					SD06				
	Result	Total Uncertainty	**Adjusted Result**	Qualifier	Unit	Result	Total Uncertainty	**Adjusted Result**	Qualifier	Unit	Result	Total Uncertainty	**Adjusted Result**	Qualifier	Unit
Uranium-238	1.08	+/- 0.244	**0.836**	V	pCi/g	0.243	+/- 0.109	**0.352**	V	pCi/g	0.588	+/- 0.170	**0.418**	V	pCi/g
Thorium-230	0.695	+/- 0.188	**0.507**	V	pCi/g	0.296	+/- 0.118	**0.414**	V	pCi/g	0.548	+/- 0.167	**0.381**	V	pCi/g
Uranium-233/234	1.15	+/- 0.253	**0.897**	V	pCi/g	0.289	+/- 0.122	**0.411**	V	pCi/g	0.859	+/- 0.211	**0.648**	V	pCi/g
Radium-226	4.76	+/- 2.02	**2.74**	V	pCi/g	0.109	+/- 1.09	**1.199**	UV	pCi/g	2.93	+/- 1.71	**1.22**	V	pCi/g
Lead-210	4.05	+/- 2.67	**1.38**	V	pCi/g	1.53	+/- 1.43	**2.96**	UV	pCi/g	3.67	+/- 1.66	**2.01**	V	pCi/g
Lead-214	0.690	+/- 0.200	**0.49**	V	pCi/g	0.353	+/- 0.113	**0.466**	V	pCi/g	0.664	+/- 0.174	**0.49**	V	pCi/g
Location ID	SD04					SD05 Background					SD06				
Thorium-232	0.445	+/- 0.148	**0.297**	V	pCi/g	0.282	+/- 0.113	**0.395**	V	pCi/g	0.586	+/- 0.173	**0.413**	V	pCi/g
Radium-228	0.763	+/- 0.255	**0.508**	V	pCi/g	0.554	+/- 0.229	**0.783**	V	pCi/g	0.608	+/- 0.229	**0.379**	V	pCi/g
Thorium-228	0.561	+/- 0.172	**0.389**	V	pCi/g	0.296	+/- 0.120	**0.416**	V	pCi/g	0.520	+/- 0.163	**0.357**	V	pCi/g
Lead-212	0.767	+/- 0.196	**0.571**	V	pCi/g	0.45	+/- 0.134	**0.584**	V	pCi/g	0.811	+/- 0.229	**0.582**	V	pCi/g
Location ID	SD04					SD05 Background					SD06				
Uranium-235/236	0.0854	+/- 0.0726	**0.0128**	V	pCi/g	-0.00545	+/- 0.00773	**0.00228**	UV	pCi/g	-0.00784	+/- 0.00908	**-0.01692**	UV	pCi/g
Uranium-232	83.5			V	%	85.0			V	%	87.3			V	%
Thorium-229	83.6			V	%	87.9			V	%	81.1			V	%
Reference 42	p. 16					p. 17-18					p. 18-19				

V = Verified by Certified Health Physicist

UV = Indicated the analyte was analyzed for but not detected and verified by a Certified Health Physicist

pCi/g = picocurie per gram

DCN: 2222-2A-BJMQ

Canadian Radium Uranium Corp. site - May 2014
Table 2. Interpreted Analytical Results for Sediment Samples

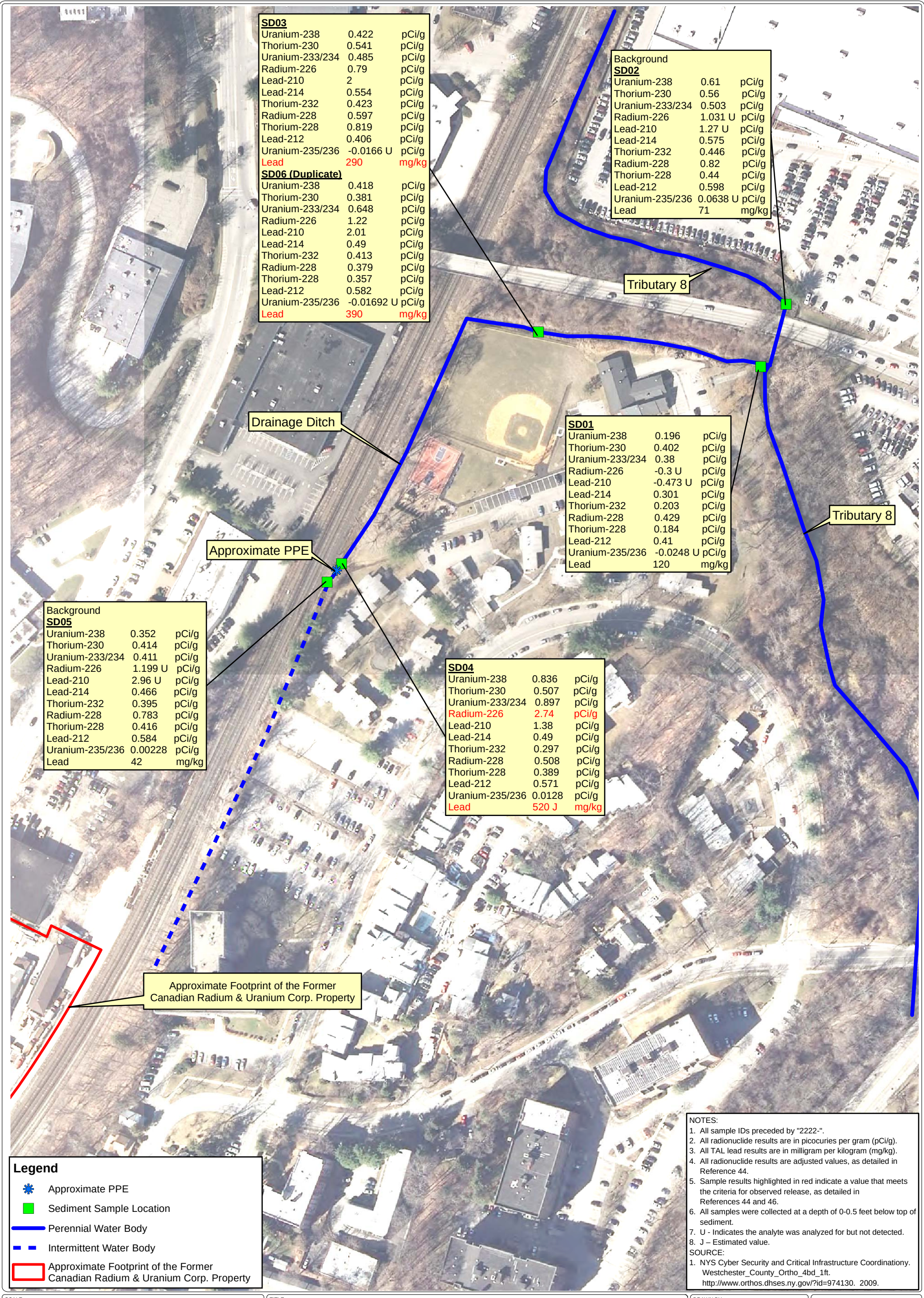
Location ID	SD02 Background					SD05 Background					2x Standard Deviation Above Mean Site-Specific Background	SD03					SD06 (Duplicate of SD03)				
	Result	Total Uncertainty	Adjusted Result	Qualifier	Unit	Result	Total Uncertainty	Adjusted Result	Qualifier	Unit		Result	Total Uncertainty	Adjusted Result	Qualifier	Unit	Result	Total Uncertainty	Adjusted Result	Qualifier	Unit
Uranium-238	0.459	+/- 0.151	0.61	V	pCi/g	0.243	+/- 0.109	0.352	V	pCi/g	**0.8458**	0.591	+/- 0.169	0.422	V	pCi/g	0.588	+/- 0.170	0.418	V	pCi/g
Thorium-230	0.417	+/- 0.143	0.56	V	pCi/g	0.296	+/- 0.118	0.414	V	pCi/g	**0.6934**	0.745	+/- 0.204	0.541	V	pCi/g	0.548	+/- 0.167	0.381	V	pCi/g
Uranium-233/234	0.369	+/- 0.134	0.503	V	pCi/g	0.289	+/- 0.122	0.411	V	pCi/g	**0.5872**	0.666	+/- 0.181	0.485	V	pCi/g	0.859	+/- 0.211	0.648	V	pCi/g
Radium-226	0.231	+/- 0.800	1.031	UV	pCi/g	0.109	+/- 1.09	1.199	UV	pCi/g	**1.3526**	2.86	+/- 2.07	0.79	V	pCi/g	2.93	+/- 1.71	1.22	V	pCi/g
Lead-210	-0.270	+/- 1.54	1.27	UV	pCi/g	1.53	+/- 1.43	2.96	UV	pCi/g	**4.505**	4.29	+/- 2.29	2.00	V	pCi/g	3.67	+/- 1.66	2.01	V	pCi/g
Lead-214	0.45	+/- 0.125	0.575	V	pCi/g	0.353	+/- 0.113	0.466	V	pCi/g	**0.6747**	0.754	+/- 0.200	0.554	V	pCi/g	0.664	+/- 0.174	0.49	V	pCi/g
Reference 42	p. 13-14					p. 17-18						p. 15					p. 18-19				

Location ID	SD02 Background					SD05 Background					2x Standard Deviation Above Mean Site-Specific Background	SD01					SD04				
	Result	Total Uncertainty	Adjusted Result	Qualifier	Unit	Result	Total Uncertainty	Adjusted Result	Qualifier	Unit		Result	Total Uncertainty	Adjusted Result	Qualifier	Unit	Result	Total Uncertainty	Adjusted Result	Qualifier	Unit
Uranium-238	0.459	+/- 0.151	0.61	V	pCi/g	0.243	+/- 0.109	0.352	V	pCi/g	**0.8458**	0.352	+/- 0.156	0.196	V	pCi/g	1.08	+/- 0.244	0.836	V	pCi/g
Thorium-230	0.417	+/- 0.143	0.56	V	pCi/g	0.296	+/- 0.118	0.414	V	pCi/g	**0.6934**	0.578	+/- 0.176	0.402	V	pCi/g	0.695	+/- 0.188	0.507	V	pCi/g
Uranium-233/234	0.369	+/- 0.134	0.503	V	pCi/g	0.289	+/- 0.122	0.411	V	pCi/g	**0.5872**	0.585	+/- 0.205	0.38	V	pCi/g	1.15	+/- 0.253	0.897	V	pCi/g
Radium-226	0.231	+/- 0.800	1.031	UV	pCi/g	0.109	+/- 1.09	1.199	UV	pCi/g	**1.3526**	0.780	+/- 1.08	-0.30	UV	pCi/g	4.76	+/- 2.02	2.74	V	pCi/g
Lead-210	-0.270	+/- 1.54	1.27	UV	pCi/g	1.53	+/- 1.43	2.96	UV	pCi/g	**4.505**	0.877	+/- 1.35	-0.473	UV	pCi/g	4.05	+/- 2.67	1.38	V	pCi/g
Lead-214	0.45	+/- 0.125	0.575	V	pCi/g	0.353	+/- 0.113	0.466	V	pCi/g	**0.6747**	0.451	+/- 0.150	0.301	V	pCi/g	0.690	+/- 0.200	0.49	V	pCi/g
Reference 42	p. 13-14					p. 17-18						p. 12, 13					p. 16				

Yellow Highlight signifies that Adjusted Result is above the Upper Limit Value (>1.5 pCi/g).
RED font signfies that adjusted concentration exceeds 2x the Standard Deviation of the Adjusted Site Specific Mean.
V = Verified by Certified Health Physicist
UV = Indicated the analyte was analyzed for but not detected and verified by a Certified Health Physicist
pCi/g = picocurie per gram

DCN: 2222-2A-BJMQ

P:\SAT2\2013 NY RAD Sites\Canadian_Radium_Uranium\MXD\15154_CRU_Sed_Results.mxd



SCALE:
150 75 0 150
Graphic Scale In Feet

PROJECT:
Canadian Radium & Uranium Corp.

CLIENT NAME:
EPA

TITLE:
Sample Location and Data Results Map
Canadian Radium & Uranium Corp.
103/105 Kisco Avenue
Mount Kisco, NY 10549

DRAWING NUMBER: 15154

FIGURE #: 5

DRAWN BY: J. Lynes

REVIEWED BY: D. Breen

PROJECT MANAGER: D. Breen

SCALE: 1" = 150'

DATE: June 2014

N W E S

WESTON SOLUTIONS, INC.
205 CAMPUS DRIVE
EDISON, NEW JERSEY 08837
732-417-5800 • FAX: 732-417-5801

The Trusted Integrator for Sustainable Solutions

May 21, 2014

Mr. Andrew Fessler, Work Assignment Manager
U.S. Environmental Protection Agency
290 Broadway - 18th Floor
New York, NY 10007-1866

Document Control No.: 2222-2A-BLXP

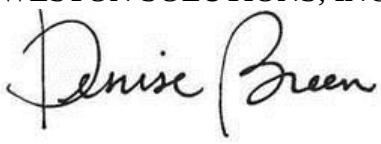
Subject: **Sampling Trip Report – Sediment Sampling**
Work Assignment No. 2222, Canadian Radium & Uranium Corp. Site Reassessment
Contract No.: EP-S5-06-04, TDD No.: S05-0013-1307-009

Dear Mr. Fessler:

Weston Solutions, Inc. (WESTON®) is pleased to submit the Sampling Trip Report for the sediment sampling associated with the Canadian Radium & Uranium Corp. Site. WESTON personnel collected sediment samples from locations along the surface water pathway on May 15, 2014. If you have any questions, please contact me at (732) 417-5814.

Very truly yours,

WESTON SOLUTIONS, INC.



Denise Breen
Assistant Project Scientist

enclosure

cc:
C. Romano, EPA (w/o enclosure)
G. Gilliland, WESTON (w/o enclosure)
Site file

I:\WO\START3\2222\46995

SAMPLING TRIP REPORT – SEDIMENT SAMPLING

SITE NAME: Canadian Radium & Uranium Corp. (CRU)
DCN: 2222-2A-BLXP
W.O.: 20405.012.013.2222.00
CLP Case No.: Not applicable

EPA I.D. NO.: N/A

SAMPLING DATES: May 15, 2014

1. Site Location: Refer to Figure 1

2. Site Map: Refer to Figure 2

2. Sample Locations: Refer to Figure 3

4. Laboratories Receiving Samples:

Analyses	Name and Address of Laboratory
Isotopic Uranium (IsoU), Isotopic Thorium (IsoTh), Radium-226, Radium-228 by alpha spectroscopy, radioisotopes by gamma spectroscopy, Target Analyte List (TAL) Inorganics (including mercury)	TestAmerica Inc. 13715 Rider North Trail Earth City, MO 63045
Stable isotopic lead	Materials and Chemistry Laboratory, Inc. 2010 Tennessee 58 Scenic Oak Ridge, TN 37830

5. Sample Dispatch Data:

- Six sediment samples and one aqueous rinsate blank for IsoU, IsoTh, Radium-226, and Radium-228 by alpha spectroscopy, and radioisotopes by gamma spectroscopy, TAL Inorganics (including mercury) analysis, and stable isotopic lead were collected on 5/15/2014 and shipped to the TestAmerica laboratory on 5/15/2014 under Federal Express Airbill No. 803786477258.

6. Sampling Personnel:

Name	Organization	Site Duties
Denise Breen	WESTON	Field Team Leader**,** Sample Management Officer (SMO), Sampler, Site Health and Safety Coordinator (SHSC)
Jeffrey Lynes	WESTON	Sampler, Global Positioning System (GPS) Data Collection

7. Additional Comments:

On May 15, 2014, WESTON personnel collected sediment samples as part of the Site Reassessment sampling event for the CRU site. A total of six sediment samples (including one environmental duplicate sample) were collected from five locations along the surface water pathway of the CRU site.

Sediment samples were collected from depositional locations using hand augers. The sediment was homogenized in dedicated, disposable aluminum trays with disposable polyethylene scoops prior to insertion into the sample containers. Potential release samples were collected near the outfall (i.e., at the probable point of entry [PPE]), downstream of the outfall within the perennial drainage ditch, and from Kisco River Tributary 8 at the confluence with the perennial drainage ditch. One background location was collected upstream from the PPE and another background location was collected from the tributary upstream of the confluence with the perennial drainage ditch. One sediment sample was designated as a matrix spike/matrix spike duplicate (MS/MSD) sample for quality assurance/quality control (QA/QC) purposes. One rinsate blank was collected to demonstrate adequate decontamination of non-dedicated sampling equipment (i.e., hand auger bucket).

The sediment samples were designated to be analyzed by TestAmerica laboratory for TAL metals analysis; IsoTh, IsoU, Radium-226, and Radium-228 by alpha spectroscopy; and radioisotopes by gamma spectroscopy. The sediment samples were also designated to be analyzed by Materials and Chemistry Laboratory, Inc. (MCL) for stable isotopic lead analysis.

WESTON logged sediment sample locations electronically using GPS equipment and performed post-processing differential correction of the GPS data in accordance with EPA Region 2 GPS Standard Operating Procedures. The processed GPS data for all samples has been transferred to the Sample Location Map (Figure 3) using Geographic Information Systems (GIS).

All samples were collected from locations associated with the former CRU site under the Region V Superfund Technical Assessment and Response Team III (START III) contract. All samples were shipped via Federal Express to the TestAmerica laboratory for analysis; the samples designated for stable isotopic lead analysis were then forwarded by TestAmerica to MCL for

analysis. The Chain-of-Custody Records and Federal Express Airbill are presented in Attachment 1.

8. Report Prepared by: Date: 5/21/2014
Denise Breen

9. Report Approved by: Date: 5/21/2014
Gerald V. Gilliland, P.G.

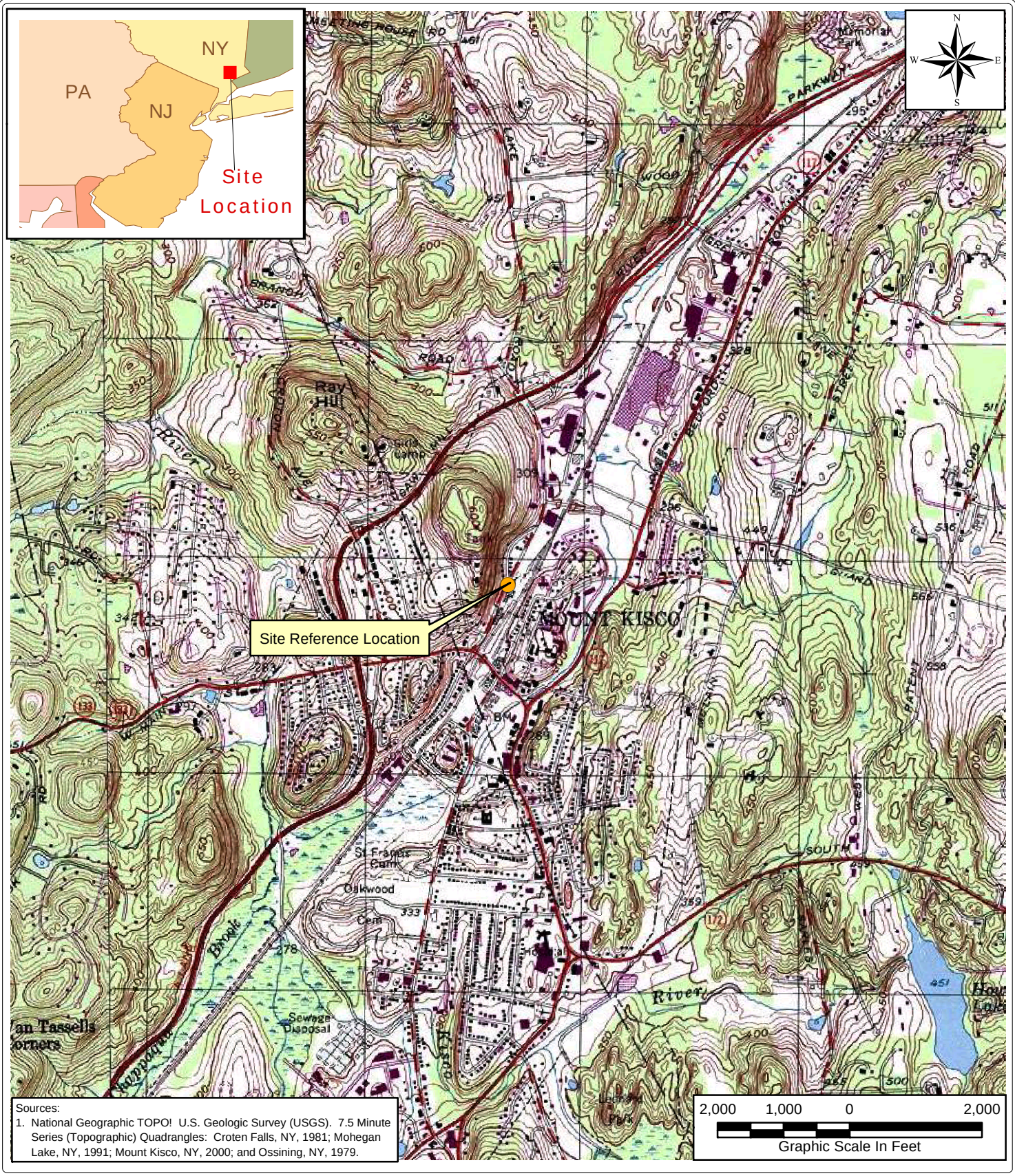
TABLE 1
SAMPLE DESCRIPTIONS – SEDIMENT SAMPLING
CANADIAN RADIUM & URANIUM CORP.
THE VILLAGE OF MOUNT KISCO, NEW YORK

Sample No.	Date	Time	Comments
2222-SD01 **(MS/MSD)**	5/15/2014	08:25	Sediment sample collected from SD01 located in Tributary 8 downstream of the Probable Point of Entry (PPE). Depth: 0–6 inches. Matrix Spike/Matric Spike Duplicate (MS/MSD) for Quality Assurance/Quality Control (QA/QC) purposes.
2222-SD02	5/15/2014	09:45	Sediment sample collected from SD02, located within Tributary 8 upstream of SD02. Depth: 0–6 inches.
2222-SD03	5/15/2014	08:50	Sediment sample collected from SD03, located in the perennial drainage ditch downstream of the PPE. Depth: 0–6 inches.
2222-SD04	5/15/2014	09:05	Sediment sample collected from SD04, located at the PPE. Depth: 0–6 inches.
2222-SD05	5/15/2014	09:15	Sediment sample collected from SD05, located in the drainage ditch upstream of the PPE. Depth: 0–6 inches.
2222-SD06	5/15/2014	08:45	Duplicate of 2222-SD03.
2222-RIN01	5/15/2014	08:10	Rinsate blank sample collected from the decontaminated hand auger bucket.

FIGURE 1 – SITE LOCATION MAP

FIGURE 2 – SITE MAP

FIGURE 3 – SAMPLE LOCATION MAP



Sources:
1. National Geographic TOPO! U.S. Geologic Survey (USGS). 7.5 Minute Series (Topographic) Quadrangles: Croton Falls, NY, 1981; Mohegan Lake, NY, 1991; Mount Kisco, NY, 2000; and Ossining, NY, 1979.

LEGEND:

Site Reference Location

TITLE:

Facility Location Map
Canadian Radium & Uranium Corp.
105 Kisco Avenue
Mount Kisco, NY 10549

PROJECT:
Canadian Radium & Uranium Corp.

CLIENT NAME:
EPA

WESTON SOLUTIONS

DATE:
May 2014

FIGURE #:
1

P:\SAT2\2013 NY RAD Sites\Canadian_Radium_Uranium\MXD\15111_CRU_TR2_Site.mxd

Sources:
1. NYS Division of Homeland Security and Emergency Services - Office of Cyber Security. Niagara County 12 Inch Ortho (4bd). http://www.orthos.dhses.ny.gov/?id=974130. November 2011.
2. NYS Division of Homeland Security and Emergency Services - Office of Cyber Security. Erie County 12 Inch Ortho (4bd). http://www.orthos.dhses.ny.gov/?id=974130. November 2011.

LEGEND:

Approximate Footprint of the Former Canadian Radium & Uranium Corp. Property

PROJECT:
Canadian Radium & Uranium Corp.

TITLE:

Site Map
Canadian Radium & Uranium Corp.
105 Kisco Avenue
Mount Kisco, NY 10549

CLIENT NAME:
EPA

WESTON SOLUTIONS

DATE:
May 2014

FIGURE #:
2

P:\SAT2\2013 NY RAD Sites\Canadian_Radium_Uranium\MXD\15112_CRU_TR2_Aerial.mxd

P:\SAT2\2013 NY RAD Sites\Canadian_Radium_Uranium\MXD\15083_CRU_TR_Sed_Sample_Loc.mxd

SCALE:
150 75 0 150
Graphic Scale In Feet

TITLE:
Sediment Sample Location Map
Canadian Radium & Uranium Corp.
103/105 Kisco Avenue
Mount Kisco, NY 10549

DRAWN BY: J. Lynes
REVIEWED BY: D. Breen
PROJECT MANAGER: D. Breen
SCALE: 1" = 150'
DATE: May 2014

N W E S

PROJECT: Canadian Radium & Uranium Corp.

CLIENT NAME: EPA

WESTON SOLUTIONS

DRAWING NUMBER: 15083

FIGURE #: 3

ATTACHMENT 1

CHAIN OF CUSTODY RECORDS and AIRBILL

USEPA CLP COC (LAB COPY)

DateShipped: 05/15/14

CarrierName: FedEx

AirbillNo: 803786477258

CHAIN OF CUSTODY RECORD

Case #:

Cooler #: 1

No: 2-051514-121625-0003

Lab: TestAmerica Inc.

Lab Contact: Erika Gish

Lab Phone: 314-298-8566

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
2222- SD01		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD01	05/15/2014 08:25	
2222-SD02		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD02	05/15/2014 09:45	
2222-SD03		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD03	05/15/2014 08:50	
2222-SD04		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD04	05/15/2014 09:05	

Sample(s) to be used for Lab QC: 2222- SD01 Tag A, 2222- SD01 Tag B, 2222- SD01 Tag C, 2222- SD01 Tag D - Special Instructions: 10-day TAT

Sample 2222-SD01 MS/MSD

Shipment for Case Complete? N

Samples Transferred From Chain of Custody #

Analysis Key

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
Sampling	Denise Breen (Weston)	5/15/14 13:00	FedEx		

USEPA CLP COC (LAB COPY)

DateShipped: 05/15/14
CarrierName: FedEx
AirbillNo: 803786477258

CHAIN OF CUSTODY RECORD

Case #:
Cooler #: 1

No: 2-051514-121625-0003

Lab: TestAmerica Inc.
Lab Contact: Erika Gish
Lab Phone: 314-298-8566

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
2222-SD05		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD05	05/15/2014 09:15	
2222-SD06		Sediment/ Weston	Grab	Stable Isotopic Lead, TAL Metals + Hg, Radioisotopes by gamma spec, Iso Th and Iso U by alpha spec	A (4 C), B (4 C), C (4 C), D (4 C) (4)	SD06	05/15/2014 08:45	

Special Instructions: 10-day TAT
Sample 2222-SD01 MS/MSD

Shipment for Case Complete? N

Samples Transferred From Chain of Custody #

Analysis Key

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
Sampling	Denise Green (Weston)	5/15/14 13:00	FedEx		

USEPA CLP COC (LAB COPY)

DateShipped: 05/15/14
CarrierName: FedEx
AirbillNo: 803786477258

CHAIN OF CUSTODY RECORD

Case #:
Cooler #: 2

No: 2-051514-122735-0004

Lab: TestAmerica Inc.
Lab Contact: Erika Gish
Lab Phone: 314-298-8566

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
2222-RIN-01		Water/ Weston	Grab	TAL Metals + Hg, Ra 228, Stable Isotopic Lead, Radioisotopes by Gamma spectroscopy, Iso U, Iso Th, Total Alpha Radium	A (HNO3 pH<2), B (HNO3 pH<2), C (HNO3 pH<2), D (HNO3 pH<2), E (HNO3 pH<2), F (HNO3 pH<2), G (HNO3 pH<2) (7)	Rinsate Blank	05/15/2014 08:10	

Sample(s) to be used for Lab QC: 2222-RIN-01 Tag A, 2222-RIN-01 Tag B, 2222-RIN-01 Tag C, 2222-RIN-01 Tag D, 2222-RIN-01 Tag E, 2222-RIN-01 Tag F, 2222-RIN-01 Tag G

Shipment for Case Complete? N

Samples Transferred From Chain of Custody #

Analysis Key

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
Sampling	Denise Breen (Weston)	5/15/14 13:00	FedEx		

Fe x. press **NEW** Package US Airbill

FedEx Tracking Number 8037 8647 7258

Form ID No. 0200

Sender's Copy

1 From Pl. print and press hard.

Date 5/15/2014 Sender's FedEx Account Number SENDER'S FEDEX ACCOUNT NUMBER ONLY

Sender's Name Denise Breen Phone (732) 417-5814

Company Weston Solutions, Inc.

Address 205 Campus Drive Dept./Floor/Suite/Room

City Edison State NJ ZIP 08837

2 Your Internal Billing Reference OPTIONAL
First 24 characters will appear on invoice.

3 To

Recipient's Name Erika Gish Phone (314) 298-8566

Company TestAmerica, Inc.

Address 13715 Rider North Trail Dept./Floor/Suite/Room
We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address
Use this line for the HOLD location address or for continuation of your shipping address.

City Earth City State MO ZIP 63045

☐ HOLD Weekday FedEx location address REQUIRED. NOT available for FedEx First Overnight.

☐ HOLD Saturday FedEx location address REQUIRED. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

4 Express Package Service * To most locations.
NOTE: Service order has changed. Please select carefully.

Packages up to 150 lbs.
For packages over 150 lbs., use the new FedEx Express Freight US Airbill.

Next Business Day

☑ FedEx First Overnight
Earliest next business morning delivery to select locations. Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Priority Overnight
Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Standard Overnight
Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days

☐ FedEx 2Day A.M.
Second business morning.* Saturday Delivery NOT available.

☐ FedEx 2Day
Second business afternoon.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Express Saver
Third business day.* Saturday Delivery NOT available.

5 Packaging * Declared value limit $500.

☐ FedEx Envelope* ☐ FedEx Pak* ☐ FedEx Box ☐ FedEx Tube ☑ Other

6 Special Handling and Delivery Signature Options

☐ SATURDAY Delivery
NOT available for FedEx Standard Overnight, FedEx 2Day A.M., or FedEx Express Saver.

☐ No Signature Required
Package may be left without obtaining a signature for delivery.

☐ Direct Signature
Someone at recipient's address may sign for delivery. *Fee applies.*

☐ Indirect Signature
If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. *Fee applies.*

Does this shipment contain dangerous goods?
One box must be checked.

☑ No ☐ Yes As per attached Shipper's Declaration. ☐ Yes Shipper's Declaration not required. ☐ Dry Ice Dry Ice, 9, UN 1845 ____ x ____ kg

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

☐ Cargo Aircraft Only

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

☐ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check

FedEx Acct. No. or Credit Card No. Exp. Date

Total Packages	Total Weight	Total Declared Value†
2	____ lbs.	$ ____ .00

†Our liability is limited to US$100 unless you declare a higher value. See back for details. By using this Airbill you agree to the service conditions on the back of this Airbill and in the current FedEx Service Guide, including terms that limit our liability.

644

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PULL AND RETAIN THIS COPY BEFORE AFFIXING TO THE PACKAGE. NO POUCH NEEDED.

Easy new Peel-and-Stick airbill. No pouch needed.
Apply airbill directly to your package. See directions on back.

PROJECT NOTE WESTON SOLUTIONS, INC.

To: Canadian Radium & Uranium Corp. Site File

Date: June 5, 2014

W.O. No.: 20405.012.013.2222.00

From: Denise Breen, Weston Solutions, Inc.

Subject: Determination of Significant Lead Concentrations in Sediment Samples

References

1. New York State Department of Environmental Conservation. Technical Guidance for Screening Contaminated Sediments. March 1998. [45 pages]
2. U.S. Environmental Protection Agency (EPA) Office of Emergency Response. Establishing an Observed Release – Quick Reference Fact Sheet. Federal Register, Volume 55, No. 241. September 1995. [7 pages]
3. International Union of Pure and Applied Chemistry, Inorganic Chemistry Division Commission on Atomic Weights and Isotopic Abundances. Atomic Weights of Elements: Review 2000. 2003. [120 pages]

WESTON personnel collected six sediment samples (including one environmental duplicate sample) from five locations along the surface water pathway of the Canadian Radium & Uranium Corp. (CRU) site in May 2014. The sediment samples were analyzed for Target Analyte List (TAL) Metals and Stable Lead Isotopes.

1. TAL Lead Interpretation:

In order to quantify the significance for Lead, Thallium and Mercury the following was performed:

1. WESTON personnel tabulated all available TAL Metal data from the May 2014 Sediment Sampling event.
2. For each analyte of concern (Lead, Thallium, and Mercury), the highest background concentration was selected and then multiplied by three. This is the criteria to find the significance of site attributable release as per Hazard Ranking System guidelines.
3. One analytical lead result (2222-SD04) of 520 mg/kg (J) was qualified with an unknown bias. In accordance with US EPA document "Using Data to Document an Observed Release and Observed Contamination", 2222-SD03 lead concentration was adjusted by dividing by the factor value for lead of 1.44 to equal 361 mg/kg.
4. Additionally, each lead result was then compared to the New York State Department of Environmental Conservation's (NYSDEC) technical guidance for Screening Contaminated Sediments criteria of 110 ppm for severe effect level.

WESTON personnel concluded that there are three release samples (2222-SD04, -SD03, and -SD06) which meet the HRS guideline criteria as an observed release of lead. Additionally, four

release sample locations (2222-SD04, -SD03, -SD06, and -SD01) meet NYSDEC technical guidance for screening contaminated sediments criteria.

There were no elevated concentrations of thallium or mercury which exceeded 3x the highest background concentrations within the May 2014 sediment sampling event.

Complete validated analytical data, adjusted concentration for 2222-SD04 lead analyte, and significant analytical results, established in accordance with the aforementioned criteria, can be found on Table 1 of this Project Note.

2. Isotopic Lead Interpretation:

In order to quantify the significance of the stable lead isotope analyses of Pb-204, Pb-206, Pb-207, and Pb-208, following was considered the relationship between mass percentages between all four lead analyses (Pb-204, Pb-206, Pb-207, and Pb-208) and the comparison to the numbers of natural abundance.

Average natural abundance according to International Union of Pure and Applied Chemistry (IUPAC):
204 – 1.4%
206 – 24.1%
207 – 22.1%
208 – 52.4%

For the sediment samples, all of the samples are slightly elevated (approximately 1.25% - 1.75%) for Pb-206 above the average natural abundance and slightly depressed for Pb-204, Pb-207, and Pb-208. This might suggest that the parent material is richer than average in U-238/Ra-226. However, this is the case for all samples, including background samples. The highest percentage of Pb-206 is from sample location 2222-SD05, which is closest to the site. This anomaly may be due to the closer proximity to the site, even though it is located upstream of the probable point of entry (PPE). This might indicate greater relative impact to this "background" location, but the numbers show greater absolute impact at the PPE and at 2222-SD03 (i.e., more discharge through the storm sewers and ditch than overland runoff across/under the RR tracks).

Complete analytical data can be found on Table 2 of this Project Note.

The stable lead isotope concentrations and mass percentages along with the TAL lead concentrations support the conclusion that there is an observed release to the perennial drainage ditch that is at least partially attributable to the site.

Denise Breen
Assistant Project Scientist

Canadian Radium Uranium Corp. site - May 2014

Table 1. Complete TAL Metal Results for Sediment Samples

Location ID	2222-SD02 (Background)				2222-SD05 (Background)				2222-SD01				2222-SD03				2222-SD06 (Duplicate of -SD03)				2222-SD04				Maximum Background	3x the Maximum Background
	Result	Qualifier	Report Limit	Unit	Result	Qualifier	Report Limit	Unit	Result	Qualifier	Report Limit	Unit	Result	Qualifier	Report Limit	Unit	Result	Qualifier	Report Limit	Unit	Result	Qualifier	Report Limit	Unit		
Aluminum	5000		240	mg/kg	4200		260	mg/kg	10000		270	mg/kg	11000		350	mg/kg	10000		310	mg/kg	9100	J	690	mg/kg	5000	15000
Antimony	3.7	UJ	12	mg/kg	4	UJ	13	mg/kg	4.1	UJ	13	mg/kg	5.7	J	18	mg/kg	5.3	J	15	mg/kg	11	UJ	35	mg/kg	4	12
Arsenic	2.8	U	12	mg/kg	3.1	U	13	mg/kg	4.2	J	13	mg/kg	5.7	J	18	mg/kg	5.6	J	15	mg/kg	26	J	35	mg/kg	3.1	9.3
Barium	41	J	60	mg/kg	16	J	65	mg/kg	150	J	66	mg/kg	100	J	89	mg/kg	99	J	77	mg/kg	100	J	170	mg/kg	41	123
Beryllium	0.89	U	6	mg/kg	0.97	U	6.5	mg/kg	1	U	6.6	mg/kg	1.3	U	8.9	mg/kg	1.2	U	7.7	mg/kg	2.6	UJ	17	mg/kg	0.97	2.91
Cadmium	0.4	U	6	mg/kg	0.44	U	6.5	mg/kg	0.8	U	6.6	mg/kg	1.2	J	8.9	mg/kg	2	J	7.7	mg/kg	3.5	J	17	mg/kg	0.44	1.32
Calcium	26000		3000	mg/kg	16000		3200	mg/kg	5200		3300	mg/kg	17000	J	4400	mg/kg	29000	J	3900	mg/kg	17000	J	8600	mg/kg	26000	78000
Chromium	26		12	mg/kg	18		13	mg/kg	44		13	mg/kg	610		18	mg/kg	510		15	mg/kg	70	J	35	mg/kg	26	78
Cobalt	8.3	J	60	mg/kg	9	J	65	mg/kg	10	J	66	mg/kg	16	J	89	mg/kg	18	J	77	mg/kg	19	J	170	mg/kg	9	27
Copper	42		30	mg/kg	38		32	mg/kg	41		33	mg/kg	140		44	mg/kg	180		39	mg/kg	210	J	86	mg/kg	42	126
Iron	12000		120	mg/kg	15000		130	mg/kg	16000		130	mg/kg	23000		180	mg/kg	22000		150	mg/kg	28000	J	350	mg/kg	15000	45000
Lead	71		12	mg/kg	42		13	mg/kg	120		13	mg/kg	290		18	mg/kg	390		15	mg/kg	520*	J*	35	mg/kg	71	213
Magnesium	10000		1200	mg/kg	6500		1300	mg/kg	5000		1300	mg/kg	7900		1800	mg/kg	8500		1500	mg/kg	7000	J	3500	mg/kg	10000	30000
Manganese	150		12	mg/kg	130		13	mg/kg	220		13	mg/kg	300		18	mg/kg	260		15	mg/kg	320	J	35	mg/kg	150	450
Nickel	16	J	48	mg/kg	17	J	52	mg/kg	20	J	53	mg/kg	40	J	71	mg/kg	38	J	62	mg/kg	58	J	140	mg/kg	17	51
Potassium	1000	J	6000	mg/kg	940	U	6500	mg/kg	1100	J	6600	mg/kg	1800	J	8900	mg/kg	1600	J	7700	mg/kg	2500	UJ	17000	mg/kg	1000	3000
Selenium	2.5	U	18	mg/kg	2.7	U	19	mg/kg	2.7	U	20	mg/kg	3.7	U	27	mg/kg	3.2	U	23	mg/kg	7.1	UJ	52	mg/kg	2.7	8.1
Silver	0.83	U	12	mg/kg	0.91	U	13	mg/kg	0.93	U	13	mg/kg	1.2	U	18	mg/kg	1.1	U	15	mg/kg	2.4	UJ	35	mg/kg	0.91	2.73
Sodium	140	J	1200	mg/kg	110	J	1300	mg/kg	150	J	1300	mg/kg	180	J	1800	mg/kg	170	J	1500	mg/kg	900	J	3500	mg/kg	140	420
Thallium	2.3	U	24	mg/kg	2.5	U	26	mg/kg	2.5	U	27	mg/kg	3.4	U	35	mg/kg	2.9	U	31	mg/kg	6.6	UJ	69	mg/kg	2.5	7.5
Vanadium	14	J	60	mg/kg	13	J	65	mg/kg	24	J	66	mg/kg	33	J	89	mg/kg	31	J	77	mg/kg	23	J	170	mg/kg	14	42
Zinc	140		60	mg/kg	130		65	mg/kg	170		66	mg/kg	430		89	mg/kg	550		77	mg/kg	760	J	170	mg/kg	140	420
Mercury	0.043	J	0.05	mg/kg	0.11		0.038	mg/kg	0.097		0.041	mg/kg	0.18		0.061	mg/kg	0.24		0.056	mg/kg	0.045	J	0.1	mg/kg	0.11	0.33
Reference 42	p. 13				p. 17				p. 12				p. 14				p. 18				pp. 15-16					

U = The substance or analyte was analyzed for, but no quantifiable concentration was found at or above the CRQL.

UJ = The analyte was not quantifiable at or above the CRQL.

J = The analyte was positively identified-the associated numerical value is the approximate concentration of the analyte in the sample.

J* = In accordance with US EPA document "Using Qualified Data to Document an Observed Release and Observed Contamination", the analytical result of 520 mg/kg J (qualified with an unknown bias) is adjusted by dividing by the factor value for lead of 1.44 to equal 361 mg/kg.

Canadian Radium Uranium Corp. site - May 2014

Table 2. Complete Isotopic Lead Results for Sediment Samples

Location ID	2222-SD02 (Background)				2222-SD05 (Background)				2222-SD01				2222-SD03				2222-SD06 (Duplicate of -SD03)				2222-SD04			
	Result	Unit	Result	Mass %	Result	Unit	Result	Mass %	Result	Unit	Result	Mass %	Result	Unit	Result	Mass %	Result	Unit	Result	Mass %	Result	Unit	Result	Mass %
Lead-204	4.0006	µg/L	1.3308	%	2.7705	µg/L	1.3175	%	8.2858	µg/L	1.3223	%	7.1488	µg/L	1.3372	%	6.2411	µg/L	1.3321	%	6.8489	µg/L	1.3273	%
Lead-206	76.2335	µg/L	25.3594	%	53.0113	µg/L	25.8765	%	159.6354	µg/L	25.4754	%	135.8966	µg/L	25.4202	%	122.5789	µg/L	25.3774	%	130.48	µg/L	25.3967	%
Lead-207	64.829	µg/L	21.5656	%	44.8521	µg/L	21.2824	%	133.8361	µg/L	21.3582	%	115.229	µg/L	21.5542	%	100.8166	µg/L	21.4585	%	110.331	µg/L	21.4878	%
Lead-208	155.5495	µg/L	51.7442	%	108.099	µg/L	51.5236	%	324.8689	µg/L	51.8441	%	276.326	µg/L	51.6883	%	244.0714	µg/L	51.8321	%	266.499	µg/L	51.7882	%

United States
Environmental Protection
Agency

Solid Waste and
Emergency Response

EPA 540-F-94-028
OSWER 9285.7-14FS
PB94-963311
November 1996

Using Qualified Data to Document an Observed Release and Observed Contamination

Office of Emergency and Remedial Response (5204G)

Quick Reference Fact Sheet

This fact sheet discusses the use of the U.S. Environmental Protection Agency's (EPA) Contract Laboratory Program (CLP) data and other sources of data qualified with a "J", "U", or "UJ" qualified or flag. This guidance provides a management decision tool for the optional use of qualified data to document all observed release and observed contamination by chemical analysis under EPA's Hazard Ranking System (HRS). The analyte and sample matrix (i.e., soil or water) specific adjustment factors given in this fact sheet allow biased CLP and non-CLP data to be adjusted to meet the HRS criteria documenting an observed release and observed contamination with data that are of known and documented quality. This fact sheet does not address using qualified data for identifying hazardous substances in a source.

INTRODUCTION

The EPA established the HRS to rank hazardous waste sites for National Priorities List (NPL) purposes under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 **(SARA).** This fact sheet was developed in response to a need to determine the usability of qualified data for site assessment and HRS scoring purposes. This fact sheet illustrates that qualified data are often of sufficiently known and documented quality, and may be used in establishing an observed release and observed contamination. This fact sheet explains rationale for why some qualified data may be used for HRS purposes; presents the background information needed to use qualified data, with and without adjustment factors; provides examples of qualified data use, and discusses issues raised during the development of the adjustment factor approach.

Under the HRS, chemical analytical data we are often used to demonstrate an observed release and observed contamination when the release sample concentration is three times the background concentration and background levels are greater than or equal to the appropriate detection limit; or if the release sample concentration is greater than or equal to the appropriate quantitation limit when background levels are below the appropriate detection limit. The release must also be at least partially attributable to the site under investigation *(Hazard Ranking System, Final Rule, 40* CFR Part 300, App. A). The data used to establish the release must be of known and documented quality. *(Hazard Ranking System Guidance Manual,* Interim Final, November 1992, OSWER Directive 9345.1-07). Data that cannot be validated may not be of known and documented quality. For more information on observed release and observed contamination, refer to the fact sheets: *Establishing an Observed Release,* September 1995, PB94-963314; *Establishing Areas of Observed Contamination.* September 1995, PB94-963312; and *Establishing Background Levels,* September 1995, PB94–963313. The factor of three represents the minimum difference in sample results that demonstrate an increase in contaminant concentration above background levels, with reasonable confidence.

Although much of the analytical data used for identifying an observed release is generated under EPA's CLP, this fact sheet applies to all data regardless of the source of the data (non-CLP data). EPA procedures require that

CLP analytical data be reviewed, or validated by EPA or third party reviewers, to ensure the data are of known and documented quality and that the determination be discussed in a data validation report that accompanies the analytical results. Based on this data validation, CLP data are classified into three categories: (1) data for which all quality control (QC) requirements have passed contract required acceptance criteria, (2) data for which at least one QC requirement has not met acceptance criteria; and (3) data for which most or all QC requirements have not met acceptance criteria. Data in the first category typically are not qualified. Data in the second category are often qualified with a "J" qualifier and, as discussed in this fact sheet, are usually usable for HRS purposes. Data in the third category are usually qualified by an "R" qualifier and are not usable for HRS purposes.

Whether data are placed into the second or third category is determined by the amount of bias associated with. the analytical results. Data validation evaluates biases resulting from laboratory analytical deficiencies or sample matrices to determine whether the data are usable. Bias indicates that the reported concentration is either higher or lower than the am concentration, and the data validation report identifies the direction of the bias or if the bias is unknown.

The EPA CLP also sets minimum quantitation limits for all analytes; the Contract Required Quantitation Limit (CRQL) for organic analytes and the Contract Required Detection Limit (CRDL) for inorganic analytes. For HRS purposes and for this fact sheet, the term CRQL refers to both the contract required quantitation limit and am contract required detection limit. (40 CFR Part 300, App. A). The CRQLs are substance specific levels that a CLP laboratory must be able to routinely and reliably detection specific sample matrices (i.e.; soil, water. sediment). The CRQLs are usually set above most instrument detection limits (IDLs) and method detection limits (MDLs).

CONSIDERATIONS FOR NON-CLP DATA

Because various laboratories and analytical methods may be used to develop non-CLP data, the following list provides the general information, sufficient for determining whether non-CLP data are usable for HRS Purposes.

(1) Identification of the method used for analysis. Methods include RCRA methods, SW-846, EPA methods, etc.

(2) Quality control (QC) data. Check each method of analysis to determine if specific QC requirements are defined. If not, seek out another method.

(3) Instrument-generated data sheets for sample results. These data sheets would be the equivalent of Form I's in CLP data.

(4) MDLs and sample quantitation limits (SQLs). The analytical method should provide the MDL. The SQL is an adjusted MDL using sample specific measurements such as percent moisture and weight.

(5) Data validation report.

USE OF BIASED QUALIFIED DATA

In the past, all qualified data have been inappropriately perceived by some people as data of low confidence or poor quality and have not been used for HRS evaluation. With careful assessment of the nature of the analytical biases or QC deficiencies in the data on a case-by-case basis, qualified data can represent an additional resource of data for establishing an observed release. Further, the D.C. District Court of Appeals in 1996 upheld EPA's case-by-case approach to assess data quality. In reviewing the use of qualified data to identify an observed release, the Court stated that if there are deficiencies in the data, "...the appropriate response is to review the deficiencies an a 'case-by-case basis' to determine their impact on 'usability of the data.'" The Court also stated with regards to data quality that, "...EPA does not face a standard of absolute perfection .... Rather, it is statutorily required to 'assure, to the maximum extent *feasible*,' that it 'accurately assesses the relative degree of risk' posed by sites" [*Board of Regents of the University of Washington, et al., v. EPA*, No.95-1324, slip op. at 8-10 (D.C. Cir. June 25, 1996).]

As discussed in this fact sheet, the application of adjustment factors to "J" qualified data can serve as a management decision tool to "adjust," or take into account, the analytical uncertainty in the data indicated by the qualifier, thereby making qualified data usable for HRS evaluation. The use of adjustment factors to account for the larger uncertainty in "J" qualified data is a conservative approach enabling a quantitative comparison of the data for use in documenting an observed release. It should be noted that the use of

adjustment factors only addresses analytical variability and does not take into account variabilities which may be introduced during field sampling. Some guidelines for using the adjustment factor approach are discussed in Exhibit 1.

CLP QA/QC PROCEDURES

CLP qualifiers are applied to analytical data based on the results of various Quality Assurance/Quality Control (QA/QC) procedures used at the laboratory. EPA analytical methods use a number of QA/QC mechanisms during sample analysis in order to assess qualitative and quantitative accuracy *(Contract Laboratory Program Statement of Work for Inorganic Analyses,* Document No. ILM02.0; *Contract Laboratory Program Statement of Work for Organic Analyses,* Document No. OLM1.8; *Quality Assurance/Quality Control Samples,* Environmental Response Team Quality Assurance Technical Information Bulletin; *Test Methods for Evaluating Solid Waste (SW-846): Physical and Chemical Methods,* Document No. SW-846). To assess data quality, the laboratory uses matrix spikes, matrix spike duplicates, laboratory control samples , surrogates, blanks, laboratory duplicates, and quarterly blind performance evaluation (PE) samples. The Agency assumes that if biases are found in the QA/QC samples, the field sample concentrations may also be biased.

Surrogates are chemically similar to the analytes of interest. They are added or "spiked" at a known concentration into the field samples before analysis. Also, selected target analytes are "spiked" into samples at a specified frequency to assess potential interferences from the sample matrix. These samples are called matrix spikes. Comparison of the known concentration of the surrogates and matnx spikes with their actual analytical results reflects the analytical accuracy. Because the surrogates are expected to behave similarly to the target analytes, they may indicate bias caused by interferences from the sample matrices. These type of interferences from the sample matrix are known as matrix effects *(CPL National Functional Guidelines for Inorganic Data Review,* Publication, 9240.1-05-01; *CLP National Functional Guidelines for Orgainic Data Review,* Publication 9240.1-05; *Test Methods for Evaluating Solid Waste (SW-846): Physical and Chemical Methods,* Document No. SW-846).

Laboratory control samples are zero blind samples which contain known concentrations of specific analytes and are analyzed in the same batch as field samples. Their results are used to measure laboratory accuracy. Blanks are analyzed to detect any extraneous contamination introduced either in the field or in the laboratory.

Laboratory duplicates are created when one sample undergoes two separate analyses. The duplicate results are compared to determine laboratory precision. Quarterly blind PE samples are single blind samples that evaluate the laboratory's capability of performing the specified analytical protocol.

CLP and other EPA analytical methods include specifications for acceptable analyte identification, target analytes, and minimum and maximum percent recovery of the QA/QC compounds. Data are validated according to guidelines which set performance criteria for instrument calibration, analyte identification, and identification and recovery of QA/QC compounds *(CLP Statement of Work and SW-846).* The *National Functional Guidelines for Data R*eview, EPA validation, was designed for the assessment of data generated under the CLP organic and inorganic analytical protocols *(CLP Statement of Work; National Functional Guidelines for Data Review).* The guidelines do not preclude the validation of field and other non CLP data. Thus, many EPA Regions have also adapted the *National Functional Guidelines for Data Review* to validate non-CLP data. Data which do not meet the guidelines' performance criteria are qualified to indicate bias or QA/QC deficiencies. The data validation report usually explains why the data were qualified and indicates the bias direction when it can be determined. Validated data that are not qualified are considered unbiased and can be used at their reported numerical value for HRS evaluation.

QUALIFIER DEFINITIONS

Most EPA validation guidelines use the data qualifiers presented in Exhibit 2 *(CLP National Functional Guidelines for Data Review).* Other qualifiers besides these may be used; the validation report should always be checked for the exact list of qualifiers and their meanings.

It should be emphasized that not meeting one or some of the contract required QA/QC acceptance criteria is often an indication that the sample was difficult to analyze, not that there is low confidence in the analysis (i.e., the

EXHIBIT 1 GUIDELINES FOR THE USE OF ADJUSTMENT FACTORS	
!	The use of adjustment factors identified in this fact sheet is a management tool for the optional use of "J" qualified data generated under CLP or other sources of data to document an observed release.
!	Adjustment qualified data should be used with non-qualified data whenever possible.
!	EPA maintains a "worst sites first" policy for placing sites on the NPL (*Additional Guidance on "Worst Sites" and "NPL Caliber Sites" to assist in SACM Implementation,* OSWER Directive 9320.2-07).
!	EPA Regions should use adjustment factors with discretion on a case-by-case basis and should always carefully consider the use of qualified data in borderline cases.
!	Resampling and/or reanalysis may be warranted if qualified data do not appear adequate to document an observed release.
!	EPA Regions may substitute higher adjustment factors based on documented, justifiable reasons but may never use a lower adjustment factor value.
!	The adjustment factors should only be applied to analytes listed in the tables. These adjustment factors should not be interpolated or extrapolated to develop factors for analytes not listed in the tables.
!	The adjustment factors apply only to "J" qualified data above the CRQL.
!	Detection below the CRQL is treated as non-quantifiable for HRS purposes.
!	"UJ" data may be used under strict circumstances as explained in this fact sheet.
!	The adjustment factors only apply to biased "J" qualified data, not to other "J" qualified data.
!	The adjustment factors do not apply to "N", "NJ", or "R" qualified data. These data can not be used to document an observed release for HRS purposes.

analysis is "under control" and can be adequate for HRS decision making). Often "J", "U", and "UJ" qualified data fall into this category.

There are instances when qualified data cannot be used since the uncertainty of the results is unknown. For example, violations of laboratory instrument calibration and tuning requirements, and gross violations of holding times reflect the possibility that the results are of unknown quality (i.e., the analysis is "out of control"). Most often these data would be qualified with an "R" or an "N" (not usable for HRS purposes).

USING "U" QUALIFIED DATA

The "U" qualifier simply means that the reported concentration of the analyte was at or below the CRQL-- there can be confidence that the true concentration is at or below the quantitation limit. Therefore, "U" qualified data can be used for establishing background levels. If the release sample concentration is above this level, as specified in the HRS, an observed release can be established. The quantitation limit for that analyte could be used as a maximum background concentration if a more conservative background level seems appropriate.

USING "J" QUALIFIED DATA

As discussed previously, some "J" qualified data can be used in establishing an observed release if the uncertainty in the reported values is documented. Qualified data should always be carefully examined by the Regions to determine the reasons for qualification before use in HRS evaluation. Resampling and/or reanalysis may be warranted if qualified data only marginally document an observed release. Whenever possible, qualified data should be used in conjunction with non-qualified data.

As described in Exhibit 2, "J" qualified data indicates that bias has been detected in the sample analysis and although the analyte is definitively present, the reported concentration is an estimate. Depending on the reasons and the direction of bias, with the use of adjustment factors, "J" qualified data can represent data of known and documented quality sufficient for use in establishing an observed release and observed contamination under the HRS.

USING "UJ" QUALIFIED DATA

A combination of the "U" and "J" qualifiers indicates that the reported value may not accurately represent the concentration necessary to positively detect the analyte in the sample. Under limited conditions, "UJ" qualified data can be used to represent background concentrations for establishing an observed release. These conditions are: instances when there is confidence that the background concentration is not detectable above the CRQL, the background concentration is biased high, and the sample measurement establishing the observed release equals or exceeds the CRQL.

DIRECTION OF BIAS IN "J" QUALIFIED DATA

It is important to understand the direction of bias associated with "J" qualified data before using the data to document an observed release. Qualified data may have high, low, or unknown bias. A low bias means that the reported concentration is likely an underestimate of the true concentration. For example, data may be biased low when sample holding times for volatile organic compounds (VOCs) are moderately exceeded or when recovery of QA/QC compounds is significantly less than the amount introduced into the sample. Low surrogate recovery would also indicate a low bias. A high bias means the reported concentration, is likely an overestimate of the true concentration. For example, data may be biased high when recovery of QA/QC compounds is significantly higher than the amount in the sample. A bias is unknown when it is impossible to ascertain whether the concentration is an overestimate or an underestimate. For example, an unknown bias could result when surrogate recoveries exceed method recovery criteria and matrix spike/matrix spike duplicate compounds below method recovery criteria fail the relative percent difference (RPD) criteria in the same sample.

Despite the bias, certain qualified data may be used without application of adjustment factors for determining an observed release under certain circumstances. The following examples are of using "J" qualified data without adjustment factors:

- Low bias release samples are likely to be underestimates of true concentrations. If the reported concentration of a low bias release sample is three times above unbiased background levels, these release samples would still meet the HRS criteria. The true concentrations would still be three times above the background level.

- High bias background samples are likely to be overestimates of true concentrations. If the reported concentration of unbiased release samples are three times above the reported background concentration, they would still meet the HRS observed release criteria because they would still be three times above the true background concentration.

The above examples show that both low bias "J" qualified release samples at their reported concentrations and high bias "J" qualified background samples may be used at their reported concentrations in these situations.

High bias release samples may not be used at their reported concentrations because they are an overestimate of true concentrations in this situation; resampling and/or re-analysis of the release samples should be considered. The true difference in the background and release concentration may be less than the HRS criteria for establishing an observed release. The reported concentration for low bias background concentrations may not be compared to release samples because it is most likely an underestimate of background level; the release sample concentration may not significantly exceed the true background concentration. However, in lieu of re-sampling and/or re-analysis, high bias release data and low bias background data may be used with adjustment factors which compensate for the probable uncertainty in the analyses.

ADJUSTMENT FACTORS FOR BIASED "J" QUALIFIED DATA

Applying adjustment factors to "J" qualified data will enable EPA to be more confident that the increase in contaminant concentrations between the background and

EXHIBIT 2 EPA CLP DATA QUALIFIERS AND THEIR USABILITY FOR DOCUMENTING AN OBSERVED RELEASE	
Usable*	**Not Usable**
"U" The substance or analyte was analyzed for, but no quantifiable concentration was found at or above the CRQL *(CLP National Functional Guidelines for Data Review).*	**"N"** The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification" *(CLP National Functional Guidelines for Data Review).*
"J" The analyte was positively identified-the associated numerical value is the approximate concentration of the analyte in the sample. The "J" qualifier indicates that one or more QA/QC requirements have not met contact required acceptance criteria but the instrumentation was functioning properly during the analysis. For example, a "J" qualifier may indicate that the sample was difficult to analyze or that the value may lay near the low end of the linear range of the instrument. "J" data are considered biased, but provide definitive analyte identification *(CLP National Functional Guidelines for Data Review).*	**"R"** The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte can not be verified and the result has been rejected. A sample result may be qualified with an "R" qualifier when the instrument did not remain "in control" or the stability or sensitivity of the instrument were not maintained during the analysis *(CLP National Functional Guidelines for Data Review).*
"UJ" The analyte was not quantifiable at or above the CRQL. In addition to not being quantifiable, one or more QA/QC requirements have not met contract acceptance criteria *(CLP Functional Guidelines for Data Review).*	**"NJ"** The analysis indicates the presence of the analyte that has een "tentatively identified" and the associated numerical value represents it's approximate concentration (CLP *National Functional Guidelines for Data Review).*

* Usable under certain circumstances as explained in this fact sheet.

release samples is due to a release. The adjustment factors are applied as "safety factors" to compensate for analytical uncertainty, allowing biased data to be used for determining an observed release. Dividing the high bias result by an adjustment factor deflates it from the high end of the acceptable range towards a low bias value. Multiplying a low bias concentration by an adjustment factor inflates it to the high end of the acceptable range.

Tables 1 through 4 (pages 11 - 18) present analyte and matrix-specific adjustment factors to address the analytical uncertainty when determining an observed release using high bias release samples and low bias background data. The factors am derived from percent recoveries of matrix spikes, surrogates, and laboratory control samples in the CLP Analytical. Results Database (CARD) from January 1991 to March 1996. A total of 32,447 samples were reviewed for volatile organic analytes; 32,913 samples for semivolatile organic analytes; 59,508 samples for pesticides/PCB analytes; and 5,954 samples for inorganic analytes.

The range of CARD data for each analyte includes 97 percent of all percent recoveries in the database, discarding outliers. The adjustment factors are ratios of percent recovery values at the 98.5 and 1.5 percentiles. The ratios generally show a consistent pattern.

Adjustment factors have been determined for all analytes in the CLP Target Compound List (organic analytes) and Target Analyte List (inorganic analytes). A tiered approach was used to derive the organic adjustment factors. Percent recoveries for surrogates were

examined first, followed by matrix spike recoveries. When both matrix spike and surrogate data were available for the same analyte, the larger adjustment factor (representing more extreme high and low percent recoveries) was used. Laboratory control samples were used to calculate the inorganic adjustment factors. Quarterly blind sample data were not used to determine adjustment factors because of the small data set available. A default adjustment factor of 10 was used for analytes when percent recovery data were unavailable.

Adjustment factors do not correct the biased sample concentration to its true value, as such "correction" is not possible. CARD data do not differentiate and quantify individual sources of variation. Instead, the ratio of percentile used to develop adjustment factors represent a "worst-case" scenario. Adjustment factors either inflate background values to the high end of the range or deflate release data to the low end. Therefore, adjustment factors compensate or adjust for the apparent analytical variability when comparing a high bias value to a low bias value (see Exhibit 3).

USING THE ADJUSTMENT FACTORS

This section of the fact sheet demonstrates how adjustment factors can be used with "J" qualified data for HRS scoring purposes, including documentation and detection limit issues.

Documentation Requirements for Using Qualified Data

In using "J" qualified data to determine an observed release, include a discussion of "J" qualifiers from the data validation report and cite it as a reference in the site assessment report or HRS documentation record. If adjustment factors are applied to "J" qualified data, reference and cite this fact sheet. These steps will ensure that the direction of bias is documented and will demonstrate how biases have been adjusted.

Detection Limit Restrictions

Adjustment factors may only be applied to "J" qualified data with concentrations above the CLP CRQL for organics or CRDL for inorganics. "J" qualified data with concentrations below the CRQL can not be used to document an observed release except as specified in the previous section entitled "Using "UJ" Qualified Data."

Application of Factors

Exhibit 3 shows how to apply the factors to "J" qualified data. Multiply low bias background sample results by the analyte-specific adjustment factor or the default factor 10 when analyte-specific adjustment factor is not available. The resulting new background value effective becomes a high bias value that may be used to determine an observed release. Divide high bias release sample data by the analyte-specific adjustment factor or the default factor of 10 when an analyte-specific adjustment factor is not available. The resulting new release sample value effectively becomes a low bias value that may be used to determine an observed release.

Note: High bias background data, low bias release data, and unbiased data may be used at their reported concentrations.

Note: Adjusted release and background values must still meet HRS criteria (e.g., release concentration must be at, least three times above background level) to determine an observed release.

Examples Using Trichloroethene in Soil and Water

1. *Release water sample is unbiased, background water sample is unbiased but all data are qualified with a "J" due to an contractual laboratory error no: analytical error.*

Background sample value: 12Fg/L (J) *no bias*
Release sample value: 40 Fg/L (J) *no bias*

The CRQL for trichloroethene is 10 Fg/Kg for soil and 10 Fg/L for water.

In this example, the qualification of the data is not related to bias in the reported concentrations. Thus, using adjustment factors is not needed and an observed release is established if all other criteria are met.

2. *Release soil sample data is biased low, background soil sample data is biased high.*

Background sample value: 12 Fg/Kg (J) high bias
Release sample value: 40 Fg/Kg (J) low bias

In this example, the direction of bias indicates that the. true release value may be higher and the true background value may be lower than reported values. The release sample concentration still exceeds background by more than three times, so an observed release is established, provided all other HRS criteria are met. Using adjustment factors is not needed.

EXHIBIT 3 USE OF ADJUSTMENT FACTORS FOR "J" QUALIFIED DATA		
Type of Sample	**Type of Bias**	**Action Required**
Background Sample	No Bias	None: Use concentration without factor
	Low Bias	Multiply concentration by factor
	High Bias	None: Use concentration without factor
	Unknown Bias	Multiply concentration by factor
Release Sample	No Bias	None: Use concentration without factor
	Low Bias	None: Use concentration without factor
	High Bias	Divide concentration by factor
	Unknown Bias	Divide concentration by factor

3. Release soil sample data is unbiased, background soil sample is biased low.

Background sample value: 12 Fg/Kg (J) *low bias*
Release sample value: 30 Fg/Kg *no bias*

In this example, the true background value is assumed to be less than the reported value; however, an observed release may still be possible. To use the data to establish an observed release, multiply the background sample data value by the adjustment factor given for trichloroethene in soil (2.11). No adjustment factor is needed for the release sample.

New background sample value:
(12 Fg/Kg) x (2.11) = 25.32 Fg/Kg (J) *high bias*

The release sample concentration does not meet or exceed the new background level by three time, so an observed release is not established.

4. Release water sample data is biased high, background water sample data is unbiased.

Background sample value: 15 Fg/L *no bias*
Release sample value: 70 Fg/L (J) *high bias*

In this example, the true release value may be lower than the reported value; however, an observed release may still be possible. To use the data to establish an observed release divide the release sample by the adjustment factor for trichloroethene in water (1.66). No adjustment factor is needed for the background sample.

New release sample value:
(70 Fg/L) ÷ (1.66) ~ 42.17 Fg/L (J) *low bias*

The new release sample concentration does not meet or exceed the background level by three times, so an observed release is not established.

5. Release soil sample data has unknown bias; background soil sample data has unknown bias.

The following example is the most conservative approach to using adjustment factors with qualified data.

Background sample value: 20 Fg/Kg (J) *unknown bias*
Release sample value: 325 Fg/Kg (J) *unknown bias*

In this example, it is not possible to determine from the reported values if an observed release is possible. To use the data to establish an observed release, divide the release sample value and multiply the background sample value by the adjustment factor given for trichloroethene in soil (2.11).

New release sample value:
(325 Fg/Kg) ÷ (2.11) = 154.03 Fg/Kg (J) *low bias*

New background sample value:
(20 Fg/Kg) x (2. 11) = 42.2 Fg/Kg (J) *high bias*

The new release sample is at least three times the new background concentration, so an observed release is established, provided all other HRS criteria are met.

ISSUES WITH USING ADJUSTMENT FACTOR APPROACH

Some issues were raised regarding the application of adjustment factors to qualified data during the Agency's internal review process.

One issue is that "J" qualifiers are added to analytical results for many reasons that may or may not affect the accuracy and precision of the analytical result. The application of an adjustment factor to "J" qualified data in which bias is not affected could be considered overly conservative.

All qualified data should be carefully evaluated to determine if the data are biased. Based on the reasons for bias, the use of an adjustment factor should only be considered as a management tool that provides a quick screening of the data for site assessment, not a means for correcting the biased value to a true value. Application of adjustment factors are intended for use with qualified data reported at or above the CRQL and may not be applicable to data which are qualified but technically sound. As stated previously, qualified data should always be carefully reviewed on a case-by-case basis prior to use in HRS evaluation.

Another issue is the validity of "10" as a default adjustment factor. A default adjustment factor of 10 was a policy decision based on the range of adjustment factors and an industry approach. The default was chosen in order to account for the maximum variability regardless of the direction of the bias. Therefore, the default value of 10 is generally considered to be a conservative adjustment factor. EPA reviewed the use of the default value of 10 and determined that this value was conservative.

Even if using adjustment factors is sometimes overly conservative, this approach is preferable to not using the data at all. EPA maintains a "worst sites first" policy that only the sites considered most harmful to human health and/or the environment should be listed. EPA considers the use of adjustment factors appropriate as a management decision tool. However, discretion is needed when applying adjustment factors. The use of adjustment factors may not be appropriate in all cases.

USE OF OTHER ADJUSTMENT FACTORS

EPA Regions may substitute higher, but never lower, adjustment factor values for the ones listed in this fact sheet on a case-by-case basis when technically justified. For example, other adjustment factors may be applied to conform with site-specific Data Quality Objectives (DQOs) or with Regional Standard Operating Procedures (SOPs) *(Data Quality Objectives Process for Superfund, Publication 9355.9-01).*

SUMMARY

For site assessment purposes, EPA Regions should not automatically discard "J" qualified data. However, site-specific data usability determinations may result in the data's not being used.

Data qualified under the EPA's CLP or from other sources of validated data may be used to demonstrate an observed release if certain measures are taken to ensure that the bias of the data qualifier is adjusted using the factor approach specified in this fact sheet. (This fact sheet provides a management decision tool for making qualified data usable for documenting an observed release.) The analyte and matrix-specific adjustment factors provided in Tables 1 through 4 of this fact sheet present these adjustment factors.

The scope of this fact sheet is limited to the situations described in Exhibit 1. The use of qualified analytical data without the adjustment factors presented in this fact sheet is limited. Higher adjustment factors may be substituted by EPA Regions on a case-by-case basis when technically justified by site-specific DQOs or SOPS.

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TABLE 1 FACTORS FOR VOLATILE ORGANIC ANALYTES				
VOLATILE ORGANIC ANALYTES	SOIL MATRIX		WATER MATRIX	
	Number of CARD Samples Reviewed	Factor	Number of CARD Samples Reviewed	Factor
1,1,1-TRICHLOROETHANE	---	10.0	---	10.0
1,1,2,2-TETRACHLOROETHANE	---	10.0	---	10.0
1,1,2-TRICHLOROETHANE	---	10.0	---	10.0
1,1-DICHLOROETHANE	---	10.0	---	10.0
1,1-DICHLOROETHENE	7,031	2.71	5,015	2.35
1,2-DICHLOROETHANE-D4	32,446	1.52	25,516	1.38
1,2-DICLOROETHENE (TOTAL)	---	10.0	---	10.0
1,2-DICHLOROPROPANE	---	10.0	---	10.0
2-BUTANONE	---	10.0	---	10.0
2-HEXANONE	---	10.0	---	10.0
4-METHYL-2-PENTANONE	---	10.0	---	10.0
ACETONE	---	10.0	---	10.0
BENZENE	7,024	1.97	5,001	1.64
BROMODICHLOROMETHANE	---	10.0	--	10.0
BROMOFORM	---	10.0	---	10.0
BROMOFLUOROBENZENE	32,444	1.7	25,518	1.26
BROMOMETHANE	---	10.0	---	10.0
CARBON DISULFIDE	---	10.0	---	10.0

TABLE 1
FACTORS FOR VOLATILE ORGANIC ANALYTES

VOLATILE ORGANIC ANALYTES	SOIL MATRIX		WATER MATRIX	
	Number of CARD Samples Reviewed	Factor	Number of CARD Samples Reviewed	Factor
CARBON TETRACHLORIDE	---	10.0	---	10.0
CHLOROBENZENE	7,018	2.0	5,015	1.54
CHLOROETHANE	---	10.0	---	10.0
CHLOROFORM	---	10.0	---	10.0
CHLOROMETHANE	---	10.0	---	10.0
CIS-1,3-DICHLOROPROPENE	---	10.0	---	10.0
DIBROMOCHLOROMETHANE	---	10.0	---	10.0
ETHYLBENZENE	---	10.0	---	10.0
METHYLENE CHLORIDE	---	10.0	---	10.0
STYRENE	---	10.0	---	10.0
TETRACHLOROETHENE	---	10.0	---	10.0
TOLUENE-D8	32,447	1.63	25,526	1.21
TRANS-1,3-DICHLOROPROPENE	---	10.0	---	10.0
TRICHLOROETHENE	6,988	2.11	4,938	1.66
VINYL CHLORIDE	---	10.0	---	10.0
XYLENE (TOTAL)	---	10.0	---	10.0

TABLE 2 FACTORS FOR SEMIVOLATILE ORGANIC ANALYTES				
	SOIL MATRIX		WATER MATRIX	
SEMIVOLATILE ORGANIC ANALYTES	Number of CARD sample Reviewed	Factor	Number of CARD Samples Reviewed	Factor
1,2,4-TRICHLOROBENZENE	6,792	4.83	4,605	3.71
1,2-DICHLOROBENZENE-D4	32,848	4.22	21,506	3.0
1,3-DICHLOROBENZENE	---	10.0	---	10.0
1,4-DICHLOROBENZENE	6,796	6.0	4,599	3.85
2,2'-OXYBIS(1-CHLOROPROPANE)	---	10.0	---	10.0
2,4,6-TRIBROMOPHENOL	32,605	9.38	21,509	3.57
2,4,5-TRICHLOROPHENOL	---	10.0	---	10.0
2,4,6-TRICHLOROPHENOL	---	10.0	---	10.0
2,4-DICHLOROPHENOL	---	10.0	---	10.0
2,4-DIMEHYLPHENOL	---	10.0	---	10.0
2,4-DINITROPHENOL	---	10.0	---	10.0
2,4-DINITROTOLUENE	6,798	4.88	4,623	3.52
2,6-DINITROTOLUENE	---	10.0	---	10.0
2-CHLORONAPHTHALENE	---	10.0	---	10.0
2-CHLOROPHENOL-D4	32,798	4.08	21,506	2.92
2-FLUOROBIPHENYL	32,913	3.38	21,532	2.84
2-FLUORPHENOL	32,781	5.05	21,511	3.34
2-METHYLNAPHTHALENE	---	10.0	---	10.0
2-METHYLPHENOL	---	10.0	---	10.0
2-NITROANILINE	---	10.0	---	10.0
2-NITROPHENOL	---	10.0	---	10.0
3,3'-DICHLOROBENZIDINE	---	10.0	---	10.0
3-NITROANILINE	---	10.0	---	10.0
4,6-DINITRO-2-METHYLPHENOL	---	10.0	---	10.0
4-BROMOPHENYL-PHENYETHER	---	10.0	---	10.0

TABLE 2
FACTORS FOR SEMIVOLATILE ORGANIC ANALYTES

SEMIVOLATILE ORGANIC ANALYTES	SOIL MATRIX		WATER MATRIX	
	Number of CARD Sample Reviewed	Factor	Number of CARD Samples Reviewed	Factor
4-CHLORO-3-METHYLPHENOL	6,715	6.26	4,609	4.46
4-CHLOROANILINE	---	10.0	---	10.0
4-CHLOROPHENYL-PHENYLETHER	---	10.0	---	10.0
4-METHYLPHENOL	---	10.0	---	10.0
4-NITROANILINE	---	10.0	---	10.0
4-NITROPHENOL	6,627	9.33	4,586	5.96
ACENAPHTHENE	6,773	4.68	4,600	3.63
ACENAPHTHYLENE	---	10.0	---	10.0
ANTHRACENE	---	10.0	---	10.0
BENZO(A)ANTHRACENE	---	10.0	---	10.0
BENZO(A)PYRENE	---	10.0	---	10.0
BENZO(B)FLUORANTHENE	---	10.0	---	10.0
BENZO(G,H,I,)PERYLENE	---	10.0	---	10.0
BENZO(K)FLUORANTHENE	---	10.0	---	10.0
BIS(2-CHLOROETHOXY)METHANE	---	10.0	---	10.0
BIS(2-CHLOROETHYL)ETHER	---	10.0	---	10.0
BIS(2-ETHYLHEXYL)PHTHALATE	---	10.0	---	10.0
BUTYLBENZYLPHTHALATE	---	10.0	---	10.0
CARBAZOLE	---	10.0	---	10.0
CHRYSENE	---	10.0	---	10.0
DI-N-BUTYLPHTHALATE	---	10.0	---	10.0
DI-N-OCTYLPHTHALATE	---	10.0	---	10.0
DIBENZ(A,H)ANTHRACENE	---	10.0	---	10.0
DIBENZOFURAN	---	10.0	---	10.0
DIETHYLPHTHALATE	---	10.0	---	10.0

TABLE 2 FACTORS FOR SEMIVOLATILE ORGANIC ANALYTES				
SEMIVOLATILE ORGANIC ANALYTES	SOIL MATRIX		WATER MATRIX	
	Number of CARD Sample Reviewed	Factor	Number of CARD Samples Reviewed	Factor
DIMETHYLPHTHALATE	—	10.0	---	10.0
FLUORANTHENE	---	10.0	---	10.0
FLUORENE	---	10.0	---	10.0
HEXACHLOROBENZENE	---	10.0	---	10.0
HEXACHLOROBUTADIENE	---	10.0	--	10.0
HEXACHLOROCYCLOPENTADIENE	---	10.0	---	10.0
HEXACHLOROETHANE	---	10.0	---	10.0
INDENO(1,2,3-CD)PYRENE	---	10.0	---	10.0
ISOPHORONE	---	10.0	---	10.0
N-NITROSO-DI-N-PROPYLAMINE	6,725	4.92	4,513	4.0
N-NITROSODIPHENYLAMINE(1)	---	10.0	---	10.0
NAPHTHALENE	---	10.0	--	10.0
NITROBENZENE-D5	32,867	3.96	21,533	2.73
PENTACHLOROPHENOL	6,597	72.5	4,550	10.12
PHENANTHRENE	---	10.0	---	10.
PHENOL-D5	32,855	3.85	21,489	3.53
PYRENE	6,543	11.86	4,612	5.67
TERPHENYL-D14	32,899	4.35	21,541	6.32

TABLE 3 FACTORS FOR PESTICIDES/PCB ANALTYES				
VOLATILE ORGANIC ANALYTES	SOIL MATRIX		WATER MATRIX	
	Number of CARD Samples Reviewed	Factor	Number of CARD Samples Reviewed	Factor
4,4'-DDD	---	10.0	---	10.0
4,4'-DDE	---	10.0	---	10.0
4,4'-DDT	5,343	12.82	3,850	7.14
ALDRIN	5,526	14.26	3,829	6.63
ALPHA-BHC	---	10.0	---	10.0
ALPHA-CHLORDANE	---	10.0	---	10.0
AROCLOR-1016	---	10.0	---	10.0
AROCLOR-1221	---	10.0	---	10.0
AROCLOR-1232	---	10.0	---	10.0
AROCLOR-1242	---	10.0	---	10.0
AROCLOR-1248	---	10.0	---	10.0
AROCLOR-1254	---	10.0	---	10.0
AROCLOR-1260	---	10.0	---	10.0
BETA-BHC	---	10.0	---	10.0
DECACHLOROBIPHENYL	57,315	17.79	33,592	10.0
DELTA-BHC	---	10.0	---	10.0
DIELDRIN	5,539	11.93	3,861	4.87

TABLE 3 FACTORS FOR PESTICIDES/PCB ANALYTES				
VOLATILE ORGANIC ANALYTES	SOIL MATRIX		WATER MATRIX	
	Number of CARD Samples Reviewed	Factor	Number of CARD Samples Reviewed	Factor
ENDOSULFAN I	—	10.0	---	10.0
ENDOSULFAN II	—	10.0	---	10.0
ENDOSULFAN SULFATE	---	10.0	---	10.0
ENDRIN	5,521	14.13	3,850	5.33
ENDRIN ALDEHYDE	---	10.0	---	10.0
ENDRIN KETONE	---	10.0	---	10.0
GAMMA-BHC (LINDANE)	5,545	11.79	3,832	10.0
GAMMA-CHLORDANE	---	10.0	---	10.0
HEPTACHLOR	5,548	7.88	3,836	5.26
HEPTACHLOR EPOXIDE	---	10.0	---	10.0
METHOXYCHLOR	---	10.0	---	10.0
TETRACHLORO-M-XYLENE	59,508	8.5	33,787	5.29
TOXAPHENE	---	10.0	---	10.0

TABLE 4 FACTORS FOR INORGANIC ANALYTES				
	SOIL MATRIX		WATER MATRIX	
VOLATILE ORGANIC ANALYTES	Number of CARD Samples Reviewed	Factor	Number of CARD Samples Reviewed	Factor
ALUMINUM	5387	1.66	6208	1.30
ANTIMONY	5392	1.98	6170	1.27
ARSENIC	5675	1.74	6303	1.35
BARIUM	5360	3.99	6201	1.25
BERYLLIUM	5399	1.28	6208	1.25
CADMIUM	5385	1.41	6166	1.29
CALCIUM	5383	1.28	6201	1.24
CHROMIUM	5389	1.29	6210	1.30
COBALT	5392	1.25	6212	1.27
COPPER	5394	1.22	6205	1.25
CYANIDE	3281	1.55	225	1.36
IRON	5391	1.34	6216	1.27
LEAD	5982	1.44	6384	1.31
MAGNESIUM	5397	1.23	6210	1.24
MANGANESE	5395	1.24	6214	1.28
MERCURY	5954	1.83	256	1.50
NICKEL	5400	1.35	6210	1.29
POTASSIUM	3874	17.49	6175	1.24
SELENIUM	5620	2.38	6278	1.14
SILVER	5392	1.74	6215	1.42
SODIUM	5024	25.43	6195	1.26
THALLIUM	5621	1.86	6253	1.37
VANADIUM	5393	1.34	6212	1.25
ZINC	5404	1.50	6224	1.29

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Establishing an Observed Release

Office of Emergency and Remedial Response | Quick Reference Fact Sheet

Abstract

EPA uses the Hazard Ranking System (HRS) (40 CFR Part 300, App. A) to evaluate Superfund sites to be proposed on the National Priorities List (NPL). Based on the HRS criteria, an observed release is established when contaminants have migrated away from a site through environmental media. This fact sheet describes an observed release, the data required, and the process used to document it. Efficient sampling also is emphasized to optimize the use of limited resources, which is especially important in light of conducting integrated assessments under the Superfund Accelerated Cleanup Model (SACM).

Introduction

When planning a Site Inspection, an integrated assessment should be considered as appropriate under the Superfund Accelerated Cleanup Model (SACM). This planning would incorporate a sampling strategy that should maximize remedial and removal resources.

Three categories of sampling generally are performed during a Site Inspection (SI):

- Source sampling to establish the presence of hazardous substances at a site;
- Sampling in the media of concern to establish an observed release, with background sampling corresponding to the source to establish attribution;
- Quality Assurance/Quality Control (QA/QC); sampling (e.g, field blanks) to ensure data integrity.

Although all three of these categories are important, this fact sheet pertains to the second category of sampling, and discusses resource conservation by using available data and an integrated sampling approach.

Determining an Observed Release

An *observed release* is based on evidence that contaminants have migrated from a site through a pathway or medium. The Hazard Ranking System (HRS) establishes two general criteria to document an observed release: there must be evidence of a hazardous substance in the medium of concern at a concentration significantly above the background level, and the release of the hazardous substance must be at least partially attributable to the site under investigation (*Hazard Ranking System, Final Rule*, 40 CFR Part 300, App. A). An observed release can be determined either by chemical analysis of samples, or by directly observing the release of the hazardous substance (to be documented) into the medium of concern (see Figure 1). Observed releases can occur through the ground-water, surface water, and air migration pathways. In contrast, the soil exposure pathway is evaluated for *observed contamination* where targets (human populations, resources, and sensitive environments) may come into direct contact with contaminants. (For more information on the soil exposure pathway, refer to the fact sheet *Establishing Areas of Observed Contamination*, September 1995, OSWER Directive 9285.7-18FS.)

The documentation of an observed release by chemical analysis should be accompanied with information on background level and attribution. Attribution requires evidence that the hazardous substance detected in a medium resulted from some portion of the release from the site. Background levels are established by sampling or by using other acceptable information, such as published or existing sample data. Existing data or data from background samples should be generated by sampling and analytical methods similar to those used for the release data (*Hazard Ranking System Guidance*

Figure 1: Flowchart for Establishing an Observed Release Under the HRS

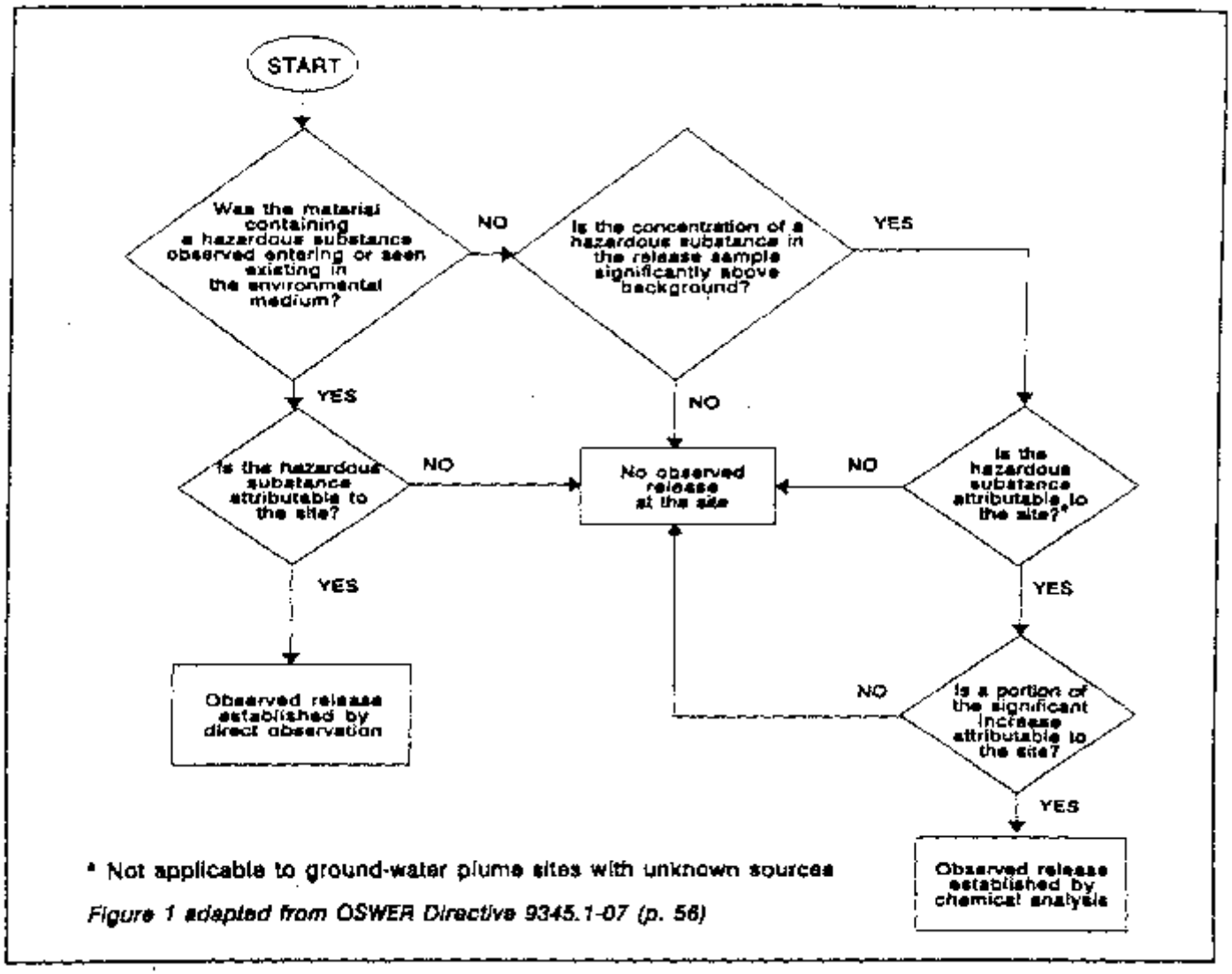

Figure 1 adapted from OSWER Directive 9345.1-07 (p. 56)

Manual, November 1992, OSWER Directive 9345.1-07). (For more information on establishing background levels, refer to the fact sheet *Establishing Background Levels*, September 1995, OSWER Directive 9285.7-19FS.)

Documenting an observed release is a prerequisite for evaluating actual contamination at targets. Actual contamination at targets indicates a high likelihood of exposure to hazardous substances. Note that the detection of contamination at targets is not in itself sufficient to establish an observed release or actual contamination (OSWER Directive 9345.1-07). The level of actual contamination is determined by comparing the release concentration to health-based or ecological benchmark values, where available. Level I contamination is at or above substance-specific benchmarks; Level II is detection below benchmark values.

Resource Considerations

Generally, the SI is a limited-scope biased sampling event. However, under SACM, traditional remedial SIs should be integrated with traditional removal site assessments. The Data Quality Objective (DQO) process provides a logical framework for planning multiple field investigations, thereby fulfilling the integrated site assessment goal of cross-program response planning and allowing optimal cross-program data usability. (See *Data Quality Objectives Process for Superfund*, September 1993, OSWER Directive 9355.9-01 for further details on the DQO process.)

When possible, available data should be used to meet SI objectives so that resources are conserved (see Exhibit 1). Samples can be strategically collected to establish an observed release and to include one or more targets (i.e.,

Exhibit 1: Considerations when Assessing the Need for Sampling

- *Is there an imminent or current threat to human health or the environment? Is a removal action warranted?* Sample at targets if human or environmental exposure to contaminants is suspected. Always sample for public health concerns.
- *Can sampling meet both removal and remedial site assessment objectives?* If yes, and site conditions warrant, an integrated sampling approach may be used. (For more information, refer to *Integrating Removal and Remedial Site Assessment Investigations*, September 1993, OSWER Directive 9345.1-16FS.)
- *What are the objectives of the SI?* Table 4-7 in *Guidance for Performing Site Inspections Under CERCLA*, 1992, OSWER Directive 9345.1-05, provides guidelines on the number of samples recommended for a focused, expanded, or single SI as part of an observed release sampling strategy.
- *Could the pathway critically affect the site Hazard Ranking System (HRS) score ($ 28.50)? If yes, must an observed release be documented for that pathway to achieve that site score?* If no, evaluating the pathway for potential contamination may be sufficient (particularly for less critical pathways).
- *What are the pathway criteria? Are targets nearby?* Each HRS pathway has certain criteria for determining and limiting target distance with respect to contaminants. For example, for the soil exposure pathway, contamination must be documented within a zero to two feet depth from the surface, and contamination must be on the property and within 200 feet of targets. For the surface water pathway, the surface water body must be within two overland miles of the site or source. Sample collection should be avoided if sampling cannot meet the pathway criteria.

dual purpose sampling). Analytical data with appropriate and adequate quality assurance/quality control (QA/QC) are needed, since benchmarks are expressed in concentration units.

The Agency for Toxic Substances and Disease Registry (ATSDR) should be consulted when there is the potential for human exposure to toxic substances. The sampling approach for these sites should include data collection for the human exposure information that ATSDR uses to determine if a health advisory is needed. ATSDR also uses this data in the preparation of a public health assessment, which is required within 12 months of proposal to the National Priorities List.

Observed Release by Direct Observation

To establish an observed release by direct observation, a hazardous substance must be observed or known to have been released into the medium of concern. Existing analytical data or other references, such as manifests, should be used to document that the hazardous substance is present or known to have been released (OSWER Directive 9345.1-07. See Exhibit 2 for examples of an observed release by direct observation.

For the ground-water pathway, an observed release by direct observation may be documented with information that hazardous materials have come to be located or deposited in the aquifer of concern (OSWER Directive 9345.1-07).
For the surface water pathway, direct observation to establish an observed release can be documented by:

- Seeing hazardous substances entering the water body through migration or knowing they have entered through direct deposition;
- Natural flooding of a source area so that hazardous substances come in direct contact with the water: in this case, the presence of a hazardous substance sigaificantly above background prior to flooding must be demonstrated (OSWER Directive 9345.1-07). Historical data may be sufficient to document flood levels, the presence of a hazardous substance, and its direct contact with flooded waters;
- Adverse effects (e.g., fish kill) associated with the release of a hazardous substance to surface water. Note that inference requires extensive documentation and verified attribution (OSWER Directive 9345.1-07).

For the air pathway, direct observation may be established by demonstrating adverse effects from a release (OSWER Directive 9345.1-07).

Observed Release by Chemical Analysis

An observed release can be documented when samples from the media of concern exhibit contamination significantly above background levels, and the contaminants are attributable to the source. Since concentrations of contaminants usually decrease with

Exhibit 2: **Examples of an Observed Release by Direct Observation For Different Media**

- Ground-water pathway--Hazardous substances placed into an old quarry where the water table has risen above the level of the deposited materials.
- Surface water pathway--An impoundment leachate seep seen entering a stream. (Collect a sample from the leachate to document hazardous substances.) Also, effluent known to contain hazardous substances (through manifests) seen entering a surface water body.
- Air pathway--A field logbook entry and photodocumentation of a dust cloud originating from a tailings pile. A sample of the fine particulate matter from the pile showing the presence of hazardous substances will verify the release (OSWER Directives 9345.1-05 and 9345.1-07).

distance from a source, sampling near sources will better establish an observed release and attribution (*Guidance for Performing Site Inspections Under CERCLA*, September 1992, OSWER Directive 9345.1-05). At a minimum, one validated sample and a background level are required to document a release, even if earlier or later sampling fails to show a release. Varying results could be due in part to intermittent releases (OSWER Directive 9345.1-07).

To document an observed release by chemical analysis, the following criteria must be met (except for radionuclides, which are discussed later in this fact sheet):

- The release of a hazardous substance must be at least partially attributable to a source at the site. (Note: This does not apply to ground-water plume sites with unknown sources.)
- The sample concentration must be greater than or equal to the appropriate detection limit (40 CFR Part 300, App. A).
- If the background level is below its detection limit, the sample concentration must be greater than or equal to the background detection limit.
- If the background level is greater than or equal to its detection limit, the sample concentration must be at least three times the background concentration (OSWER Directive 9345.1-07).
- The detection limits must be calculated or determined properly. The detection limit used for comparison often depends on the source of the analytical data. Detection limits may be different for release and background samples. Detection limits such as those provided by the Contract Laboratory Program (CLP) may be used (OSWER Directive 9345.1-07).

Observed release sampling variables differ according to the medium, or pathway. These variables include temporal and spatial variation, hazardous substances present, and documentation of location and collection conditions.

Ground-water Pathway

For the ground-water pathway, certain types of wells, including monitoring, irrigation, or drinking water wells, may be used to establish an observed release. To establish an observed release, the well(s) closest to the contamination source should be sampled. It is preferable to select background well(s) outside the influence of a source and in the same zone of the same aquifer being evaluated. Cross-gradient or upgradient background sample locations are used when flow gradient information is available. (Ground-water flow gradient information is not required for HRS scoring purposes.) Establishing an observed release in the ground-water pathway could be further complicated by uncertainties about ground-water flow direction, and any resultant uncertainty about background and attribution. Caution should be exercised regarding the use of wells that are close to the site to determine background levels. For example, landfills and impoundments could interfere with natural ground-water flow. Pumping also may affect ground-water direction and plume movement. If available, pumping rates of nearby wells (including those sampled) may serve as a useful source of information for addressing both sample comparability and contaminant effect. Note: The same well may not necessarily be used to document actual contamination of targets. For a target population, actual contamination should be documented using a drinking water well.

The characteristics of suspected contaminants in ground water should be considered when selecting sample locations and depths. Contaminants in ground water may not be evenly dispersed. For example, oils and organic substances lighter than water (light non-aqueous phase liquids [LNAPLs]) tend to float on top of the water table. Contaminants heavier than water (dense non-aqueous phase liquids [DNAPLs]) sink to the bottom of the water column (OSWER Directive 9345.147).

Surface Water Pathway

Aqueous effluent, sediment, and tissue samples from sessile, benthic organisms are used to document an observed release to the surface water pathway. Generally, at least two samples (aqueous or sediment) are required for documenting an observed release in the surface water pathway. They are: a background sample slightly upstream of the Probable Point of Entry (PPE) for contaminants from the site or source; and a sample act or slightly downstream of the PPE. Exceptions to this two sample minimum requirement are when: 1) the surface water body originates at the site (no upstream background exists), 2) multiple PPEs exist, or 3) tidal flow exists. In the first case, one sample may be sufficient to document a release. In the second case, it may be advisable to sample upstream of each PPE. In this case, sampling is necessary at the PPE or downstream of each PPE to establish an observed release. In the third case, background data may need to be collected inside and outside the tidal area.

Aqueous samples may be used to document current releases to a surface water body. A preferred way is to collect the downstream sample first, and to collect aqueous samples before sediments to avoid the introduction of any contaminants not associated with the site or medium. Aeration of a sample should be minimized to prevent reducing the concentration of contaminants such as volatile organic chemicals.

Seasonal and other potential variations such as irrigation and flooding should be considered when sampling in this pathway. Deep, slow-moving surface water bodies often exhibit some chemical or thermal stratification. Stratification can occur where two streams converge. Additionally, the absorption or dilution of substances is affected by stream movement, and depositional conditions vary within the riffles or close to stream edges (OSWER Directive 9345.1-07).

Sediment samples may be used to document historical releases to a surface water body. Ideally, the characteristics of the suspected contaminant(s) should be known in order to select the best sample medium, location, and sampling method. Often, sediments are scoured and deposited in bends of streams and other flowing surface water bodies. Sample from like areas (e.g., inside bend deposition areas) for comparability. Grain size, organic content, and structure can affect adsorbance of substances to sediments, possibly introducing bias to the samples. For example, trichloroethylene (TCE) could adsorb to certain particles (OSWER Directive 9345.1-07).When possible, differentiate sediments from soils, especially when sampling along the edge of a water body. Note that in arid or semiarid locations (less than 20 inches mean annual precipitation), "sediments" include areas with intermittently flowing waters as well as contiguous intermittently flowing ditches. Contamination in these areas should be evaluated in the surface water pathway (40 CFR Part 300, App. A).

Tissue sampling can pose challenges for comparability because of differences between members of the same species, differences between species, variations within a study population, species mobility, and tissue differentiation. The target sample species should be examined for type of organism, approximate age, gender, size of population, migratory nature, and seasonal, feeding, spawning, or other periodic activities that influence concentration of substances within the organism (OSWER Directive 9345.1-07). Due to the potential difficulty of collecting comparable samples, tissue samples are more readily used to document actual contamination instead of an observed release. It is prudent to collect tissue samples in concert with other sampling activities when documenting an observed release.

For tissue sampling, both the rationale for the tissue selection and the accuracy of measurement should be established. Edible tissues from sessile, benthic organisms are preferred for HRS evaluation. (Generally, non-sessile benthic organisms, finfish, amphibians, and reptiles should not be used.)

Note that the surface water pathway requires sampling at or beyond the target to establish actual contamination; in contrast, the ground-water pathway requires sampling at the target.

Air Pathway

It is important to consider temporal variability in air sampling because large variations in substance concentration can occur over a very short time. Emissions characteristics depend upon topography and changeable atmospheric conditions, including temperature, pressure, wind speed and direction, precipitation, and atmospheric stability.

Monitoring wind direction is important in documenting migration of hazardous substances from the source. Wind roses, which detail the percentage of predominant wind direction, should be developed for the sampling period to document shifts in wind direction (OSWER Directive 9345.1-07).

For the air pathway, an air sample may be used to document both an observed release and actual contamination of targets within a certain radius from the source. An observed release by chemical analysis can be difficult to establish for the air pathway because of the challenge of obtaining comparable and verifiable samples. Under the HRS, EPA evaluates outdoor ambient air conditions only, indoor air samples are not evaluated for this pathway (OSWER Directive 9345.1-07).

Partial Attribution and Multiple Source Sites

Sources of contamination other than those from the site are often present. For example, substances may originate from non-point sources such as pesticide application, and from products containing lead.

Establishing background levels is especially important when attributing hazardous substances to varied sources. Background and site sample data should be from the same medium using similar sampling and analytical methods. Background samples should be collected from outside the influence of contamination from the site under investigation, but do not have to be free of contamination for purposes of attribution. The data need only support that the sample concentration is beyond an established background level. The location of other potential sources should be thoroughly reviewed and documented so that the appropriate background sampling locations can be selected. Background levels for ubiquitous substances should account for local variability; several samples may be required to establish the background levels (OSWER Directive 9345.1-07).

Where attribution is questionable, sampling should be done to gather analytical data demonstrating that the contamination is at least partially attributable to the site. Contamination from sites sometimes can be isolated by identifying hazardous substance unique to the site under investigation. Special analytical services and close evaluation of data may be required to identify these hazardous substances. Information about the disposal practices and waste products of nearby facilities may help identify target compounds associated with the site (OSWER Directive 9345.1-05).

Attribution may be established through the use of manifests, labels, records, oral or written statements, or other information regarding hazardous substances present at the site or at alternative sources. If these references confirm the presence of a hazardous substance at the site, attribution generally can be established even if specific sources where the substance was deposited cannot be documented (OSWER Directive 9345.1-07).

Sufficient samples from the site under investigation and from other known potential sources (or other adjacent areas) should be obtained to demonstrate that an increase in contaminant levels is attributable to the site. Additional information beyond analytical samples may be required if the other sites release intermittently. To attribute contamination sufficiently, collect the following data:

- Concentration gradients (e.g., samples from multiple wells or a series of samples between the site and alternative sources)
- Flow gradients and other information about the media of concern
- Data that associate the site with a unique substance or unique ratios of different substances (OSWER Directive 9345.1-07).

Complex factors affecting attribution (e.g., soil contamination in an industrial area) may require conducting an Expanded Site Inspection (ESI). In many cases, attribution concerns may be addressed by characterizing other sources at a site and those of neighboring sites (OSWER Directive 9345.1-05).

To establish attribution for the ground-water pathway, it is preferable to sample wells located between site sources and other sources. Three wells generally are needed to define flow direction and to verify the source versus another source. For surface water, a sample may be collected downstream of or at the confluence. It may be necessary to sample background and attribution along each tributary if multiple sources are located upstream (OSWER Directive 9345.1-07).

Transformation Products

It is possible to establish an observed release based on documenting the existence of a transformation product, if the transformation product is itself a hazardous substance. In these cases, the observed release must be documented by chemical analysis (OSWER Directive 9345.1-07).

Transformation products are substances found when a hazardous substance is changed in the environment by physical, chemical, or biological processes. Most transformation products at hazardous waste sites are the result of degradation (OSWER Directive 9345.1-07).

In order to attribute the parent substances and the transformation product to the site, the presence of a transformation product in a sample at a level significantly above the background level(s) should be documented.

The following references may be useful for documenting parent substances and transformation products:

- Site-specific studies on the transformation process by qualified research organizations (e.g., U.S. Government agencies, universities)
- Technical reports on transformation from EPA's Office of Research and Development
- Databases containing EPA-reviewed information Articles from peer-reviewed journals
- Textbooks on soil, environmental microbiology, biotechnology, and biotreatment processes and their effectiveness (OSWER Directive 9345.1-07).

For determining an observed release, conditions at the site must be conducive to, or must not impede, transformation, and at least one source must be able to release the substance to a pathway (OSWER Directive 9345.1-07).

Radionuclide Sites

The criteria for documenting an observed release by direct observation apply to radionuclides. Table 7-1 in the *Hazard Ranking System, Final Rule* provides the HRS factor categories that are evaluated differently when radionuclides are present (40 CFR Part 300, App. A).

Radionuclide sites are divided into three groups for documenting an observed release by chemical analysis:

- Radionuclides that exist naturally and ubiquitous radionuclides
- Man-made radionuclides which are not ubiquitous
- External gamma radiation (for the soil exposure pathway only). For gamma radiation, measure the exposure rate at one meter above ground. (For more information, refer to the fact sheet *Establishing Background Levels*, September 1995, OSWER Directive 9285.7-19FS.)

Observed releases from a combination of radionuclides and hazardous wastes (mixed waste) should be documented separately. Establishing an observed release requires:

- Identification of the radionuclide of concern and the physical and chemical properties of the radionuclide;
- On-site and background levels for that radionuclide; and
- Detection limit for the radionuclide.

Specific requirements for establishing an observed release for each of the three groups of radionuclides can be found in Section 7.1.1 of the *Hazard Ranking System, Final Rule* (40 CFR Part 300, App. A).

Summary

Documenting an observed release requires evidence that the concentration of the hazardous substance of concern significantly exceeds the background level. The hazardous substance must be attributable at least in part to the site under investigation (except for sites with ground-water contamination from unknown sources). Establishing an observed release requires thorough documentation. The sampling design of the Sl should attempt to meet multiple HRS data needs with a limited number of samples.

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INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

INORGANIC CHEMISTRY DIVISION
COMMISSION ON ATOMIC WEIGHTS AND ISOTOPIC ABUNDANCES*

ATOMIC WEIGHTS OF THE ELEMENTS: REVIEW 2000

(IUPAC Technical Report)

Prepared for publication by
J. R. DE LAETER[1], J. K. BÖHLKE[2,‡], P. DE BIÈVRE[3], H. HIDAKA[4], H. S. PEISER[2], K. J. R. ROSMAN[1], AND P. D. P. TAYLOR[3]

[1]Department of Applied Physics, Curtin University of Technology, Perth, Australia; [2]United States Geological Survey, 431 National Center, Reston, VA 20192, USA; [3]Institute for Reference Materials and Measurements, European Commission – JRC B-2440, Geel, Belgium; [4]Department of Earth and Planetary Systems Science, Hiroshima University, Higashi-Hiroshima 739-8526, Japan

*Membership of the Commission for the period 2000–2001 was as follows:

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‡Corresponding author

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Atomic weights of the elements: Review 2000

(IUPAC Technical Report)

Abstract: A consistent set of internationally accepted atomic weights has long been an essential aim of the scientific community because of the relevance of these values to science and technology, as well as to trade and commerce subject to ethical, legal, and international standards. The standard atomic weights of the elements are regularly evaluated, recommended, and published in updated tables by the Commission on Atomic Weights and Isotopic Abundances (CAWIA) of the International Union of Pure and Applied Chemistry (IUPAC). These values are invariably associated with carefully evaluated uncertainties. Atomic weights were originally determined by mass ratio measurements coupled with an understanding of chemical stoichiometry, but are now based almost exclusively on knowledge of the isotopic composition (derived from isotope-abundance ratio measurements) and the atomic masses of the isotopes of the elements. Atomic weights and atomic masses are now scaled to a numerical value of exactly 12 for the mass of the carbon isotope of mass number 12. Technological advances in mass spectrometry and nuclear-reaction energies have enabled atomic masses to be determined with a relative uncertainty of better than 1×10^{-7}. Isotope abundances for an increasing number of elements can be measured to better than 1×10^{-3}. The excellent precision of such measurements led to the discovery that many elements, in different specimens, display significant variations in their isotope-abundance ratios, caused by a variety of natural and industrial physicochemical processes. While such variations increasingly place a constraint on the uncertainties with which some standard atomic weights can be stated, they provide numerous opportunities for investigating a range of important phenomena in physical, chemical, cosmological, biological, and industrial processes. This review reflects the current and increasing interest of science in the measured differences between source-specific and even sample-specific atomic weights. These relative comparisons can often be made with a smaller uncertainty than is achieved in the best calibrated "absolute" (= SI-traceable) atomic-weight determinations. Accurate determinations of the atomic weights of certain elements also influence the values of fundamental constants such as the Avogadro, Faraday, and universal gas constants. This review is in two parts: the first summarizes the development of the science of atomic-weight determinations during the 20th century; the second summarizes the changes and variations that have been recognized in the values and uncertainties of atomic weights, on an element-by-element basis, in the latter part of the 20th century.

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$_{7}$N Nitrogen 738
$_{8}$O Oxygen 739
$_{9}$F Fluorine 740
$_{10}$Ne Neon 741
$_{11}$Na Sodium (Natrium) 741
$_{12}$Mg Magnesium 742
$_{13}$Al Aluminium (Aluminum) 742
$_{14}$Si Silicon 743
$_{15}$P Phosphorus 744
$_{16}$S Sulfur 744
$_{17}$Cl Chlorine 745
$_{18}$Ar Argon 746
$_{19}$K Potassium (Kalium) 747
$_{20}$Ca Calcium 748

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$_{21}$Sc	Scandium	749
$_{22}$Ti	Titanium	750
$_{23}$V	Vanadium	750
$_{24}$Cr	Chromium	751
$_{25}$Mn	Manganese	752
$_{26}$Fe	Iron (Ferrum)	752
$_{27}$Co	Cobalt	753
$_{28}$Ni	Nickel	753
$_{29}$Cu	Copper (Cuprum)	754
$_{30}$Zn	Zinc	755
$_{31}$Ga	Gallium	755
$_{32}$Ge	Germanium	756
$_{33}$As	Arsenic	757
$_{34}$Se	Selenium	758
$_{35}$Br	Bromine	759
$_{36}$Kr	Krypton	759
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$_{50}$Sn	Tin (Stannum)	767
$_{51}$Sb	Antimony (Stibium)	768
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$_{54}$Xe	Xenon	770
$_{55}$Cs	Caesium (Cesium)	771
$_{56}$Ba	Barium	771
$_{57}$La	Lanthanum	772
$_{58}$Ce	Cerium	773
$_{59}$Pr	Praseodymium	773
$_{60}$Nd	Neodymium	774
$_{62}$Sm	Samarium	774
$_{63}$Eu	Europium	775
$_{64}$Gd	Gadolinium	776
$_{65}$Tb	Terbium	776
$_{66}$Dy	Dysprosium	777
$_{67}$Ho	Holmium	777
$_{68}$Er	Erbium	778
$_{69}$Tm	Thulium	778
$_{70}$Yb	Ytterbium	779

$_{71}$Lu Lutetium 779
$_{72}$Hf Hafnium 780
$_{73}$Ta Tantalum 780
$_{74}$W Tungsten (Wolfram) 781
$_{75}$Re Rhenium 781
$_{76}$Os Osmium 782
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PREFACE

Purpose of the review

This review describes the gradual evolution of knowledge, understanding, and detailed information on the atomic weights of the chemical elements and their isotopic compositions in normal materials, as evaluated regularly by IUPAC. Atomic weights at the start of the 20th century were a well-recognized part of chemistry, but are now interdisciplinary, both in their measurements and their applications. Under these circumstances, such a review has clear purposes and aims at:

- tracing the history of concepts, such as that of "atomic weights" once believed to be constants of nature;
- describing the methods of atomic-weight determinations;
- giving current knowledge of the best values of the atomic weights based on the elements' isotopic compositions;
- indicating the estimated uncertainties of all these data in accord with methods of measurement science, as established during the century;
- adopting scales of measurements in accord with the modern system of units as also developed during the century;
- warning of known limitations of the above data for exceptional materials; and
- exploring applications for the differential measurement of isotopic composition to all branches of materials science.

This review is not primarily concerned with definitions and technical terms, as this matter is the responsibility of IUPAC's Interdivisional Commission on Nomenclature and Symbols (IDCNS), recently renamed Interdivisional Committee on Terminology, Nomenclature and Symbols (ICTNS). Questions of semantics generally, when derived by logic or based on historic use, or in accord with conventions in related fields, are vigorously debated. Even CAWIA, whose very name includes the much-disputed term "atomic weight," has not been able to avoid involvement. When Tomas Batuecas, President of the Atomic Weights Committee, persuaded the authorities in the IUPAC Bureau in 1963 to change the term to "atomic mass", traditional chemists revolted, "atomic weights" was retained, and

Edward Wichers, who had previously been Commission President, was quietly reinstalled in the chair of the Atomic Weights Commission. Other substitute terms, such as "relative atomic mass" and "mean relative atomic mass", have since found strong backing, and the International Organization for Standardization (ISO) *Standards Handbook on Quantities and Units* lists "relative atomic mass" with the annotation "formerly called atomic weight". CAWIA members, however, have rationalized the retention of the use of "atomic weight" when clearly defined. The principal value of the work of CAWIA and this review, however, does not hinge on that or any other term. Whereas in this review we have retained the use of "atomic weight", we have for other terms tended to use those advocated by the Bureau International des Poids et Mesures (BIPM), which makes recommendations for all measurements and for the use of the International System of Units of Measurement (SI).

Acknowledgments

This review has only been made possible because of those who have contributed to our knowledge of atomic weights and isotope abundances over the past 100 years. As we move into the 21st century, we acknowledge all those individuals who have worked in the field during the 20th century. In particular, we express our appreciation to the members of CAWIA and its predecessors, who have given so much of their time and talents to advance the discipline to the authoritative status it enjoys today.

The authors are indebted to their colleagues on CAWIA under the chairmanship of Prof. Ludolf Schultz, who authorized the preparation of this review at the 1997 meeting of CAWIA in Geneva, and have given advice and encouragement over the intervening period of time. The help of CAWIA members in reviewing sections has been of great value. In particular, we acknowledge substantial advice and assistance from Dr. T. B. Coplen, Prof. N. N. Greenwood, Dr. N. E. Holden, and Dr. E. Roth, including the discovery by Holden of several errors in a previous review.

In compiling this review, the authors have drawn extensively on articles written by past and current members of CAWIA who have kindly permitted their material to be used without restriction. In particular, the framework of the previous element-by-element review was used as the basis for the present review. Its basic philosophy was maintained, and some CAWIA members are coauthors of both reviews. We also thank CAWIA's parent organization IUPAC, through its Division of Inorganic Chemistry, for supporting this initiative.

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List of acronyms

BIPM	Bureau International des Poids et Mesures
CAWIA	Commission on Atomic Weights and Isotopic Abundances
CBNM	Central Bureau for Nuclear Measurements (European Community)
CGPM	General Conference on Weights and Measures (BIPM)
CEA	Commissariat à l'Énergie Atomique
CIPM	International Committee for Weights and Measures (BIPM)
CODATA	Committee on Data for Science and Technology (ICSU)
EC	European Commission
GISP	Greenland ice sheet precipitation

IAEA	International Atomic Energy Agency
ICP-MS	inductively coupled plasma-source mass spectrometry
ICSU	International Council of Scientific Unions
ICTNS	Interdivisional Committee on Terminology, Nomenclature and Symbols (IUPAC)
IDCNS	Interdivisional Commission on Nomenclature and Symbols (IUPAC)
IDMS	isotope dilution mass spectrometry
IMGC	Istituto di Metrologie "Gustavo Colonnetti" (Italy)
IRMM	Institute of Reference Materials and Measurements (EC)
ISO	International Organization for Standardization
IUPAC	International Union of Pure and Applied Chemistry
IUPAP	International Union of Pure and Applied Physics
LSVEC	lithium-svec (a lithium carbonate)
NBL	New Brunswick Laboratory
NBS	National Bureau of Standards (USA)
NGS	natural gas standard
NIST	National Institute of Standards and Technology (USA)
NML	National Measurement Laboratory, CSIRO (Australia)
NRLM	National Research Laboratory for Metrology (Japan)
NSVEC	nitrogen-svec (a gaseous nitrogen)
PTB	Physikalisch-Technische Bundesanstalt (Germany)
SAIC	Subcommittee on the Assessment of the Isotopic Composition of the Elements
SI	Système International d'Unités, the International System of Units
SIAM	Subcommittee on Isotope Abundance Measurements
SIMS	secondary ion mass spectrometry
SLAP	standard light Antarctic precipitation
SRM	standard reference material
SUN-AMCO	Commission on Symbols, Units, Nomenclature, Atomic Masses and Fundamental Constants (IUPAP)
TICE	Table of Isotopic Compositions of the Elements (CAWIA)
TSAW	Table of Standard Atomic Weights (CAWIA)
USGS	United States Geological Survey
VSMOW	Vienna standard mean ocean water

PART 1: HISTORY, ASSESSMENT, AND CONTINUING SIGNIFICANCE OF ATOMIC-WEIGHT DETERMINATIONS

Introduction

The 20th century was the stage on which impressive advances in scientific knowledge were achieved. This is well illustrated by the development of the science of atomic-weight determinations (see Table 1). At the beginning of the 20th century, some elements had not yet been isolated, but the discovery of Ga, with predicted mass and properties, convinced chemists of the usefulness of the periodic listing of the elements. Becquerel [1] had just announced the discovery of radioactivity, and Thomson was still to discover stable isotopes. By contrast, at the end of the 20th century, the science of atomic weights has attained a high level of sophistication and international recognition. In recent decades, the experimental comparison of the abundance ratios of two given isotopes in two materials has attained remarkably small uncertainties even when applied to very small samples, and especially when comparisons are made with synthetic mixtures of materials with enriched isotopes. Nevertheless, there is every indication that further improvement in instrumental performance and measurement precision will greatly benefit isotope science in the future. The detection of small variations in atomic weight of some elements

in natural terrestrial materials has yielded many important opportunities for application of isotope-abundance measurements and a never-ending demand for improvements in measurement techniques.

Many of these achievements are due to the work of the committees concerned with atomic weights and isotopic compositions. Some such national committees existed as early as in the last years of the 19th century [2]. Then, at the very beginning of the 20th century, the International Committee on Atomic Weights was formed. In 1920, it was reconstituted as part of IUPAC and has so continued ever since. The Committee, and its variously renamed Commissions, has issued at regular intervals reports on progress in the science relating to atomic weights [3–19]. In 1979, the Commission on Atomic Weights received a new name Commission on Atomic Weights and Isotopic Abundances (CAWIA) and formally undertook the responsibility for evaluating new isotopic-composition data through its Subcommittee on the Assessment of the Isotopic Compositions of the Elements (SAIC), now titled the Subcommittee of Isotope Abundance Measurements (SIAM), and for examining the implications of these and other measurements on the values of the atomic weights. In its reports, CAWIA has provided the results of such investigations to the scientific community on a regular basis.

Table 1 Important events in the history of atomic weights.

1892	The American Chemical Society forms a Committee on Atomic Weights.
1896	H. A. Becquerel discovers radioactivity.
~1900	T. W. Richards develops the "Harvard method" for determining atomic weights.
1902	The International Committee on Atomic Weights is formed.
1912	J. J. Thomson discovers isotopes of Ne by a mass-spectrometric technique.
1913	The International Committee is affiliated with the International Association of Chemical Societies.
1919	F. W. Aston demonstrates the effectiveness of the first mass spectrograph. E. Rutherford demonstrates nuclear transformations by impact between nuclei.
1920	The International Committee on Atomic Weights is affiliated with IUPAC at its formation. A. J. Dempster calculates the atomic weight of Mg by using the relative isotope abundances together with the whole number masses of the stable isotopes of Mg. F. W. Clarke publishes the last version of his major element-by-element review of atomic weights based solely on the chemical method.
1921	The International Committee on Atomic Weights becomes the Committee on Chemical Elements with responsibility for radioactive and stable isotopes.
1929	W. F. Giauque and H. L. Johnston discover that O has three isotopes, which leads to IUPAP using a mass scale based on $m(^{16}O) = 16$ atomic mass units, whereas IUPAC continues to use $A_r(O) = 16$.
1930	The Committee on Chemical Elements is subdivided into three parts, one of which becomes the Atomic Weights Committee.
1932	H. C. Urey and colleagues discover the isotope ^2H.
1938	O. Hahn, F. Strassmann, and L. Meitner discover nuclear fission.
1940	A. O. Nier designs a magnetic sector mass spectrometer for isotope-abundance ratio measurements.
1947	H. C. Urey summarizes the thermodynamic properties of substances in relation to their isotopic composition.
1950	A. O. Nier carries out the first "absolute" isotope-abundance measurement for Ar by calibrating two mass spectrometers by means of synthetic mixtures of Ar isotopes.

(*continues on next page*)

Table 1 (*Continued*).

1954	The NBS introduces a mass spectrometer-based program to certify isotopic reference materials and to measure the "absolute" isotope abundances of selected elements.
1957	A. O. Nier and A. Ölander independently suggest that $A_r(^{12}C) = 12$ and $m(^{12}C) = 12$ u be adopted to replace the $A_r(O) = 16$ and $m(^{16}O) = 16$ atomic mass units.
1959/1960	IUPAC and IUPAP agree to unify the two existing scales to a $A_r(^{12}C) = m(^{12}C) / u = 12$. Everling, König, Mattauch, and Wapstra publish isotope mass values.
1962	Cameron and Wichers publish a comprehensive element-by-element review, presenting the atomic weights of the elements on the scale of $A_r(^{12}C) = 12$ exactly. The CBNM commences a similar program to that established by NBS in 1954.
1969	The renamed Commission of Atomic Weights associates every recommended $A_r(E)$ value with an estimated expanded uncertainty, $U[A_r(E)]$, of restricted magnitude of either 1 or 3 in the last digit of $A_r(E)$.
1979	The Commission receives the name CAWIA and publishes for the first time a Table of Isotopic Compositions of the Elements.
1984	CAWIA publishes a comprehensive element-by-element review, updating the values for atomic weights that had occurred since 1962, largely as the result of isotope-abundance determinations.
1985	CAWIA permits $U[A_r(E)]$ to be stated as any single value in the last digit of $A_r(E)$.
1993	Audi and Wapstra publish their 1993 Atomic Mass Table, which is accepted by CAWIA to calculate atomic weights.
2003	CAWIA publishes a comprehensive element-by-element review of the atomic weights, with an overview of the achievements of sciences related to atomic-weight determinations during the 20th century.

For each of the chemical elements, E, CAWIA compiles atomic weights, $A_r(E)$, with estimated uncertainties, $U[A_r(E)]$. Abundances of isotopes, ^iE, can be represented as mole fractions, $x(^iE)$, where i is the mass number of the isotope. $A_r(^iE)$ is its relative mass. $\Sigma[x(^iE)] = 1$ for a given E. CAWIA (and its predecessors) has reviewed the status of atomic-weight determinations from time to time. Several notable atomic-weight compilations were done in the 19th century, followed by a landmark review published in 1920 by Clarke [20], who recalculated the atomic weights of all known elements from evaluated measured mass ratios of stoichiometric compounds and elements on the scale of $A_r(O) = 16$. In contrast with later reviews, Clarke's review was based principally on the so-called chemical (or Harvard) method. Clarke's review remained the definitive work on atomic weights for the next 20 years or more. In 1953, A. O. Nier carried out an early evaluation of some relative isotope-abundance measurements by mass spectrometry for the Atomic Weights Committee [21]. The comprehensive review by Cameron and Wichers [22], was the direct result of the decision by IUPAC and the International Union of Pure and Applied Physics (IUPAP), to adopt a new atomic-weight scale based on $A_r(^{12}C) = 12$. It drew heavily on new values for atomic weights based on atomic masses [23], which have since been updated with encouragement by IUPAP and relied upon by CAWIA. Mass spectrometric measurements of the abundances of the isotopes were encouraged and evaluated by CAWIA. This combined method has since been accepted for measuring atomic weights for all but the monoisotopic elements. A subsequent review [24] critically examined, on an element-by-element basis, changes that had occurred in atomic weights since the 1962 review and also described changes in the methodology of reporting atomic-weight information. In a related publication, Peiser [25] pointed out that many IUPAC-recommended atomic weights were still based on experimental determinations that appeared to be short of the best state of the art.

In 1997, CAWIA decided to initiate another major review, which would be an attempt to describe the developments in atomic-weight determinations during the 20th century, and to present our knowl-

edge of the field in a single volume. This review is the result of that decision. Another aim of this review is to summarize the current CAWIA-evaluated knowledge of the numerical values of all atomic weights $A_r(E)$ and their uncertainties $U[A_r(E)]$, their reliability and the limitations to their applicability. This may be of value to users who, on a given topic, might otherwise have to consult several of CAWIA's biennial reports. As explained in the Preface, this review is not primarily concerned with terminology, which is the responsibility of ICTNS within IUPAC. Nevertheless, the Commission in its 1973 report [6] found it necessary to explain its understanding of "normal" and "well-characterized" materials. Subsequent Commission reports for 1975 and 1977 [7,8] further amplified these definitions and recommended appropriate labeling of commercially available chemicals.

History

The ancient Greeks considered the idea some 2500 years ago that matter might be composed of atoms (Greek: *atomos*; uncuttable). They introduced the idea that all matter is not capable of infinite subdivision, and called the ultimate and indivisible constituents of matter "atomos." In the 17th century, the Irishman Robert Boyle developed chemical analysis—the technique for breaking down substances into their constituents. He defined an element as a material that could be identified by scientific experiment and could not be broken down by chemical means into still simpler substances. This is the definition that is still in use today.

The French scientist Antoine Lavoisier revolutionized chemistry in the 18th century by introducing accurate weighing of substances, including gaseous matter. He observed that a given amount of matter has a mass that remains the same when it is redistributed from one chemical combination to another, whether in the solid, liquid, or gaseous state. The analysis of the French chemist Joseph Proust showed that a particular chemical compound always contained the same elements united in the same proportions by mass ("weight").

The English schoolteacher John Dalton, at the start of the 19th century, tested Proust's hypothesis and noted that the same elements can sometimes combine in different proportions to produce different substances. In his atomic theory, all matter was made up of particles called atoms of various elements. Atoms of the same element were alike in every compound. Atoms of different elements differed in their mass ("weight"). In chemical reactions, atoms preserved their identity and were not destroyed. When Dalton published his atomic theory, he included tables of atomic weights [26].

The Italian physicist Amadeo Avogadro made a distinction between the chemical atom (smallest part of matter that can enter into chemical combination) and the physical molecule (smallest particle of a chemical compound), and suggested that equal volumes of all gases contain the same number of molecules under the same conditions of temperature and pressure, whereas a molecule (Greek: a small mass) may contain more than one distinguishable atom [27].

The English physician William Prout [28] noted that Dalton's atomic-weight values of elementary gases were nearly exact multiples of the atomic weight of H, $A_r(H)$, and suggested that H was the primordial matter from which all elements are formed. For a while, it appeared that a number of atomic-weight values agreed with this hypothesis, and testing it led to a major measurement effort of determining atomic-weight values over the remainder of the 19th century.

At the Karlsruhe Congress in September 1860, about 140 leading European chemists met to formulate an understanding of the nature of atoms and molecules and to reach a consensus with respect to an atomic-weight scale. The Italian chemist Stanislao Cannizzaro presented his "Sketch of a Course in Theoretical Chemistry" [29], in which he called attention to the value of Avogadro's distinction between atoms and molecules as an organizing device for the interpretation of chemical phenomena. The interchange of the terms "atoms" and "molecules" had led to confusion and to instances of two different atomic weights being assigned to the same element. Lothar Meyer and Dimitri Mendeleyev both attended this Congress and subsequently developed periodic tables of the chemical elements based on revised atomic weights. Mendeleyev left open spaces in places where no known element filled that space

[30]. He also predicted the properties of these unknown elements. When Sc, Ga, and Ge were discovered over the next 16 years and found to conform with Mendeleyev's predicted chemical properties, atomic weights became established in the periodic table and their usefulness more fully understood.

By the end of the 19th century, the atomic theory and its implications for the chemical elements had taken firm hold. Nature was seen to be using remarkably few types of elementary "building blocks" for all materials. With an understanding of simple number valences of these "elements", the stage was set for chemistry to emerge as a science based on measurement of the interactions between numbers of "atoms" of the elements in simple number proportions. Chemical reactions, energies, and products, could now all be represented by simple formulae and equations. With newly developed balances of high precision, the relative mass values of atoms of the elements could be determined. When these relative values were scaled to the mass of a H atom equal to one, or to the mass of an O atom equal to 16, chemists called them "atomic weights".

In the 19th century, quantitative chemical-composition measurements of materials with relative uncertainties a little smaller than 1 % became possible and widely practiced. In order to achieve that level of uncertainty, chemists needed ratios between constants called "atomic weights" to be determined to an even smaller uncertainty than they could achieve in chemical analysis. To determine atomic weights to best possible accuracies, Berzelius and others developed the quantitative gravimetric study of the known stoichiometric compounds and acquired knowledge of the characteristic reactions for each known element. Often, the compounds and reactions involved O, less frequently H, Cl, Br, or Ag. Atomic weights scaled to the mass of the H and O were mutually related through the O/H mass ratio in water, which was measured with great skill under carefully controlled conditions of purity.

At the end of the 19th century, this prodigious effort culminated in 1886 in the publication of an atomic weights table by Clarke [31], in which he relied heavily on the work of Berzelius, Brauner, and others. Although not all elements were known at that time, it is interesting to note that two-thirds of the atomic weights listed agreed to better than 1 %, and almost 40 % agreed to better than 0.1 % with those of the 1959 table of the Atomic Weights Committee [32]. The comparison between the two data sets is justifiable because the atomic-weight scale was then based on $A_r(O) = 16$, whereas the current value is 15.9994. A comparison of the atomic weights of polyisotopic elements as determined by "absolute" physical and chemical techniques is given in Peiser et al. [24]. New and better atomic-weight determinations by classical chemical methods was a factor in enabling chemists to make the remarkable progress in the science in the 20th century, for instance, in purification and recovery methodologies. These chemists, among them Richards, Urbain, Hönigschmid, Brauner, and Baxter, who measured atomic weights with very small uncertainties, were accorded the highest honor by the scientific community.

Commission on Atomic Weights and Isotopic Abundances

As early as 1872 F. W. Clarke, chief chemist at the USGS, recognized that measurement comparability between laboratories made uniformly recognized atomic weights desirable. Under his leadership, the best contemporary knowledge of the atomic weights became the primary task of the American Chemical Society's Committee on Atomic Weights in 1892 [31].

An elaborate international election by 57 chemists from many nations was organized by W. Ostwald in 1902, and, as a result, an atomic-weights committee was initially entrusted to just three members who had obtained the highest number of election votes [2]: Clarke, K. Siebert from Germany, and T. E. Thorpe from England. There was a strong feeling that France, a leader in the promotion of rational unification in measurement science, had to be represented on the Committee. So, first H. Moissan and, after his death, G. Urbain of France were coopted to the Committee. This Committee preserved continuity through World War I, despite problems in contacting German colleagues through Switzerland as is documented in IUPAC's archives. In 1913, the International Committee on Atomic Weights joined the International Association of Chemical Societies.

After World War I, the Committee flourished. It became part of IUPAC when it was established in 1920. IUPAC saw the Committee's mandate at the heart of its own responsibilities to the world's scientific community. Indeed, no data set of science and technology has been involved more extensively or in as many disciplines, technologies, and commercial transactions, as is the IUPAC table of recommended atomic weights, now called the standard atomic weights.

In 1921, it was decided to reorganize and enlarge this Committee by giving it the responsibility of advising on the existence of radioactive and stable isotopes, as well as on atomic weights. It was renamed the Committee on Chemical Elements. Two members of the Committee were Francis Aston and Frederick Soddy, both of whom had received Nobel Prizes in Chemistry. Altogether six Nobel Prize winners have served on the Committee. In 1930, the Committee on Chemical Elements was subdivided into three parts, one of which became the Atomic Weights Committee. In 1969, after several further reorganizations, the IUPAC responsibility for atomic weights fell upon the Commission on Atomic Weights, renamed CAWIA in 1979, which has the role of evaluating new isotope-abundance data and publishing tables of Standard Atomic Weights and Isotopic Compositions of the Elements on a regular basis. Interesting historical accounts of the International Commission have been given by Holden [2,32].

In 1969, there was a serious move within IUPAC to eliminate the Atomic Weights Commission. Not that atomic weights were not needed—not that the Commission had performed badly—but because atomic weights were then thought to be so accurate that any further improvement was at most an "academic" exercise of no interest or relevance to professional chemists or chemical technology, and certainly not to commerce. The recognition that isotope-abundance variations would impair the "accuracy" of atomic weights was one of the arguments to continue the work of the Commission.

In the 1970s, it became clear that the very techniques that yielded accurate atomic weights could be employed to do chemical analyses and other chemical measurements to better accuracies than had previously been achieved. New applications came into prominence, among them the use of subtle differences in sample atomic weights and isotopic compositions to identify sources of materials and influences from manufacturing processes and mechanisms of biological reactions. From the classical emphasis on better atomic weights, we have come to the understanding that it is not simply the accuracy of atomic weights that is all-important, but of equal significance is the uncertainty associated with the standard atomic weights. The subtle differences in isotope abundances and atomic weights now drive mass spectrometrists to measure samples with as high precision as possible. Improvements in the values of the standard atomic weights aim to give scientists a reliable basis to evaluate what uncertainties are introduced into an analytical result when the standard atomic weights are used as reference values.

Urey [33], De Bièvre [34], and others have pointed out that variations in isotope abundances are a vast information source. Nature has provided over 300 stable and long-lived isotopes, which are of immense value to science by their ability to carry information through their "isotopic signatures." The ability of a mass spectrometer to measure isotope-abundance ratios with high precision enables it to act as instrument of choice for comparing amounts of isotopic substance, that is numbers of atoms, in two samples just like a conventional chemical precision "balance" compares the amounts of mass quantity in two material objects [35]. The mass spectrometer takes the particulate nature of matter fully into account in that it sorts out atoms on the basis of their mass, then counts them, thus leading to the direct measurement of ratios of numbers of atoms (i.e., ratios of amounts of substance). These two features make isotope mass spectrometry one of the most powerful analytical tools we have at our disposal [36,37].

While CAWIA made outstanding progress in assessments of atomic-weight determinations, the more universal art of measurement at the highest achievable accuracy also advanced. By the end of the 19th century, the field of measurement science, called metrology, became widely recognized as a fundamental aspect of the scientific method and an essential gateway to progress in technology. For metrological concepts to be conveniently used in science and industry, two major steps had to be taken:

(1) Magnitudes of the measured quantities had to be expressed in the familiar decimal system of numbers.
(2) Physics-developed laws of mathematical relationships between different quantities had to be involved so that most measurements could be expressed in terms of coherent units of a few base quantities.

A consistent system of measurement units thus became possible, and international agreement was needed.

The General Conference on Weights and Measures (CGPM) operates every four years under the Convention of the Metre, a diplomatic treaty concluded in 1875 and adhered to by most industrialized countries. In 1960, CGPM established the SI under the above concepts. Virtually all international bodies have adopted the SI and attempt to facilitate its almost universal application, especially in chemistry, with its prime interest in "amount of substance" (a base quantity in SI since 1971). Until recently, chemists had few methods of directly measuring "amount"—that is, counting "absolute" numbers of entities, or their ratios—but were limited to the use of an amount–related property of matter—"mass," the ratio of which could be measured by a remarkably accurate measuring device (i.e., a balance). For over a century, laboratory balances have been effectively used in comparing the masses of two similar objects to a relative precision of 1×10^{-6}. These mass ratios needed mass-to-number specific conversion factors in order to yield the desired ratios of numbers of entities, the true aim of measurement in chemistry. These factors involve atomic weights. The wide adherence to the SI by chemists thus appears to present at most minor hurdles in traditional semantics. One major task, however, remains for CAWIA: the development of agreed methods for the assignment of uncertainties, the essential quality assessments of all good measurements, under guidance by ISO [38].

Discovery of radioactivity and isotopes

The discovery of radioactivity by the French scientist H. A. Becquerel [1] caused a fundamental upheaval in the science of atomic weights, as it opened up the possibility that radioactive elements characterized by spontaneous emission of "rays", and their decay products, could have different atomic weights. One component of these "rays", called alpha particles, carried appreciable mass and were identified as He nuclei by W. Ramsey and F. Soddy [39]. Soddy [40] also demonstrated the chemical identity of mesothorium 1 (^{228}Ra) and Ra, and concluded that there were chemical elements with different radioactive properties and different atomic weights, but with the same chemical properties and therefore occupying the same position in the periodic table. Soddy coined the word "isotope" (Greek: *isos topos*: in the same place), to account for these radioactive species. The original definition of "isotope" referred to the fact that a second species could be inserted at the same place in Mendeleyev's tables. At that time, the phenomenon was thought to be a characteristic only of some radiogenic elements. The possibility of the existence of an isotope of H of mass 2 would have been judged pure speculation. The discovery of ^{2}H in nature had to wait for approximately another 20 years.

The study of the natural radioactive decay chains for Th and U led to the hypothesis that the radioactive parent isotopes, ^{232}Th and ^{238}U, would decay by loss of an integral number of alpha- and associated beta-particles, into different stable end isotopes of Pb—^{208}Pb and ^{206}Pb, respectively. Lead from radioactive minerals should therefore differ in atomic weight according to the proportion of U and Th in the mineral and with the age of the sample. That hypothesis proved to be correct. The measured atomic-weight value for "common" Pb (from a nonradioactive source material) was reported by Baxter and Wilson to be 207.2 [41]. Soddy and Hyman [42] reported that Pb in a thorium silicate mineral had an atomic-weight value of 208.3. Richards and Lembert [43] reported the atomic-weight value of Pb in U minerals to be as low as 206.4. It was concluded that Pb was made up of a mixture of stable isotopes, each having a different relative mass not differing appreciably from a whole number value when scaled to $A_r(O) = 16$.

The second event that had a profound effect on the future of the determination of atomic weights was the discovery of the stable isotopes of Ne by J. J. Thomson [44], although Sir William Crookes had postulated the existence of isotopes based on the spectroscopic analysis of Yb some years earlier. Using a positive ray parabola technique, Thomson demonstrated that Ne exists in at least two isotopic forms, of mass numbers 20 and 22 in the approximate proportion 9 to 1. This provided an explanation for the measured atomic weight of naturally occurring Ne of 20.2, which differed appreciably from a whole number value. This discovery marked the advent of a new field in spectroscopy—the "spectroscopy of mass"—which, as Thomson foresaw, would have great applicability in chemistry.

Thomson encouraged F. W. Aston at the Cavendish Laboratory at Cambridge University to continue this work by building a mass analyzer that possessed the property of focusing as well as analyzing positive rays with a much higher resolution than Thomson's parabola method. Aston [45] was able to confirm the presence of ^{20}Ne and ^{22}Ne and showed that a third stable isotope at mass number 21 also existed, and confirmed that the masses of the isotopes were integrally related to each other and to that of H and O. The discovery that Cl possessed two stable isotopes provided further confirmation for fractional atomic weights and supported the concept of a whole number rule for the isotopes [46]. Aston analyzed a sample of Pb that yielded lines on the photographic plate at mass positions 206, 207, and 208 with relative intensities of 100, 10.4, and 4.5, respectively [47]. Aston concluded that mass 207 must be the end product of the actinium radioactive decay series and was probably derived from an isotope of U, which would have a mass of 235. Aston's outstanding work in developing increasingly sophisticated mass spectrographs enabled him to systematically survey the isotopic compositions of most elements and to establish an atomic-mass scale, which was to be essential to the determination of atomic weights by the "physical" method.

As one now thinks about the new insights thus provided by Aston, one is reminded of how, much earlier still, Prout had hypothesized, from partially confusing data, that there was a numeric pattern to atomic weights that had to be of significance. This integral value pattern could be fitted with far greater precision to the relative atomic-mass values of isotopes. The remaining much smaller departures from integral values are the result of the mass equivalence of binding forces affecting atomic masses, the subject of the next section.

Atomic masses

As important as the concept of atomic weights of the chemical elements in their normal occurrence is to chemists, so is the concept of atomic masses of individual isotopes to physicists. In nuclear physics, the atomic-mass values are linked directly to the binding energies of particles in the atomic nucleus and for the energy balance in nuclear reactions. Much of the early effort in designing and building new mass spectrometers, particularly double focusing mass spectrometers, was driven by the desire to measure atomic masses with the highest possible precision.

Masses of atoms in their atomic and nuclear ground states are important in many areas of science, such as in nuclear physics and technology, nuclear astrophysics, and mechanical resonances in crystals. In the context of this review, atomic masses (together with isotope abundances) contribute to the calculation of atomic weights of polyisotopic elements, and uniquely determine the atomic weights of the monoisotopic elements. They also play an important role in determining the values of some of the fundamental constants. The atomic masses are derived by a least-squares adjustment from data consisting predominantly of redundant mass-spectrometric measurements based on the "mass-doublet" technique (in which the masses of isotopes with identical mass number are compared) but also of nuclear-reaction data and spontaneous-fission information. Atomic-mass tables have thus been produced over an extended period of time by A. H. Wapstra and his colleagues [23,48–51]. IUPAC–CAWIA accepts these atomic-mass values in composing its Tables of Standard Atomic Weights (TSAW). Atomic masses are published with the support of the Commission on Symbols, Units, Nomenclature, Atomic Masses and Fundamental Constants (SUN-AMCO) of IUPAP. The Atomic Mass Table constitutes part of the basic

data set of the Committee on Data for Science and Technology (CODATA) of the International Council of Scientific Unions (ICSU), and is one of the most comprehensive sets of scientific data published to date [52].

The relative uncertainties associated with atomic masses are typically of the order of 1×10^{-8}, and little improvement in this level of uncertainty is expected through mass-spectrometric and nuclear-reaction data. A different approach has recently been developed to determine atomic masses, resulting in a reduction of up to two orders of magnitude in the uncertainties for the atomic masses of some isotopes (including ^{12}C and ^{28}Si). The technique involves a Penning Trap [53] in which an isolated ion's cyclotron motion in a magnetic field is compared to a reference ion's motion. The ratio of the cyclotron frequencies determines their relative masses, which are then converted to a scale based on the mass of the ^{12}C atom. The published uncertainties of the atomic masses measured by this method impose no significant constraints and, in their differences from the IUPAP values, introduce no significant additional uncertainties with which the atomic weights of polyisotopic elements are evaluated.

Determination of atomic weights

An obstacle to measurements of "atomic" weights during the 19th century was the disagreement over how to write chemical formulae. At that time, a number of chemists tried to use 100 for the atomic number of U. The best chemical atomic weights were those determined by the "Harvard method". T. W. Richards of Harvard University was largely responsible for the development of this method (pioneered by the Belgian chemist J. Stas), in which atomic weights were determined by the preparation of high-purity chlorides or bromides of the element followed by the measurement of the mass ratio to the corresponding silver halide. Solutions containing near-equivalent amounts of reactants were mixed, and the point of exact equivalence determined. This was often followed by the quantitative collection and weighing of the precipitated silver halide. These measurements often attained uncertainties better than 1×10^{-4} for some elements. The consistency between the set of atomic weights derived from chlorides and those from bromides depended on the atomic-weight ratio between Cl and Br, which was evaluated carefully [22].

Richards' work on atomic weights received worldwide recognition, and for it he was awarded the Nobel Prize for Chemistry in 1914. G. P. Baxter was Richards' principal associate and succeeded him as head of the Atomic Weights Laboratory at Harvard University. Baxter not only applied the Harvard method to additional elements, but also made highly precise determinations of the atomic (or molecular) weights of gaseous elements by gas density measurements. O. Hönigschmid came to Harvard to work with Richards and then returned to the University of Münich where he devoted the remainder of his career to atomic-weight determinations.

Richards, Baxter, Hönigschmid, and their associates achieved a remarkable record in atomic-weights research. Of the 194 independent determinations of atomic weights reported in the literature from 1883 to 1947 using the Harvard method, these three scientists and their associates accounted for 142 of them. The atomic weights of 65 elements were determined by this method, and, until recently, the IUPAC-recommended atomic weights of some elements were still based partly on these measurements.

Into this ordered measurement program for atomic weights by the Harvard method came the discovery of isotopes. Experimental investigations in nuclear physics began to require specialized instruments—one of which was the mass spectrometer. Thomson [44] and Aston [45–47] demonstrated that some elements were polyisotopic. Dempster [54] calculated the atomic weight of Mg using the relative abundances of their stable isotopes together with "whole number" mass values of the isotopes, and shortly afterwards made similar studies of Li, K, Ca, and Zn [55,56]. Thus began what would become the ultimate demise of chemically determined atomic weights. From this time until the late 1930s, Aston, Dempster, Nier, and others determined the isotopic compositions of most of the elements, so that

the "physical" method of determining atomic weights became a superior alternative to the "chemical" technique, and later superseded it entirely.

The atomic weight of an element in a specific sample is currently defined as "the ratio of the average mass per atom of that element to 1/12 the rest mass of one ^{12}C atom with all atoms in their nuclear and atomic ground states". Former definitions differed only by the scale-determining mass of the reference atoms, which included H and O. The establishment of a consistent and accurate set of atomic weights, especially one applicable to a wide range of normal terrestrial occurrences, has been a major ongoing task in science. TSAW is an important set of scientific data, as atomic weights are fundamental to convert two base quantities of the SI into each other, "mass" and "amount of chemically defined substance"—both of which are essential in analytical chemistry and to the understanding of chemical reactions. Atomic weights are not only fundamental to science and technology, but are also basic to trade and commerce, which are directly involved with "amount" of specified substances. In practice, a material property, mass, is used because of the general availability of balances (which measure mass ratios), and because many chemical measurements do not involve well-defined entities. Mass ratios thus remain a sometimes necessary and convenient alternative to amount-of-substance ratios. Nevertheless, the determination and continuing evaluation of atomic weights, which was one of the major tasks of chemistry in the 19th century, remains of key importance in the development of metrology of "amount of substance" at the close of the 20th century.

Avogadro's realization that equal volumes of ideal gases under identical conditions contained equal numbers of atoms or molecules (with relative molecular mass equal to the sum of the atomic weights of all atoms composing a single molecule), led to a simple method of measuring atomic weights from measures of volume and mass of gaseous specimens. That method was the only choice for the nonreactive noble gases for which compounds were unknown until the last 15 years of the 20th century. Of this method's other uses, the most important was the reaction between exactly equivalent amounts of gaseous H and O (to form water). The comparison provided their atomic-weight ratio and hence the relation between two historically important atomic-weight scales, based on $A_r(H) = 1$, attractive for numeric simplicity, and that based on $A_r(^{16}O) = 16$, derived from the element that has stoichiometrically reliable compounds with many other elements. The kinetic theory of gases, which describes the statistics of random molecular motions in gases, added greatly to the understanding and practice of this physicochemical method of atomic-weight determination. It is noteworthy that the instrumental realization of near-perfect conditions for inert gases in a mass spectrometer enables the kinetic theory of gases to be applied once again to atomic-weight measurements. Experimental values for mass fractionation through the pressure "pinhole" of the gas inlet system of the mass spectrometer can be compared to theoretical values resulting from the kinetic theory of gases [57]. Thus, one can measure the degree of imperfection of the primary measurement while the measurement is in progress. Values very close to the theoretical value of ½ in the exponent of the isotope mass ratio have been obtained [58,59]. This approach can be useful for any element that can be converted into an inert gaseous compound such as $Fe(PF_3)_5$, $Ni(PF_3)_4$, $Pt(PF_3)_4$, and WF_6 [60]. Measurements monitored in this way yield results identical to those that were calibrated by means of synthetic isotope-abundance ratios. The near-perfect disorder in the gas phase thus continues to contribute to atomic-weight measurements. By surprising contrast, the near-perfect order in the solid phase (i.e., in crystals), has only marginally added to our knowledge of atomic weights

Atomic-weight scale

By 1928, it seemed that most of the scientific issues surrounding atomic weights had been resolved. The discovery of isotopes had explained the existence of nonintegral atomic weights, and both chemists and physicists were in agreement that a common scale for atomic weights could be based on the assumption that O was monoisotopic and hence $A_r(O) = 16$. Furthermore, the established chemical technique for determining atomic weights could be supplemented by independent mass-spectrometric data from

physics. Then in 1929, an analysis of optical absorption bands in the earth's atmosphere revealed that O had three isotopes [61,62]. This led to the unsatisfactory state of affairs in which physicists used an atomic-weight scale based on $A_r(^{16}O) = 16$, while chemists continued to use an elemental $A_r(O) = 16$ scale. This difference in scale definition necessitated a factor of 1.000 275 to convert the physics-derived values into numbers consistent with the scale used by chemists. A further complication then arose when it was shown that the isotopic composition of O was not invariant in nature. Thus, the two mass scales were not even related by a fixed constant, but rather the conversion factor varied from 1.000 268 to 1.000 278, depending on the source of O. The situation is also difficult because, if the chemical community adopted the $A_r(^{16}O) = 16$ scale, a relative change of 275×10^{-6} would be required in all chemical amounts whose values depend on the size of the mole. Furthermore, with two sets of atomic weights there were two sets of values for the fundamental constants—the Avogadro, N_A, the Faraday, F, and the universal gas constant, R—and errors were made by failures to match mass values with the appropriate constant [63].

In 1957, A. O. Nier and A. Ölander independently proposed a new scale in which $A_r(^{12}C) = 12$, partly because C is used as a reference standard in atomic mass determinations [64], and partly because, for the sake of equity, both chemists and physicists would have to change their respective scales, albeit by small amounts. IUPAC and IUPAP agreed to unify the two scales in 1959 and 1960, respectively, which required increases of 318×10^{-6} and 42×10^{-6} in the corresponding physical and chemical atomic-scale units of mass respectively. It had taken 31 years to achieve a single scale for atomic weights. At the time of the Cameron and Wichers [22] review of the atomic weights based on the unified scale, 47 of the 62 polyisotopic elements had atomic weights that were based entirely or in part on physical measurements, the atomic weight of Ne was based on gas density measurements, and those of the remaining 14 polyisotopic elements were based on chemical measurements.

The Ninth CGPM in 1948 instructed the International Committee for Weights and Measures (CIPM) to make recommendations on "a practical system of units of measurement." In 1960, the CGPM adopted the thus recommended SI, and, in 1971, with the specific advice of IUPAC, IUPAP, and ISO, redefined the mole as an SI base unit for the measurement of the quantity of "amount of substance", which thus became a new SI base quantity designed specifically to facilitate measurements in analytical chemistry and to make them consistent with the SI. The new definition was:

> "The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon 12. When the mole is used the elementary entities must be specified and may be atoms, ions, electrons, other particles or specified groups of such particles. In this definition, it is understood that unbound atoms of carbon 12, at rest in their ground state, are referred to."

That number of entities per mole is given the symbol N_A (the Avogadro constant). The linear scale for atomic weights (defined as dimensionless mean relative mass values), is given by $A_r(^{12}C) = 12$. When $m(E)$ is the average mass of an atom of element E, we have:

$$A_r(E) = 12 \cdot m(E) / m(^{12}C) \quad (1)$$

Since the atomic weight of an element is the weighted sum of the relative masses of its isotopes, $A_r(^iE)$, expressed on the identical scale of $A_r(^{12}C) = 12$, and the abundance (mole fraction) of isotope ^iE is $n(^iE)/n(E)$, or $x(^iE)$:

$$A_r(E) = \Sigma\, [x(^iE) \cdot A_r(^iE)]. \quad (2)$$

An equivalent equation applies for molar-mass values, but they are not dimensionless quantities and are usually expressed in units of gram per mole:

$$M(E) = N_A\, m(E) = 12 \cdot [M(E)/M(^{12}C)]\ \text{g mol}^{-1}. \quad (3)$$

Since the molar mass of an element is also the sum of the fractional abundances of the isotopes multiplied by their molar mass values, one can also write:

$$M(\mathrm{E}) = \Sigma\,[x(^{i}\mathrm{E})\cdot M(^{i}\mathrm{E})], \tag{4}$$

for which, when expressed in numbers, the units must be given: g mol^{-1}. For instance:

$$M(^{12}\mathrm{C}) = 12\ \mathrm{g\ mol^{-1}} = N_{\mathrm{A}}\, m(^{12}\mathrm{C}). \tag{5}$$

The "unified atomic mass unit" u commonly is used for atomic-scale mass values and is defined by:

$$12\ \mathrm{u} = m(^{12}\mathrm{C}). \tag{6}$$

The SI base unit of mass is the kilogram: kg = 1000 g and

$$\mathrm{g/u} = N_{\mathrm{A}}\ \mathrm{mol}. \tag{7}$$

Whereas the above equations refer to abundances, in practice one measures abundance ratios $R_{i/j} = x(^{i}\mathrm{E})/x(^{j}\mathrm{E})$ with respect to a chosen isotope ^{j}E. With the summations taken over all isotopes i only, one can calculate atomic weights from the $R_{i/j}$ values, the quantities actually measured:

$$A_{\mathrm{r}}(\mathrm{E}) = \Sigma\,[A_{\mathrm{r}}(^{i}\mathrm{E})\cdot R_{i/j}(^{i}\mathrm{E})]\,/\,\Sigma\,R_{i/j}(^{i}\mathrm{E}). \tag{8}$$

This equation is readily proved by multiplying every right-hand term by $x(^{j}\mathrm{E})$, thereby changing the denominator into $\Sigma\,x(^{i}\mathrm{E}) = 1$ and the numerator into the right-hand side of eq. 2.

"Absolute" isotope abundances yield "absolute" atomic weights

Isotope-abundance values that are free from all known sources of bias within stated uncertainties are referred to as "absolute" isotope abundances, and they can be determined by "calibrating" the mass spectrometer by means of gravimetrically measured, synthetic mixtures of materials in which an isotope is enriched (or depleted) by a known or measurable factor. The isotope-abundances ratios in the original materials and in the synthetic mixture are used to eliminate biases and thus to convert the "observed" isotope ratios into "absolute" isotope ratios and hence into "absolute" isotope abundances. It is CAWIA custom to estimate the uncertainties in the calibrated isotope-abundance values so as to engender great reliability to these values. Such uncertainties are called expanded uncertainties [38].

In its simplest form, an isotope-abundance ratio mass spectrometer is an instrument that provides for the ionization of the atoms of a sample, the mass-dependent dispersion, the ion collection, and the measurement of the isotopes as ion currents. One might assume that the isotope-abundance ratios of an element in a sample would be identical to the corresponding ion-current ratios. Unfortunately, this is not always true at the level of uncertainty desired. A variety of physical and chemical mechanisms conspire to alter the ion beams within the mass spectrometer so that the observed isotope ratios, R_{obs}, are not identical to the "true" ratios, R_{true}. The most typical, and often unrecognized error that must be corrected is mass-dependent isotope fractionation. Indeed, many chemical and physical processes involved in the isotope-abundance measurement procedures are mass dependent (e.g., mass law in chemical reactions, mass effects in gas inlet flows, Raleigh distillation, mass dependence of some collectors, etc.). Hence, $R_{\mathrm{true}} = K_{\mathrm{i}}R_{\mathrm{obs}}$, where K_{i} is an instrumental mass bias correction factor that is often a multivariate function comprised of some or all of the following:

- biases introduced when loading the sample into the ion source,
- biases introduced by the physical and chemical processes involved in ion production,
- biases introduced during the transmission of the ion beam from the ion source to the collector (for example, wall adsorption and desorption), and
- biases introduced in the collector systems and in ion-current measurement.

The first attempt to "calibrate" a mass spectrometer to enable measurements of "absolute" isotope abundances was undertaken for the noble gas Ar, using synthetic mixtures of enriched ^{36}Ar and ^{40}Ar to correct for mass discrimination effects in a gas-source mass spectrometer [65]. This procedure permitted the calculation of the atomic weight of Ar together with nine other elements in the same mass spectrometer, assuming that the mass discrimination for all these elements could be corrected by using the same "calibration" factor as had been determined for Ar [65,66].

In 1954, NBS commenced a mass spectrometry-based program at the request of the U.S. Atomic Energy Commission and the USGS to produce certified isotopic reference materials [67]. Metrology, the science and practice of precise and reliable measurements, generally involves the quantification and certification of a quantity (property) in a divisible or transportable reference material, the constancy and homogeneity of that quantification in that material having been appropriately tested at or near the highest attainable precision. The important role of reference materials in metrology is to check, verify, disseminate, and calibrate measurement procedures and instrumentation [68]. Such reference materials in atomic-weight and isotopic-composition measurements have become very important and are sure to become more and more indispensable in the future. CAWIA conservatively estimates the uncertainty of their certified values [37].

Initially, the aim of the NBS (now renamed the National Institute of Standards and Technology, NIST) program was to assure in-sample and between-sample homogeneity for these isotopic reference materials. NBS progressively introduced isotopic reference materials with certified values based on "calibrated" isotope measurements. These "absolute" isotope abundances, together with the corresponding atomic masses, yielded atomic weights of a specific element in a specific sample. The European Commission's (EC) CBNM, in Geel (Belgium), later renamed the Institute for Reference Materials and Measurements (IRMM), joined the effort, the results of which are listed in Table 2.

Table 2 Atomic weights of the elements in specified reference materials as determined by NBS/NIST and CBNM/IRMM by "calibrated" mass spectrometry.

Element	Atomic weight A_r(E) and uncertainty $U[A_r(E)]$[a]		Year of publication	Relative uncertainty[a] $\times 10^6$
Chlorine	35.452 73	±0.000 97	1962	27.4
Silver	107.8682	±0.001 0	1962	9.3
Bromine	79.903 63	±0.000 92	1964	11.5
Copper	63.5455	±0.001 0	1964	15.7
Chromium	51.996 12	±0.000 33	1966	6.3
Magnesium	24.304 97	±0.000 44	1966	18.1
Lead	207.2152	±0.000 15	1968	0.72
Boron	10.811 756	±0.000 20	1969	18.4
Rubidium	85.467 76	±0.000 26	1969	3.0
Boron	10.811 756	±0.000 053	1970	4.8
Rhenium	186.206 79	±0.000 31	1973	1.7
Potassium	39.098 304	±0.000 058	1975	1.5
Silicon	28.085 5258	±0.000 0555	1975	2.0
Thallium	204.383 33	±0.000 18	1980	0.9
Silver	107.868 15	±0.000 11	1982	1.0
Strontium	87.616 814	±0.000 117	1982	1.3
Lithium	6.940 69	±0.000 29	1983	41.8
Gallium	69.723 07	±0.000 13	1986	1.9
Nickel	58.693 353	±0.000 147	1989	2.5

(*continues on next page*)

Table 2 (*Continued*).

Element	Atomic weight A_r(E) and uncertainty $U[A_r(E)]$[a]		Year of publication	Relative uncertainty[a] $\times 10^6$
Iron	55.845 14	±0.000 48	1992	8.6
Silicon	28.085 382	±0.000 023	1992	0.82
Lithium	6.940 05	±0.000 24	1997	34.6
Silicon	28.085 3842	±0.000 003 5	1997	0.12
Xenon	131.292 77	±0.000 36	1998	2.7
Sulfur	32.065 333	±0.000 080	1999	2.5
Uranium	238.028 906	±0.000 27	1999	1.13

[a]As given by the authors.

Powell and Murphy [69] have described the calibration procedures developed at NBS/NIST to determine the "absolute" isotopic compositions of elements. The NBS initiative has prompted other laboratories to make "absolute" determinations of isotopic composition. De Laeter et al. [36] have described a similar but alternative approach used at IRMM. In such cases, the reference material should comprise a large lot of high-purity material, which can then be distributed to the science community. A comprehensive mass-spectrometric study to identify and control sources of measurement bias using this material is then undertaken. By these methods, high-precision measurements of the isotopic composition of Si have been made at IRMM as part of an international effort to redetermine the Avogadro constant and the molar volume of Si in crystals of high perfection and purity [70,71]. At the present time, the best-calibrated measurements for eight elements listed in Rosman and Taylor [72] have been carried out in laboratories other than NBS/NIST and CBNM/IRMM. The work of T.-L. Chang and his associates at the University of Beijing is particularly noteworthy.

Variations in isotope abundances yield variations in atomic weights

Although the calibration systems outlined above can produce accurate values for the isotope abundances and hence for the atomic weights of specific samples, it must be recognized that the uncertainty associated with the standard atomic weights as listed in TSAW for a given element may be limited by variations in its isotopic composition amongst readily available "normal" terrestrial materials. Substantial variations in the isotopic compositions of many elements result from radioactive decay and from isotope fractionation processes, both natural and man-made. Comprehensive compilations of published papers on isotope abundances have been maintained at CBNM (now IRMM) since 1965, and this database has been used extensively by the Commission on Atomic Weights (now CAWIA) in preparing its reports since at least 1976 [7,73].

For some elements, including many with low atomic numbers, the real isotope-abundance variations are much larger than the uncertainties of "absolute" isotope-abundance measurements. In such cases, the uncertainties in the standard atomic weights cannot be reduced by improved measurements. It is actually more likely that future studies will cause the ranges of some standard atomic weights to be enlarged as new occurrences of varying isotopic composition are revealed. For some elements, real variations have only been observed by high-precision differential isotope-abundance measurements, but those variations are smaller than the overall uncertainties of the "absolute" isotope-abundance measurements. In such cases, future work may either expand or reduce the uncertainties in the standard atomic weights. In this review, and in the decisions of CAWIA generally, variations in the atomic weights caused by deliberate actions designed to produce isotopically fractionated materials are excluded from consideration. However, it must be recognized that such materials have become distributed in the environment, and may be encountered unexpectedly in the laboratory.

Radioactive decay

A given isotope may be radioactive (subject to radioactive decay), radiogenic (a product of radioactive decay), or both. Radioactive isotopes decrease in abundance according to the radioactive decay equation:

$$N/N_0 = e^{-\lambda t} \tag{9}$$

where N_0 and N are the initial and measured (after time t) numbers of atoms of a radioactive isotope, respectively, and λ is the decay constant, in units of t^{-1} (for long-lived isotopes usually in reciprocal years). In the absence of other isotope fractionation mechanisms, radioactive decay alone can alter the isotope abundance of the parent element over time, but it may not necessarily lead to variations among different samples at a given time (such as the present) because all occurrences of the element have decayed at the same rate. For example, the radioactive decay of ^{87}Rb ($\lambda = 2.1 \times 10^{-11}$ a^{-1}) is calculated to have caused the $n(^{87}\text{Rb})/n(^{85}\text{Rb})$ ratio to change by about 6 % in the 4.56×10^9 a since the formation of the earth, but all occurrences of Rb of terrestrial origin sampled within historic times have essentially the same value of $n(^{87}\text{Rb})/n(^{85}\text{Rb})$, hence the same atomic weight.

Radioactive decay also can alter substantially the isotopic composition of the element that includes the product isotope. Stable radiogenic isotopes increase in abundance as the products of radioactive decay:

$$N_p = N_0 [1 - e^{-\lambda t}] \tag{10}$$

where N_p is the number of atoms of the product (radiogenic) isotope after time t. Substantial variations in isotope abundances occur for some elements whose isotopes include products of radioactive decay. The degree of variation largely depends on the age of the sample and the relative abundances of the parent and product element in a sample, which can vary widely owing to geochemical processes. For example, the decay of ^{87}Rb to ^{87}Sr can cause a substantial increase in the $n(^{87}\text{Sr})/n(^{86}\text{Sr})$ ratio of a material with a large $n(\text{Rb})/n(\text{Sr})$ ratio, but will have relatively little effect on the $n(^{87}\text{Sr})/n(^{86}\text{Sr})$ ratio of a material with a small $n(\text{Rb})/n(\text{Sr})$ ratio. Furthermore, the magnitude of the change in the Sr isotope-abundance ratio of any substance caused by the decay of Rb will depend on the period of time the substance has had its present form, and the extent to which it has approximated a closed system. Because certain rock formations and specific mineral grains typically crystallize with very different $n(\text{Rb})/n(\text{Sr})$ ratios and commonly are closed with respect to Rb and Sr exchange with the external environment, it is possible to have variations in the $n(^{87}\text{Sr})/n(^{86}\text{Sr})$ ratio in individual samples. The most extreme variations in the isotope-abundance ratios of Sr and other elements with radiogenic isotopes are likely to be found at relatively small scales of observation, such as in individual mineral grains. This is especially evident for some of the noble gases, which may be almost entirely radiogenic in some occurrences. Reported variations in the isotope abundances of many elements are increasing as a result of the use of microprobe techniques in mass spectrometry. The selection of uncertainties for the standard atomic weights is especially difficult for elements with radiogenic isotopes.

Isotopes that are both radioactive and radiogenic can either increase or decrease in relative abundance depending on the decay constants for production and decay, and on the geochemical processes that may separate different elements in a decay series. Some types of nuclear transformations other than radioactive decay also can cause variations in the abundances of certain isotopes in natural terrestrial materials. For example, the interaction of energetic cosmic-ray particles with the atmosphere and with the earth's surface results in the production of a large number of isotopes by nuclear reactions such as spallation (a nuclear reaction with more than one product nucleon) and neutron capture. Some well-known cosmogenic isotopes (e.g., ^{14}C and ^{36}Cl) are radioactive and are used in geochronology [74]. However, the abundances of isotopes such as these are generally many orders of magnitude too small to have a measurable effect on the atomic weights of these elements in materials in which they are normally found.

Isotope fractionation from natural processes

Isotopes of some elements may be fractionated substantially by physical, chemical, or biological processes, the rates or equilibrium states of which are mass dependent. Processes that differentiate on mass, and that commonly yield measurable changes in isotopic composition, include changes of physical state (e.g., evaporation, condensation, crystallization, melting, and sublimation), ion exchange, sorption and desorption, diffusion, ultra-filtration, and a variety of biological processes including photosynthesis, assimilation, respiration, and dissimilatory oxidation-reduction reactions. These changes are commonly larger and more readily detected in the case of "light" elements. For example, as early as 1939, it was shown that the $n(^{13}C)/n(^{12}C)$ ratios in various samples of C varied by up to 5 % of that ratio [75]. The atomic weight of C is therefore dependent on the source of the material used in the analysis, and on the extent of C isotope fractionation in nature.

Equilibrium isotope fractionation results when the forward and backward reaction rates are the same between multiple coexisting phases or species with a common element. The equilibrium isotope fractionation factor (α) is given by:

$$\alpha_{a/b} = R_a / R_b \tag{11}$$

where a and b are two chemical species in isotopic equilibrium and R is the abundance ratio of two isotopes of an element [$R = n(^{i}E)/n(^{j}E)$, where ^{i}E and ^{j}E typically are the heavier and lighter isotopes of an element, respectively]. The factor α is related to the thermodynamic equilibrium constant for the isotope exchange reaction between two isotopes of the element E.

Kinetic isotope fractionation results from differences in the dissociation energies of isotopically different molecules of a given chemical species undergoing an irreversible transformation. The kinetic isotope fractionation factor commonly is designated either in the same way as the equilibrium fractionation factor ($\alpha_{a/b}$, where a is the product species and b is the reactant species), or as its reciprocal ($\beta = 1/\alpha$). Kinetic fractionation can also be expressed as the ratio of the reaction rates of the two isotopically different molecules (or substrates) undergoing the reaction: $\alpha_{kin} = k_i / k_j$ where k_i and k_j refer to the reaction rates of molecules containing the heavier and lighter isotopes of the element in question.

The magnitudes of equilibrium isotope fractionations depend in part on state variables, temperature being the most important, whereas the magnitudes of kinetic fractionations commonly vary with the overall reaction rate and mechanism. Equilibrium isotope fractionation commonly results in heavier isotopes being concentrated in more oxidized compounds and in more condensed phases, whereas kinetic isotope fractionation generally results in lighter isotopes being concentrated in the products of the reaction and heavier isotopes concentrated in the residual (unreacted) molecules ($k_j > k_i$; $\alpha_{kin} < 1$). Measurements of mass-dependent fractionations of the stable isotopes of H, Li, B, C, N, O, S, and Cl have been used in a wide variety of studies in the earth sciences [76–81]. As is the case with the radiogenic isotopes, some of the largest variations in isotope-abundance ratios caused by fractionation processes are commonly observed at relatively small scales, or in substances with low concentrations of an element. Thus, it is likely that the ranges in atomic weights reported for environmental occurrences of these elements will continue to increase as analytical methods improve to permit smaller quantities and a wider range of samples to be analyzed with increasing precision.

Because natural variations in the isotopic compositions of the elements commonly are small and because the differences commonly are more useful than the actual values [33,36,37], several different expressions have been used to amplify the differences and to obviate the need for "absolute" measurements for reporting purposes. Isotopic measurements of elements exhibiting isotope fractionation commonly are given with respect to a δ (delta) scale defined by:

$$\delta(^{i}E)_S = [R_S / R_{RM}] - 1 \tag{12}$$

where R_S and R_{RM}, refer to the isotope-abundance ratios $n(^{i}E)/n(^{j}E)$ in a sample, S, and a reference material, RM, respectively [9,16,17].

Delta values commonly are reported in parts per thousand, or per mill ($\delta \times 1000$ ‰), and measured by comparing the apparent isotope-abundance ratio in a sample with that of a reference material measured under precisely the same conditions, without any attempt to determine the "absolute" isotope-abundance ratios of either material. For light elements such as H, C, N, O, and S, many of these types of analyses have been made on dual-inlet mass spectrometers by comparing the mass detector signals from a sample gas and a reference gas that are admitted alternately in several cycles to the ion source while flowing steadily from a large reservoir [82]. A static gas-source mass spectrometer was introduced subsequently for isotopic analyses of rare gases [83]. Recently, large numbers of relative isotope-abundance ratio measurements have been made on continuous-flow-inlet machines by integrating the detector signals for whole pulses of sample or reference gas admitted to the ion source in a He-carrier stream [84]. Relative isotope-abundance ratio measurements by TIMS and ICPMS have revealed subtle isotope fractionations in some of the heavier elements such as Ca, Fe, and Cu, among others [85].

Delta scales of differential isotope-ratio measurements have been used extensively in the earth sciences since the 1950s, and most of the documented variations in the atomic weights of common light elements were determined by these methods. It is possible to calculate atomic weights from δ measurements if the isotope abundances of the reference material (values of R_{RM}) are known independently, but this may be a source of substantial uncertainty in some cases. Other quantities have been defined for reporting subtle variations in the isotopic compositions of some of the heavier elements in the earth sciences. For example, to emphasize processes related to planetary evolution, an ε scale has been defined for elements such as Nd, Hf, and Sr in rocks and minerals as the deviation, at the time of crystallization of the sample, from the isotopic composition in a hypothetical chondritic meteorite or bulk earth reservoir.

Documented variations in isotope-abundance ratios and corresponding atomic-weight variations in normal materials have been studied by the Commission since 1979 [9]. A preliminary report on the statistical evaluation of isotope abundances was prepared by the Commission in 1991 [15]. The relation between delta scales, isotope abundances, and atomic-weight values is illustrated by the large variations observed in H (Fig. 1). Relative measurements of variations in $n(^2\mathrm{H})/n(^1\mathrm{H})$ are made by comparison to the isotopic reference material Vienna standard mean ocean water (VSMOW). A positive sign for $\delta(^2\mathrm{H})$ indicates that the sample is enriched in the isotope of higher mass compared to VSMOW. Isotope fractionation in H occurs largely because of vapor-pressure differences between $^1H_2{}^{16}O$ and $^1H^2H^{16}O$, and occurs when evaporation or condensation takes place, the magnitude depending on the temperature. As a result, the ^2H content in H_2O on earth ranges from about 0.0082 to 0.025 % [85]. Polar ice contains approximately two-thirds as much ^2H as ocean water. The altitude at which precipitation occurs also affects the isotopic composition. Including all natural sources of H, the extreme values of the atomic weight are 1.007 851 to 1.008 010 [85]. Measured variations in $\delta(^2\mathrm{H})$ have provided useful information about natural processes in hydrology, meteorology, paleoclimatology, oceanography, and cosmochemistry.

A classic example of natural isotopic variations in commercially available materials is that of B. As early as 1948, Thode et al. [86] showed that variations from 4.222 to 4.270 existed in the $n(^{11}\mathrm{B})/n(^{10}\mathrm{B})$ ratios in samples from different geological sources. The isotope fractionation in aqueous B solutions is caused by differences in inter-atomic vibrational energy and symmetry between the trigonal species $B(OH)_3$ and the tetragonal anion $B(OH)_4^-$. McMullen et al. [87] reported calibrated B isotope measurements in brines and minerals from Searle's Lake, which enabled the standard atomic weight to be set at 10.811(3), giving a range that covered all major mineral sources of B known at that time.

For elements with more than two isotopes, the conversion of relative isotope abundance-ratio measurements to atomic weights may involve an assumption about the mass dependence of the isotope fractionation processes. For example, most variations in the isotope abundance of ^{17}O may be calculated from those of ^{18}O and ^{16}O: $\{[n(^{17}\mathrm{O})/n(^{16}\mathrm{O})]_a/[n(^{17}\mathrm{O})/n(^{16}\mathrm{O})]_b\} = \{[n(^{18}\mathrm{O})/n(^{16}\mathrm{O})]_a/[n(^{18}\mathrm{O})/n(^{16}\mathrm{O})]_b\}^z$,

where z is approximately equal to the ratio of the relative mass differences, i.e., $z \approx [m(^{17}O) - m(^{16}O)] / [m(^{18}O) - m(^{16}O)] \approx 1/2$, though it may differ slightly for different materials. In tabulating atomic-weight variations caused by isotope fractionation for elements with more than two isotopes, CAWIA generally has applied this approximation of the mass-dependent relation to the variations in reported δ values, using the "absolute" isotopic composition of a reference material as a basis. This relation clearly cannot be applied to elements whose isotopic variations are caused by radioactive decay, which is not a mass-dependent fractionation process. In addition, it is now recognized that photochemical reactions among atmospheric compounds can cause isotope fractionation that cannot be approximated by the mass-dependent fractionation equation. For example, several minor atmospheric O-bearing compounds commonly exhibit variations in the relative abundances of ^{16}O, ^{17}O, and ^{18}O in which the exponent z is significantly larger than 1/2 [88].

Examples of exceptional natural variability in atomic weights for some elements occur at the Oklo mine site in the Gabon, southwest Africa. Fission reactions occurred spontaneously approximately 1.8×10^9 a ago in high-grade U ore, which at that time had a ^{235}U abundance in excess of 3 %, as compared to the present-day abundance of 0.72 %. As a result of this event, elements enriched in isotopes that are the stable end members of fission chains are found within the ore body and the surrounding sedimentary materials [89]. In addition, some isotopes with large neutron-capture cross-sections are depleted, and the products of these reactions correspondingly enriched [90]. Such exceptional geological occurrences are excluded by CAWIA in recommending standard atomic weights, but an annotation "g" is included for the affected elements in TSAW to indicate that such abnormal variations are known.

The standard atomic weight of H and its uncertainty include most, but not all, of the variations observed. Analytical uncertainties normally are of the order of 1 ‰ on the δ scale.

As TSAW is intended to be used largely by the chemical community, the values listed have been derived from both natural occurrences and bench chemicals ("off-the-shelf" reagents). Cameron and Wichers [22] stated that the standard atomic weights apply to elements as they exist in Nature, without artificial alteration of isotopic composition, and to mixtures that do not include isotopes of radiogenic origin. De Bièvre and Peiser [91] argued that, with minor exceptions to be covered by footnotes and annotations, the implied range of the standard atomic weights is intended to apply to all samples from natural terrestrial occurrences as well as to samples found in laboratories involved in chemical investigations, technological applications, and to materials of commerce. Thus, according to current practice, an essential task in determining the standard atomic weight of an element is to conduct a survey of naturally occurring materials and commercially available reagents to ensure that the uncertainty limits associated with each standard atomic weight include the observed range of isotope abundances. A Subcommittee on Natural Isotopic Fractionation of CAWIA recently has prepared a report that examines the extent of isotope fractionation for certain key elements in order to give a better understanding of the limitations imposed on standard atomic weights by the variations in the isotope abundances of natural materials [85]. Unfortunately, complete surveys have not, as yet, been undertaken for a number of elements.

In recommending standard atomic weights, CAWIA generally has not attempted to estimate the average or composite isotopic composition of the earth or of any subset of terrestrial materials. This is partly because many of these quantities are poorly known and because the numbers of analyses in the literature commonly are biased toward specific substances or unusual geochemical situations that have been the subject of ongoing research. Instead, CAWIA has attempted to find a single value and symmetrical uncertainty that would include almost all substances likely to be encountered, especially in the laboratory and in commerce.

Isotopic anomalies also occur in meteoritic and lunar materials. They have provided insights into the nuclear and chemical processes involved in the formation and evolution of the solar system [92]. It is even possible to identify some of this anomalous material with sites where nucleosynthetic processes

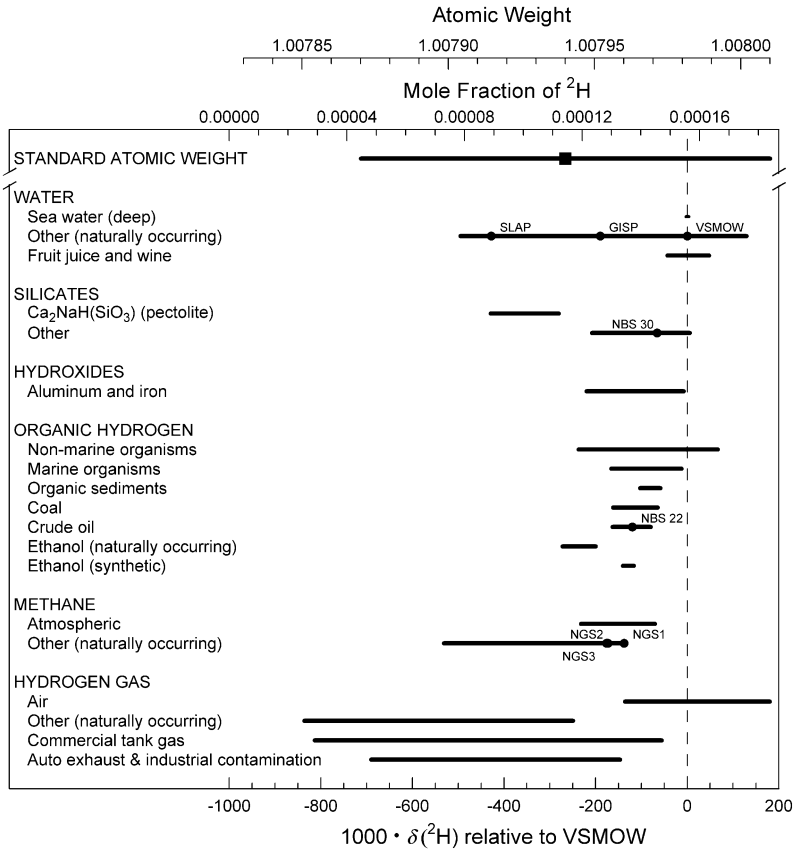

Fig. 1 Summary of variations in the atomic weight of H in terrestrial materials [from 85]. Horizontal axes indicate:

- variations in measured relative isotope-abundance ratios $\delta(^2H)$ expressed as deviations from the $n(^2H)/n(^1H)$ ratio of VSMOW (in ‰),
- corresponding variations in the mole fractions of ^2H, calculated from the $\delta(^2H)$ values by using the calibrated isotope measurements of VSMOW and SLAP isotopic reference materials, and
- corresponding atomic weights calculated from the mole fractions and atomic masses.

have taken place. Because of their importance to cosmochemistry, CAWIA, through a Subcommittee on Non-Terrestrial Isotope Abundance Data, maintains an ongoing survey of reported isotope abundances in non-terrestrial materials and the processes responsible for their differences from terrestrial values. Non-terrestrial materials are not included in CAWIA's definition of a "normal" material and, therefore, do not affect TSAW, but selective reviews of non-terrestrial isotopic compositions and processes have been included regularly in CAWIA documents [9–18].

Artificial isotopic variations

Apart from natural processes causing variations in the isotopic compositions of the elements, there are several technological effects that need to be recognized. Some isotopically altered elements may be produced by distillation, electrolysis, or crystallization, as well as from nuclear bomb tests, nuclear reactors, and nuclear fuel-processing plants. Some of the isotopes released into the environment from these sources have been used as "environmental tracers" in hydrology, oceanography, biology, and geology. For example, a large quantity of radioactive tritium, ^3H, which has a relatively low natural cosmogenic abundance in the atmosphere, was released to the troposphere and stratosphere by thermonuclear bomb

tests in the 1950s and 1960s. The resulting long-lived pulse of high concentrations in atmospheric water vapor of ^{3}H, with a half-life of 12.3 a, has been exploited as a tracer of subsurface water movement in oceans, lakes, aquifers, and ice fields. Many isotopes, including ^{3}H, that were released inadvertently to the environment by human activities are widely distributed, but their concentrations are usually too small to have a significant effect on the atomic weights.

In contrast, there are a number of materials used for experimental or industrial purposes that have deliberately altered isotopic compositions. Isotope separation has been used to produce enriched isotopes for the past 50 years, ^{235}U enrichment being a well-known example of this technology. De Bièvre [93] drew attention to the variability in the isotopic composition of Li. The minor isotope ^{6}Li is valuable as a nuclear source material for tritium production and as a neutron absorber in nuclear fusion. As a result, Li distributed commercially for use in laboratories may be depleted in ^{6}Li by as much as 80 % relative to its normal abundance, with a range in A_r(Li) from 6.94 to >6.99 [94,95]. This range is much larger than that implied by the standard atomic weight for Li, 6.941(2), for which reason CAWIA introduced a specific annotation to alert users of TSAW [16]. It should also be noted that the best value obtained on a material referred to in Table 5 is associated with a still much smaller uncertainty of ±0.000 24 than the implied range of ±0.002 for the standard atomic weight, A_r(Li).

Nitrogen enriched in ^{15}N has been widely used as an experimental tracer for studies of nutrient cycles in agriculture. Many other similar uses have been made of isotopically altered H, O, C, N, S, and other elements. Synthetic isotope mixtures and pure isotopic compounds are produced for use in calibration of measurements of isotope-abundance ratios, and of concentration measurements by isotope dilution mass spectrometry (IDMS). Substances with deliberately altered isotopic compositions can have atomic weights that are far outside the uncertainties given in TSAW, but they tend to be more localized in occurrence. Those substances should be appropriately labeled, but such markings may be viewed to have only limited reliability.

Although artificial enrichment of isotopes such as ^{2}H and ^{235}U gained substantial technological importance and success during the last 60 years, separation methods based on thermal diffusion, centrifugation, electrophoresis, evaporation, neutron irradiation, or crystallization have so far failed economically to supply the small quantities of many stable isotopes that would find beneficial use in IDMS for analytical and other applications. Selective laser excitement, followed by chemical separation, may conceivably provide the future method of choice for the numerous small quantities of isotopic materials that are needed.

Atomic weights of the monoisotopic elements

An element is considered to be monoisotopic by CAWIA if it has one and only one isotope that is either stable or has a half-life greater than 1×10^{10} a. At various times, the term "mononuclidic" has been used synonymously with "monoisotopic"; similarly, radioactive isotopes have been referred to as "radionuclides" or "radioisotopes". Thus, CAWIA considers Th to be monoisotopic because ^{232}Th has a half-life of 1.4×10^{10} a, and the half-lives of the other isotopes of Th are all less than 1×10^{10} a. In contrast, Pa is not classified as a monoisotopic element because the half-life of the most abundant isotope ^{231}Pa is only $3.25(1) \times 10^{4}$ a. All isotopes of elements of atomic number greater than 83 have half-lives less than 10^{10} a, except for ^{232}Th. The following 21 elements are considered to be monoisotopic in the evaluation of the atomic weights: Be, F, Na, Al, P, Sc, Mn, Co, As, Y, Nb, Rh, I, Cs, Pr, Tb, Ho, Tm, Au, Bi, and Th.

With the exception of Be, all monoisotopic elements have odd numbers of protons, even numbers of neutrons, and, therefore, odd atomic numbers. The mass formula in nuclear physics has a pairing term such that nuclei with even numbers of protons or neutrons tend to be more stable than those with single unpaired particles. This pairing explains why the great majority of monoisotopic elements have odd masses and atomic numbers and, incidentally, why elements with even atomic numbers have relatively large numbers of isotopes. Naturally occurring radioisotopes of some of the monoisotopic ele-

ments (e.g., ^{10}Be, ^{129}I) are generated by cosmic-ray reactions with other elements. Although trace amounts of these cosmogenic isotopes may occur in isolation from the major isotopes of the corresponding elements, such anomalous occurrences in minute quantities are, for the time being, considered to be insignificant in the evaluation of the atomic weights. Some radioisotopes were more abundant early in earth's history (e.g., ^{26}Al, ^{129}I) and have decayed to very low concentrations over geologic time, so they also have no significant effect on the atomic weights of the corresponding elements.

The atomic (nuclidic) masses are known with small uncertainties, and the standard atomic weights of monoisotopic elements are at first sight identical to their respective atomic masses. It is, nevertheless, necessary to examine causes for small differences in the two number sets and their respective uncertainties. Both the atomic-weight values of the monoisotopic elements and their respective atomic-mass values have changed in the past as a result of differing changes in the defining scales. Both sets of values now refer to the common numeric scale based on the atomic mass of the ^{12}C isotope.

The Table of Atomic Masses published by Audi and Wapstra [51], which is recognized by IUPAP, is the basis for the atomic weights of the monoisotopic elements in recent editions of the TSAW [17–19]. When adopting these values, CAWIA has had to consider how uncertainties assigned to the atomic weights in TSAW should compare with the standard uncertainties given in the Table of Atomic Masses. Examination of the history of published atomic masses of the monoisotopic elements reveals changes that are large compared with the earlier-stated uncertainties. It has been shown [96,97] that the standard deviations of least-squares adjusted data, such as the atomic-mass values, can be subject to small discrepancies between different portions of the set of values, as well as between subsequent evaluations. To minimize the frequency of changes in the recommended atomic weights of the monoisotopic elements, CAWIA currently assigns expanded uncertainties to the atomic-weight values in TSAW that are a factor of six times the standard deviations given in the Table of Atomic Masses. From 1961 to 1969, CAWIA abbreviated the atomic-mass values to five or six significant figures and equated them numerically to atomic weights with the justification that chemists were not interested in additional significant figures. That argument was rejected by CAWIA in 1969 when it decided to disseminate the most precise A_r(E) values consistent with all reasonably reliable published information, and to round off the last digit of A_r(E) if it was uncertain by more than ±1. This restriction has subsequently been relaxed.

Until recently, CAWIA also considered increasing the uncertainties of the standard atomic weights of monoisotopic elements to account for the remote possibility of undetected isotopes or isomers with long half-lives. CAWIA now discounts this possibility for several reasons:

- Many searches for specific isotopes with sensitive mass spectrometers have been unsuccessful.
- Since the discovery of ^{180}Ta over 40 years ago, no naturally occurring radioisotope of a monoisotopic element has been found.
- The likelihood of finding undiscovered isotopes that could affect the standard atomic weights of monoisotopic elements is further restricted by the fact that the island of β stability for isotopes is very narrow. One would expect to find any naturally occurring odd atomic-number isotope only within one or two mass units of the stable isotopes.

At the time of the 1984 CAWIA review [24], it was still customary to calculate the maximum possible concentrations of undiscovered isotopes as derived from failures to discern them by sensitive mass-spectrometric measurements. These maxima are referred to subsequently in some cases in this report, even though, on the one hand, they are so low that they would hardly affect the atomic weights at the current levels of precision, while on the other hand, they probably overestimate the likely abundances of hypothetical isotopes. The end result is that in TSAW of recent years, the standard atomic-weight values of the monoisotopic elements are numerically equal to the respective atomic masses, but with larger uncertainties arising from IUPAC's preference for expanded uncertainties and in recognition of the effects of minor revisions to the atomic-mass tables.

Atomic weights for fundamental constants

The responsibility for examining experimental and theoretical work on fundamental constants, and providing a self-consistent set of values for the fundamental constants and associated conversion factors on a regular basis, is held by CODATA. This data set is derived from a least-squares adjustment involving a large number of measurements including the atomic-mass compilation [51,52]. Some fundamental constants are directly dependent on atomic mass and atomic-weight data, and these in turn affect the values of other fundamental constants (as shown in Fig. 2).

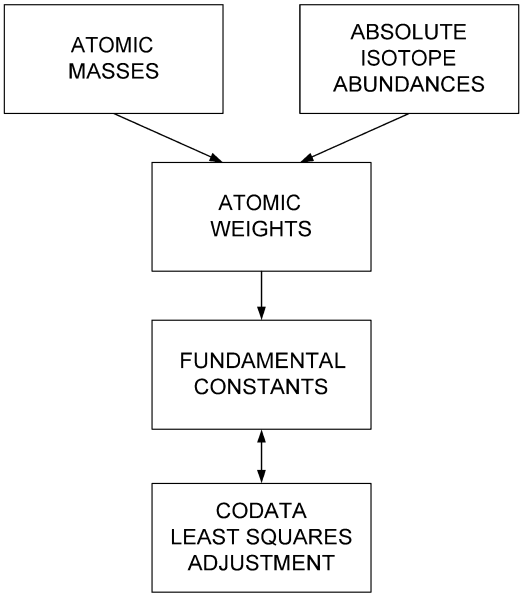

Fig. 2 Role of atomic weights in influencing the magnitude and uncertainty of fundamental constants such as N_A, F and R.

The traditional method of determining the universal gas constant, R, is based on measurements of the molar volume of O and N, but such measurements have been hampered by sorption of gas on the walls of the vessel. An alternative procedure is to measure the speed of sound C_o in Ar at the triple point temperature of water using an acoustic interferometer because this avoids the necessity of an "absolute" volume determination. Thus, R can be determined from the equation

$$R = M(\mathrm{Ar})\ C_o^{\,2}/(\gamma\, T_i) \tag{13}$$

where M(Ar) is the molar mass of Ar, γ is the heat-capacity ratio c_p/c_v for an ideal monatomic gas, and T_i is the temperature of the triple point of water [98]. A new value of $R = 8.314\ 472$ J mol^{-1} K^{-1}, with a relative uncertainty of 1.7×10^{-6}, has been determined by measuring the speed of sound in Ar in a spherical acoustical resonator [98]. This uncertainty is approximately five times smaller than the uncertainty in the 1986 CODATA value [99]. The 1998 CODATA value [52] gives the relative uncertainty in R as 1.7×10^{-6}, in agreement with the experimental value [98]. The work of Nier [65] is still accepted as the best measurement of the isotope abundances of Ar [72], which in turn determines the atomic weight of Ar through which R is derived. Improvements in mass-spectrometric techniques, together with careful control of synthetic isotope mixtures, might permit the uncertainty of the current value of M(Ar) to be reduced, especially if the isotope abundances of the actual sample of Ar used in the acoustical-resonator experiment are measured.

Improvement in the value of R was and remains important because it would yield a reduction in the uncertainties of all the 1986 CODATA recommended values that are derived from R [99]. These include the Stefan–Boltzmann constant, σ, and the Boltzmann constant, k. When the value of R derived by Moldover et al. [98] is used to evaluate σ, the resulting value of 5.670 400(40) $\times 10^{-8}$ W m^{-2} K^{-4} has a relative uncertainty of 6.9×10^{-6}, some five times smaller than the previous value [100]. Similarly, the value of k is 1.380 6503(24) $\times 10^{-23}$ J K^{-1}, with an uncertainty of 1.7×10^{-6}, approximately five times smaller than the previous relative uncertainty of 8.5×10^{-6}. The CODATA values were adjusted to reflect these improvements in 1998 [52].

The Faraday constant F is the molar elementary charge and can be calculated from fundamental constants such as N_A, the electronic charge, the proton magnetogyric ratio, the magnetic moment of the proton in nuclear magnetons, and the ampere. In 1973, a serious discrepancy was reported between the electrochemically determined value of F and the CODATA value derived from the least-squares adjustment technique [100]. It was decided to exclude the existing electrochemical values from the CODATA recommended value, which was therefore based purely on calculations from other fundamental constants. The 1973 CODATA value of F was 96 484.55 C mol^{-1}, whereas the electrochemical values ranged from 96 486.2 to 96 487.2 C mol^{-1}. In an attempt to resolve the discrepancy, a new experimental determination was performed on the mass equivalence of the unit quantity of electricity involved in the electrochemical deposition or dissolution of Ag (E_{Ag}). Using the IUPAC value for the atomic weight of Ag, 107.8682(10), and the equation $F = M(\mathrm{Ag})/E_{Ag}$, a new value of F = 96 486.33 C mol^{-1} was obtained [101]. The relative uncertainty of 2.5×10^{-6} in this value represented an approximate threefold improvement over the previous best determination of F. More importantly, it was consistent with the earlier electrochemically based determinations. Since the largest source of uncertainty in the calculation of F was A_r(Ag), a new value of 107.868 15(11) was obtained for A_r(Ag) [102]. This reduced the uncertainty in F by almost a factor of 10 and yielded F = 96 486.18(13) C mol^{-1}. As a result of these new determinations, the 1986 CODATA value was adjusted to F = 96 485.309 C mol^{-1}, with a relative uncertainty of 0.30×10^{-6} [99]. The 1998 CODATA recommended value, with greater influence from the least-squares adjusted values of other fundamental constants, is now F = 96 485.3415(39) C mol^{-1} with a relative standard uncertainty of 4.0×10^{-8} [52].

The Avogadro constant N_A is defined as "the number of atoms per mole contained in 0.012 kg of the ground-state carbon isotope, ^{12}C, at rest". An accurate determination of the value of N_A is important because it relates the macroscopic masses of chemically equivalent substances to those of the corresponding atomic-scale entities. Thus, it has the potential to provide a more reliable and consistent international system of measurement units through a least-squares adjustment of fundamental constants. For example, a determination of N_A to a relative uncertainty of 10^{-7} would yield a more accurate value of the volt on the basis of the Josephson effect. Further improvements in the determination of N_A would permit the SI unit of mass, the kilogram, to be defined by a fixed number of specified atomic-scale entities. The kilogram is the only one remaining of the seven base SI units that is still defined by means of an artifact. The International Prototype Kilogram, a platinum-iridium cylinder, is maintained at the BIPM in France. However, the mass of this standard changes with time owing to surface effects and cleaning. This variability of the Prototype Kilogram necessarily introduces a relative uncertainty contribution of about 5×10^{-8} not only into the value of N_A, but also into any mass measurements made on the unified atomic-mass scale of u, but expressed in terms of the kilogram of the SI.

Various methods have been used to measure N_A: gas kinetics, Brownian motion, gravitational and electrical field effects acting on oil drops, and X-ray diffraction analysis by using the equation: $N_A = M(\mathrm{E})/\rho\, V_c$ applicable to atoms of mean molar mass, M(E), occupying a crystal of macroscopic density, ρ, with a primitive unit-cell volume, V_c [103,104]. Deslattes et al. [105] reported measurements of the cell dimensions, density, and atomic weight of nearly perfect Si crystals. These measurements give a value of N_A of 6.022 0943 $\times 10^{23}$ mol^{-1}, with an uncertainty of $1.05 \times 10^{-6} \times N_A$. This appeared to represent a 30-fold reduction in the uncertainty from previous direct measurements [99], but, owing to an

unsuspected error in measurement, had to be corrected later by more than the originally estimated uncertainty [52,106].

At the 36th General Assembly of IUPAC in 1991, CAWIA endorsed an "absolute" determination of the atomic weight of Si in a single sample of 28.085 382(23), which, when combined with new determinations of density and interatomic spacing, gave a value of $N_A = 6.022\ 1363 \times 10^{23}$ mol^{-1} with an uncertainty of 1.1×10^{-6} [106]. The new value was in excellent agreement with the 1987 CODATA value of N_A ($6.022\ 1367 \times 10^{23}$ mol^{-1}), which has a relative uncertainty of 0.59×10^{-6}. The demands of the semiconductor industry have resulted in the production of Si crystals of great purity and physical perfection. This development has permitted a new set of measurements, which have been carried out by scientists from the Physikalisch-Technische Bundesanstalt (PTB), in Braunschweig, Germany, IRMM, and NIST. Improvements in the mass spectrometry of Si have yielded a more accurate value for its atomic weight, and the notion of the molar volume of Si as being a "natural constant" is now well confirmed [71,107]. Based on a worldwide collaboration of IRMM in Geel, the PTB, National Research Laboratory for Metrology (NRLM) in Tsukuba, the Istituto di Metrologie "Gustavo Colonnetti" (IMGC) in Torino, NIST, and the National Measurement Laboratory (NML) in Sydney, a value of $6.022\ 137\ 7(12) \times 10^{23}$ mol^{-1} may now be held to be more reliable than the value resulting from electromagnetic measurements because it is based exclusively on independent measurements with no assumptions made for any other fundamental constant(s). Moreover, scanning tunneling microscopy, capable of detecting small surface imperfections, and new methods for detecting and measuring micro-voids should lead to a reduction of the uncertainty of measurement of the dimensions of the molar volume of Si in ideal crystal form. The 1998 CODATA value $6.022\ 141\ 99(47)$ mol^{-1} with a relative uncertainty of 7.9×10^{-8} [52] may be modified in the next CODATA reassessment based on the best current knowledge of the fundamental constants.

Atomic weights and metrology in chemistry

The end of the 20th century set the scene in which measurements of amount of substance (and of chemical measurements in general) could adopt the concepts of metrology and metrological requirements, generating a renewed interest in the link between amounts of substance and mass. On the one hand, chemistry and chemical reactions are most conveniently described in terms of numbers of well-defined entities, wherefore the adoption of "amount of substance" as an SI base quantity has strong appeal. Amount-of-substance measurements are essentially a process of counting numbers or, rather, measuring ratios of large numbers [108]. On the other hand, we usually work with mass, which is not based on well-identified entities, but simply on mass ratios. It is well suited for "bulk" material measurements, as we have a convenient tool available to measure mass ratios: the balance. It is important, however, to recognize that mass does not offer a unique way for quantification of materials—as many chemists implicitly think and use mass—both types of measurements relate to important, useful, and differing base quantities. For pure substances of known composition, there is the possibility of converting the one into the other by use of the factor of the atomic weight. As the isotopic composition of the substances we handle deviate from a "constant" because of natural and anthropogenic reasons, it is important to realize that we have an apparently "variable" conversion factor (atomic weight or atomic-weight sum) between mass and amount of substance [109].

At some time in the future when the A_r(Si) and, through it or by other means, the value of N_A, will have a relative uncertainty of less than 5×10^{-8} (the current uncertainty related to the artifact "prototype kilogram", the SI primary standard of mass), it will become convenient to "define" N_A in an equivalent way as the speed of light has now been "defined" as an invariant, exactly known constant. Just as the speed of light now links the more precisely defined unit of frequency exactly to that of length, so N_A would then link the unit of mass exactly to that more perfectly defined unit for amount of substance. That opens the possibility for making all mass measurements of precisely defined chemical substances in terms of the number of specified chemical entities.

Tables of standard atomic weights

The IUPAC-recommended atomic weights of the elements and their uncertainties are listed in the Table of Standard Atomic Weights, TSAW [19] (Table 3). TSAW and its predecessor tables represent, with minor exceptions covered by footnotes and annotations, the values that are intended to apply to virtually all samples from terrestrial sources as well as those found in laboratories involved in chemical investigations, for technological applications, and in materials of commerce. TSAW lists a single atomic weight for each element (with at least one stable isotope) associated with an estimated symmetrical uncertainty that would include the majority of substances likely to be encountered in elemental or chemically bound form. These uncertainties have always been estimated by CAWIA (and its predecessor Commissions) by consideration and evaluation of all the relevant published literature such that any user of the atomic-weight data would with high probability find the atomic weight of any element in any normal sample to be in the range indicated by the uncertainty for the currently recommended TSAW atomic weight. These values thus correspond to expanded uncertainties as now defined by ISO [38], and they also are found to be generally consistent with those calculated by orthodox statistical procedures from column 9 in Table 5. Since 1979, the atomic weights in TSAW [9] have been called the "standard atomic weights". Excluded from consideration in these atomic weights are most materials with deliberately altered isotopic compositions, extraterrestrial materials, and materials affected by nuclear reactions as at the Oklo natural nuclear reactor.

CAWIA has adopted the practice of adding annotations to the standard atomic weights that now form an integral part of the TSAW (Table 3). The exceptional situation with respect to Li has been addressed by including a special footnote referring to the large variations of A_r(Li) in commercial products. Other annotations used repetitively in TSAW are as follows:

g: Geological specimens are known in which the element has an isotopic composition outside the limits for normal material. The difference between the atomic weight of the element in such specimens and that given in the Table may exceed the stated uncertainty.

m: Modified isotopic compositions may be found in commercially available material because it has been subjected to an undisclosed or inadvertent isotope fractionation. Substantial deviations in the atomic weight of the element from that given in the Table can occur.

r: Range in isotopic composition of normal terrestrial material prevents a more precise A_r(E) being given; the tabulated A_r(E) value should be applicable to any normal material.

Roth [110] has discussed the rationale behind these annotations, and the more fundamental question of how an atomic weight should be defined for a polyisotopic element, in light of the knowledge that its value depends on the population of atoms on which the measurement is made. Nature does not provide uniform samples of polyisotopic elements, the atomic weights of which can be measured with ever increasing precision. It is, therefore, necessary to select an adequately homogeneous sample that is available in sufficient quantity, and distributed with prescribed safeguards, so that it can be used for the purpose of specifying it as a carrier of an atomic-weight reference value.

The current TSAW (Table 3) reflects the best experimental values of atomic weights, taking account of the natural variabilities and experimental errors outlined above. Although the majority of users of atomic weights tend not to follow detailed discussions on reliability and applicability of data, these details are provided in the CAWIA report for the year in which the last change in the relevant atomic

weight was made. Since the 1971 report [5], Commission reports have provided graphical displays of the widely differing uncertainties of the recommended atomic weights (see Fig. 3).

Table 3 Table of Standard Atomic Weights (TSAW) 2001. [Scaled to $A_r(^{12}C) = 12$, where ^{12}C is a neutral atom in its nuclear and electronic ground state. From ref. 19, with the addition of four changes to the atomic weights recommended by CAWIA at the General Assembly in 2001.]

Atomic number	Name	Symbol	Atomic weight	Footnotes
1	Hydrogen	H	1.007 94(7)	g m r
2	Helium	He	4.002 602(2)	g r
3	Lithium	Li	[6.941(2)]†	g m r
4	Beryllium	Be	9.012 182(3)	
5	Boron	B	10.811(7)	g m r
6	Carbon	C	12.0107(8)	g r
7	Nitrogen	N	14.0067(2)	g r
8	Oxygen	O	15.9994(3)	g r
9	Fluorine	F	18.998 4032(5)	
10	Neon	Ne	20.1797(6)	g m
11	Sodium (Natrium)	Na	22.989 770(2)	
12	Magnesium	Mg	24.3050(6)	
13	Aluminium (Aluminum)	Al	26.981 538(2)	
14	Silicon	Si	28.0855(3)	r
15	Phosphorus	P	30.973 761(2)	
16	Sulfur	S	32.065(5)	g r
17	Chlorine	Cl	35.453(2)	g m r
18	Argon	Ar	39.948(1)	g r
19	Potassium (Kalium)	K	39.0983(1)	
20	Calcium	Ca	40.078(4)	g
21	Scandium	Sc	44.955 910(8)	
22	Titanium	Ti	47.867(1)	
23	Vanadium	V	50.9415(1)	
24	Chromium	Cr	51.9961(6)	
25	Manganese	Mn	54.938 049(9)	
26	Iron (Ferrum)	Fe	55.845(2)	
27	Cobalt	Co	58.933 200(9)	
28	Nickel	Ni	58.6934(2)	
29	Copper (Cuprum)	Cu	63.546(3)	r
30	Zinc	Zn	65.409(4)	
31	Gallium	Ga	69.723(1)	
32	Germanium	Ge	72.64(1)	
33	Arsenic	As	74.921 60(2)	
34	Selenium	Se	78.96(3)	r
35	Bromine	Br	79.904(1)	
36	Krypton	Kr	83.798(2)	g m
37	Rubidium	Rb	85.4678(3)	g
38	Strontium	Sr	87.62(1)	g r
39	Yttrium	Y	88.905 85(2)	
40	Zirconium	Zr	91.224(2)	g
41	Niobium	Nb	92.906 38(2)	
42	Molybdenum	Mo	95.94(2)	g

(*continues on next page*)

Table 3 (*Continued*).

Atomic number	Name	Symbol	Atomic weight	Footnotes
43	Technetium*	Tc		
44	Ruthenium	Ru	101.07(2)	g
45	Rhodium	Rh	102.905 50(2)	
46	Palladium	Pd	106.42(1)	g
47	Silver (Argentum)	Ag	107.8682(2)	g
48	Cadmium	Cd	112.411(8)	g
49	Indium	In	114.818(3)	
50	Tin (Stannum)	Sn	118.710(7)	g
51	Antimony (Stibium)	Sb	121.760(1)	g
52	Tellurium	Te	127.60(3)	g
53	Iodine	I	126.904 47(3)	
54	Xenon	Xe	131.293(6)	g m
55	Caesium (Cesium)	Cs	132.905 45(2)	
56	Barium	Ba	137.327(7)	
57	Lanthanum	La	138.9055(2)	g
58	Cerium	Ce	140.116(1)	g
59	Praseodymium	Pr	140.907 65(2)	
60	Neodymium	Nd	144.24(3)	g
61	Promethium*	Pm		
62	Samarium	Sm	150.36(3)	g
63	Europium	Eu	151.964(1)	g
64	Gadolinium	Gd	157.25(3)	g
65	Terbium	Tb	158.925 34(2)	
66	Dysprosium	Dy	162.500(1)	g
67	Holmium	Ho	164.930 32(2)	
68	Erbium	Er	167.259(3)	g
69	Thulium	Tm	168.934 21(2)	
70	Ytterbium	Yb	173.04(3)	g
71	Lutetium	Lu	174.967(1)	g
72	Hafnium	Hf	178.49(2)	
73	Tantalum	Ta	180.9479(1)	
74	Tungsten (Wolfram)	W	183.84(1)	
75	Rhenium	Re	186.207(1)	
76	Osmium	Os	190.23(3)	g
77	Iridium	Ir	192.217(3)	
78	Platinum	Pt	195.078(2)	
79	Gold (Aurum)	Au	196.966 55(2)	
80	Mercury (Hydrargyrum)	Hg	200.59(2)	
81	Thallium	Tl	204.3833(2)	
82	Lead (Plumbum)	Pb	207.2(1)	g r
83	Bismuth	Bi	208.980 38(2)	
84	Polonium*	Po		
85	Astatine*	At		
86	Radon*	Rn		
87	Francium*	Fr		
88	Radium*	Ra		
89	Actinium*	Ac		
90	Thorium*	Th	232.0381(1)	g
91	Protactinium*	Pa	231.035 88(2)	

(*continues on next page*)

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Table 3 (*Continued*).

Atomic number	Name	Symbol	Atomic weight	Footnotes
92	Uranium*	U	238.028 91(3)	g m
93	Neptunium*	Np		
94	Plutonium*	Pu		
95	Americium*	Am		
96	Curium*	Cm		
97	Berkelium*	Bk		
98	Californium*	Cf		
99	Einsteinium*	Es		
100	Fermium*	Fm		
101	Mendelevium*	Md		
102	Nobelium*	No		
103	Lawrencium*	Lr		
104	Rutherfordium*	Rf		
105	Dubnium*	Db		
106	Seaborgium*	Sg		
107	Bohrium*	Bh		
108	Hassium*	Hs		
109	Meitnerium*	Mt		
110	Ununnilium*	Uun		
111	Unununium*	Uuu		
112	Ununbium*	Uub		
114	Ununquadium*	Uuq		
116	Ununhexium*	Uuh		

*Element has no stable isotopes. However, three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated.

†Commercially available Li materials have atomic weights that range between 6.939 and 6.996; if a more accurate value is required, it must be determined for the specific material.

g Geological specimens are known in which the element has an isotopic composition outside the limits for normal material. The difference between the atomic weight of the element in such specimens and that given in the Table may exceed the stated uncertainty.

m Modified isotopic compositions may be found in commercially available material because it has been subjected to an undisclosed or inadvertent isotopic fractionation. Substantial deviations in atomic weight of the element from that given in the Table can occur.

r Range in isotopic composition of normal terrestrial material prevents a more precise A_r(E) being given; the tabulated A_r(E) value should be applicable to any normal material.

At the time of the 1961 review [22], only a limited number of elements were assigned an uncertainty. The first year in which CAWIA included the uncertainty for each element was in 1969 [4]. The uncertainties, $U[A_r(E)]$ were constrained to be either ±1 or ±3 in the last digit, except for the monoisotopic elements, for which ±1 alone was used. At that time, the approximate "uncertainty" estimates did not seem to justify a more precise statement. In 1985, CAWIA adopted a procedure that allowed single-digit uncertainties from 1 to 9 [12].

For the 21 monoisotopic elements, the atomic weights depend only on the atomic masses, and therefore are now known to a relative uncertainty of at most 1×10^{-7} (see above, "Atomic weights of the monoisotopic elements"). Consequently, their atomic weights can be considered for most purposes as constants of nature, as all atomic weights were once believed to be. Peiser et al. [24] compared the atomic weights determined by the Harvard method with the currently accepted physically determined values for the monoisotopic elements. With the exception of Sc, the values were the same to within a factor of 4×10^{-4}, demonstrating the high level of precision of the Harvard method. For the polyiso-

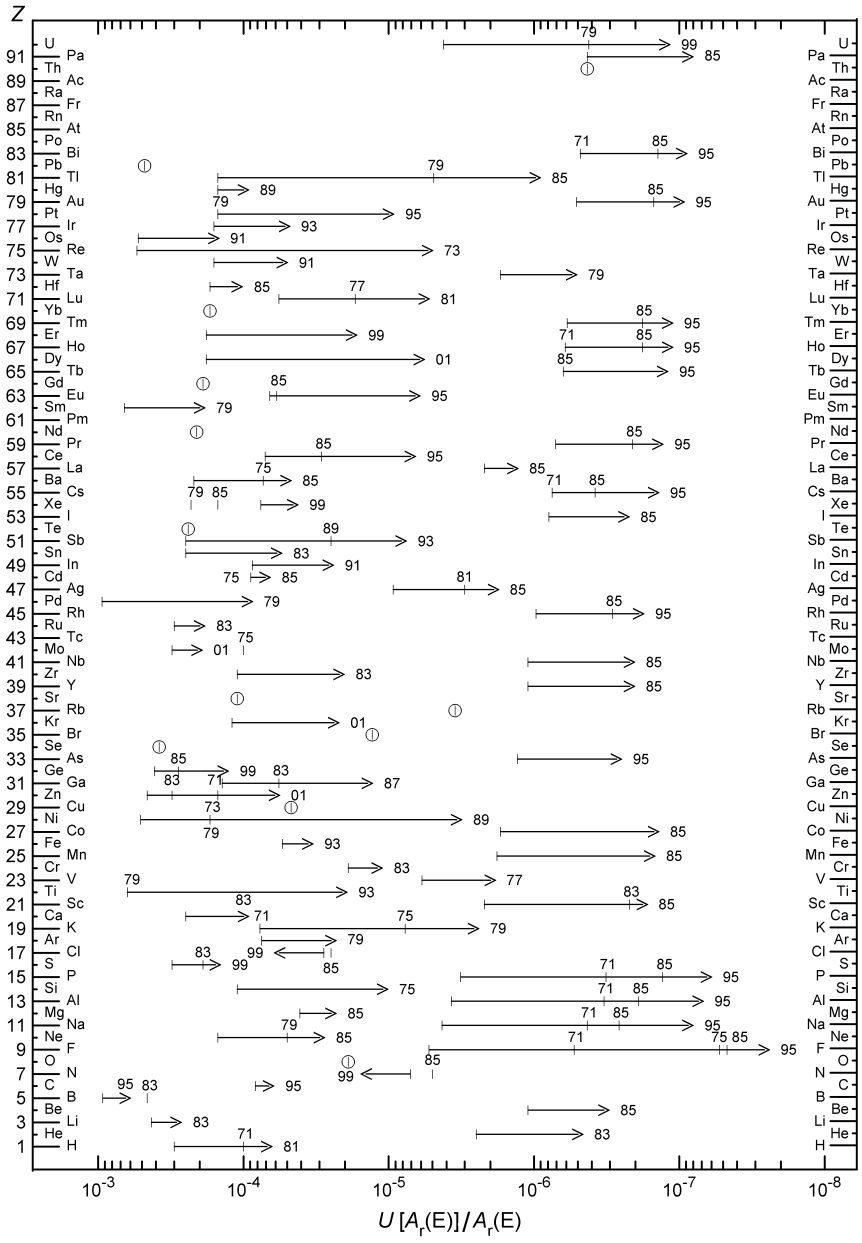

Fig. 3 Changes in the relative uncertainties of the IUPAC recommended (standard) atomic weights from 1969 to 2001. Plotted along the ordinate are the elements, E, in order of ascending atomic number, Z. The relative uncertainties of the recommended atomic weights, $U[A_r(E)]\,/\,A_r(E)$, are displayed along the exponential abscissa, decreasing to the right. For each element, the tip of the arrow indicates the current (2001) value, and the two-digit year indicates when that value was last changed. The foot of the arrow indicates the 1969 value, which is not labeled. For K, Ti, Cd, Cs, Ho, Pt, and Bi, the label at the foot of the arrow indicates a year when the atomic weight was changed by an amount that left the relative uncertainty unchanged at the scale of this illustration. Whenever an uncertainty was changed in intervening years of biennial IUPAC reviews, the change is indicated by a small vertical stroke with the two-digit year of change, even when that stroke falls outside the arrow line. Small circles indicate situations in which no change in relative uncertainty occurred between 1969 and 2001. For all elements except N and Cl, the relative uncertainties in 2001 were less than or equal to the relative uncertainties in 1969.

topic elements, important improvements in our knowledge of atomic weights since the review by Cameron and Wichers [22] have been due almost entirely to new mass-spectrometric measurements of isotope abundances, or to reassessments of uncertainties of mass-spectrometric data underlying earlier values.

Relative differences between the isotopic compositions of different samples commonly can be measured with greater precision than the "absolute" isotopic compositions. For this reason, there are essentially four different categories of elements with contrasting constraints on their atomic weights:

1. monoisotopic,
2. polyisotopic with no reliable current evidence for natural variation,
3. polyisotopic with credible evidence of variation within the uncertainties of the best "absolute" measurement, and
4. polyisotopic with considerable variation extending beyond the range implied by the uncertainties of the best "absolute" measurement.

The annotation "r", referring to atomic weights whose uncertainties reflect variation, applies only to elements of category 4. Atomic-weight values of elements in category 3 may enter category 4 as more precise "absolute" determinations are made, or as materials with wider variability are discovered. Similarly, elements in category 2 can change to higher categories as measurements improve.

An example of an element with large isotope-abundance variability in common materials is H (Fig. 1 and [85]). Accurate "absolute" isotope-abundance measurements have been made on two water samples, VSMOW and standard light Antarctic precipitation (SLAP), which also form the basis for normalizing the δ scale in most laboratories. Delta measurements on other natural substances and artificial reagents range widely, illustrating the difficulty of assigning a single value to the standard atomic weight for H. In 1997, CAWIA selected a standard atomic weight and uncertainty that include the values of essentially all types of materials likely to be encountered in laboratories [18]. The atomic weight of H in tap water is included within the range of the uncertainty, but its value may be expected to differ among laboratories and it is likely to be somewhat higher in most cases than the standard atomic weight. Similarly for O, the standard atomic weight and uncertainty were assigned in 1997 to include those of all common materials, even though it is substantially different than that in normal tap water. Other elements for which analogous decisions have been made include He, Li, B, C, N, Si, S, Cl, Si, Cu, Se, Sr, and Pb, as described in Part 2 of this review.

For some elements, and for some purposes (e.g., geochronology), it may be necessary to determine the atomic weight of an element in a given material used in an experiment rather than relying on the standard atomic weight. In analytical laboratories receiving a variety of samples, it may be necessary either to measure the isotopic compositions of all samples, or to accept the uncertainty of the atomic weight as a component of analytical uncertainty associated with chemical calibration. Compiled data (e.g., Fig. 1; see also [85]) may be compared with the requirements of a proposed investigation to indicate whether the standard atomic weight is sufficiently precise or if an isotope analysis is needed for a particular material under study.

Table 4 gives the comparison of the atomic weights in 1900 (at the beginning of the 20th century) and as they were at the conclusion of the 20th century [19]. The changes that have occurred to the atomic weights as a function of time are graphically represented in Fig. 3, and described in detail by Coplen and Peiser [111]. At the 2001 IUPAC General Assembly, CAWIA recommended four changes to the 1999 TSAW, namely: A_r(Zn) = 65.409(4), A_r(Kr) = 83.798(2), A_r(Mo) = 95.94(2), and A_r(Dy) = 162.500(1). These 2001 changes are incorporated in Tables 3 and 4 and in Fig. 3.

In the reports for 1981, 1989, and 1993 [10,14,16], CAWIA published atomic-weight tables abridged to five significant figures because the full TSAW "exceeds the needs of many users," and the abridged table would increase "the length of time during which a given table has full validity, a desirable attribute for textbooks and numerical tables." These expectations were not fully realized because every set of TSAW revisions so far has necessitated at least one change in the abridged table.

Tables of the isotopic compositions of the elements

Although Tables of Atomic Weights have been published since before the turn of the 20th century, the Table of the Isotopic Compositions of the Elements (TICE) is a much more recent innovation. Nier [21] carried out an evaluation of relative isotope-abundance measurements for the Atomic Weights Committee in 1954, but comprehensive compilations of TICE were not prepared by CAWIA until 1975 [7], 1977 [8], and 1979 [9], when they were contained in the CAWIA biennial reports. Subsequent versions of TICE were published by CAWIA separately from the biennial reports [72,112–114].

The production of TICE was initiated by CBNM from 1965 and was institutionalized in SAIC (1975–1984) leading up to the previous element-by-element review [24]. It is now managed by SIAM, which reviews all the mass-spectrometric determinations of isotope abundances that have been published since the last TICE has been published. This involves a critical evaluation of the published literature to reach a consensus on which is the "best" measurement from a single terrestrial source, together with a determination as to whether or not the "best" measurement on a single source is representative of other occurrences of the same element.

The "best" measurement is most useful if made on a homogeneous material available in bulk so that samples of it can be used as a reference material, but this is not the case for all reference materials currently in use. If the best measurement was made on a reference material, the identity of the material is given in TICE. The isotope abundances of the "best" measurement are reproduced from the original literature after due CAWIA evaluation. The uncertainties on the last digits are given in parentheses as reported in the original publication, and TICE indicates the type of uncertainty listed. Where data are published as isotope-abundance ratios, the ratios and their uncertainties are converted to abundances using orthodox procedures [115]. The symbol "C" is appended to the "best" measurement when calibrated mixtures have been used to correct the mass spectrometer for bias, giving an "absolute" result to within the uncertainties stated in the original publication. "F" is appended when calibrated mixtures have been used to correct the mass spectrometer for isotope fractionation, but the measurement fails to fulfill all the requirements of a fully calibrated measurement. "L" is appended when the linearity of the mass spectrometer has been established for the relevant abundance ratios by using synthetic mixtures of isotopes or certified materials produced by a standards laboratory. "N" is appended when none of the above requirements have been met. TICE includes values for normal terrestrial samples, but does not include values published for meteoritic or other extraterrestrial materials.

In the most recent published version of TICE [72], an attempt is made to list the range in natural variations derived from the publications whose measurements have been accepted by SIAM. No data are given unless a range in isotope abundances has been reliably established. The limits do not include certain exceptional geological samples that carry the annotation "g".

Table 4 Comparison of the Table of Atomic Weights in 1900 [20] and 2001.

The 2001 data are from Table 3. The 1900 values are scaled to $A_r(O) = 16$; those for 2001 to $A_r(^{12}C) = 12$. Since on the latter scale $A_r(O) = 15.9994(3)$ the two data sets can be fairly compared within the accuracy of the set for 1900.

Element name	1900	2001[a]	Element name	1900	2001[a]
Aluminium	27.1	26.981 538(2)	Molybdenum	96.0	95.94(2)
Antimony	120.4	121.760(1)	Neodymium	143.6	144.24(3)
Argon	Not measured	39.948(1)	Neon	Not measured	20.1797(6)
Arsenic	75.0	74.921 60(2)	Nickel	58.7	58.6934(2)
Barium	137.40	137.327(7)	Niobium	93.7	92.906 38(2)
Beryllium	9.1	9.012 182(3)	Nitrogen	14.0	14.0067(2)
Bismuth	208.1	208.980 38(2)	Osmium	191.0	190.23(3)
Boron	11.0	10.811(7)	Oxygen	16.000	15.9994(3)
Bromine	79.95	79.904(1)	Palladium	107.0	106.42(1)
Cadmium	112.4	112.411(8)	Phosphorus	31.0	30.973 761(2)
Calcium	40.1	40.078(4)	Platinum	194.9	195.078(2)
Carbon	12.0	12.0107(8)	Potassium	39.11	39.0983(1)
Cerium	139	140.116(1)	Praseodymium	140.5	140.907 65(2)
Caesium	132.9	132.905 45(2)	Protactinium	Not known	231.035 88(2)
Chlorine	35.45	35.453(2)	Rhenium	Not known	186.207(1)
Chromium	52.1	51.9961(6)	Rhodium	103.0	102.905 50(2)
Cobalt	58.93	58.933 200(9)	Rubidium	85.4	85.4678(3)
Copper	63.6	63.546(3)	Ruthenium	101.7	101.07(2)
Dysprosium	Not known	162.500(1)	Samarium	150.3	150.36(3)
Erbium	166.0	167.259(3)	Scandium	44.1	44.955 910(8)
Europium	Not known	151.964(1)	Selenium	79.2	78.96(3)
Fluorine	19.05	18.998 4032(5)	Silicon	28.4	28.0855(3)
Gadolinium	157.0	157.25(3)	Silver	107.92	107.8682(2)
Gallium	70.0	69.723(1)	Sodium	23.05	22.989 770(2)
Germanium	72.5	72.64(1)	Strontium	87.6	87.62(1)
Gold	197.2	196.966 55(2)	Sulfur	32.07	32.065(5)
Hafnium	Not known	178.49(2)	Tantalum	182.8	180.9479(1)
Helium	Not measured	4.002 602(2)	Tellurium	127.5	127.60(3)
Holmium	Not known	164.930 32(2)	Terbium	160	158.925 34(2)
Hydrogen	1.008	1.007 94(7)	Thallium	204.15	204.3833(2)
Indium	114	114.818(3)	Thorium	232.6	232.0381(1)
Iodine	126.85	126.904 47(3)	Thulium	170.7	168.934 21(2)
Iridium	193.1	192.217(3)	Tin	119.0	118.710(7)
Iron	56.0	55.845(2)	Titanium	48.15	47.867(1)
Krypton	Not measured	83.798(2)	Tungsten	184.0	183.84(1)
Lanthanum	138.6	138.9055(2)	Uranium	239.6	238.028 91(3)
Lead	206.92	207.2(1)	Vanadium	51.4	50.9415(1)
Lithium	7.03	6.941(2)	Xenon	Not measured	131.293(6)
Lutetium	Not known	174.967(1)	Ytterbium	173.2	173.04(3)
Magnesium	24.3	24.3050(6)	Yttrium	89.0	88.905 85(2)
Manganese	55.0	54.938 049(9)	Zinc	65.4	65.409(4)
Mercury	200.0	200.59(2)	Zirconium	90.4	91.224(2)

[a]Figures in parenthesis indicating uncertainties in the preceding digit.

TICE also lists "representative" isotopic compositions, which, in the opinion of CAWIA, represent the isotopic compositions of substances that may be encountered in the laboratory. The uncertain-

ties listed in parentheses cover the range of probable variations of chemicals and natural materials as well as estimates for experimental errors. Annotations applied to these values are "m", which refers to modified isotopic compositions found in commercially available materials and "r", indicating that the range in isotopic compositions existing in normal terrestrial material limits the precision of the isotope abundances. The atomic weights calculated from the representative isotopic compositions in TICE generally are consistent with the A_r(E) values listed in TSAW, but with minor discrepancies in some cases resulting from: (1) rounding errors may be caused by the single-digit rule for $U[A\mathrm{r(E)}]$; (2) the representative isotopic compositions of the noble gases refer to their occurrences in air; and (3) TSAW is updated and published on a biennial basis whereas TICE is published less frequently. Table 5 presents the current version of TICE, including modifications from the 2001 meeting of CAWIA and from the compilation of Coplen et al. [85].

Table 5 Table of the Isotopic Compositions of the Elements (TICE), 2001.

Z	E	M	Range of natural variations (mole fraction)	Annotation	Best measurement from a single terrestrial source (mole fraction)	Ref.	Available reference materials[a]	Representative isotopic composition (mole fraction)
1	2	3	4	5	6	7	8	9
1	H	1 2	0.999 816–0.999 974 0.000 026–0.000 184	m,r	0.999 844 26(5) 2s C 0.000 155 74(5)	[116]	VSMOW* CEA IAEA NIST	0.999 885(70) 0.000 115(70)[b]
2	He	3 4	4.6×10^{-10}–0.000 041 0.999 959–1	g,r	0.000 001 343(13) 1s C 0.999 998 657(13)	[117]	Air*	0.000 001 34(3) 0.999 998 66(3) (in air)
3	Li	6 7	0.077 14–0.072 25 0.922 75–0.927 86	m,r	0.075 89(24) 2s C 0.924 11(24)	[118]	IRMM-016* IAEA NIST	[0.0759(4)][c] [0.9241(4)]
4	Be	9			1.0000	[119]		1.0000
5	B	10 11	0.189 29–0.203 86 0.796 14–0.810 71	m,r	0.1982(2) 2s C 0.8018(2)	[120]	IRMM-011* NIST	0.199(7) 0.801(7)
6	C	12 13	0.988 53–0.990 37 0.009 63–0.011 47	r	0.988 922(28) P C 0.011 078(28)	[121]	NBS19* IAEA NIST	0.9893(8) 0.0107(8)
7	N	14 15	0.995 79–0.996 54 0.003 46–0.004 21	r	0.996 337(4) P C 0.003 663(4)	[122]	Air* IAEA NIST	0.996 36(20)[d] 0.003 64(20)
8	O	16 17 18	0.997 38–0.997 76 0.000 37–0.000 40 0.001 88–0.002 22	r	0.997 6206(5) 1s N 0.000 3790(9)[e] 0.002 0004(5)	[123] [124]	VSMOW* IAEA NIST	0.997 57(16) 0.000 38(1) 0.002 05(14)
9	F	19			1.0000	[125]		1.0000
10	Ne	20 21 22	0.8847–0.9051 0.0027–0.0171 0.0920–0.0996	g,m,r	0.904 838(90) 1s C 0.002 696(5) 0.092 465(90)	[126]	Air*	0.9048(3) 0.0027(1) 0.0925(3) (in air)

(*continues on next page*)

Table 5 (*Continued*).

Z	E	M	Range of natural variations (mole fraction)	Annotation	Best measurement from a single terrestrial source (mole fraction)	Ref.	Available reference materials[a]	Representative isotopic composition (mole fraction)
1	2	3	4	5	6	7	8	9
11	Na	23			1.0000	[127]		1.0000
12	Mg	24	0.789 58–0.790 17		0.789 92(25) 2s C	[128]	NIST-	0.7899(4)
		25	0.099 96–0.100 12		0.100 03(9)		SRM980*	0.1000(1)
		26	0.109 87–0.110 30		0.110 05(19)			0.1101(3)
13	Al	27			1.0000			1.0000
14	Si	28	0.922 05–0.92241	r	0.922 2968(44) 2s C	[70]	IAEA	0.922 23(19)
		29	0.046 78–0.046 92		0.046 8316(32)		IRMM	0.046 85(8)
		30	0.030 82–0.031 02		0.030 8716(32)		NIST	0.030 92(11)
15	P	31			1.0000	[119]		1.0000
16	S	32	0.944 54–0.952 81	r	0.9504074(88) 2s C	[129]	IAEA-S1*	0.9499(26)
		33	0.007 30–0.007 93		0.0074869(60)		CEA	0.0075(2)
		34	0.039 76–0.047 34		0.0419599(66)		IAEA	0.0425(24)
		36	0.000 13–0.000 19		0.00014579(89)		NIST	0.0001(1)
17	Cl	35	0.756 44–0.759 23	m,g	0.757 71(45) 2s C	[130]	NIST-	0.7576(10)
		37	0.240 77–0.243 56		0.242 29(45)		SRM975*	0.2424(10)
18	Ar	36		g	0.003 365(6) P C	[65]	Air*	0.003 365(30)
		38			0.000 632(1)			0.000 632(5)
		40			0.996 003(6)			0.996 003(30) (in air)
19	K	39			0.932 5811(292) 2s C	[131]	NIST-	0.932 581(44)
		40			0.000 116 72(41)		SRM985*	0.000 117(1)
		41			0.067 3022(292)			0.067 302(44)
20	Ca	40	0.969 33–0.969 47	g,r	0.969 41(6) 2s N	[132]	NIST-	0.969 41(156)[h]
		42	0.006 46–0.006 48		0.006 47(3)		SRM915*	0.006 47(23)
		43	0.001 35–0.001 35		0.001 35(2)			0.001 35(10)
		44	0.020 82–0.020 92		0.020 86(4)			0.020 86(110)
		46	0.000 04–0.000 04		0.000 04(1)			0.000 04(3)
		48	0.001 86–0.001 88		0.001 87(1)			0.001 87(21)
21	Sc	45			1.0000	[133]		1.0000
22	Ti	46			0.082 49(21) 2s C	[134]		0.0825(3)
		47			0.074 37(14)			0.0744(2)
		48			0.737 20(22)			0.7372(3)
		49			0.054 09(10)			0.0541(2)
		50			0.051 85(13)			0.0518(2)
23	V	50	0.002 487–0.002 502	g	0.002 497(6) 1s F	[135]		0.002 50(4)
		51	0.997 498–0.997 513		0.997 503(6)			0.997 50(4)
24	Cr	50	0.042 94–0.043 45		0.043 452(85) 2s C	[136]	NIST-	0.043 45(13)
		52	0.837 62–0.837 90		0.837 895(117)		SRM979*	0.837 89(18)
		53	0.095 01–0.095 53		0.095 006(110)			0.095 01(17)
		54	0.023 65–0.023 91		0.023 647(48)			0.023 65(7)
25	Mn	55			1.0000	[119]		1.0000

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Table 5 (*Continued*).

Z	E	M	Range of natural variations (mole fraction)	Annotation	Best measurement from a single terrestrial source (mole fraction)	Ref.	Available reference materials[a]	Representative isotopic composition (mole fraction)
1	2	3	4	5	6	7	8	9
26	Fe	54	0.058 37–0.058 61		0.058 45(23) 2s C	[137]	IRMM-014*	0.058 45(35)
		56	0.917 42–0.917 60		0.917 54(24)			0.917 54(36)
		57	0.021 16–0.021 21		0.021 191(65)			0.021 19(10)
		58	0.002 81–0.002 82		0.002 819(27)			0.002 82(4)
27	Co	59			1.0000	[119]		1.0000
28	Ni	58			0.680 769(59) 2s C	[138]		0.680 769(89)
		60			0.262 231(51)			0.262 231(77)
		61			0.011 399(4)			0.011 399(6)
		62			0.036 345(11)			0.036 345(17)
		64			0.009 256(6)			0.009 256(9)
29	Cu	63	0.689 83–0.693 38	r	0.691 74(20) 2s C	[139]	NIST-SRM976*	0.6915(15)
		65	0.306 62–0.310 17		0.308 26(20)			0.3085(15)
30	Zn	64			0.482 68(214) 2s C	[140]		0.482 68(321)
		66			0.279 75(51)			0.279 75(77)
		67			0.041 02(14)			0.041 02(21)
		68			0.190 24(82)			0.190 24(123)
		70			0.006 31(6)			0.006 31(9)
31	Ga	69		m	0.601 079(62) 2s C	[141]	NIST-SRM994*	0.601 08(9)
		71			0.398 921(62)			0.398 92(9)
32	Ge	70			0.203 75(77) 2s C	[351]		0.2038(18)
		72			0.273 11(103)			0.2731(26)
		73			0.077 56(46)			0.0776(8)
		74			0.367 29(85)			0.3672(15)
		76			0.078 30(43)			0.0783(7)
33	As	75			1.0000	[119]		1.0000
34	Se	74		r	0.008 89(3) 1s N	[142]		0.0089(4)
		76			0.093 66(18)			0.0937(29)
		77			0.076 35(10)			0.0763(16)
		78			0.237 72(20)			0.2377(28)
		80			0.496 07(17)			0.4961(41)
		82			0.087 31(10)			0.0873(22)
35	Br	79			0.506 86(26) 2s C	[143]	NIST-SRM977*	0.5069(7)
		81			0.493 14(26)			0.4931(7)
36	Kr	78		g,m	0.003 5518(32) 2s C	[144]		0.003 55(3)
		80			0.022 8560(96)			0.022 86(10)
		82			0.115 930(62)			0.115 93(31)
		83			0.114 996(58)			0.115 00(19)
		84			0.569 877(58)			0.569 87(15)
		86			0.172 790(32)			0.172 79(41) (in air)
37	Rb	85		g	0.721 654(132) 2s C	[145]	NIST-SRM987*	0.7217(2)
		87			0.278 346(132)			0.2783(2)

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Table 5 (*Continued*).

Z	E	M	Range of natural variations (mole fraction)	Annotation	Best measurement from a single terrestrial source (mole fraction)	Ref.	Available reference materials[a]	Representative isotopic composition (mole fraction)
1	2	3	4	5	6	7	8	9
38	Sr	84	0.0055–0.0058	g,r	0.005 574(16) 2s C	[146]	NIST-	0.0056(1)
		86	0.0975–0.0999		0.098 566(34)		SRM987*	0.0986(1)
		87	0.0694–0.0714		0.070 015(26)		NIST	0.0700(1)[h]
		88	0.8229–0.8275		0.825 845(66)			0.8258(1)
39	Y	89			1.0000	[147]		1.0000
40	Zr	90		g	0.514 52(9) 2s N	[148]		0.5145(40)
		91			0.112 23(12)			0.1122(5)
		92			0.171 46(7)			0.1715(8)
		94			0.1738(12)			0.1738(28)
		96			0.027 99(5)			0.0280(9)
41	Nb	93			1.0000	[127]		1.0000
42	Mo	92		g	0.147 69(1) 2s L	[149]		0.1477(31)
		94			0.092 28(1)			0.0923(10)
		95			0.159 022(4)			0.1590(9)
		96			0.166 76(7)			0.1668(1)
		97			0.095 618(7)			0.0956(5)
		98			0.241 959(6)			0.2419(26)
		100			0.096 671(4)			0.0967(20)
43	Tc				—			—
44	Ru	96		g	0.055 420(1) 1s N	[150]		0.0554(14)
		98			0.018 688(2)			0.0187(3)
		99			0.127 579(6)			0.1276(14)
		100			0.125 985(4)			0.1260(7)
		101			0.170 600(10)			0.1706(2)
		102			0.315 519(11)			0.3155(14)
		104			0.186 210(11)			0.1862(27)
45	Rh	103			1.0000	[119]		1.0000
46	Pd	102		g	0.01020(8) 2s C	[151]		0.0102(1)
		104			0.1114(5)			0.1114(8)
		105			0.2233(5)			0.2233(8)
		106			0.2733(2)			0.2733(3)
		108			0.2646(6)			0.2646(9)
		110			0.1172(6)			0.1172(9)
47	Ag	107		g	0.518 392(51) 2s C	[102]	NIST-	0.518 39(8)
		109			0.481 608(51)		SRM978*	0.481 61(8)
48	Cd	106		g	0.0125(2) 2s F	[152]		0.0125(6)
		108			0.0089(1)			0.0089(3)
		110			0.1249(6)			0.1249(18)
		111			0.1280(4)			0.1280(12)
		112			0.2413(7)			0.2413(21)
		113			0.1222(4)			0.1222(12)
		114			0.2873(14)			0.2873(42)
		116			0.0749(6)			0.0749(18)

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Table 5 (*Continued*).

Z	E	M	Range of natural variations (mole fraction)	Annotation	Best measurement from a single terrestrial source (mole fraction)	Ref.	Available reference materials[a]	Representative isotopic composition (mole fraction)
1	2	3	4	5	6	7	8	9
49	In	113		g	0.042 88(5) 2s N	[153]		0.0429(5)
		115			0.957 12(5)			0.9571(5)
50	Sn	112		g	0.009 73(3) 1s C	[154]		0.0097(1)
		114			0.006 59(3)[f]	[155]		0.0066(1)
		115			0.003 39(3)[f]			0.0034(1)
		116			0.145 36(31)			0.1454(9)
		117			0.076 76(22)			0.0768(7)
		118			0.242 23(30)			0.2422(9)
		119			0.085 85(13)			0.0859(4)
		120			0.325 93(20)			0.3258(9)
		122			0.046 29(9)			0.0463(3)
		124			0.057 89(17)			0.0579(5)
51	Sb	121		g	0.572 13(32) 2s C	[156]		0.5721(5)
		123			0.427 87(32)			0.4279(5)
52	Te	120		g	0.000 96(1) 2se N	[157]		0.0009(1)[i]
		122			0.026 03(1)			0.0255(12)
		123			0.009 08(1)			0.0089(3)
		124			0.048 16(2)			0.0474(14)
		125			0.071 39(2)			0.0707(15)
		126			0.189 52(4)			0.1884(25)
		128			0.316 87(4)			0.3174(8)
		130			0.337 99(3)			0.3408(62)
53	I	127			1.0000	[158]		1.0000
54	Xe	124		g,m	0.000 952(3) 3s C	[58]		0.000 952(3)
		126			0.000 890(2)			0.000 890(2)
		128			0.019 102(8)			0.019 102(8)
		129			0.264 006(82)			0.264 006(82)
		130			0.040 710(13)			0.040 710(13)
		131			0.212 324(30)			0.212 324(30)
		132			0.269 086(33)			0.269 086(33)
		134			0.104 357(21)			0.104 357(21)
		136			0.088 573(44)			0.088 573(44) (in air)
55	Cs	133			1.0000	[127]		1.0000
56	Ba	130		g	0.001 058(2) 3se F	[159]		0.001 06(1)
		132			0.001 012(2)			0.001 01(1)
		134			0.024 17(3)			0.024 17(18)
		135			0.065 92(2)			0.065 92(12)
		136			0.078 53(4)			0.078 54(24)
		137			0.112 32(4)			0.112 32(24)
		138			0.716 99(7)			0.716 98(42)
57	La	138		g	0.000 9017(5) 2se N	[160]		0.000 90(1)
		139			0.999 0983(5)			0.999 10(1)

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Table 5 (*Continued*).

Z	E	M	Range of natural variations (mole fraction)	Annotation	Best measurement from a single terrestrial source (mole fraction)	Ref.	Available reference materials[a]	Representative isotopic composition (mole fraction)
1	2	3	4	5	6	7	8	9
58	Ce	136	0.001 85–0.001 86	g	0.001 86(1) 2s C	[161]		0.001 85(2)
		138	0.002 51–0.002 54		0.002 51(1)			0.002 51(2)[h]
		140	0.884 46–0.884 49		0.884 49(34)			0.884 50(51)
		142	0.111 14–0.111 14		0.111 14(34)			0.111 14(51)
59	Pr	141			1.0000	[147]		1.0000
60	Nd	142	0.2680–0.2730	g	0.2716(4) 2se N	[162]		0.272(5)
		143	0.1212–0.1232		0.1218(2)			0.122(2)[h]
		144	0.2379–0.2397		0.2383(4)			0.238(3)
		145	0.0823–0.0835		0.0830(2)			0.083(1)
		146	0.1706–0.1735		0.1717(3)			0.172(3)
		148	0.0566–0.0578		0.0574(1)			0.057(1)
		150	0.0553–0.0569		0.0562(1)			0.056(2)
61	Pm				—			—
62	Sm	144		g	0.030 734(9) 2s F	[163]		0.0307(7)
		147			0.149 934(18)			0.1499(18)
		148			0.112 406(15)			0.1124(10)
		149			0.138 189(18)			0.1382(7)
		150			0.073 796(14)			0.0738(1)
		152			0.267 421(66)			0.2675(16)
		154			0.227 520(68)			0.2275(29)
63	Eu	151		g	0.47810(42) 2se C	[164]		0.4781(6)
		153			0.52190(42)			0.5219(6)
64	Gd	152		g	0.002 029(4) 2se N	[165]		0.0020(1)
		154			0.021 809(4)			0.0218(3)
		155			0.147 998(17)			0.1480(12)
		156			0.204 664(6)			0.2047(9)
		157			0.156 518(9)			0.1565(2)
		158			0.248 347(16)			0.2484(7)
		160			0.218 635(7)			0.2186(19)
65	Tb	159			1.0000	[147]		1.0000
66	Dy	156		g	0.000 56(2) 2S C	[166]		0.000 56(3)
		158			0.000 95(2)			0.000 95(3)
		160			0.023 29(12)			0.023 29(18)
		161			0.188 89(28)			0.188 89(42)
		162			0.254 75(24)			0.254 75(36)
		163			0.248 96(28)			0.248 96(42)
		164			0.2826(36)			0.282 60(54)
67	Ho	165			1.0000	[147]		1.0000
68	Er	162		g	0.001 391(30) 2s C	[167]		0.001 39(5)
		164			0.016 006(20)			0.016 01(3)
		166			0.335 014(240)			0.335 03(36)
		167			0.228 724(60)			0.228 69(9)
		168			0.269 852(120)			0.269 78(18)
		170			0.149 013(240)			0.149 10(36)

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Table 5 (*Continued*).

Z	E	M	Range of natural variations (mole fraction)	Annotation	Best measurement from a single terrestrial source (mole fraction)	Ref.	Available reference materials[a]	Representative isotopic composition (mole fraction)
1	2	3	4	5	6	7	8	9
69	Tm	169			1.0000	[147]		1.0000
70	Yb	168		g	0.001 27(2) 2se N	[162]		0.0013(1)
		170			0.0304(2)			0.0304(15)
		171			0.1428(8)			0.1428(57)
		172			0.2183(l0)			0.2183(67)
		173			0.1613(7)			0.1613(27)
		174			0.3183(14)			0.3183(92)
		176			0.1276(5)			0.1276(41)
71	Lu	175		g	0.974 16(5) 2se N	[168]		0.9741(2)
		176			0.025 84(5)			0.0259(2)
72	Hf	174	0.001 619–0.001 621		0.001 620(9) 2se N	[168]		0.0016(1)
		176	0.052 06–0.052 71		0.052 604(56)			0.0526(7)[h]
		177	0.185 93–0.186 06		0.185 953(12)			0.1860(9)
		178	0.272 78–0.272 97		0.272 811(22)			0.2728(7)
		179	0.136 19–0.1363		0.136 210(9)			0.1362(2)
		180	0.350 76–0.351		0.350 802(26)			0.3508(16)
73	Ta	180			0.000 123(3) 1se N	[127]		0.000 12(2)
		181			0.999 877(3)			0.999 88(2)
74	W	180			0.001 198(2) 1s N	[169]		0.0012(1)
		182			0.264 985(49)			0.2650(16)
		183			0.143 136(6)			0.1431(4)
		184			0.306 422(13)			0.3064(2)
		186			0.284 259(62)			0.2843(19)
75	Re	185			0.373 98(16) 2s C	[170]	NIST-	0.3740(2)
		187			0.626 02(16)		SRM989*	0.6260(2)
76	Os	184		g,r	0.000 197(5) 1s N	[171]		0.0002(1)
		186			0.015 859(44)			0.0159(3)
		187			0.019 644(12)			0.0196(2)[h]
		188			0.132 434(19)			0.1324(8)
		189			0.161 466(16)			0.1615(5)
		190			0.262 584(14)			0.2626(2)
		192			0.407 815(22)			0.4078(19)
77	Ir	191			0.372 72(15) 1s N	[172]		0.373(2)
		193			0.627 28(15)			0.627(2)
78	Pt	190			0.000 136 34(68) 1s N	[173]		0.000 14(1)
		192			0.007 826 59(35)			0.007 82(7)
		194			0.329 6700(77)			0.329 67(99)
		195			0.338 315 57(42)			0.338 32(10)
		196			0.252 4166(36)			0.252 42(41)
		198			0.071 6349(42)			0.071 63(55)
79	Au	197			1.0000	[119]		1.0000

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Table 5 (*Continued*).

Z	E	M	Range of natural variations (mole fraction)	Annotation	Best measurement from a single terrestrial source (mole fraction)	Ref.	Available reference materials[a]	Representative isotopic composition (mole fraction)
1	2	3	4	5	6	7	8	9
80	Hg	196			0.001 5344(19) 1s N	[174]		0.0015(1)
		198			0.099 68(13)			0.0997(20)
		199			0.168 73(17)			0.1687(22)
		200			0.230 96(26)			0.2310(19)
		201			0.131 81(13)			0.1318(9)
		202			0.298 63(33)			0.2986(26)
		204			0.068 65(7)			0.0687(15)
81	Tl	203	0.294 94–0.295 28		0.295 24(9) 2s C	[175]	NIST-	0.2952(1)
		205	0.704 72–0.705 06		0.704 76(9)		SRM997*	0.7048(1)
82	Pb	204	0.0104–0.0165	g,r	0.014 245(12) 2s C	[176]	NIST-	0.014(1)
		206	0.2084–0.2748		0.241 447(57)		SRM981*	0.241(1)[h]
		207	0.1762–0.2365 0.1762		0.220 827(27)		NIST	0.221(1)[h]
		208	0.5128–0.5621		0.523 481(86)			0.524(1)[h]
83	Bi	209			1.0000	[119]		1.0000
84	Po							
85	At							
86	Rn							
87	Fr							
88	Ra							
89	Ac							
90	Th	232		g	1.0000	[177]		1.0000
91	Pa	231			1.0000	[178]		1.0000
92	U	234	0.000 050–0.000 059	g,m,r	0.000 054 20(42) 2s C	[179]	IRMM-	[0.000 054(5)]
		235	0.007 198–0.007 207		0.007 200(1)		184*	[0.007 204(6)][c]
		238	0.992 739–0.992 752		0.992 745(10)		CEA	[0.992 742(10)]
							IRMM	
							NBL	

*Reference material used for the best measurement.

[a]NIST materials were previously labeled NBS. IRMM materials were previously labeled CBNM.

[b]Tank hydrogen has a ^{2}H abundance as low as 0.0032 atom %.

[c]Materials depleted in ^{6}Li and ^{235}U are commercial sources of laboratory shelf reagents. In the case of Li such samples are known to have ^{6}Li abundances in the range 2.007–7.672 %, with natural materials at the higher end of this range. In the case of U, the ^{235}U abundance has been reported to range from 0.21–0.7207 atom percent, far removed from the natural value.

[d]The Commission recommends that the value of 272 be employed for $^{14}N/^{15}N$ of N_2 in air for the calculation of atom percent ^{15}N from measured $\delta^{15}N$ values.

[e]The best measurement reports a calibrated $^{16}O/^{18}O$ ratio on VSMOW.

[f]The original data for Sn has been adjusted to take into account possible errors due to ^{115}In contamination, and an error in the ^{114}Sn abundance.

[h]Evaluated isotopic composition is for most but not all commercial samples.

[i]An electron multiplier was used for these measurements and the measured abundances were adjusted using a "square root of the masses" correction factor.

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Table 5 (*Continued*).

The column contents are as follows:

Column l: The elements are tabulated in order of ascending atomic number (Z).

Column 2: The symbols for the elements (E) are listed using the abbreviations recommended by IUPAC.

Column 3: The mass number (M) for each isotope is listed.

Column 4: Range of natural variations (from [72,85]). No data are given in this column unless a range has been reliably established. The limits given do not include certain exceptional samples; these are noted with a "g" in column 5.

Column 5: Annotations

- g Geologically exceptional specimens are known in which the element has an isotopic composition outside the reported range (refers to column 4).
- m Modified isotopic compositions may be found in commercially available material because it has been subjected to an undisclosed or inadvertent isotope fractionation. Substantial deviations from the isotopic compositions given can occur (refers to column 9).
- r Range in isotopic composition proven to exist in normal terrestrial material limits the precision of the isotope abundances (refers to column 9).

Column 6: The best measurement from a single terrestrial source. The values are reproduced from the original literature. The uncertainties on the last digits are given in parenthesis as reported in the original publication. As they are not reported in any uniform manner in the literature, ls, 2s, 3s indicates l, 2, or 3 standard deviations, P indicates some other error as defined by the author, and "se" indicates standard error (standard deviation of the mean). Where data are published as isotope-abundance ratios, the ratios and their uncertainties are converted to mole fractions using orthodox procedures.

"C" is appended when calibrated mixtures have been used to correct the mass spectrometer for bias, giving an "absolute" result within the errors stated in the original publication.

"F" is appended when calibrated mixtures have been used to correct for isotope fractionation but the measurement fails to fulfill all of the requirements of a "C" measurement.

"L" is appended when the linearity of the mass spectrometer has been established for the relevant abundance ratios by using synthetic mixtures of isotopes or certified materials produced by an appropriate Standards laboratory.

"N" is appended when none of the above requirements are met.

The user is cautioned that:

a. Since the data are reproduced from the literature, the sum of the isotope abundances may not equal l exactly.

b. When a range of compositions has been established, the samples used for the best measurement may come from any part of the range.

c. An uncalibrated "best measurement" is not necessarily free of systematic errors.

Column 7: Reference for the best measurement given in Column 6.

Column 8: Reference materials with normal terrestrial isotopic compositions that are known to be available. An asterisk indicates the reference material used for the best measurement. When additional reference materials are available, the distributors are listed in lieu of specific reference materials (see Appendix).

Column 9: Representative isotopic composition. In this column are listed the values that, in the opinion of CAWIA, represent the isotopic composition of chemicals and/or natural materials that may be encountered in the laboratory. For most elements, these values will yield approximately the standard atomic weight, but may not necessarily correspond to the most abundant natural material. The uncertainties listed in parentheses cover the range of probable isotope-abundance variations among different materials as well as experimental errors, which are derived by applying statistical guidelines used by CAWIA for assigning uncertainties to published isotope-abundance measurements.

NOTE: This table has been adapted from the Table of the Isotopic Compositions of the Elements, 1997 [72] with additions from the compilation of Coplen et al. [85,180] and unpublished data prepared by CAWIA at the General Assembly in 2001.

Continuing significance of atomic weights and isotope abundances

During the second half of the 20th century, CAWIA witnessed the increasing importance of isotope-abundance measurements for the determination of atomic weights. Thus, mass-spectrometric methods have replaced older chemical methods for precise atomic-weight measurements, and it is difficult to foresee substantial use of the only known alternative, the X-ray-crystal-cell-density method. With the development of mass-spectrometric methods, it has become widely recognized that variations in the isotopic compositions of many elements can provide useful information about chemical behavior as well as the history and sources of different chemical substances. CAWIA has had and will continue to have an important role in this area of study. In recognition of this shift in focus, CAWIA was renamed by IUPAC in 2001 to become the Commission on Isotopic Abundances and Atomic Weights.

One of the primary future aims of the Commission will be to ensure that every polyisotopic element is represented by a homogeneous bulk reference material that can be divided into precisely similar samples, with a certified atomic weight having an estimated relative uncertainty of less than 1 in 10^5. Precise isotopic compositions and atomic weights for individual samples could be determined by differential mass spectrometry in comparison with those reference materials. Isotopic surveys of natural sources and knowledge of isotope fractionation by natural and artificial processes could provide more precise atomic-weight values for users in chemistry and commerce.

Another important development of the latter part of the 20th century was the proliferation of many types of mass spectrometers for a variety of uses. Inductively coupled plasma/mass spectrometry (ICP/MS), glow-discharge mass spectrometry, accelerator mass spectrometry, secondary-ion mass spectrometry (SIMS) and various types of laser-source mass spectrometers are available on a commercial basis. The continuous-flow gas-source mass spectrometer is a recent instrument, which is being applied with success in many scientific areas [84]. This trend toward diversity of instrumentation should continue into the future, especially by integrating mass spectrometers with other equipment, for instance, those in which ongoing rapid chemical reactions are studied for fractionation effects and equilibria between isotopes. Because of the widespread availability of these various types of instruments, it is increasingly important to provide guidelines for producing accurate isotope-abundance data that are based on a full understanding of the principles of mass spectrometry and mass-fractionation effects. Widely available reference materials will be essential for routine testing of sample preparation and calibration of mass spectrometry. In addition, future experimenters should expect periodic testing regimes for optimum mass-spectrometer performance.

In this review, we have described by examples how physicochemical mechanisms are responsible for variations in isotopic composition that can be explored using mass spectrometers. These observed variations are meaningful and reflect real processes in nature in addition to those arising from instrumental mass fractionation. Such physicochemical mechanisms in future will continue to be exploited much more widely in many fields of science to aid understanding of natural and industrial processes, including extraterrestrial phenomena. Measured isotopic anomalies in meteoritic material, using SIMS, have already been helpful to our understanding of astrophysical mechanisms and even the sites of nucleosynthesis [92]. We can expect element isotopic compositions to be used increasingly for diagnosis of substance histories in geology, cosmology, biology, archeology, and in materials derived from synthesis or those submitted to regulatory authority assessment of fraud, adulteration, or illegal brand-imitation. Precise isotopic signatures could be used widely in chemical process control, accompanied by immediate feedback before a rejectable product has been manufactured.

Isotope-abundance studies have thus played and will continue to play an essential role in the environmental arena. The study of Pb isotopes in ice cores is chosen from the past as just one successful example. It has confirmed that industrial processes and the use of leaded petrol have increased the amount of Pb in the atmosphere by a factor of at least 100 since preindustrial times, and that this atmospheric Pb can be traced over long distances. Because Pb additives to gasoline have a variety of isotopic compositions, owing to variations in the age and constitution of their U and Th parents in respec-

tive ore-bodies, details of the origin of Pb pollution can be successfully deciphered [181]. More reliable detail of man's use of lead in history is to be expected from future improved isotope-abundance measurements, on topics such as when lead was first melted or when the Romans started using lead lining in aqueducts.

The world must learn to live with the use and misuse of radioactivity and nuclear reactions. In the management of these opportunities and hazards we see a vital application for isotope analysis. For example, plutonium is a particularly hazardous component of nuclear bombs in which the isotopic composition of the Pu depends on the nature of the nuclear reactions. From measurements of the $n(^{240}\mathrm{Pu})/n(^{239}\mathrm{Pu})$ ratio, Kersting et al. [182] have traced the movement of Pu in groundwater from the underground bomb site in Nevada. Similarly, at the Oklo natural reactor, the element and isotope abundances of a number of elements have been measured in the surrounding geological formations. These measurements indicate that some elements were relatively immobile and remained within the reactor zones, whereas others migrated to the surrounding geological materials and some escaped almost entirely [89]. Such studies of natural geological repositories will become of vital importance in understanding the effectiveness in containing radioactive waste products of the nuclear industry.

A very large number of environmental studies have made use of isotope-abundance measurements of the light elements, especially H, C, N, O, and S, which all exhibit rather pronounced isotope fractionation. Such measurements have been used extensively for tracing sources and movement of water, nutrients, and pollutants in the hydrosphere and biosphere of earth. Already, the published literature in isotopic-composition measurements in the environment is very extensive and will surely multiply in volume and importance.

"Fingerprinting" has been a function first of analytical chemistry, and later also of crystallography through phase identification. Now, isotope-abundance measurements have an analogous function and are likely to play an increasing role. Almost every molecule in every material, living or inanimate, has an isotopic fingerprint, a signature of its past. These isotopic signatures find important application in such areas as detection of fraud; for example, by using C isotope ratios to assess the origins of sugars, wines, and fruit juices or O isotope ratios to assess the origins of fruit juices [183]. As such cases will often be taken to court, isotope-abundance measurements on food and drink will need to be firmly "anchored" in "absolute" or SI-traceable values. IRMM has therefore started to anchor δ scales in such values, by certifying primary isotopic gas standards as an alternative to consensus procedures [59]. Voluntary isotopic standards generally will contribute powerfully to fair trade in the world.

CAWIA [17] has advised manufacturers to provide more detailed information about the atomic weights or isotopic compositions of laboratory chemicals made from elements that exhibit substantial variation. With increasing precision of analytical measurements, it may be expected that this advice will become more widely followed and, possibly in some instances, recognized in law.

De Bièvre et al. [37] have discussed the advantages of using IDMS in elemental concentration (content) measurements. It has already been used extensively in characterising elemental reference materials. Nature has provided more than 300 stable and long-lived isotopes so that IDMS can be an excellent metrological technique for accurate elemental concentration measurements. With the improved capabilities of automated mass spectrometers, and an anticipated wider availability of radioisotopes, their use in IDMS may become more widespread and, in some ways, more convenient than stable isotopes. Only radioisotopes are available for the IDMS assay of the monoisotopic elements, all of which, other than F, have radioisotopes of sufficient half-life. The measurement of minute amounts of Pb in the environment (e.g., ice cores), to demonstrate atmospheric pollution levels, using the radioisotope $^{205}\mathrm{Pb}$ as a tracer, is a good illustration of the established value of high-sensitivity IDMS [184]. Suitable facilities for handling radioactive materials will surely become widespread in chemical laboratories.

It is our hope that the atomic-weights community will remain well represented by the renamed Commission on Isotopic Abundances and Atomic Weights. The Commission should retain and disseminate a good understanding of the importance and use of the instrumentation necessary to produce precise and accurate isotopic-composition data and of isotopic reference materials for sample atomic-

weight measurements and calibration of mass spectrometers. The Commission should maintain close contact with laboratories having experience in atomic-weight measurements and the production of credibly certified reference materials as this is a highly specialized and expensive task. Because atomic-weight and isotopic-composition measurements are now recognized as within "la haute métrologie", and amount-of-substance measurements are integrated into the SI, a strong liaison activity among the different groups involved in harmonization of symbols and notations, including IUPAC, will be highly desirable. An internationally agreed set of standard atomic weights will remain useful, even for BIPM, because the atomic weights constitute the link between the quantities mass and amount-of-substance. The Commission will have a continuing role also in summarizing source-specific isotopic-composition data such as given in the recent compilation of Coplen et al. [85], and preparing related materials for teaching in chemistry.

PART 2: ELEMENT-BY-ELEMENT REVIEW OF THE STANDARD ATOMIC WEIGHTS

Introduction

The aim of this part is to provide interested specialists and scholars with a condensed account of the assessment of individual atomic weights and their uncertainties, with emphasis on the developments during the past 40 years, as they have arisen almost exclusively from mass spectrometry. The review does not describe or analyze details of the experimental techniques, and does not raise issues of nomenclature.

A section for an element is included if it occurs naturally on earth with a characteristic isotopic composition, and if it has at least one stable or quasi-stable isotope. The entries are in order of atomic number. Each section begins with a heading comprising the chemical symbol, with its preceding subscript atomic number, and the chemical name or names in English texts. This is followed by the standard atomic-weight value A_r(E), and its expanded uncertainty $U[A_r(E)]$. This uncertainty is numerically the same in the positive and negative directions and is expressed by a single digit in parentheses applicable to the last figure of the decimal in A_r(E). Thus, for example, A_r(Si) = 28.0855(3) indicates that the standard atomic weight of Si is between 28.0852 and 28.0858. This means that the Commission on Atomic Weights and Isotopic Abundances (CAWIA) is confident that the true atomic weight of Si in the great majority of normal samples of natural terrestrial materials and laboratory chemicals will fall within this range. The annotations "g", "m", and "r" may then be listed on the same line as the atomic-weight value depending on whether one or more of those annotations apply to that element. Definitions of these annotations are given in Part 1. The following entry (in square brackets) gives the date when the atomic weight and/or the annotations were last modified by CAWIA.

The tabulation next lists all the stable and quasi-stable isotopes of the element by chemical symbol with preceding mass number in subscript. The following column lists the atomic masses (in unified atomic mass units), with their uncertainties, from Audi and Wapstra [51]. The figures in parentheses represent the uncertainties in the last significant figure of the atomic mass value. The last column records the mole fractions of these isotopes in a representative normal occurrence as evaluated by CAWIA (Table 5, column 9). The representative isotopic compositions generally correspond approximately to the standard atomic weight and are recommended for evaluating average properties of materials of unspecified commercial or natural terrestrial origin. Thus, a given sample may not be represented exactly by the values given if the element exhibits natural variation in its isotopic composition. Figures in parentheses indicate the estimated uncertainties of the isotopic composition that are due to either measurement uncertainty (as evaluated by CAWIA) or documented variability, whichever is larger. For elements with no known variation, the given uncertainties are based on statistical evaluation of experimental errors.

The text for each element begins with a brief description of the origin of the name of each element and its discoverer, followed by a summary of the information and its literature sources as given in

the former Element by Element Review [24]. Developments are then followed through the last 16 years of CAWIA analysis of significant literature publications. Relevant concepts and discussions in CAWIA's biennial reports are described. These sections emphasize the current status and mention any additional pertinent comparisons. The text for some elements ends with notes on radioactive properties of some isotopes and their possible effect on the atomic weights. It should be noted that reference materials are available for a number of polyisotopic elements. These reference materials may have been calibrated using synthetic mixtures of enriched isotopes and are provided by a number of internationally recognized agencies. Details of these reference materials are not given in Part 2, but are listed in column 8 of Table 5 in Part 1. Details of the sources of the reference materials are given in Appendix A.

$_1$H Hydrogen A_r(H) = 1.007 94(7) g, m, r [Since 1981]

Isotope	Atomic mass/u	Mole fraction
^{1}H	1.007 825 0319(6)	0.999 885(70)
^{2}H	2.014 101 7779(6)	0.000 115(70)

The name derives from the Greek *hydro* for "water" and *genes* for "forming" because it burned in air to form water. It was discovered by the English physicist Henry Cavendish in 1766.

The major stable isotope ^{1}H is also known as protium. The minor stable isotope ^{2}H is known as deuterium, with symbol D. The low concentration of ^{2}H in normal sources of H may have delayed its discovery until 1931 when H isotope fractionation was demonstrated by distillation, electrolysis, evaporation, and in environmental samples. The atomic weight of H has been based on mass-spectrometric measurements since 1938. In its report for 1961 [22], CAWIA recommended A_r(H) = 1.007 97(1) based on the average and the range of ^{2}H concentrations measured in H extracted from fresh- and saltwaters [185]; however, it was noted that substances other than water could have a wider range of atomic weights. In 1969, CAWIA [4] rounded the atomic-weight value and increased the uncertainty to A_r(H) = 1.0080(3), accounting for variations in the isotopic composition of a wider range of substances. In 1971, CAWIA [5] recommended A_r(H) = 1.0079(1) to reflect more accurately the atomic weights of the most abundant H sources, and yet to incorporate the major known variations. In 1981, CAWIA [10] altered the atomic weight and reduced the uncertainty again to include all but a very small fraction of the known variations and recommended A_r(H) = 1.007 94(7).

The currently accepted "best measurement" of the "absolute" isotopic composition of H from a single natural source was performed on VSMOW (distributed by the IAEA and NIST), the reference material endorsed by CAWIA as the basis of the delta (δ) scale for relative isotope-ratio measurements [16]. According to this measurement [116], VSMOW has a mole fraction of ^{2}H = 0.000 155 74(5), corresponding to $A_r(H_{VSMOW})$ = 1.007 981 75(5). The uncertainty of that value corresponds to a δ^2H uncertainty of 0.3 ‰, which is equal to or slightly smaller than typical uncertainties of most relative isotope-ratio measurements of H. Variations in the isotopic composition of H in chemicals and natural terrestrial systems are known to exceed 1000 ‰, which is much larger than the uncertainty due to either relative or "absolute" isotope-ratio measurements. Therefore, the accuracy and precision of the standard atomic weight of H are limited almost entirely by real variations, hence the annotation "r".

For water sources, the range of published δ^2H values extends from –495 ‰ (mole fraction of ^{2}H = 0.000 0787; A_r(H) = 1.007 9042) [186], to +129 ‰ (mole fraction of ^{2}H = 0.000 1758; A_r(H) = 1.008 0020) [187]. Seawater, the largest reservoir of water near the earth's surface, has a relatively uniform isotopic composition and atomic weight near that of VSMOW; whereas precipitation, polar ice, lakes, rivers, and groundwaters have atomic weights that range widely, generally decreasing with latitude and elevation and increasing with evaporation. The highest δ^2H value reported for a material of natural terrestrial origin is +180 ‰ for atmospheric H_2 [188]. An unusual anthropogenic occurrence of water from a H_2S well yielded δ^2H values as high as +375 ‰ (mole fraction of ^{2}H = 0.000 0214; A_r(H) = 1.008 0404 [189]). Hydrogen samples with low atomic weights, some of which are outside the range

of the standard atomic-weight uncertainties, have been reported from some types of natural and artificial H_2 gases, hence the annotation "g". The naturally occurring H sample with the lowest atomic weight (δ^2H = –836 ‰; mole fraction of ^{2}H = 0.000 0255; A_r(H) = 1.007 8507) is H_2 gas collected from a natural gas well in Kansas, USA [190]. That sample, and other similar ^{2}H-depleted H_2-rich natural gases elsewhere, may have formed by natural chemical reduction of water during low-temperature reactions with ultramafic (Fe-Mg-silicate) rocks. Hydrogen gases produced artificially by electrolysis and as by-products of petrochemical processing commonly are depleted in ^{2}H. Though not natural, those gases are considered to be important because they are used commonly in laboratories. Commercial tank H_2 has been reported to have δ^2H as low as –813 ‰ [mole fraction of ^{2}H = 0.000 0291; A_r(H) = 1.007 8543] [85].

The radioactive isotope ^{3}H, also known as tritium with symbol T, decays by negative beta emission to ^{3}He with a half-life of 12.3 years. Tritium is formed naturally in the atmosphere by cosmic-ray reactions such as ^{14}N (n,t) ^{12}C and artificially in nuclear reactors. Large quantities of ^{3}H were injected into the atmosphere as a by-product of thermonuclear bomb tests, mostly in the 1950s and 1960s. Tritium reacts in the atmosphere to form HTO and other compounds that are distributed with widely varying concentrations in the near-surface environment of the earth. Those variations, and other local anthropogenic ^{3}H anomalies, are used commonly in environmental studies; however, concentrations of ^{3}H in normal sources of H are too low by several orders of magnitude to have a measurable effect on the atomic weight of H.

$_2$He Helium A_r(He) = 4.002 602(2) g, r [Since 1983]

Isotope	Atomic mass/u	Mole fraction
^{3}He	3.016 029 3094(12)	0.000 001 34(3)
^{4}He	4.002 603 2497(15)	0.999 998 66(3)

The name derives from the Greek *helios* for "sun". The element was discovered by spectroscopy during a solar eclipse in the sun's chromosphere by the French astronomer Pierre-Jules-Cesar Janssen in 1868. It was independently discovered and named helium by the English astronomer Joseph Norman Lockyer. It was thought to be only a solar constituent until it was later found to be identical to the helium in the uranium ore cleveite by the Scottish chemist William Ramsay in 1895. Ramsay originally called his gas kypton, until it was identified as helium. The Swedish chemists Per Theodore Cleve and Nils Abraham Langet independently found helium in cleveite at about the same time.

In contrast to the other noble gases, which are separated for commercial use almost entirely from air, a large amount of commercial He is derived from natural gas deposits containing relatively high concentrations of radiogenic ^{4}He. In its 1961 report [22], CAWIA recommended A_r(He) = 4.0026 based on the atomic mass of ^{4}He to four decimal places from Everling et al. [23]. The ^{3}He mole fraction in air of 0.000 137 % as determined by Nier [191] had a negligible effect on this atomic weight. This isotope is present in natural sources of He with a smaller abundance than that of any other stable isotope relative to its elemental composition. After an evaluation of the natural variations in the isotopic composition of He, based chiefly on the paper by Mamyrin et al. [192], CAWIA in 1969 [4] recommended A_r(He) = 4.002 60(1), which was identical to the atomic mass of ^{4}He to six significant figures. A subsequent "absolute" determination of the isotopic composition of atmospheric He by Clarke et al. [193] yielded a $n(^3\text{He})/n(^4\text{He})$ ratio of 1.384×10^{-6}, corresponding to A_r(He) = 4.002 6019, confirming CAWIA's recommended value. As a result of this measurement, but also acknowledging evidence for significant variation in the atomic weight of He in materials other than the atmosphere, CAWIA in 1983 [11] recommended A_r(He) = 4.002 602(2). This was the first time the atomic weight of He differed from that of the ^{4}He isotope, but the uncertainty included both the atmospheric value and the value of pure ^{4}H because almost pure ^{4}He can be found in some natural gases and radioactive ores, hence, the annotation "r". The isotope-abundance data of Sano et al. [117] were accepted subsequently as the "best

measurement" from a single source (air), but did not result in a change in the standard atomic weight of He. The indicated range for the standard atomic weight of He has a lower limit of 4.002 600, corresponding to a mole fraction of ^{3}He = 3.3×10^{-6}. That range includes some natural ^{3}He-enriched sources, but it does not include all He from volcanic rocks or associated geothermal springs and gases, some of which have ^{3}He mole fractions more than 10 times that of atmospheric He, hence the annotation "g." Those types of ^{3}He-enriched sources are considered to represent emissions of primordial He from incompletely degassed regions deep within the earth [194].

Helium, a "noble" gas, is chemically the most unreactive element with the lowest boiling point (4.2 K). Apart from its presence in gaseous or fluid inclusions and interstitial positions in crystals, and in voids in clathrate compounds, He occurs naturally only as a monoatomic gas. Helium is too light to be held in the atmosphere by earth's gravitation over periods comparable with the age of the earth; thus, ^{4}He in the atmosphere has been derived almost entirely from degassing of the solid earth, where it is produced by alpha decay of heavy radioisotopes. The minor isotope ^{3}He is believed to be largely primordial, with minor amounts derived from beta decay of ^{3}H, which is produced by the reaction ^{6}Li (n,α) ^{3}H in the earth, by cosmic-ray reactions in the atmosphere, or by nuclear explosions and industry. Accumulations of ^{3}He produced by radioactive decay of anthropogenic ^{3}H provide a useful tool for determining ages of groundwaters and surface waters, including the ocean. The physical properties of ^{3}He in gas, liquid, and solid phases and of ^{3}He/^{4}He mixtures have been the subjects of many experimental studies that have contributed decisively to our understanding of quantum physics and chemistry [195].

$_3$Li Lithium A_r(Li) = 6.941(2) g, m, r [Since 1983]

Isotope	Atomic mass/u	Mole fraction
^{6}Li	6.015 1223(5)	0.0759(4)
^{7}Li	7.016 0041(5)	0.9241(4)

The name derives from the Latin *lithos* for "stone" because lithium was thought to exist only in minerals at that time. It was discovered by the Swedish mineralogist Johan August Arfwedson in 1818 in the mineral petalite $LiAl(Si_2O_5)_2$. Li was isolated in 1855 by the German chemists Robert Wilhelm Bunsen and Augustus Matthiessen.

In its 1961 report [22], CAWIA altered A_r(Li) from 6.940 to 6.939 based on the adjustment of the chemical determinations by Richards and Willard [196] to the $A_r(^{12}C) = 12$ scale. CAWIA recognized evidence of natural variability of the isotopic composition of Li from mass spectrometry by Cameron [197]. In 1969, CAWIA [4] changed the basis to the "absolute" mass-spectrometric measurement by Svec and Anderson [198] and other mass-spectrometric data, and recommended A_r(Li) = 6.941(3). That value of A_r(Li) has remained unchanged, but is now based on other calibrated mass-spectrometric measurements of superior accuracy by Flesch et al. [199], Callis et al. [200], Michiels and De Bièvre [201], and Qi et al. [94,118], yielding with current atomic masses [51], A_r(Li) = 6.9391(2), 6.940 15(30), 6.940 69(24), and 6.940 05(24), respectively. Although Li occurs in diverse geological associations and although the relative mass difference of the isotopes is large, the variability in most terrestrial sources appears to be smaller than an implied range ±0.002 in the A_r(Li) value. Hence, CAWIA in 1983 felt justified in lowering $U[A_r(Li)]$ to ±0.002, but the annotations "g" and "r" could not be deleted [11]. In the 1995 report of CAWIA [17], it was recommended that δ^7Li values be reported relative to the lithium carbonate reference material LSVEC. The lowest ^{7}Li content reported for a naturally occurring sample is from dissolved Li in groundwater from a coastal aquifer in South Carolina with δ^7Li = –19 ‰ [85]. For this sample, the mole fraction of ^{7}Li = 0.9227 and A_r(Li) = 6.9387. The highest ^{7}Li abundance reported in a naturally occurring sample is from Li in pore water from a marine sediment core with δ^7Li = +56.3 ‰ [202]. For this sample, the mole fraction of ^{7}Li = 0.9278 and A_r(Li) = 6.9438.

The minor isotope ^{6}Li is a potentially valuable nuclear source material for tritium production, an important component in hydrogen bombs, and a neutron absorber for the nuclear-fusion reaction.

Lithium depleted in ^{6}Li may be distributed in commerce, with mole fractions of ^{6}Li as low as 0.02 and atomic weights in excess of 6.99 [93,94]. This is the justification for the "m" annotation. In 1993, CAWIA expressed concern about the availability on the commercial market of such depleted materials and decided to put the atomic-weight value and uncertainty between square brackets and to add a dagger symbol to warn that, if a more accurate value is required, it must be determined on a sample of the material concerned [16].

$_4$Be Beryllium A_r(Be) = 9.012 182(3) [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{9}Be	9.012 1822(4)	1.0000

The name derives from the Greek word *beryllos* for "beryl" ($3BeO{\cdot}Al_2O_3{\cdot}6SiO_2$), a gemstone in which it is found. It was discovered by the French chemist and pharmacist Nicholas-Louis Vauquelin in beryl and emerald in 1797. The element was first separated in 1828 by the French chemist Antoine-Alexandre-Brutus Bussy and independently by the German chemist Friedrich Wöhler. Because the salts of beryllium have a sweet taste, the element was also known as glucinium from the Greek *glykys* for "sweet", until IUPAC selected the name beryllium in 1949.

In its 1961 report [22], CAWIA proposed A_r(Be) = 9.0122 based on atomic mass data from Everling et al. [23]. In 1969, CAWIA [4] reassessed the data and added one more significant figure: A_r(Be) = 9.012 18(1). In the 1985 CAWIA report [12], the atomic weight and uncertainty of Be were revised to their current values in light of the atomic mass data of Wapstra and Audi [50]. A search by mass spectrometry for other stable isotopes of Be failed to detect any [119].

^{10}Be is a cosmic-ray spallation product from N, O, Ne, and Ar and decays with a half-life of $1.6(2) \times 10^6$ a. ^{10}Be is pervasive on the earth's surface in equilibrium mole fractions of less than 10^{-11}, which is too small to affect the atomic weight of Be in normal materials. Beryllium is the only monoisotopic element with an even atomic number, but it has an odd mass number like all other monoisotopic elements.

$_5$B Boron A_r(B) = 10.811(7) g, m, r [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{10}B	10.012 9371(3)	0.199(7)
^{11}B	11.009 3055(4)	0.801(7)

The name derives from the Arabic *buraq* for "white". Although its compounds were known for thousands of years, it was not isolated until 1808 by the French chemists Louis-Joseph Gay-Lussac and Louis-Jacques Thenard.

In its 1961 report [22], CAWIA recommended A_r(B) = 10.811(3) based on calibrated mass-spectrometric measurements on brines and minerals from Searles Lake by McMullen et al. [87] and on atomic masses from Everling et al. [23]. The uncertainty was based on variations in natural abundances reported by McMullen et al. [87] and Thode et al. [86]. In 1969, CAWIA [4] reduced the number of significant figures based on new calibrated data showing wider variability of natural abundances of B isotopes by Finley et al. [203] and Schwarcz et al. [204]. New isotope-abundance data of high accuracy further confirmed earlier results [120,205].

In 1981, CAWIA [10] concluded that the range of isotope-abundance variations typical of the most common sources is covered by A_r(B) = 10.811(2). This value includes major commercial sources of B in California and Turkey [206]. However, the existence of normal terrestrial occurrences with sample atomic weights outside these implied limits could not be denied. Under the 1983 policy of a more liberal use of any single-digit uncertainty, CAWIA changed the recommended standard atomic weight

to $A_r(B) = 10.811(5)$ to which the annotation "r" clearly applies [11]. In 1985, the "g" annotation was added to reflect the occurrence of materials with anomalous isotopic compositions [12]. Compared with most other standard atomic weights, the tabulated value for B until 1995 was relatively uncertain with $U[A_r(B)]/A_r(B) = 463 \times 10^{-6}$. That uncertainty increased to 648×10^{-6} in 1995 when CAWIA decided to increase $U[A_r(B)]$ from 0.005 to 0.007 [17] to include the isotopic composition of B in seawater [207]. Natural variations in $n(^{11}B)/n(^{10}B)$ are reported as $\delta^{11}B$ values relative to the reference material NIST SRM 951, which has $n(^{11}B)/n(^{10}B) = 4.0436$ [205]. Reported $\delta^{11}B$ values compiled by Coplen et al. [85] range from a low of –34.2 ‰ [mole fraction of $^{11}B = 0.7961$; $A_r(B) = 10.8062$] in a metamorphic mineral sample from Antarctica [208] to a high of +59.2 ‰ [mole fraction of $^{11}B = 0.8107$; $A_r(B) = 10.8207$] in brine from a volcanic crater lake in southeastern Australia [209]. Separated and enriched isotopes of B are commercially available; the atomic weights of such samples can differ from one another by up to almost 10 %. Although CAWIA is unaware of undisclosed commercial sales of such material, an "m" annotation warns users of the possibility of its inadvertent dissemination.

$_6$C Carbon $A_r(C) = 12.0107(8)$ g, r [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{12}C	12 (exactly, by definition)	0.9893(8)
^{13}C	13.003 354 838(5)	0.0107(8)

The name derives from the Latin *carbo* for "charcoal". It was known in prehistoric times in the form of charcoal and soot. In 1797, the English chemist Smithson Tennant proved that diamond is pure carbon.

The ^{12}C isotope has served since 1960 as the scale-determining reference for the definition of the unified atomic mass unit and is the basis of all atomic weights. The zero value for the delta scale used in relative isotope-ratio measurements of C since the 1950s was based on a sample of fossil marine carbonate (Belemnitella Americana, Peedee Formation, Cretaceous Period, South Carolina, also known as PDB). Until 1990, the "best measurement" from a single natural source was attributed to Craig [210] for an evaluation of a measurement by Nier [65] on CO_2 from a Solenhofen limestone sample. For the "absolute" $n(^{13}C)/n(^{12}C)$ ratio in the PDB standard, Craig adopted a value of 0.011 2372(300), corresponding to a ^{13}C mole fraction of 0.01111(3) and an $A_r(C)$ value of 12.011 15(3).

In its 1961 report [22], CAWIA recommended $A_r(C) = 12.011\ 15(5)$, based on the atomic masses of Everling et al. [23] and the range of natural isotopic variations reported by Craig [211], hence the annotation "r". In its 1969 report [4], CAWIA recommended $A_r(C) = 12.011(1)$. The larger uncertainty was assigned to include all terrestrial sources of C whose isotopic compositions had been measured to that time. After the supply of PDB was exhausted, a modified delta scale was recommended for relative C isotope-ratio measurements (referred to as the Vienna PDB, or VPDB scale) that yields the same zero value as the PDB scale when based on measurements of a new carbonate reference material known as NBS 19 [212]. Chang and Li [121] reported calibrated measurements of the isotopic composition of C in NBS 19, providing an "absolute" basis for the VPDB delta scale, such that a material with a $\delta^{13}C$ value of 0 ‰ has $n(^{12}C)/n(^{13}C) = 89.449$ [mole fraction of $^{13}C = 0.011056$; $A_r(C) = 12.01109$]. Chang and Li's data were adopted subsequently by CAWIA as the "best measurement" of the atomic weight of C from a single source. In 1995, CAWIA recommended $A_r(C) = 12.0107(8)$ as a result of a reevaluation of variations in normal terrestrial materials [17].

Variations in the $n(^{13}C)/n(^{12}C)$ ratio of terrestrial sources of C are caused largely by biogeochemical reactions and physical processes. Some of the largest effects are associated with oxidation-reduction reactions including photosynthesis, such that organic substances and reduced natural gases typically are depleted in ^{13}C relative to carbonate materials and the atmosphere. Differences in the degree of ^{13}C depletion during photosynthesis are characteristic of some groups of plants and may be passed along to plant consumers, such that C isotope studies can be used to identify features of animal diets and paleoclimates. Variations in the relative rates of organic C production, burial, and oxidation through

geologic time are recorded in the isotopic compositions of sedimentary rocks. The highest reported $\delta^{13}C$ value in the compilation by Coplen et al. [85] [+37.5 ‰; mole fraction of ^{13}C = 0.011 466; $A_r(C)$ = 12.011 50] is from dissolved carbonate in reduced marine sediment pore water [213]. The lowest $\delta^{13}C$ value in that compilation [–130.3 ‰; mole fraction of ^{13}C = 0.009 629; $A_r(C)$ = 12.009 66] is from crocetane recovered from the ocean bottom at cold seeps in the northern Pacific Ocean [214]. The annotation "g" indicates that some of the reported analyses are outside the range of the standard atomic-weight uncertainty.

The radioactive ^{14}C isotope has a half-life of 5730 a. It is introduced continuously to the near-surface environment of the earth by cosmic-ray reactions, from cosmic dust, and by nuclear technology. It is of great interest for prehistoric dating as well as archaeological, anthropological, paleotemperature, and zoological studies. Yet, this isotope never occurs in normal C sources in concentrations high enough to affect significantly the $A_r(C)$ value. Before nuclear weapons tests, the abundance of ^{14}C in the atmosphere had an average concentration of only about 10^{-16}. It should be noted that a half-life of 5568 a (the so-called "Libby half-life"), has been adopted by convention for calculations in geochronology [215].

$_7$N Nitrogen $A_r(N) = 14.0067(2)$ g, r [Since 1999]

Isotope	Atomic mass/u	Mole fraction
^{14}N	14.003 074 0074(18)	0.996 36(20)
^{15}N	15.000 108 973(12)	0.003 64(20)

The name derives from the Latin *nitrum* and Greek *nitron* for "native soda" and *genes* for "forming". It was discovered by the Scottish physician and chemist Daniel Rutherford in 1772.

The primary reference material for the relative abundance measurements of N isotopes is atmospheric N_2 [216], which is homogeneous with respect to analytical uncertainties [217] and is assigned a $\delta^{15}N$ value of 0 ‰. Junk and Svec [122] reported calibrated measurements of the "absolute" isotope ratio of N_2 in air with an average $n(^{14}N)/n(^{15}N)$ ratio of 272.0(3). In 1961, CAWIA [22] adopted the calibrated measurements of Junk and Svec [122] as the "best measurement" and recommended $A_r(N)$ = 14.0067. In 1969, CAWIA [4] assigned $U[A_r(N)] = 0.0001$ in recognition of the predominance of one isotope, ^{14}N. In 1985, CAWIA [12] recommended $A_r(N)$ = 14.006 74 and $U[A_r(N)]$ = 0.000 07 to reflect a change in the procedures for reporting uncertainties. CAWIA subsequently recommended adoption of 272 exactly for the $n(^{14}N)/n(^{15}N)$ ratio corresponding to a $\delta^{15}N$ value of 0 ‰ [218]. De Bièvre et al. [219] reported uncalibrated measurements corrected for mass spectrometer inlet fractionation effects that yield a $n(^{14}N)/n(^{15}N)$ ratio for atmospheric N_2 of 271.87(11), in agreement with the earlier measurement [122]. In 1999 [19], CAWIA increased the uncertainty and removed a significant figure from the atomic weight of N after reviewing reported isotope-abundance variations in the literature [85].

Relative isotope-ratio measurements of N commonly have uncertainties of the order of 0.1 ‰, which is significantly smaller than the reported uncertainty of the "absolute" calibrated "best measurement" (±1.1 ‰). Variations in the isotopic composition of N in chemical reagents and natural terrestrial systems are known to exceed 200 ‰, which is much larger than the uncertainty due to either relative or "absolute" isotope-ratio measurements. Therefore, the accuracy and precision of the standard atomic weight of N are limited almost entirely by real variations, hence the annotation "r".

Measurable variations in the isotope abundances (and atomic weights) of N are found in most N compounds. The vast majority of N chemical reagents, manufactured N fertilizers, and environmental samples have $\delta^{15}N$ values between about –15 and +20 ‰ [mole fraction of ^{15}N = 0.003 61 to 0.003 74; $A_r(N)$ = 14.006 67 to 14.006 80]. Isotope fractionations are caused by physical, chemical, and biological processes. Some of the largest common effects in the natural environment are caused by microbially mediated oxidation and reduction reactions and by ammonia or nitric acid evaporation. The most ^{15}N-enriched N occurrences reported in nature include dissolved nitrate that had undergone partial microbial reduction (denitrification) in groundwater [e.g., $\delta^{15}N$ = +103 ‰; mole fraction of ^{15}N = 0.004 039;

A_r(N) = 14.007 10] [85], and nitrate in Antarctic ice that may have been fractionated by evaporation of HNO_3 [δ^{15}N = 150 ‰; mole fraction of ^{15}N = 0.004 210; A_r(N) = 14.007 27] [220]. The most ^{15}N-depleted substances from natural terrestrial environments include epibenthic algae from a saline pond in the Dry Valleys region of Antarctica [δ^{15}N = –49 ‰; mole fraction of ^{15}N = 0.003 484; A_r(N) = 14.006 55] [221] and nitrous oxide from groundwater undergoing microbial denitrification [δ^{15}N = –55 ‰; mole fraction of ^{15}N = 0.003 462; A_r(N) = 14.006 53] [85]. Still lower values have been reported for NO_x escaping from a nitric acid production facility [δ^{15}N = –150 ‰; mole fraction of ^{15}N = 0.003 115; A_r(N) = 14.006 18] [222], and for a commercially available potassium nitrite reagent [δ^{15}N = –80 ‰; mole fraction of ^{15}N = 0.003 371; A_r(N) = 14.006 43] [85]. The annotation "g" reflects the fact that a number of samples are known to have atomic weights outside the uncertainties of the standard atomic weight of N. Many thousands of isotopic analyses of N have been made since the 1950s; nevertheless, more occurrences of extreme values may be expected as work expands in the fields of contaminant hydrology, biology, and atmospheric chemistry. In addition, the common use of artificially enriched substances in agricultural and environmental research has resulted in substantial numbers of samples with N atomic weights approaching the atomic masses of the ^{15}N and ^{14}N isotopes.

$_8$O Oxygen A_r(O) = 15.9994(3) g, r [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{16}O	15.994 914 6223(25)	0.997 57(16)
^{17}O	16.999 131 50(22)	0.000 38(1)
^{18}O	17.999 1604(9)	0.002 05(14)

The name derives from the Greek *oxys* for "acid" and *genes* for "forming" because the French chemist Antoine-Laurent Lavoisier originally thought that oxygen was an acid producer because burning phosphorous and sulfur and dissolving them in water produced acids. Oxygen was discovered independently by the Swedish pharmacist and chemist Carl-Wilhelm Scheele in 1771, and the English clergyman and chemist Joseph Priestly in 1774. Scheele's *Chemical Treatise on Air and Fire* was delayed in publication until 1777, so Priestly is credited with the discovery because he published first.

In its 1961 report [22], CAWIA adopted A_r(O) = 15.9994(1) based on the mass-spectrometric measurements of Nier [65] on atmospheric O_2 and the atomic masses of Everling et al. [23], though it was recognized that the uncertainty did not cover the range of known natural variations. In its 1969 report [4], CAWIA increased $U[A_r(O)]$ to 0.0003 to include the range of normal terrestrial sources of O. The value has remained unchanged since then.

Two major sources of O are air and water. The best "absolute" measurement of the complete isotopic composition of O in atmospheric O_2 is that of Nier [65], which yielded values of 0.997 587, 0.000 374, and 0.002 039 for the mole fractions of ^{16}O, ^{17}O, and ^{18}O, respectively. Those values correspond to A_r(O) = 15.999 376 when calculated with current atomic masses [50]. Dole et al. [223] and Kroopnick and Craig [224] detected no variation in the isotopic composition of atmospheric O_2, but found that ^{18}O could be measurably enriched by low-temperature fractional distillation used to separate O_2 from N_2. The best measurement of the partial isotopic composition of O in water, according to CAWIA, is given by Baertschi [123], who obtained a value of 0.002 005 20(45) for $n(^{18}O)/n(^{16}O)$ in the VSMOW reference material. For several years, the isotopic composition of VSMOW was obtained by combining Baertschi's [123] $n(^{18}O)/n(^{16}O)$ ratio with a value of 0.000 372(4) for $n(^{17}O)/n(^{16}O)$, which was derived from Nier's earlier data [65] by assuming that the relative fractionation of the isotopes is governed by the relative mass differences, such that $[n(^{17}O)/n(^{16}O)]_s/[n(^{17}O)/n(^{16}O)]_{RM} = \{[n(^{18}O)/n(^{16}O)]_s/[n(^{18}O)/n(^{16}O)]_{RM}\}^{0.5}$ [210], where s and RM refer to the sample and reference material, respectively. More recently, Baertschi's [123] $n(^{18}O)/n(^{16}O)$ ratio has been combined with a new value of 0.000 3799(8) for $n(^{17}O)/n(^{16}O)$, recommended by Li et al. [124] on the basis of new meas-

urements, to obtain the "best measurement" of the total isotopic composition of O in a water sample (VSMOW).

Relative isotope-ratio measurements of O in water and many other substances commonly are expressed relative to VSMOW, in which case the $\delta^{18}O$ value of VSMOW is 0 ‰ by definition. However, two other scales have been used commonly: (1) in studies of atmospheric gases and related topics, atmospheric O_2 may be assigned a $\delta^{18}O$ value of 0 ‰; (2) in studies of marine carbonate deposits and related topics, a specimen of marine carbonate (PDB, Peedee belemnite) may be assigned a $\delta^{18}O$ value of 0 ‰. The carbonate scale has been retained since the supply of PDB was exhausted by assigning a value of –2.2 ‰ for the $\delta^{18}O$ value of NBS 19 carbonate, yielding the VPDB (Vienna PDB) $\delta^{18}O$ scale [212].

Relating atomic weights to relative isotope-ratio measurements may be complicated in principle by the observation that the exponent in the mass-dependent fractionation equation may deviate significantly from one half, and by the fact that relative isotope-ratio measurements generally do not include ^{17}O. Nevertheless, though the value of the exponent may be as high as 0.52 [225] or 0.53 [226] in common substances, the atomic-weight errors caused by these differences are small compared to the uncertainty of the "absolute" measurement of atomic weight. Larger deviations from mass-dependent fractionation of ^{18}O, ^{17}O, and ^{16}O have been observed in minor atmospheric gases such as O_3, CO_2, N_2O, and CO, apparently as a result of non-mass-dependent photochemical reactions [88]. Similar features have been observed in sulfate and nitrate in atmospheric deposition and some types of soils [227,228], and it is likely that the number and variety of samples reported to exhibit non-mass-dependent O isotope fractionation will increase rapidly in the future.

Variations in the atomic weight of O in surface water on the earth commonly are correlated with those of H, as the isotopes of both elements are fractionated by evaporation and condensation [229]. Whereas ocean water has almost constant values of H and O atomic weight worldwide (near that of VSMOW), precipitation varies widely with the lowest values being at high latitudes. Natural variations in the isotopic composition of O have been exploited since the 1950s in studies of the hydrological cycle, biogeochemistry, and paleoclimates. The highest natural terrestrial $\delta^{18}O$ value in the compilation of Coplen et al. [85] [+109 ‰; mole fraction of ^{18}O = 0.002 218; $A_r(O)$ = 15.999 76] is from marine N_2O [230]. The lowest natural $\delta^{18}O$ value in the compilation [–63 ‰; mole fraction of ^{18}O = 0.001 875; $A_r(O)$ = 15.999 04] is from Antarctic precipitation [231]. Given the relatively small uncertainties in the best "absolute" measurements (±0.25 ‰) and in typical relative measurements (±0.1 ‰ or less), it is evident that the uncertainty of the standard atomic weight of O (corresponding to ±70 ‰) is dominated by real natural variations, hence the annotation "r". The annotation "g" is given because some natural terrestrial materials have atomic weights that are outside the range of the standard atomic weight uncertainty, at both the high and low ends. For example, a commercial tank CO gas was reported to have $\delta^{18}O$ = –229 ‰ [mole fraction of ^{18}O = 0.001543; $A_r(O)$ = 15.998 34] [85].

$_9$F Fluorine A_r(F) = 18.998 4032(5) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{19}F	18.998 403 20(7)	1.0000

The name derives from the Latin *fluere* for "flow" or "flux" because fluorite (CaF_2) was used as a flux in metallurgy owing to its low melting point. It was discovered in hydrofluoric acid by the Swedish pharmacist and chemist Carl-Wilhelm Scheele in 1771, but it was not isolated until 1886 by the French pharmacist and chemist Ferdinand-Frederic-Henri Moisson.

The CAWIA report in 1961 [22] proposed $A_r(F)$ = 18.9984 based on atomic mass data by Everling et al. [23]. The revision of these data by Wapstra and Gove [48] led to a refinement of $A_r(F)$ to 18.998 40 in the CAWIA report of 1971 [5] and to 18.998 403 in 1975 [7]. The atomic weight and uncertainty of F were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass

data of Audi and Wapstra [51]. Radioisotopes of F are not suitable for IDMS because of their short half-lives.

$_{10}$Ne Neon A_r(Ne) = 20.1797(6) g, m [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{20}Ne	19.992 440 176(3)	0.9048(3)
^{21}Ne	20.993 846 74(4)	0.0027(1)
^{22}Ne	21.991 385 50(25)	0.0925(3)

The name derives from the Greek *neos* for "new". It was discovered from its bright orange spectral lines by the Scottish chemist William Ramsay and the English chemist Morris William Travers in 1898 from a liquefied air sample.

In its 1961 report [22], CAWIA recommended A_r(Ne) = 20.183 based on gas-density measurements by Baxter and Starkweather [232] and Baxter [233], recalculated to the $A_r(^{12}C) = 12$ scale. At that time, the only reported measurements by mass spectrometry were uncalibrated and were not considered to be reliable enough to serve as the basis for the atomic weight. In 1967, CAWIA evaluated the results of two new calibrated measurements [3]. Measurements by Eberhardt et al. [234] and by Walton and Cameron [235] were in excellent agreement, and CAWIA recommended A_r(Ne) = 20.179(3). Both groups compared their calibrated samples with various commercial sources of Ne and reported that no variations were found. The assignment of $U[A_r(Ne)] = 0.003$ was caused by the concern of CAWIA that because almost all commercial Ne was liquefied for purification from air, laboratory samples might be enriched in the heavy isotope relative to natural atmospheric Ne. After a review of the published data in 1979, CAWIA reduced its assessment of this potential fractionation effect and recommended $U[A_r(Ne)] = 0.001$ [9]. In 1985, CAWIA [12] reduced $U[A_r(Ne)]$ further and recommended A_r(Ne) = 20.1797(6) by combining the earlier results with new calibrated measurements reported by Bottomley et al. [126]. The atomic weight and its uncertainty refer to atmospheric Ne. The annotation "g" refers to occurrences of Ne with diverse and anomalous isotopic compositions in some minerals and natural gases, derived in part from earth's mantle and from various nuclear reactions such as ^{18}O (α,n) ^{21}Ne and ^{25}Mg (n,α) ^{22}Ne [236–238].

$_{11}$Na Sodium (Natrium) A_r(Na) = 22.989 770(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{23}Na	22.989 769 66(26)	1.0000

The name derives from the English soda and Latin *sodanum* for "headache remedy". The chemical symbol Na derives from the Latin *natrium* for "natron" (soda in English). It was discovered in 1807 by the English chemist Humphry Davy from electrolysis of caustic soda (NaOH).

The 1961 CAWIA report [22] proposed the atomic weight for Na to be A_r(Na) = 22.9898 based on atomic mass data by Everling et al. [23], and also quoted experimental evidence from the literature concerning upper limits for the hypothetical presence of ^{21}Na and ^{22}Na, which were determined as 10^{-8} and 3×10^{-8}, respectively [127]. These stable isotopes—if they exist at all—cannot cause a change in the eighth significant figure in A_r(Na).

The revision of the atomic mass data by Wapstra and Gove [48] led to a refinement of A_r(Na) to 22.989 77(1) in the 1971 CAWIA report [5]. The atomic weight and uncertainty of Na were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{12}$Mg Magnesium A_r(Mg) = 24.3050(6) [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{24}Mg	23.985 041 87(26)	0.7899(4)
^{25}Mg	24.985 837 00(26)	0.1000(1)
^{26}Mg	25.982 593 00(26)	0.1101(3)

The name derives from Magnesia, a district in the northeastern region of Greece called Thessalia. The Scottish chemist Joseph Black recognized it as a separate element in 1755. In 1808, the English chemist Humphry Davy obtained the impure metal, and in 1831 the French pharmacist and chemist Antoine-Alexandre Brutus Bussy isolated the metal in the pure state.

In the 1961 CAWIA report [22], the atomic weight of Mg was based on the isotopic composition reported by White and Cameron [128] and the atomic masses from the 1960 compilation of Everling et al. [23]. In its 1967 report [3], CAWIA adopted A_r(Mg) = 24.305 based on the "absolute" isotopic measurements of Catanzaro et al. [239] and the mineral survey of Catanzaro and Murphy [240], who reported no detectable variations in 60 samples of natural Mg from various geological sources. In 1969, CAWIA assigned the uncertainty $U[A_r(Mg)] = 0.001$ to this value [4]. The value and uncertainty were slightly modified by CAWIA in 1985 to 24.3050(6), to be consistent with its own Technical Guidelines [12].

The annotation "g" was added to Mg by CAWIA in its 1971 report [5], based on a published abstract report of a partial mineral survey by Lepin et al. [241] who documented considerable natural variability in sources from the former Soviet Union. Since there were no comparable findings in other publications on Mg such as that by Catanzaro and Murphy [240], CAWIA concluded that the specimens studied by Lepin et al. [241] must have been very exceptional, thereby justifying the annotation "g" in preference to reducing the precision of the tabulated value. A later credible study by Schramm et al. [242] found no anomalies in atomic-weight values greater than experimental error. Although cosmochemical-induced anomalies in ^{26}Mg can be produced, they will not affect the atomic weight of Mg of natural terrestrial origin. CAWIA, therefore, decided to make a study of the actual data obtained by Lepin et al. [241]. As a result, CAWIA concluded that experimental uncertainties and not atomic weight variability probably caused a considerable range of values to be reported, and therefore removed the annotation "g" from the Mg standard atomic weight. Recently, precise measurements by ICPMS have indicated variations of $n(^{26}Mg)/n(^{24}Mg)$ that can be reported as δ^{26}Mg values relative to the SRM-980 reference material [85]. Chang et al. [243] report a range of δ^{26}Mg values from a low of –1.95 ‰ (mole fraction of ^{26}Mg = 0.1099; A_r(Mg) = 24.3046) in marine calcareous shell material (foraminifera) to a high of +2.55 ± 0.12 ‰ (mole fraction of ^{26}Mg = 0.1103; A_r(Mg) = 24.3055) in seawater.

$_{13}$Al Aluminium (Aluminum) A_r(Al) = 26.981 538(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{27}Al	26.981 538 41 (24)	1.0000

The name derives from the Latin, *alum* and *alumen* for "stringent" because the early Romans called any substance with a stringent taste alum. The element was known in prehistoric times. In 1825, the Danish physicist, Hans Christian Oersted, isolated impure aluminum. The pure metal was first isolated by the German chemist Friedrich Wöhler in 1827.

The CAWIA report in 1961 [22] proposed the atomic weight of Al to be A_r(Al) = 26.9815, based on atomic mass data by Everling et al. [23], and experimental evidence from the literature concerning upper limits for the hypothetical presence of ^{25}Al, ^{26}Al, ^{28}Al, ^{29}Al, and ^{30}Al [127]. This evidence shows that these isotopes could at most affect A_r(Al) by one digit in the seventh significant figure. The revision of the atomic mass data by Wapstra and Gove [48] led to a refinement of A_r(Al) to 26.981 54(1) in the 1971 CAWIA report [5]. The atomic weight and uncertainty of Al were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

^{26}Al is radioactive with a half-life of $7.05(24) \times 10^5$ a, too short for survival of a detectable amount of primordial isotope. However, ^{26}Al is recognized as a spallation product of Ar from cosmic rays. In addition, secondary cosmic rays including muons interact with Si-bearing rocks to produce ^{26}Al in measurable amounts, but far below levels that would affect the atomic-weight value in normal materials [244]. ^{27}Al is the most abundant isotope in the earth's crustal rocks with an uneven atomic number.

$_{14}$Si Silicon A_r(Si) = 28.0855(3) r [Since 1975]

Isotope	Atomic mass/u	Mole fraction
^{28}Si	27.976 926 49(22)	0.922 23(19)
^{29}Si	28.976 494 68(22)	0.046 85(8)
^{30}Si	29.973 770 18(22)	0.030 92(11)

The name derives from the Latin *silex* and *silicis* for "flint". Amorphous silicon was discovered by the Swedish chemist Jöns Jacob Berzelius in 1824. Crystalline silicon was first prepared by the French chemist Henri Sainte-Claire Deville in 1854.

In its 1961 report [22], CAWIA recommended A_r(Si) = 28.086(1) based on the average value of seven reported mass-spectrometric determinations, with atomic masses by Everling et al. [23]. In 1969, CAWIA [4] noted that the range of these seven values was greater than ±0.001 and recommended A_r(Si) = 28.086(3). In 1975, CAWIA [7] recommended the current value, A_r(Si) = 28.0855(3), based on superior "absolute" mass-spectrometric measurements by Barnes et al. [245] and atomic masses by Wapstra and Gove [48]. CAWIA at that time already had judged some of the reported variability of the isotopic composition of Si to be excessive. This is borne out by an investigation by Douthitt [246] who studied Si in terrestrial materials and comprehensively reviewed the literature. He found that the variability in igneous rocks is much smaller than the range indicated above, but it is real and is related to O isotope fractionation. The Si isotope fractionation in some clays, marine sediments and opals is larger, but still within the range implied by the $U[A_r(\mathrm{Si})]$ value of 0.0003. Therefore, in 1983 [11] CAWIA added the annotation "r" because a more precisely stated standard atomic weight with a single-digit uncertainty would conflict with the actual sample atomic weights of possible sources of Si. In 1991 and 1994, CAWIA noted that, while new values with considerably smaller uncertainties (uncertainty 0.000 12 on an atomic-weight value of 28.085 65) had been determined on Si isotopic reference materials [247,248], the range in isotopic composition of normal terrestrial materials prevent a more precise standard atomic weight being given. δ^{30}Si measurements are expressed relative to NBS 28 SiO_2 as distributed by IAEA and NIST. The lowest δ^{30}Si value found in the literature (–3.7 ‰) is from biogenic sponge spicules [246]. For this sample, the mole fraction of ^{30}Si = 0.030 816 and A_r(Si) = 28.085 22. The highest δ^{30}Si found in the literature (+3.4 ‰) is from silicified algal matter [249] in sediments. For this sample, the mole fraction of ^{30}Si = 0.031 023 and A_r(Si) = 28.085 78.

In recent history, A_r(Si) determinations have been directly related to attempts to quantify as accurately as possible the relationship between atomic scale and macroscopic physical quantities as represented by determinations of Avogadro's constant [70,71,105,106,250,251]. In the course of this work, it was clearly demonstrated that careful crystallization of Si is accompanied by isotope fractionation. Detailed atomic-scale theories of the growing crystal–liquid interface are being developed such as are needed to predict the isotopic composition changes as a function of the parameters controlling crystallization. The preparation of synthetic mixtures of Si isotopes in order to "calibrate" measurements of the Si atomic weight is described in [252].

Radioactive ^{32}Si is a cosmogenic isotope, and it is potentially available from the nuclear industry in sufficient quantities to make it of value in IDMS measurements, given its relatively long half-life.

$_{15}$P Phosphorus A_r(P) = 30.973 761(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{31}P	30.973 761 49(27)	1.0000

The name derives from the Greek *phosphoros* for "bringing light" because it has the property of glowing in the dark. This was also the ancient name for the planet Venus, when it appears before sunrise. Phosphorus was discovered by the German merchant Hennig Brand in 1669.

The CAWIA report in 1961 [22] recommended the atomic weight A_r(P) = 30.9738, based on atomic mass data from Everling et al. [23], and quoted experimental evidence from the literature concerning upper limits for the hypothetical presence of ^{28}P, ^{29}P, ^{30}P, ^{32}P, ^{33}P, and ^{34}P. This evidence, however, does not rule out an effect on A_r(P) in the seventh significant figure. The revision of the atomic mass data by Wapstra and Gove [48] led to a refinement of A_r(P) to 30.973 76(1) in the 1971 CAWIA report [5]. The atomic weight and uncertainty of P were changed to their current values in the 1995 report of CAWIA [17] based on the atomic mass data of Audi and Wapstra [51]. ^{32}P and ^{33}P are cosmogenic and also can be produced by the nuclear industry, but their concentrations in normal materials are too small to affect A_r(P). They have differing half-lives and offer the potential for self-calibration of IDMS measurements.

$_{16}$S Sulfur A_r(S) = 32.065(5) g, r [Since 1999]

Isotope	Atomic mass/u	Mole fraction
^{32}S	31.972 070 73(15)	0.9499(26)
^{33}S	32.971 458 54(15)	0.0075(2)
^{34}S	33.967 866 87(14)	0.0425(24)
^{36}S	35.967 080 88(25)	0.0001(1)

The name derives from the Latin *sulphurium* and the Sanskrit *sulveri*. Sulfur was known as brenne stone for "combustible stone" from which brim-stone is derived. It was known from prehistoric times and thought to contain hydrogen and oxygen. In 1809, the French chemists Louis-Joseph Gay-Lussac and Louis-Jacques Thenard proved the elemental nature of sulfur.

In its 1961 report [22], CAWIA recommended A_r(S) = 32.064(3) based on the abundances of S isotopes in virgin Texas sulfur reported by Bradt et al. [253] and in meteoritic S reported by MacNamara and Thode [254], with atomic masses from Everling et al. [23]. CAWIA observed that this value was in good agreement with the results of chemical determinations and that the uncertainty was assigned largely on the basis of natural variability, as documented by Rankama [255] and Duckworth [256]. In 1969, CAWIA [4] recommended a change in the value of A_r(S) from 32.064(3) to 32.06(1). The reduction in the number of significant figures was motivated by the reported range of natural variability and by new guidelines for the assignment of uncertainties to the standard atomic weights. A reevaluation of the literature in 1983 led CAWIA to recommend [11] A_r(S) = 32.066(6), which included essentially all reported values at that time. Then, as a result of new "absolute" measurements of the isotopic compositions of several reference materials [59,257], CAWIA in 1999 [19] recommended A_r(S) = 32.065(5). More recent publications confirmed this decision [129,258]. The annotation "g" was added in 1993 [16] and remains currently to account for minor occurrences of S with A_r(S) outside the range covered by the atomic-weight uncertainty [85].

For many years, the "best measurement" of the "absolute" isotope abundances of S according to CAWIA was a calibrated mass-spectrometric measurement by MacNamara and Thode [254] on meteoritic sulfide, with an uncertainty of around ±1 ‰. Relative isotope-ratio measurements of S generally involve only the isotopes ^{34}S and ^{32}S. The δ scale until recently was based on a value of 0 ‰ for Canyon Diablo troilite (CDT), a meteoritic sulfide sample, for which the ratio $n(^{32}S)/n(^{34}S)$ measured by gas source mass spectrometry was assumed to be 22.22 [259], despite the fact that this was not the same as

the ratio derived from the calibrated measurement [254]. Recently, a substitute δ scale for relative isotope-ratio measurements (referred to as the Vienna CDT, or VCDT scale) was devised to yield the same zero value as the CDT scale when based on measurements of a new sulfide reference material known as IAEA-S-1, which was assigned a δ^{34}S value of –0.3 ‰ [260,261]. This was done in part because of documented heterogeneity of the original CDT material [262]. Ding et al. [257] reported calibrated measurements of the isotopic composition of S in IAEA-S-1 with an uncertainty of ±0.3 ‰, providing an "absolute" basis for the VCDT δ scale, such that a material with a δ^{34}S value of 0 ‰ has $n(^{32}S)/n(^{34}S) = 22.6436$. Relative isotope-ratio measurements are commonly made with uncertainties of ±0.2 ‰ or less. Because of natural variations, the uncertainty in the standard atomic weight corresponds to a range of about ±60 ‰, which is more than two orders of magnitude larger than the analytical uncertainties, hence the annotation "r".

Isotopes of S are fractionated by various chemical, physical, and biological processes. The major variations in the atomic weight of S on earth are caused by kinetic isotope fractionations accompanying microbial oxidation-reduction reactions such as bacterial reduction of aqueous sulfate, in which the residual unreacted substrate is gradually depleted in the lighter isotopes, which react more rapidly. Over geologic time, processes such as these have resulted in major reservoirs of terrestrial S with different atomic weights: oxidized forms such as marine sulfate commonly being heavy in comparison with the bulk earth and the majority of reduced forms such as organic S and sulfide. Primordial S held in the deep earth and released in some volcanic emissions has a δ^{34}S value close to 0 ‰ [A_r(S) = 32.0639]. Seawater sulfate currently has a uniform δ^{34}S value of +21.1 ‰; [A_r(S) = 32.0657], though it has been different in the geological past. The highest value of the atomic weight of S found in the literature [263] is from sulfate in reduced-sediment pore water undergoing sulfate reduction that had δ^{34}S = +135 ‰ [mole fraction of ^{34}S = 0.0473; A_r(S) = 32.075]. The lowest value of the atomic weight of S found in the literature [85] is from sulfide in an ice-covered sewage treatment lagoon that had δ^{34}S = –55 ‰ [mole fraction of ^{34}S = 0.0398; A_r(S) = 32.059].

The radioactive isotope ^{35}S is produced by cosmic-ray interactions with ^{40}Ar in the atmosphere and decays to ^{35}Cl with a half-life of 87 days. ^{35}S is useful as an environmental tracer in hydrologic studies, both at natural and artificially enriched levels, but its abundance is several orders of magnitude too small to affect A_r(S).

$_{17}$Cl Chlorine A_r(Cl) = 35.453(2) g, m, r [Since 1999]

Isotope	Atomic mass/u	Mole fraction
^{35}Cl	34.968 852 71(4)	0.7576(10)
^{37}Cl	36.965 902 60(5)	0.2424(10)

The name derives from the Greek *chloros* for "pale green or greenish yellow color" of the element. It was discovered by the Swedish pharmacist and chemist Carl-Wilhelm Scheele in 1774. In 1810, the English chemist Humphry Davy proved it was an element.

In its 1961 report [22], CAWIA recommended A_r(Cl) = 35.453(1), based on the atomic weight of Ag and on Ag-silver chloride weight ratios determined chemically by many well-known authorities. CAWIA also observed that this value was in excellent agreement with the value determined by calibrated mass spectrometry A_r(Cl) = 35.4527(7), reported by Shields et al. [130], who reported no evidence for natural variability. In an extensive discussion of the atomic weights of Ag, Br, and Cl in its 1967 report [3], CAWIA retained the 1961 atomic-weight value, but stated that it was based on the physical measurement by Shields et al. [130] combined with the atomic mass data from Mattauch et al. [264]. Following its 1967 discussion of Ag, Cl, and Br, which were important in the chemical determination of atomic weights of several other elements, CAWIA did not assign any new atomic-weight values defined purely on the basis of chemical measurements. In 1985, CAWIA altered the atomic weight of Cl to 35.4527(9) to conform to the Technical Guidelines on atomic-weight uncertainties [12]. Since

1985, relative isotope-ratio mass spectrometry has yielded abundant evidence for variability in the atomic weight of Cl in both natural and artificial substances [85], which resulted in the 1999 decision of CAWIA to increase the uncertainty and remove a significant figure from the atomic weight of Cl, and to add the annotation "r" [19].

The "best measurement" of the isotopic composition of Cl from a single source was performed on a reference material (NIST SRM 975) that is no longer available. A replacement material (NIST SRM 975a) is in preparation. The best measurement [130] yielded a mole fraction of ^{37}Cl = 0.242 29(45), corresponding to A_r(Cl) = 35.4527(9). The basis of the delta scale for relative Cl isotope-ratio measurements currently is standard mean ocean chloride (SMOC), with δ^{37}Cl = 0 ‰, despite reported evidence for variability in $n(^{37}\text{Cl})/n(^{35}\text{Cl})$ of seawater chloride [85]. SMOC is reported to have a δ^{37}Cl value 0.52 ‰ less than that of NIST SRM 975 [265], implying that SMOC has a mole fraction of ^{37}Cl = 0.242 19 and A_r(Cl) = 35.4525, within the uncertainty of the best "absolute" measurement on SRM 975. Other measurements indicate that SMOC has a δ^{37}Cl value 0.43 ‰ less than that of NIST SRM 975 [266], also within the uncertainty of the best "absolute" measurement.

Chlorine isotopes in the chloride ion may be fractionated in nature and the laboratory by diffusion, ion filtration, and halide mineral precipitation. The lighter isotope ^{35}Cl diffuses more rapidly in aqueous solutions, whereas the concentration of the heavier isotope ^{37}Cl is higher in halide minerals than in coexisting solutions. Chlorine isotopes also have been fractionated photochemically in the laboratory [267]. Environmental chloride samples are reported to have δ^{37}Cl values ranging from about –7.7 ‰ [268] to +7.5 ‰ [269], corresponding to mole fractions of ^{37}Cl = 0.2408 to 0.2436 and A_r(Cl) = 35.450 to 35.455 [85]. Chlorinated organic solvents from different commercial sources commonly have different Cl isotopic compositions. The Cl isotopes of those compounds may also be fractionated by biochemical degradation reactions. Chlorinated solvents are reported to have δ^{37}Cl values ranging from at least –6.0 ‰ to +4.4 ‰ [85], corresponding to mole fractions of ^{37}Cl = 0.2411 to 0.2430 and A_r(Cl) = 35.450 to 35.454. The range of Cl atomic weights in nature and in laboratory reagents is larger than the range indicated by the standard atomic-weight uncertainty value, hence the annotation "g". Larger ranges of variation may be found as measurements are made on a wider range of environments and of Cl-bearing species.

The radioactive isotope ^{36}Cl decays to ^{36}Ar with a half-life of $301(2) \times 10^3$ a. It is produced both naturally and artificially by slow-neutron reactions with ^{35}Cl. Large quantities of ^{36}Cl were injected into the atmosphere as a by-product of nuclear bomb tests in the oceans. Both natural cosmogenic ^{36}Cl and bomb-produced ^{36}Cl from the atmosphere have been useful as environmental tracers in hydrologic studies [270]; however, the concentrations normally encountered are too low by several orders of magnitude to have a measurable effect on the atomic weight of Cl.

$_{18}$Ar Argon A_r(Ar) = 39.948(1) g, r [Since 1979]

Isotope	Atomic mass/u	Mole fraction
^{36}Ar	35.967 546 26(27)	0.003 365(30)
^{38}Ar	37.962 7322(5)	0.000 632(5)
^{40}Ar	39.962 383 124(5)	0.996 003(30)

The name derives from the Greek *argos* for "lazy" or "inactive" because it does not combine with other elements. It was discovered in 1894 by the Scottish chemist William Ramsay and the English physicist Robert John Strutt (Lord Rayleigh) in liquefied air. Rayleigh's initial interest derived from a problem posed by the English physicist Henry Cavendish in 1785, i.e., when oxygen and nitrogen were removed from air, there was an unknown residual gas remaining.

The atomic weight of Ar is based on analyses of Ar separated from air. In 1961, CAWIA [22] changed the recommended value of A_r(Ar) from 39.944, based on gas-density measurements, to 39.948, based on the calibrated mass-spectrometric measurements reported by Nier [65], which have been ac-

cepted since then as the "best measurement" from a single source. In 1969, CAWIA [4] recommended A_r(Ar) = 39.948(3) after a general evaluation of uncertainties. However, at its meeting in 1979, CAWIA examined the available literature and recommended a smaller uncertainty, so that A_r(Ar) = 39.948(1) [9]. This value of A_r(Ar) was one of the critical parameters used by Moldover et al. [98] to determine the value of the universal gas constant R by acoustic methods.

Argon isotope abundances commonly are reported as ratios with respect to ^{36}Ar, for example, $n(^{40}\text{Ar})/n(^{36}\text{Ar})$. The calibrated "absolute" isotope-ratio measurement of Nier [65] corresponds to a $n(^{40}\text{Ar})/n(^{36}\text{Ar})$ ratio of 296.0, with uncertainty of ±0.5 in the ratio or ±1.8 ‰ in δ^{40}Ar. Relative isotope-ratio measurements of Ar commonly have uncertainties of similar magnitude, whereas, the isotopic composition of Ar in gases from common sources is known to vary from the atmospheric ratio to almost pure ^{40}Ar [237]. The atomic weight uncertainty assigned to Ar by CAWIA in 1979 is an order of magnitude larger than the uncertainty of the "absolute" isotope-abundance measurement owing to natural variability, hence the annotation "r" [9].

Radiogenic ^{40}Ar is produced (along with ^{40}Ca) by decay of a minor isotope of K (^{40}K), which has a total half-life of $1.26(1) \times 10^9$ a. This radioactivity results in many geological samples having anomalous amounts of ^{40}Ar and is the basis of the K-Ar and Ar-Ar dating methods used in geochronology. It should be noted that a value of 295.5 for the atmospheric $n(^{40}\text{Ar})/n(^{36}\text{Ar})$ ratio has been adopted by convention for calculations in geochronology [271]; this value was derived from the isotope abundances given by Nier [65], but it is not equal to the ratio given by Nier in the same paper. Samples containing only minor components of noble gases from nonradiogenic sources may have A_r(Ar) values approaching the atomic mass of ^{40}Ar. Owing to the wide distribution of K, even major sources of Ar such as some natural gas deposits and geothermal reservoirs can have sufficiently high ^{40}Ar concentrations to be outside the atomic weight uncertainty, hence the annotation "g". In contrast, it is much less common for natural samples to have $n(^{40}\text{Ar})/n(^{36}\text{Ar})$ ratios significantly less than that of air. Radiogenic ^{36}Ar can accumulate by decay of ^{36}Cl (half-life = $3.01(2) \times 10^5$ a), which in turn is produced from ^{35}Cl by neutron capture associated with cosmic-ray interactions in the atmosphere and with U and Th decay in the solid earth. Similarly, ^{38}Ar may accumulate as a result of reactions such as ^{37}Cl (n,γ) ^{38}Cl or ^{35}Cl (α,p) ^{38}Cl. Some samples of Ar extracted from microscopic Cl-bearing inclusions in minerals have been reported to have anomalously high concentrations of ^{36}Ar and ^{38}Ar that may be attributable to nucleogenesis [272].

Radioactive ^{37}Ar and ^{39}Ar are formed continuously in the atmosphere as products of cosmic-ray reactions, and they are components of cosmic dust entering the earth's atmosphere. Both isotopes also are formed by nuclear reactions on and beneath the earth's surface. At the present time, most of the new ^{39}Ar introduced to the atmosphere each year is from nuclear reactors. ^{39}Ar decays to ^{39}K with a half-life of 269 a; while ^{37}Ar decays to ^{37}Cl with a half-life of 35 days. The amounts of ^{37}Ar and ^{39}Ar in normal samples are variable and may be useful in environmental studies, but they are several orders of magnitude too small to affect the standard atomic weight of Ar at its current level of reported uncertainty.

$_{19}$K Potassium (Kalium) A_r(K) = 39.0983(1) [Since 1979]

Isotope	Atomic mass/u	Mole fraction
^{39}K	38.963 7069(3)	0.932 581(44)
^{40}K	39.963 998 67(29)	0.000 117(1)
^{41}K	40.961 825 97(28)	0.067 302(44)

The name derives from the English "potash" or "pot ashes" because it is found in caustic potash (KOH). The chemical symbol K derives from the Latin kalium via the Arabic qali for alkali. It was first isolated by the British chemist Humphry Davy in 1807 from electrolysis of potash (KOH).

The value of A_r(K) = 39.102 for the atomic weight of K was adopted by CAWIA in its 1961 report [22], based on the mass-spectrometric measurements of Nier [65] and atomic masses by Everling et al. [23]. This value was near the upper range of the best chemical determinations. In the 1969 report [4], CAWIA assigned an uncertainty $U[A_r(K)] = 0.003$ to this value. A new analysis by Marinenko [273] of older chemical data by Bates and Wichers [274] led CAWIA in 1971 [5] to assign more credence to the chemical evidence for a lower value, and $A_r(K) = 39.098(3)$ was recommended based on the mean value of chemical and mass-spectrometric determinations. In the 1975 report [7], CAWIA recommended $A_r(K) = 39.0983(3)$, based on the "absolute" mass-spectrometric measurements of Garner et al. [131], who also reported the results of a mineralogical study of possible isotopic variations. The uncertainty was reduced to $U[A_r(K)] = 0.0001$ in the 1979 CAWIA report [9], based on an evaluation of possible variations of the isotope abundances and the effects of small errors in the abundance measurements. CAWIA added the annotation "g" in 1991 [15] because the results of Hinton et al. [275] indicated values outside the atomic-weight uncertainty. The annotation "g" was removed in 1995 [17] after the work of Humayun and Clayton [276] did not support the results of Hinton et al.

The minor isotope, ^{40}K, is radioactive with a total half-life of $1.26(1) \times 10^9$ a [277], and decays to both ^{40}Ar and ^{40}Ca. As a result of decay, $A_r(K)$ will decrease by approximately 1.5×10^{-4} % in one half-life. The K/Ar and K/Ca decay systems are used extensively in geochronology [77].

$_{20}$Ca Calcium A_r(Ca) = 40.078(4) g [Since 1983]

Isotope	Atomic mass/u	Mole fraction
^{40}Ca	39.962 5912(3)	0.969 41(156)
^{42}Ca	41.958 6183(4)	0.006 47(23)
^{43}Ca	42.958 7668(5)	0.001 35(10)
^{44}Ca	43.955 4811(9)	0.020 86(110)
^{46}Ca	45.953 6927(25)	0.000 04(3)
^{48}Ca	47.952 533(4)	0.001 87(21)

The name derives from the Latin *calx* for "lime (CaO)" or "limestone ($CaCO_3$)" in which it was found. It was first isolated by British chemist Humphry Davy in 1808 with help from the Swedish chemist Jöns Jacob Berzelius and the Swedish court physician M. M. af Pontin.

In its 1961 report [22], CAWIA recommended $A_r(Ca) = 40.08(1)$, based on the chemical measurements of Hönigschmid and Kempter [278] and isotope-abundance measurements by Nier [279]. A recalculation of the chemical ratio using current values of the atomic weights of the other elements involved [11] gives the following results from the listed comparisons:

$CaC1_2$/2Ag	0.514 451	$A_r(Ca) = 40.080$	
$CaC1_2$/AgCl	0.387 200	$A_r(Ca) = 40.082$	[278]

The best mass-spectrometric measurements, as chosen by CAWIA, are those by Moore and Machlan [132], yielding $A_r(Ca) = 40.078$. Because these measurements were not calibrated for bias, some weight is still given to the chemical determinations. Further evidence is provided by the X-ray density method [280] which, on recalculation with the current atomic weights of the other elements involved, yields $A_r(Ca) = 40.079(2)$. In 1983, CAWIA [11] with its liberalized policy on uncertainties, was able to recommend as standard atomic weight $A_r(Ca) = 40.078(4)$ weighted toward the mass-spectrometric measurement [132]. It would take a large error even to come close to the limit of the indicated uncertainty since Ca has a predominant isotope. Moreover, the stated uncertainty includes all chemical, X-ray, and mass-spectrometric measurements believed to be significant by CAWIA, as enumerated in its 1983 report [11].

There is evidence for minor isotope fractionation of Ca in Nature [281], causing variability of $A_r(Ca)$ in normal sources that is within the uncertainty of the standard atomic weight. Variations in

$n(^{44}Ca)/n(^{40}Ca)$ can be reported as $\delta^{44}Ca$ values relative to the calcium carbonate reference material NIST-SRM 915a [85]. A recent compilation [85] yielded a range of published $\delta^{44}Ca$ values in natural samples from a low of –2.17 ‰ in a cougar bone [mole fraction of ^{44}Ca = 0.02082; $A_r(Ca)$ = 40.0778] [282] to a high of +2.76 ‰ in egg white [mole fraction of ^{44}Ca = 0.02092; $A_r(Ca)$ = 40.0784] [282]. Elemental Ca with $\delta^{44}Ca$ = –6.0 ‰ [mole fraction of ^{44}Ca = 0.02074; $A_r(Ca)$ = 40.0773] also has been reported [281]. De La Roche and DePaolo [283] have shown that variations in the isotopic composition of marine Ca have occurred over the last 80 Ma. In addition, there are many reports of anomalous isotopic composition of some minor samples of Ca, some of which may have arisen from the decay of ^{40}K to ^{40}Ca. The annotation "g" is therefore maintained for this element. ^{41}Ca is an extinct radioisotope (with a half-life of 0.1 Ma), which can be used to date the early history of the solar system through its decay to ^{41}K.

$_{21}$Sc Scandium A_r(Sc) = 44.955 910(8) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{45}Sc	44.955 9102(12)	1.0000

The name derives from the Latin *scandia* for Scandinavia, where the mineral was found. It was discovered by the Swedish chemist Lars-Fredrik Nilson in 1879 in an ytterbium sample. In the same year, the Swedish chemist Per Theodore Cleve proved that scandium was Mendeleev's hypothetical element "eka-boron".

CAWIA in 1961 [22] recommended the atomic weight $A_r(Sc)$ = 44.956, although the atomic mass of its only stable isotope was known with superior precision. At that time, CAWIA considered the possibility of the discovery of other naturally occurring, long-lived, or stable isotopes or isomers of Sc, and cited an experimental limit of 0.00002 for the mole fraction of ^{46}Sc [127], which could affect the atomic weight by up to 2 in the seventh significant figure. In 1969, CAWIA [4] considered the sixth significant figure to be established and recommended $A_r(Sc)$ = 44.9559(1) because, on the basis of theory and experience, the likelihood of the existence of a significant long-lived undiscovered isotope of Sc was remote.

In the atomic mass table published by Wapstra and Gove in 1971 [48], the mass of ^{45}Sc is given as 44.955 9174(22). This uncertainty was calculated from a least-squares adjustment and is largely a measure of the consistency of mass values for isotopes with similar mass and atomic numbers. For conversion of atomic masses to atomic weights of monoisotopic elements, CAWIA's procedure was to round the values to fewer digits so that the uncertainty in the atomic mass value multiplied by six was equal to or less than one in the last digit of the atomic-weight value. By this rule, no change in the atomic-weight value was needed. When the atomic mass table was revised in 1977 by Wapstra and Bos [49], ^{45}Sc was given a mass of 44.955 9136(15), which by the above rule should yield $A_r(Sc)$ = 44.955 91(1). CAWIA, however, did not act at that time because of its hesitation to recommend rounding-off changes in the atomic weights of the monoisotopic elements, which are tabulated to higher precision than is required for the great majority of applications in chemistry.

In a review of that decision in 1983, it was pointed out that in the case of Sc the additional digit represented reliable accuracy. The mass of ^{45}Sc was closely tied to that of Ti [284], which itself is closely tied to ^{12}C, the isotope that defines the atomic-weight scale. Under these circumstances, CAWIA felt justified in refining the standard atomic weight of Sc to $A_r(Sc)$ = 44.955 91(1) in its 1983 report [11]. The atomic weight and uncertainty of Sc were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{22}$Ti Titanium A_r(Ti) = 47.867(1) [Since 1993]

Isotope	Atomic mass/u	Mole fraction
^{46}Ti	45.952 6295(12)	0.0825(3)
^{47}Ti	46.951 7637(10)	0.0744(2)
^{48}Ti	47.947 9470(10)	0.7372(3)
^{49}Ti	48.947 8707(10)	0.0541(2)
^{50}Ti	49.944 7920(11)	0.0518(2)

The name derives from the Latin *titans*, who were the mythological "first sons of the earth". It was originally discovered by the English clergyman William Gregor in the mineral ilmenite ($FeTiO_3$) in 1791. He called this iron titanite menachanite and the element menachin, for the Menachan parish where it was found. It was rediscovered in 1795 by the German chemist Martin Heinrich Klaproth, who called it titanium because it had no characteristic properties to use as a name. Titanium metal was first isolated by the Swedish chemists Sven Otto Pettersson and Lars Fredrik Nilson.

In its 1961 report [22], CAWIA recalculated the chemical ratios of Baxter and Butler [285,286] upon which A_r(Ti) had been based since 1927. It recommended A_r(Ti) = 47.90 be retained. In 1969, CAWIA [4] gave the same value with an uncertainty of 0.03 based on the chemical work [285,286] coupled with consideration of the isotope-abundance measurements by Nier [279], Hibbs [287], Mattraw and Pachucki [288], Hogg [289], Darwin [290], and Belsheim [291], which yielded values of A_r(Ti) ranging from 47.87 to 47.89. Hogg [289] and Belsheim [291] searched for but discovered no terrestrial variability in A_r(Ti).

Recalculation of the chemical ratios [285,286] based on current values of the other atomic weights involved [51] yields the following results for the listed comparisons:

$TiC1_4$/4Ag = 0.439 680 A_r(Ti) = 47.878 [285,286]
$TiBr_4$/4Ag = 0.851 788 A_r(Ti) = 47.907 [285,286]

In 1979, CAWIA [9] reexamined the chemical and mass-spectrometric determinations and recommended A_r(Ti) = 47.88(3), which includes consideration of all the above values but is weighted toward the calibrated mass-spectrometric measurements of Belsheim [291]. Recalculated with the more recent atomic masses by Wapstra and Bos [49], they yield A_r(Ti) = 47.87(1). Since then, two papers have been published by Heydegger et al. [292] and Niederer et al. [293], reporting isotope-abundance measurements for Ti. Although neither is a calibrated measurement, they are both of high precision. When these are normalized to the $n(^{46}\text{Ti})/n(^{48}\text{Ti})$ ratio of Belsheim [291], the new values confirm the work of Belsheim. However, if Belsheim's ratios are in error, it would be carried as a systematic error to the more recent work. For that reason, CAWIA has retained the high uncertainty of $U[A_r(\text{Ti})] = 0.03$, and continues to be especially concerned in its search for new evidence that might lead to an improvement of A_r(Ti) or $U[A_r(\text{Ti})]$. Titanium is an abundant, widely distributed element, yet it was the element with the most uncertain atomic weight with $U[A_r(\text{Ti})]/A_r(\text{Ti}) = 626 \times 10^{-6}$. This situation changed in 1993 [16] when CAWIA acknowledged the work of Shima and Torigoye [134] by accepting their "calibrated" measurement value of 47.867(1). Titanium has undergone (since 1979), the largest relative change in standard atomic-weight value recommended by CAWIA during the past 25 years.

$_{23}$V Vanadium A_r(V) = 50.9415(1) [Since 1977]

Isotope	Atomic mass/u	Mole fraction
^{50}V	49.947 1627(14)	0.002 50(4)
^{51}V	50.943 9635(14)	0.997 50(4)

The name derives from the Scandinavian goddess of love and beauty, Freyja Vanadis, because of its many beautiful multicolored compounds. It was discovered by the Swedish physician and chemist Nils-

Gabriel Sefström in 1830. It had originally been discovered by the Spanish mineralogist Andres Manuel del Rio y Fernandez in 1801, who named it erythronium, after the plant of that name whose flowers have many beautiful colors. Del Rio later decided that it was really chromium in his lead sample. Vanadium metal was first isolated by the English chemist Henry Enfield Roscoe in 1869.

In its 1961 report [22], CAWIA accepted $A_r(V) = 50.942$ based on mass-spectrometric data by Hess and Inghram [294], Leland [295], and White et al. [127]. CAWIA recommended a more precise $A_r(V) = 50.9414(3)$ in 1969 because it is an element with a predominant isotope [4]. A number of determinations of the isotopic composition of V, for instance [296] and [297], have since been considered. As a result, CAWIA in the 1977 report [8], refined $A_r(V)$ to 50.9415(1). Balsiger et al. [296] have also shown that the isotopic composition of five chondritic meteorites were identical within experimental error to the terrestrial diabase W-1 and a laboratory standard.

Two stable isobars, ^{50}Ti and ^{50}Cr, are the immediate neighbors in the chart of nuclides, to ^{50}V, whose β^+ and β^- decay modes are, therefore, predictable. The nuclear angular momentum of ^{50}V, however, is high but consistent with long half-lives, evidently too long to be readily observed. The isobars render the mass-spectrometric determination of the abundance of the isotope ^{50}V subject to careful chemical determination of the trace presence of Ti and Cr.

$_{24}$Cr Chromium A_r(Cr) = 51.9961(6) [Since 1983]

Isotope	Atomic mass/u	Mole fraction
^{50}Cr	49.946 0495(14)	0.043 45(13)
^{52}Cr	51.940 5115(15)	0.837 89(18)
^{53}Cr	52.940 6534(15)	0.095 01(17)
^{54}Cr	53.938 8846(15)	0.023 65(7)

The name derives from the Greek *chroma* for "color", from the many colored compounds of chromium. It was discovered in 1797 by the French chemist and pharmacist Nicolas-Louis Vauquelin, who also isolated chromium in 1798.

In its 1961 report [22], CAWIA recommended $A_r(Cr) = 51.996(1)$ calculated from the isotopic composition reported by Flesch et al. [298] with atomic masses from Everling et al. [23]. The mass-spectrometric measurements were corrected for mass bias by calibration with known mixtures of separated N isotopes. In 1966, Shields et al. [136] redetermined the isotopic composition of Cr calibrating the mass spectrometers with carefully prepared gravimetric standards mixed from separated isotopes of Cr, of very high chemical and isotopic purity. The atomic weight calculated from this work using atomic masses from Mattauch et al. [264] was $A_r(Cr) = 51.9961(3)$. In its 1967 report [3], CAWIA recommended "retaining the atomic weight of 51.996 but stating it without limit of error". However, in 1969, CAWIA [4] added uncertainties to all atomic weights and recommended a value of 51.996(1) for Cr. With its liberalized policy on single-digit uncertainties, CAWIA recommended the standard atomic weight to four decimal places in 1983, $A_r(Cr) = 51.9961(6)$ [11]. Measurements of $n(^{53}Cr)/n(^{52}Cr)$ can be expressed as δ^{53}Cr values with respect to NIST SRM 979 [85,136]. Ellis et al. [299] report isotope fractionation of Cr during chromate reduction, resulting in δ^{53}Cr values in groundwater samples as high as +5.8 ‰ [mole fraction of ^{53}Cr = 0.09553; $A_r(Cr) = 51.9982$], which is outside the current range of uncertainty of the standard atomic weight.

$_{25}$Mn Manganese A_r(Mn) = 54.938 049(9) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{55}Mn	54.938 0493(15)	1.0000

The name derives from the Latin *magnes* for "magnet" since pyrolusite (MnO_2) has magnetic properties. It was discovered by the Swedish pharmacist and chemist Carl-Wilhelm Scheele in 1774. In 1774, the Swedish chemist Johan Gottlieb Gahn first isolated the metal.

The 1961 CAWIA report [22] proposed the atomic weight of Mn to be A_r(Mn) = 54.9380 based on atomic mass data by Everling et al. [23]. Leipziger [119] has confirmed experimentally that at the upper limits for the hypothetical presence of stable or quasi-stable Mn isotopes, the atomic weight of Mn would be affected at most by one unit in the seventh significant figure. The atomic weight and uncertainty of Mn were changed to their current values in the 1995 report of CAWIA [17] based on the atomic mass data of Audi and Wapstra [51].

^{53}Mn is radioactive with a half-life of $3.7(2) \times 10^6$ a, too short for survival of a detectable amount of primordial isotope. However, ^{53}Mn has been identified on earth as a cosmic-ray product and as a constituent of cosmic dust by Imamura et al. [300], who measured about one disintegration per min. per gram of Mn in sediment cores corresponding to a concentration of 3×10^{-13}, much too small to affect the standard atomic weight.

$_{26}$Fe Iron (Ferrum) A_r(Fe) = 55.845(2) [Since 1993]

Isotope	Atomic mass/u	Mole fraction
^{54}Fe	53.939 6147(14)	0.058 45(35)
^{56}Fe	55.934 9418(15)	0.917 54(36)
^{57}Fe	56.935 3983(15)	0.021 19(10)
^{58}Fe	57.933 2801(15)	0.002 82(4)

The name derives from the Anglo-Saxon *iron* of unknown origin. The element has been known from prehistoric times. The chemical symbol Fe is derived from the Latin *ferrum* for "firmness." It is of interest to note that ^{56}Fe has a larger mass defect than any other nuclide. It is, therefore, the ultimate end-product of stellar nuclear fusion.

In its 1961 report [22], CAWIA recommended A_r(Fe) = 55.847(3) based on the average value of two reported mass-spectrometric determinations by Valley and Anderson [301,302], and White and Cameron [128], and on atomic masses by Everling et al. [23]. In 1993, CAWIA [16] changed the recommended value for the standard atomic weight to A_r(Fe) = 55.845(2) based on calibrated measurements carried out on a metallic Fe sample of high purity by Taylor et al. [137,303]. Several recent studies have indicated natural isotope fractionation in Fe-containing materials [304–306]. The magnitude of the uncertainty assigned to the atomic-weight value [16] was based mainly on the variations of Fe isotopic composition reported by Dixon et al. [304]; however, subsequent studies have indicated somewhat different ranges. According to the compilation of Coplen et al. [85], reported δ^{56}Fe values range from –2.9 ‰ [mole fraction of ^{56}Fe = 0.91742; A_r(Fe) = 55.8448] in human blood [307] to +1.36 ‰ [mole fraction of ^{56}Fe = 0.91760; A_r(Fe) = 55.8453] in part of a banded iron formation [308]; where δ^{56}Fe refers to $n(^{56}\text{Fe})/n(^{54}\text{Fe})$ relative to the reference material IRMM-014 [85,137].

$_{27}$Co Cobalt A_r(Co) = 58.933 200(9) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{59}Co	58.933 1999(15)	1.0000

The name derives from the German *Kobold* for "evil spirits or goblins", who were superstitiously thought to cause trouble for miners because the mineral contained arsenic that injured their health and the metallic ores did not yield metals when treated with the normal methods. It was discovered in 1735 by the Swedish chemist Georg Brandt.

The 1961 CAWIA report [22] proposed the atomic weight of Co to be A_r(Co) = 58.9332, based on the atomic mass data by Everling et al. [23]. The atomic weight and uncertainty of Co were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51]. ^{59}Co is readily transformed to ^{60}Co, which decays to ^{60}Ni with a half-life of 5.272 a. ^{60}Co therefore serves as an extremely reproducible standard for radiation exposure.

$_{28}$Ni Nickel $A_{r(}$Ni) = 58.6934(2) [Since 1989]

Isotope	Atomic mass/u	Mole fraction
^{58}Ni	57.935 3477(16)	0.680 769(89)
^{60}Ni	59.930 7903(15)	0.262 231(77)
^{61}Ni	60.931 0601(15)	0.011 399(6)
^{62}Ni	61.928 3484(15)	0.036 345(17)
^{64}Ni	63.927 9692(16)	0.009 256(9)

The name derives from the German *nickel* for "deceptive little spirit" because miners called mineral niccolite (NiAs) by the name *kupfernickel* (false copper) because it resembled copper ores in appearance, but no copper was found in the ore. It was discovered by the Swedish metallurgist Axel-Frederik Cronstedt in 1751.

The 1961 CAWIA report [22] recommended A_r(Ni) = 58.71. That value was based on the isotope-abundance measurements of White and Cameron [128] and the atomic masses determined by Collins et al. [309]. CAWIA noted in this report that all chemical determinations that had been reported and believed to be significant gave a mean value for the atomic weight of 58.69. In 1969, CAWIA [4] assessed the uncertainties of the above measurements and recommended a value of $U[A_r(\text{Ni})] = 0.03$, but CAWIA retained A_r(Ni) = 58.71. In 1973, CAWIA [6] reexamined both the chemical and mass-spectrometric measurements and recommended a lower value of A_r(Ni) = 58.70(1). At the same time, CAWIA lowered the uncertainty because A. E. Cameron believed he could explain the higher value given in ref. [128] through having overestimated ^{64}Ni by failing to recognize ^{64}Zn or ^{48}Ti ^{16}O traces.

The best chemical determinations appeared in a series of papers by Baxter and associates [310–312]. Recalculation of these determinations based on the current atomic weights of the other elements involved [11] yields the following results from the listed comparisons:

Ni/0 (reduction NiO) = 0.366 87	A_r(Ni) = 58.700	[310]
$NiC1_2$/2Ag = 0.600 729	A_r(Ni) = 58.693	[311]
$NiC1_2$/2AgCl = 0.452 133	A_r(Ni) = 58.694	[311]
$NiBr_2$/2Ag = 1.012 120	A_r(Ni) = 58.694	[312]
$NiBr_2$/2AgBr = 0.581 818	A_r(Ni) = 58.690	[312]

In 1973, CAWIA [6] included in their assessment two other mass-spectrometric determinations by Inghram and Hess [313] and Mattraw and Pachucki [138], which may have been overlooked in the earlier review. Both these determinations, when recalculated with current atomic masses [51], yield A_r(Ni) = 58.700. Thus, all the chemical and mass-spectrometric measurements agreed to establish a

value of A_r(Ni) = 58.70(1) based on what appeared as overwhelming evidence. Nevertheless, that value is a little higher than the average (58.694) of Baxter's excellent determinations, whose credibility is increased by the proof of accuracy of the parallel work on the atomic weight of Co.

Barnes et al. [314] completed a superior, but not "absolute" mass-spectrometric measurement, which gave A_r(Ni) = 58.688, in good agreement with the chemical determinations. Following the 1977 CAWIA meeting, another reexamination was begun, and in 1979 [9] CAWIA recommended the standard atomic-weight value of A_r(Ni) = 58.69(1), weighted toward the chemical determinations of Baxter and associates. At its 1989 meeting [14], CAWIA changed its recommended value for the atomic weight of Ni to A_r(Ni) = 58.6934(2) based on the calibrated mass-spectrometric determination by Gramlich et al. [315]. The excellent agreement between the average of the chemical values and this new determination illustrates the remarkable accuracy of the determinations of Baxter and associates. Gramlich et al. [316], in a second paper, have compared the isotopic composition of Ni in 29 minerals, salts, and metals and found no statistically significant variations. Therefore, no additional allowance to the overall uncertainty was necessary because the isotopic composition of terrestrial Ni is apparently invariant within the measurement uncertainty.

It should be noted that with this change the atomic weight of Ni is now one of the most accurately known for a polyisotopic element, with an uncertainty of $U[A_r(\mathrm{Ni})] = 3 \times 10^{-6}$, whereas the 1979 value had a relative uncertainty of 0.02 %. This represents an improvement in accuracy of almost two orders of magnitude.

$_{29}$Cu Copper (Cuprum) A_r(Cu) = 63.546(3) r [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{63}Cu	62.929 6007(15)	0.6915(15)
^{65}Cu	64.927 7938(19)	0.3085(15)

The name derives from the Latin *Cuprum* for Cyprus, the island where the Romans first obtained copper. The chemical symbol, Cu, also comes from the Latin *cuprum*. The element has been known since prehistoric times.

In its 1961 report [22], CAWIA recommended A_r(Cu) = 63.54 based on the chemical determinations of Hönigschmid and Johannsen [317] and Reur and Bode [318]. In its 1967 report [3], CAWIA recommended a value of 63.546(1) based on the "absolute" abundance ratio measurement by Shields et al. [319], who obtained A_r(Cu) = 63.5455(4). The recommended uncertainty was increased to $U[A_r(\mathrm{Cu})] = 0.003$ in 1969 [4] to include natural variations of up to about 0.15 % in the isotope abundances of Cu reported by Shields et al. [139], and given the annotation "r" to indicate that the precision was limited by natural variability. This variability in Nature is supported by recent work by Gale et al. [320] and Maréchal et al. [321]. CAWIA's recommended range is significantly larger than the ±0.001 suggested by Shields et al. [139], who claimed even this was a liberal range of variation for bulk or processed Cu. Variations in $n(^{65}\mathrm{Cu})/n(^{63}\mathrm{Cu})$ can be expressed as δ^{65}Cu values relative to the reference material NIST SRM 976 [85,319]. In the compilation of Coplen et al. [85], the lowest reported δ^{65}Cu value in a naturally occurring sample is –7.65 ‰ [mole fraction of ^{65}Cu = 0.3066; A_r(Cu) = 63.542] for a specimen of a Cu-chloride mineral (atacamite) from Chile [320]. The highest reported δ^{65}Cu value is +9 ‰ [mole fraction of ^{65}Cu = 0.3102; A_r(Cu) = 63.549] for a Cu-carbonate mineral (aurichalcite) from Globe, Arizona [139]. Some of these values are outside the range of the stated atomic-weight uncertainty and may justify a reevaluation by CAWIA of the atomic-weight uncertainty or annotations [85].

$_{30}$Zn Zinc **A_r(Zn) = 65.409(4)** **[Since 2001]**

Isotope	Atomic mass/u	Mole fraction
^{64}Zn	63.929 1461(18)	0.482 68(321)
^{66}Zn	65.926 0364(17)	0.279 75(77)
^{67}Zn	66.927 1305(17)	0.041 02(21)
^{68}Zn	67.924 8473(17)	0.190 24(123)
^{70}Zn	69.925 325(4)	0.006 31(9)

The name derives from the German *zink* of unknown origin. It was first used in prehistoric times, where its compounds were used for healing wounds and sore eyes and for making brass. It was recognized as a metal as early as 1374.

In its 1961 report [22], CAWIA recommended A_r(Zn) = 65.37, based on the earlier chemical data (recalculated on the ^{12}C scale) by Hönigschmid and von Mack [322], Baxter and Grose [323], and Baxter and Hodges [324]. CAWIA was aware of isotopic composition data by Hess et al. [325] and Leland and Nier [326], both of which, with atomic masses by Everling et al. [23], yielded the higher value of A_r(Zn) = 65.387. Recognizing this unresolved discrepancy, CAWIA in 1969 [4] assessed $U[A_r(Zn)] = 0.3$.

Marinenko and Foley in 1971 [327] published a coulometric determination, which also yielded a higher value A_r(Zn) = 65.377(3), whereupon CAWIA in its 1971 report [5] changed the recommended value to A_r(Zn) = 65.38(1). Another mass-spectrometric value was published in 1972 when Rosman [328] used a gravimetrically prepared mixture of enriched Zn isotopes to give an "absolute" isotopic composition, which yielded A_r(Zn) = 65.396(5). Faced with this ongoing discrepancy between chemical and physical values, CAWIA in 1983 [11] recommended that A_r(Zn) = 65.39 and increased $U[A_r(Zn)]$ to 0.02, explaining that the value was now weighted toward the mass-spectrometric measurement of Rosman [328], but the uncertainty included the coulometric measurement of Marinenko and Foley [327]. The atomic weight and uncertainty of Zn were changed to their current values in 2001 as a result of the calibrated measurement of Chang et al. [140]. Maréchal et al. [321] report variations in the isotopic composition of Zn in natural samples that are within the uncertainty of the standard atomic weight.

$_{31}$Ga Gallium **A_r(Ga) = 69.723(1)** **[Since 1987]**

Isotope	Atomic mass/u	Mole fraction
^{69}Ga	68.925 581(3)	0.601 08(9)
^{71}Ga	70.924 7073(20)	0.398 92(9)

The name derives from the Latin *gallia* for France or perhaps from the Latin *gallus* for "le coq or cock" because it was discovered in zinc blende by the French chemist Paul-Emile Lecoq de Boisbaudan in 1875. It was first isolated in 1878 by Le coq de Boisbaudan and the French chemist Émile-Clément Jungflesch.

In its 1961 report, CAWIA [22] recommended A_r(Ga) = 69.72, based on the chemical ratio determinations by Richards and Craig [329] and Lundell and Hoffman [330] as well as the isotope-abundance determinations by Inghram et al. [331,332]. In 1969, CAWIA assigned the uncertainty $U[A_r(Ga)] = 0.01$ [4]. Recalculating the chemical ratios based on current values of the other atomic weights involved [11] yields A_r(Ga) = 69.735, while the mass-spectrometric value [332] with current atomic masses gives A_r(Ga) = 69.72. CAWIA discounted Marinenko's [333] highly precise coulometric assay of Ga and As. Based on plausible confidence in the stoichiometry of a GaAs sample, he calculated A_r(Ga) = 69.737 [333]. In the meantime, de Laeter and Rosman [334] published a mass-spectrometric

measurement that confirmed the earlier mass-spectrometric measurements, yielding A_r(Ga) = 69.724(2). CAWIA therefore recommended an atomic weight of A_r(Ga) = 69.723(4) in 1983 [11].

In 1987, CAWIA [13] reviewed the calibrated mass-spectrometric data of Machlan et al. [141], who reported A_r(Ga) = 69.723 07(13). This value is in excellent agreement with the previous mass-spectrometric measurement of de Laeter and Rosman [334], allowing the previous uncertainty to be decreased to $U[A_r(Ga)] = 0.001$. Although no isotopic variations from six meteorites has been observed by de Laeter [335], Nief and Roth [336] found that the ^{69}Ga isotope was progressively enriched toward the anode and ^{71}Ga enriched toward the cathode when an electric current passes through a liquid Ga column just above its melting point. Furthermore, Gramlich and Machlan [316] showed that significant variations occurred in the $n(^{69}Ga)/n(^{71}Ga)$ ratio of commercially high-purity Ga from different lots of material and different manufacturers, some exhibiting ratios 0.19 % higher and 0.12 % lower than the laboratory reference material. The higher ratio represents a shift of 0.0009 in the atomic weight, which does not exceed $U[A_r(Ga)] = 0.001$. Purification of Ga by successive recrystallizations is accompanied by small variations in isotopic composition, which measurably affect the triple-point temperature [337]. Based on this information, CAWIA in 1987 [13] recommended A_r(Ga) = 69.723(1), which has remained unchanged since that time.

$_{32}$Ge Germanium A_r(Ge) = 72.64(1) [Since 1999]

Isotope	Atomic mass/u	Mole fraction
^{70}Ge	69.924 2500(19)	0.2038(18)
^{72}Ge	71.922 0763(16)	0.2731(26)
^{73}Ge	72.923 4595(16)	0.0776(8)
^{74}Ge	73.921 1784(16)	0.3672(15)
^{76}Ge	75.921 4029(16)	0.0783(7)

The name derives from the Latin *germania* for Germany. It was discovered and isolated by the German chemist, Clemens-Alexander Winkler in 1886 in the mineral argyrodite ($GeS_2 \cdot 4Ag_2S$).

In its 1961 report [22], CAWIA recommended A_r(Ge) = 72.59, based on chemical ratio determinations by Baxter and Cooper [338,339] and Hönigschmid et al. [340]. CAWIA noted that five mass-spectrometric measurements averaged to A_r(Ge) = 72.628, which conflicted with the accepted chemical values. In 1969, CAWIA assigned $U[A_r(Ge)] = 0.03$ [4].

Recalculation of the chemical determinations based on values of the atomic weights in 1983 [11] yielded the following results from the listed comparisons:

$GeCl_4/4Ag = 0.496\,928$	A_r(Ge) = 72.589	[338]
$GeCl_4/4AgCl = 0.374\,010$	A_r(Ge) = 72.602	[338]
$GeBr_4/4Ag = 0.909\,016$	A_r(Ge) = 72.600	[339]
$GeBr_4/4AgBr = 0.522\,195$	A_r(Ge) = 72.599	[339]
$GeBr_4/4Ag = 0.909\,000$	A_r(Ge) = 72.593	[340]
$GeBr_4/4AgBr = 0.522\,175$	A_r(Ge) = 72.584	[340]
$GeCl_4/4Ag = 0.496\,893$	A_r(Ge) = 72.584	[341]
$GeCl_4/4AgCl = 0.373\,977$	A_r(Ge) = 72.583	[341]

Assigning equal weight to these determinations yielded an A_r(Ge) of 72.592.

Early mass-spectrometric determinations [342–346] with atomic mass data [49] gave A_r(Ge) values ranging from 72.602 to 72.638. Ge is a difficult element to analyze by solid-source mass spectrometry. Reynolds [345] and Artakuni et al. [347] avoided the problem by the introduction of volatile GeF_4, from $BaGeF_6$, into the spectrometer, but their measurements experienced other difficulties.

Equating the density of the structural crystal cell of elemental Ge with the macroscopic density gives A_r(Ge) = 72.63 [348], in accord with the mass-spectrometric value. Graham et al. [344] compared

six different terrestrial sources of Ge. They found only slight variations in atomic weight of one of these and showed that normal preparative procedures caused no isotope fractionation. Shima [346] also showed that eight meteoritic samples had an indistinguishable isotopic composition from that of a laboratory reference standard. Because there was a large range in the measured isotope abundances and there were no calibrated measurements available, CAWIA had no cogent reason for increasing the standard atomic-weight value of Ge.

In 1985, following a new measurement of the isotopic composition by Green et al. [349], CAWIA reexamined the value for the atomic weight [12]. Although this was not a calibrated measurement, the instrument used was checked for linearity using U isotopic reference materials. The new value confirmed earlier mass-spectrometric work after allowance for known sources of isotopic discrimination. CAWIA then decided that a higher value of A_r(Ge) = 72.61(2) contained the most probable value and recommended this value. It noted that there was still concern over the discrepancy between the chemical value and that determined by mass spectrometry, but while not wishing to discard the chemical work favored the mass-spectrometric value. Green et al. [349], using a double spike, also compared the isotope abundances of Ge in 12 materials including Ge minerals, various reagents and transistor Ge, but found no variations outside of the experimental errors of about 1 ‰ per mass unit corresponding to a change of 0.003 in the atomic weight.

In 1999, two new measurements of the isotopic composition of Ge by Kipphardt et al. [350] and Chang et al. [351] yielded values of 72.6276(32) and 72.639(7), respectively, for the atomic weight. Both measurements were calibrated, but did not agree within their uncertainties. However, at its meeting in 1999, CAWIA chose the higher value of A_r(Ge) = 72.64 and reduced the uncertainty to $U[A_r(\mathrm{Ge})] = 0.01$ [19]. The work of Chang et al. [351] included measurements on five natural terrestrial samples, which showed no evidence of isotope fractionation. However, measurements of Ge in iron meteorites by multicollector inductively coupled plasma mass spectrometry indicate that isotope fractionation of this magnitude may occur in some meteorites [352].

$_{33}$As Arsenic A_r(As) = 74.921 60(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{75}As	74.921 5966(18)	1.0000

The name derives from the Latin *arsenicium* and the Greek *arsenikos* for "masculine or male" because the ancients thought that metals were different sexes. It was known in prehistoric times for its poisonous sulfides. The German scientist and philosopher, Albert von Bollstadt (Albert the Great/Albertus Magnus) is thought to have obtained the metal around 1250.

The 1961 CAWIA report [22] proposed the atomic weight to be A_r(As) = 74.9216 based on atomic mass data by Everling et al. [23]. The atomic weight and uncertainty of As were changed to their current values in the 1995 report of CAWIA [17] based on the atomic mass data of Audi and Wapstra [51].

$_{34}$Se Selenium A_r(Se) = 78.96(3) r [Since 1999]

Isotope	Atomic mass/u	Mole fraction
^{74}Se	73.922 4767(16)	0.0089(4)
^{76}Se	75.919 2143(16)	0.0937(29)
^{77}Se	76.919 9148(16)	0.0763(16)
^{78}Se	77.917 3097(16)	0.2377(28)
^{80}Se	79.916 5221(20)	0.4961(41)
^{82}Se	81.916 7003(22)	0.0873(22)

The name derives from the Greek *Selene*, who was the Greek goddess of the Moon because the element is chemically found with tellurium (*Tellus*—the Roman goddess of the earth). It was discovered by the Swedish chemist Jöns Jacob Berzelius in 1817, while trying to isolate tellurium in an impure sample.

In its 1961 report, CAWIA [22] recommended A_r(Se) = 78.96 based on the chemical determinations by Hönigschmid and collaborators [142,353]. Two measurements of the isotopic composition of Se were reported by White and Cameron [128] and Hibbs [354], giving A_r(Se) equal to 78.99 and 78.97, respectively. In 1969, CAWIA recommended $U[A_r(\mathrm{Se})] = 0.03$ [4]. Both the atomic weight and the uncertainty values have since remained unchanged, but the underlying considerations deserve to be described here.

Hönigschmid and Kapfenberger [353] criticized all previous atomic-weight determinations because the methods used involved the preparation of elemental Se and the weighing of SeO_2, which operations were subject to unresolved difficulties. In CAWIA's view, the Hönigschmid method was indeed superior. Recalculations of his chemical determinations using current values of the other atomic weights involved [11] yields the following results from the listed comparisons:

2Ag/Ag2Se = 0.732 081	A_r(Se) = 78.953	[353]
$SeOCI_2$/2Ag = 0.768 794	A_r(Se) = 78.951	[142]
$SeOC1_2$/2AgCI = 0.578 624	A_r(Se) = 78.953	[142]

This excellent consistency of the results from three different chemical methods, coupled with the established reliability of Hönigschmid's measurements, must be balanced against adverse factors. Inherent limitations apply to classical chemical methods such that they are uncertain by about 1×10^{-5}. Selenium chemistry also is subject to particular difficulties. Thirdly, the results all come from only one laboratory, which is undesirable. CAWIA had these considerations in mind when it conceded that the above agreement could be fortuitous and chose a standard value displaced a little toward the mass-spectrometric values. A new ionization method for Se was published by Wachsmann and Heumann [355]. The calculated atomic weight from their noncorrected data yields 78.9594(8), which is in good agreement with the existing value. Variations in the isotope abundances of Se in terrestrial samples have been established by Krouse and Thode [356] using high-precision differential methods of measurements. The annotation "r" was added by CAWIA in 1999 [19], based on a reevaluation of the data of Krouse and Thode [356].

^{82}Se is radioactive with the enormously long half-life of about 10^{20} a. For the purposes of this review, therefore, it is considered to be a stable isotope.

$_{35}$Br Bromine A_r(Br) = 79.904(1) [Since 1965]

Isotope	Atomic mass/u	Mole fraction
^{79}Br	78.918 3379(20)	0.5069(7)
^{81}Br	80.916 291(3)	0.4931(7)

The name derives from the Greek *bromos* for "bad stench or bad odor". It was first prepared by the German chemist Carl Löwig in 1825, but it was first publicly announced in 1826 by the French chemist and pharmacist Antoine-Jérôme Balard, and so the discovery is, therefore, credited to him.

In its 1961 report [22], CAWIA recommended A_r(Br) = 79.909(2) based on a chemical determination of the mass ratio AgBr/Ag = 1.740 785(6) [357] and an updated evaluation of the atomic weight of Ag, which was then the major source of the uncertainty in A_r(Br). The values of A_r(Br) and A_r(Ag) were especially important at that time because the atomic weights of many other elements were determined by the mass ratios of their bromides to Ag or AgBr. In its 1965 reevaluation, summarized in the 1967 report [3], CAWIA adopted the calibrated mass-spectrometric measurements of Catanzaro et al. [143], which yielded A_r(Br) = 79.904(1) and essentially ended the era of chemical determinations of atomic weights for this element. Catanzaro et al. [143], as Cameron and Lippert [358] had done earlier, reported finding no significant variations in the atomic weight of Br from many different sources.

$_{36}$Kr Krypton A_r(Kr) = 83.798(2) g, m [Since 2001]

Isotope	Atomic mass/u	Mole fraction
^{78}Kr	77.920 388(7)	0.003 55(3)
^{80}Kr	79.916 379(4)	0.022 86(10)
^{82}Kr	81.913 4850(28)	0.115 93(31)
^{83}Kr	82.914 137(4)	0.115 00(19)
^{84}Kr	83.911 508(3)	0.569 87(15)
^{86}Kr	85.910 615(5)	0.172 79(41)

The name derives from the Greek *kryptos* for "concealed" or "hidden". It was discovered in liquefied atmospheric air by the Scottish chemist William Ramsay and the English chemist Morris William Travers in 1898. A wavelength in the atomic spectrum of ^{86}Kr is the fundamental standard of length.

The atomic weight of Kr is based on analyses of Kr separated from air. In its 1961 report [22], CAWIA recommended A_r(Kr) = 83.80 based on the isotope-abundance measurements by Nier [66] and the atomic masses given by Everling et al. [23]. In 1969, CAWIA [4] recommended $U[A_r(\mathrm{Kr})] = 0.01$. Walton et al. [359] reported measurements of the isotopic composition of a sample of Kr over a period of four years using two different mass spectrometers with results essentially identical to those of Nier [66]. No evidence was reported in those studies for variations in the isotopic composition of natural Kr. The atomic weight and uncertainty of Kr were changed to their current values in 2001 as a result of the calibrated measurement by Aregbe et al. [144].

Recent reviews have concluded that the vast majority of Kr in and on the earth is indistinguishable isotopically from atmospheric Kr [237,360]. However, minor localized occurrences may be found that have been fractionated isotopically by processes such as diffusion or crystal–liquid partitioning. Also, the isotope abundances of Kr may be altered locally by spontaneous or neutron-induced fission of U, or by neutron capture by Br. The annotation "g" refers mainly to fission product Kr such as is found at the Oklo natural nuclear reactor. The annotation "m" refers to the availability of commercial Kr from which specific isotopes may have been separated.

The radioactive isotopes ^{81}Kr (cosmogenic) and ^{85}Kr (released from nuclear industry) are present in the atmosphere and hydrosphere and are used as environmental tracers in hydrology and oceanog-

raphy, but their abundances are several orders of magnitude too small to have a measurable effect on the atomic weight of Kr.

$_{37}$Rb Rubidium A_r(Rb) = 85.4678(3) g [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{85}Rb	84.911 7924(27)	0.7217(2)
^{87}Rb	86.909 1858(28)	0.2783(2)

The name derives from the Latin *rubidus* for deepest red because of the two "deep red lines" in its spectra. It was discovered in the mineral lepidolite by the German chemist Robert Wilhelm Bunsen and the German physicist Gustav-Robert Kirchoff in 1861. Bunsen isolated rubidium in 1863.

In its 1961 report [22], CAWIA recommended A_r(Rb) = 85.47 based on the average of A_r(Rb) = 85.473 for the chemical determinations by Archibald et al. [361] and Archibald and Hooley [362] and the mass-spectrometric determination of Nier [66], who reported a mole fraction of ^{85}Rb = 0.7215, corresponding to A_r(Rb) = 85.4678(2). In 1969, CAWIA [4] recommended the current value of A_r(Rb) = 85.4678(3) based on the "absolute" isotope-abundance measurement by Catanzaro et al. [145], who reported a mole fraction of ^{85}Rb = 0.72165(13), plus the work of Shields et al. [363], who found no isotopic variations in terrestrial samples, and the atomic masses of Wapstra and Gove [48].

^{87}Rb is β^- active with a half-life of $4.88(5) \times 10^{10}$ a, which leaves A_r(Rb) unaffected at the currently given precision of about 3×10^{-6} in up to 10^6 a. In contrast, accumulation of the ^{87}Sr product of ^{87}Rb decay causes anomalous atomic-weight values of Sr in many Rb-bearing materials, as noted in the section on Sr.

$_{38}$Sr Strontium A_r(Sr) = 87.62(1) g, r [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{84}Sr	83.913 426(4)	0.0056(1)
^{86}Sr	85.909 2647(25)	0.0986(1)
^{87}Sr	86.908 8816(25)	0.0700(1)
^{88}Sr	87.905 6167(25)	0.8258(1)

The name derives from Strontian, a town in Scotland. The mineral strontianite is found in mines in Strontian. The element was discovered in 1792 by the Scottish chemist and physician Thomas Charles Hope, who observed the brilliant red flame color of strontium. It was first isolated by the English chemist Humphry Davy in 1808.

In its 1961 report [22], CAWIA recommended A_r(Sr) = 87.62 based on the mass-spectrometric determination of Nier [279] and on the atomic masses of Everling et al. [23]. In its 1969 report [4], CAWIA assessed $U[A_r(Sr)] = 0.01$. An "absolute" isotope-abundance determination was published by Moore et al. [146], giving a calculated A_r(Sr) = 87.616 81(12) for a specific sample. Known natural variations in the abundance of ^{87}Sr, the product isotope of radioactive ^{87}Rb decay, prevent the recommendation of a more precise standard atomic-weight value. The $n(^{87}Sr)/n(^{86}Sr)$ ratio is a convenient measure of that variability. In the above sample, it was 0.7103. A value for that ratio as high as 1.200 has been reported by Compston et al. [364]. The annotation "r" indicates that the value of $U[A_r(Sr)] = 0.01$ represents isotopic composition variability more than experimental uncertainty. Anomalous traces of almost pure ^{87}Sr have been reported from Rb ores by Mattauch [365], for which the atomic weight will not be in the tabulated standard atomic weight range. In 1969, CAWIA [4] therefore added the appropriate annotation "g."

The appreciable variability in $n(^{87}Sr)/n(^{86}Sr)$ is the basis for Rb-Sr geochronology, and for analysis of source components in mixtures of water and geologic materials. The variability of the isotopic composition of Sr in nature is discussed by Faure [77].

$_{39}$Y Yttrium A_r(Y) = 88.905 85(2) [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{89}Y	88.905 8485(26)	1.0000

The name derives from the Swedish village of Ytterby where the mineral gadolinite was found. In 1794, the Finnish chemist Johan Gadolin discovered yttrium in the mineral ytterbite, which was later renamed gadolinite for Gadolin. Gadolin originally called the element ytterbium after ytterbite. The name was subsequently shortened to yttrium, and later another element was given the name ytterbium. The Swedish surgeon and chemist Carl-Gustav Mosander separated the element in 1843.

The CAWIA report in 1961 [22] proposed the atomic weight of Y to be A_r(Y) = 88.905 based on atomic mass data by Everling et al. [23]. CAWIA also quoted comprehensive experimental data setting the upper limits for other hypothetical stable isotopes of Y with mass numbers 85 to 95 at 5×10^{-6}, corresponding to a possible effect on A_r(Y) in the seventh significant figure [147]. In 1969, CAWIA [4] found the data quoted reliable enough to add an extra decimal in A_r(Y), which thus became equal to 88.9059(1). The atomic weight and uncertainty of Y were changed to their current values in the 1995 report of CAWIA [17] based on the atomic mass data of Wapstra and Audi [50].

$_{40}$Zr Zirconium A_r(Zr) = 91.224(2) g [Since 1983]

Isotope	Atomic mass/u	Mole fraction
^{90}Zr	89.904 7022(24)	0.5145(40)
^{91}Zr	90.905 6434(23)	0.1122(5)
^{92}Zr	91.905 0386(23)	0.1715(8)
^{94}Zr	93.906 3144(26)	0.1738(28)
^{96}Zr	95.908 275(3)	0.0280(9)

The name derives from the Arabic *zargun* for "gold-like". It was discovered in zirconia by the German chemist Martin-Heinrich Klaproth in 1789. Zirconium was first isolated by Swedish chemist Jöns Jacob Berzelius in 1824 in an impure state, and finally by the chemists D. Lely, Jr. and L. Hamburger in a pure state in 1914.

The atomic weight of Zr has been taken to be A_r(Zr) = 91.22 since 1927, and this value was reconfirmed by the 1961 CAWIA report [22], taking into consideration existing isotope abundances by White and Cameron [128] and using atomic mass data from Everling et al. [23]. The uncertainty in 1969 [4] was assessed as $U[A_r(Zr)] = 0.01$. Since then, two isotopic composition measurements have been carried out by Minster and Ricard [366] yielding A_r(Zr) = 91.224 with an estimated uncertainty of +0.002 and –0.005, and by Nomura et al. [148] yielding A_r(Zr) = 91.2235(5).

Shima [151] showed that the isotopic composition of nine meteoritic samples and two terrestrial standards were identical, within experimental error, to a laboratory standard. In a similar manner, Minster and Ricard [366] have shown that the isotopic composition in two meteoritic samples, one lunar sample and a terrestrial zircon are identical to a laboratory standard. In 1983, CAWIA [11], on the basis of the excellent agreement between the above mass-spectrometric measurements, refined the standard atomic weight to A_r(Zr) = 91.224(2). The annotation "g" refers to anomalous occurrences such as at the Oklo natural nuclear reactor.

$_{41}$Nb Niobium A_r(Nb) = 92.906 38(2) [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{93}Nb	92.906 3762(24)	1.0000

The name derives from the Greek mythological character Niobe, who was the daughter of Tantalus (see the element tantalum), because the elements niobium and tantalum were originally thought to be identical elements. Niobium was discovered in a black mineral from America called columbite by the British chemist and manufacturer Charles Hatchett in 1801 and he called the element columbium. In 1809, the English chemist William Hyde Wollaston claimed that columbium and tantalum were identical. Forty years later, the German chemist and pharmacist, Heinrich Rose, determined that they were two different elements in 1846 and gave the name niobium because it was so difficult to distinguish it from tantalum. Finally, in 1866, the Swiss chemist Jean-Charles Galissard de Marignac separated these elements. The name columbium continued to be used in America and niobium in Europe until IUPAC adopted the name niobium in 1949. Niobium was first isolated by the chemist C. W. Blomstrand in 1846.

The 1961 CAWIA report [22] proposed A_r(Nb) = 92.906, based on atomic mass data by Everling et al. [23]. It also quoted experimental evidence from the literature concerning upper limits for the hypothetical presence of any other stable isotopes of Nb with mass numbers between 89 and 98 [127]. Such isotopes could not cause a change in the seventh significant figure of A_r(Nb). On assessment of the reliability of the data, CAWIA [4] decided in 1969 to add one significant figure to the recommended value. A_r(Nb) thus became equal to 92.9064(1). The atomic weight and uncertainty of Nb were changed to their current values in the 1985 report of CAWIA [12], based on the atomic mass data of Wapstra and Audi [50].

$_{42}$Mo Molybdenum A_r(Mo) = 95.94 (2) g [Since 2001]

Isotope	Atomic mass/u	Mole fraction
^{92}Mo	91.906 810(4)	0.1477(31)
^{94}Mo	93.905 0867(20)	0.0923(10)
^{95}Mo	94.905 8406(20)	0.1590(9)
^{96}Mo	95.904 6780(20)	0.1668(1)
^{97}Mo	96.906 0201(20)	0.0956(5)
^{98}Mo	97.905 4069(20)	0.2419(26)
^{100}Mo	99.907 476(6)	0.0967(20)

The name derives from the Greek *molybdos* for "lead". The ancients used the term lead for any black mineral that leaves a mark on paper. Molybdenum was discovered by the Swedish pharmacist and chemist Carl Wilhelm Scheele in 1778. It was first isolated by the Swedish chemist Peter-Jacob Hjelm in 1781.

In its 1961 report [22], CAWIA recommended A_r(Mo) = 95.94 based on the chemical ratio measurements of Hönigschmid and Wittmann [367]. Recalculation of their measurements based on current values of A_r(Ag) and A_r(Cl) [11] gives the mass ratio $MoCl_5/5Ag$ = 0.506 552 and A_r(Mo) = 95.939. In 1969, after reevaluating the uncertainties associated with this work, CAWIA recommended a value of $U[A_r(Mo)]$ = 0.03 [4]. In its 1975 report [7], CAWIA evaluated five papers [368–372] dealing with mass-spectrometric determinations of the isotopic composition of Mo. Although they were judged not to be of equal reliability, their results all fall in the range of A_r(Mo) = 95.93 to 95.94 in close agreement with the chemical value. CAWIA recommended retaining the value of 95.94, but with the reduced uncertainty of $U[A_r(Mo)]$ = 0.01. The uncertainty of A_r(Mo) was changed to its current value in 2001 as a result of a reevaluation of isotopic measurements by Wieser and de Laeter [373] using revised statistical guidelines. Wieser and de Laeter reported no evidence of substantial variations in the isotopic com-

positions in Mo in a number of molybdenites and commercial chemicals; whereas other studies have indicated minor variations in the isotopic composition of Mo that are smaller than the uncertainty of the standard atomic weight [374]. The annotation "g" refers to anomalous occurrences at the Oklo natural nuclear reactor.

$_{43}$Tc Technetium

This element has not been allocated atomic weight or isotope-abundance values as CAWIA has listed it as an element with no stable isotopes. Technetium has three radioactive isotopes: ^{96}Tc, with an atomic mass of 96.906 364(5) u and $t_{1/2}$ of $2.6 \pm 0.4 \times 10^6$ a; ^{98}Tc, with an atomic mass of 97.907 215(4) u and $t_{1/2}$ of $4.2 \pm 0.3 \times 10^6$ a; and ^{99}Tc with an atomic mass of 98.906 253 6(21) u and $t_{1/2}$ of $2.1 \pm 0.3 \times 10^5$ a [375].

Convincing experimental evidence is now available that Tc occurs in "weighable" amounts resulting from the spontaneous fission of ^{238}U. It is estimated that the amount of Tc produced is approximately 2×10^{-12} of the amount of U present [376]. This result has yet to be accepted by CAWIA, but it seems appropriate to mention this information in the present review.

Other reasons for briefly discussing this element are the origin of its name and the way it has been discovered. The name derives from the Greek *technitos* for "artificial". Conventional wisdom is that Tc was first synthesized in 1937 by the Italian physicists C. Perrin and Emilio Segre in Palermo, Italy, who separated Tc from a sample of deuteron-bombarded Mo. However, in 1925 Noddack et al. [377] reported the discovery of element Z = 43, which they called Masurium, based on line identification of X-ray emission spectra from concentrated residues of U-rich minerals. This "discovery" was not acknowledged, and the Perrin–Segre discovery became accepted by the scientific community. A recent experiment by Armstrong and Van Assche [376] has simulated the Noddack et al. [377] experiment and given convincing proof as to the validity of the earlier discovery.

$_{44}$Ru Ruthenium A_r(Ru) = 101.07(2) g [Since 1983]

Isotope	Atomic mass/u	Mole fraction
^{96}Ru	95.907 604(9)	0.0554(14)
^{98}Ru	97.905 287(7)	0.0187(3)
^{99}Ru	98.905 9385(22)	0.1276(14)
^{100}Ru	99.904 2189(22)	0.1260(7)
^{101}Ru	100.905 5815(22)	0.1706(2)
^{102}Ru	101.904 3488(22)	0.3155(14)
^{104}Ru	103.905 430(4)	0.1862(27)

The name derives from the Latin *ruthenia* for the old name of Russia. It was discovered in a crude platinum ore by the Russian chemist Gottfried Wilhelm Osann in 1828. Osann thought that he had found three new metals in the sample, pluranium, ruthenium, and polinium. In 1844, Russian chemist Karl Karlovich Klaus was able to show that Osann's mistake was due to the impurity of the sample, and Klaus was able to isolate the ruthenium metal.

In its 1961 report [22], CAWIA changed the recommended atomic-weight value, A_r(Ru), from 101.1 to 101.07. In 1969, CAWIA [4] assigned an uncertainty $U[A_r(\text{Ru})]$ of 0.03 to that value of A_r(Ru), which was based on the abundance measurements by Friedman and Irsa [378], Baldock [379], and White et al. [127], and not on the chemical determination by Gleu and Rehm [380] in view of the large uncertainties in the chemical determination. The best measurements of the isotopic composition, on which the above representative isotopic composition is based, corresponds to the work by Devillers et al. [381], yielding A_r(Ru) = 101.068(13) calculated with the atomic mass data by Wapstra and Bos [49]. The use in 1961 of earlier atomic mass data [23] does not significantly affect the magnitude of the ear-

lier A_r(Ru) determinations. Feitknecht et al. [382] found no significant differences between three meteoritic and one terrestrial sample. Devillers et al. [381] found no significant differences between a meteoritic sample, two samples of well-defined geographic origin, and a commercial sample. In view of the excellent agreement between all the data, CAWIA [11] recommended in 1983 a reduction in $U[A_r(\mathrm{Ru})]$ from 0.03 to 0.02, and A_r(Ru) = 101.07. The annotation "g" refers to anomalous occurrences at the Oklo natural nuclear reactor.

$_{45}$Rh Rhodium A_r(Rh) = 102.905 50(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{103}Rh	102.905 504(3)	1.0000

The name derives from the Greek *rhodon* for rose because of the "rose color of dilute solutions of its salts". It was discovered by the English chemist and physicist William Hyde Wollaston in 1803 in a crude platinum ore.

In 1961, CAWIA [22] proposed A_r(Rh) = 102.905 based on atomic mass data by Everling et al. [23]. On the basis of Leipziger's unsuccessful search for minor stable isotopes of Rh [119], it was concluded that they could affect at most the seventh significant figure of the atomic-weight value. CAWIA changed the A_r(Rh) value to 102.9055(1) in 1969 [4]. The atomic weight and uncertainty of Rh were further changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{46}$Pd Palladium A_r(Pd) = 106.42(1) g [Since 1979]

Isotope	Atomic mass/u	Mole fraction
^{102}Pd	101.905 607(3)	0.0102(1)
^{104}Pd	103.904 034(5)	0.1114(8)
^{105}Pd	104.905 083(5)	0.2233(8)
^{106}Pd	105.903 484(5)	0.2733(3)
^{108}Pd	107.903 895(4)	0.2646(9)
^{110}Pd	109.905 153(12)	0.1172(9)

The name derives from the second largest asteroid of the solar system Pallas (named after the goddess of wisdom and arts—Pallas Athene). The element was discovered by the English chemist and physicist William Hyde Wollaston in 1803, one year after the discovery of Pallas by the German astronomer H. W. M. Olbers in 1802. The discovery was originally published anonymously by Wollaston to obtain priority, while not disclosing any details about his preparation.

In its 1961 report [22], CAWIA recommended the atomic weight of Pd to be A_r(Pd) = 106.4 based on the isotope-abundance measurements by Sites et al. [383] using atomic masses by Everling et al. [23]. The uncertainty $U[A_r(\mathrm{Pd})] = 0.1$ was assigned by CAWIA in 1969 [4], which gave Pd the least precisely tabulated atomic weight at that time. New calibrated isotope-abundance measurements of Pd were made by Shima et al. [384], yielding A_r(Pd) = 106.415(4). No variations outside the errors of the measurements were found among three terrestrial samples. Using these new abundance values and evidence of lack of significant natural variations, CAWIA, in its 1979 report [9], recommended A_r(Pd) = 106.42(1).

In 1981, Mermelengas et al. [385] reported convincing evidence that a sample of Pd from the South African Igneous Complex was enriched in the heavier isotopes giving an atomic weight of 106.434. Further measurements by Rosman et al. [386] of other Pd samples from the same region taken from different locations and representing different stages of industrial purification of ores were unable to detect other fractionated material. The isotopically fractionated sample has, therefore, been consid-

ered "abnormal" because of its rarity, and the atomic weight remains 106.42(1). The "g" annotation arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa [387] and the anomalous South African sample [386].

The possible recovery of significant quantities of nonradioactive ^{106}Pd from fission product wastes has been discussed by McDuffie [388]. This source of Pd is not likely to be available in the foreseeable future.

$_{47}$Ag Silver (Argentum) A_r(Ag) = 107.8682(2) g [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{107}Ag	106.905 093(6)	0.518 39(8)
^{109}Ag	108.904 756(3)	0.481 61(8)

The name derives from the Anglo-Saxon *seofor* and *siolfur*, which is of unknown origin. The chemical symbol, Ag derives from the Latin *argentum* and Sanskrit *argunas* from "bright". The element was known in prehistoric times.

In its 1961 report [22], CAWIA recommended A_r(Ag) = 107.870(3) after carefully reviewing the reliability of this value. It was recognized to be of great importance because about 42 other elements had their atomic weights determined in terms of the equivalence of their halides to Ag or Ag halides. The above value for A_r(Ag) was based on seven chemical (Ag/$AgNO_3$ twice; Ag/AgI; AgI/AgCl four times), and a number of mass-spectrometric determinations, one of which was a calibrated measurement [389], using atomic masses by Everling et al. [23]. CAWIA gave equal weight to the average of these chemical determinations, A_r(Ag) = 107.8714, and the mass-spectrometric atomic weight of Shields et al. [389], of 107.8686(6).

In 1967, CAWIA [3] with news of an "absolute" isotopic composition determination for Br, saw that there was a self-consistent set of reliable "absolute" mass-spectrometric measurements for Cl, Br, and Ag. The basis for A_r(Ag) was changed to a value of A_r(Ag) = 107.868, and the uncertainty $U[A_r(Ag)]$ reduced to 0.001. CAWIA pointed out that the new values gave a calculated combining ratio AgCl/Ag = 1.328 667, which is exactly the assessed best chemical ratio. Whereas this agreement corresponded to about 1 part in 10^6, the ratio AgBr/Ag showed a disparity of 19 parts in 10^6, which was thought to be due to a bias in the chemical work.

In 1981, CAWIA [10] welcomed a superior new "absolute" isotope-abundance measurement for Ag by Powell et al. [102], yielding A_r(Ag) = 107.868 15(11). These authors found no significant difference between a number of Ag metal and mineral samples with one minor exception now believed to be due to an impurity. CAWIA was able to recommend A_r(Ag) = 107.8682(3). In 1983, CAWIA retained the "g" annotation because of the Oklo occurrence [11]. In 1985, the uncertainty in the atomic weight of Ag was reduced to 0.0002 [12].

Through the greater use of mass-spectrometric determinations of atomic weights, Ag is losing some of its key role attributable to the stability of its monovalent ion. However, the atomic weight of Ag has lost none of its significance as a principal means for determining the Faraday constant. The atomic weight determination of [102] coupled with the best value of the electrochemical equivalent of Ag, has re-established the electrochemical method as the most accurate for determining the Faraday constant, and has significantly contributed to least squares adjustments of the fundamental constants.

$_{48}$Cd Cadmium A_r(Cd) = 112.411(8) g [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{106}Cd	105.906 458(6)	0.0125(6)
^{108}Cd	107.904 183(6)	0.0089(3)
^{110}Cd	109.903 006(3)	0.1249(18)
^{111}Cd	110.904 182(3)	0.1280(12)
^{112}Cd	111.902 7577(30)	0.2413(21)
^{113}Cd	112.904 4014(30)	0.1222(12)
^{114}Cd	113.903 3586(30)	0.2873(42)
^{116}Cd	115.904 756(3)	0.0749(18)

The name derives from Greek *kadmeia* for "calamine (zinc carbonate)", with which it was found as an impurity in nature. It may have been found in furnace flue dust in Thebes, a city in the Boeottia region of central Greece. The mythological king of Phoenicia, Cadmus, founded Thebes and would be a source for the name of the ore. The element was discovered and first isolated by German physician Fredrich Stromeyer in 1817.

In its 1961 report [22], CAWIA recommended A_r(Cd) = 112.40 based on seven chemical determinations by Hönigschmid and Schlee, and Baxter in cooperation with various associates, although it was noted that several isotope-abundance measurements yielded slightly higher values. Nevertheless, CAWIA in 1969 [4] assigned $U[A_r(Cd)] = 0.01$. In 1975, Rosman and de Laeter [390] published measurements of the isotopic composition of reagent Cd and eight terrestrial minerals. They estimated the mass discrimination by two methods. The first method interpolated the discrimination at Cd from measurements made on certified isotopic reference materials of Ag (NBS 978) and Pb (NBS 981), while the second determined it by introducing a gravimetrically prepared Cd double-spike into samples of reagent Cd. They reported A_r(Cd) = 112.410(5). In 1975, CAWIA [7] accepted this measurement as the most reliable available. It was moreover in fair agreement with earlier mass-spectrometric measurements, including those quoted in the 1961 report as well as determinations by White and Cameron [128] and Hibbs [354] yielding, respectively, A_r(Cd) = 112.43 and 112.42. As the chemical measurements, seemingly consistent with each other, had averaged 112.400 with little spread, CAWIA justified the retention of $U[A_r(Cd)] = 0.01$ with A_r(Cd) now 112.41. In 1985, CAWIA reexamined the data [12], taking account of a confirmatory measurement by Rosman et al. [152], which gave A_r(Cd) = 112.412. With its liberalized policy on single digit uncertainties, it then recommended an intermediate value of A_r(Cd) = 112.411(8), which has remained unchanged to the present.

It might be of some interest to note that all chemical measurements that gave an A_r(Cd) value below 112.40 depended on the purity of $CdBr_2$, for which freedom from traces of chloride at the time was hard to prove. Incidentally also, it is of interest that Rosman and de Laeter [391,392] found that Cd in the majority of meteorite samples showed no variations from the terrestrial composition although four unequilibrated ordinary chondrites exhibited enhancement of either their heavier or lighter isotopes. The "g" annotation arises from the presence of naturally occurring Cd fission products found in fossil reactors at Gabon, southwest Africa [393].

^{113}Cd is β^--active, but its half-life is so long (10^{16} a) that it does not affect A_r(Cd) measurably even over geologic time periods. It decays into the minor isotope of In, but abnormal occurrences of that element with anomalous A_r(In) from the decay of ^{113}Cd have not been reported.

$_{49}$In Indium A_r(In) = 114.818(3) [Since 1991]

Isotope	Atomic mass/u	Mole fraction
^{113}In	112.904 062(4)	0.0429(5)
^{115}In	114.903 879(40)	0.9571(5)

The name derives from the term "indigo" for the indigo-blue line in the element's spark spectrum. It was discovered in 1863 by the German physicist Ferdinand Reich and the German metallurgist Hieronymus Theodor Richter, while examining zinc blende. They isolated indium in 1867.

In its 1961 report [22], CAWIA recommended A_r(In) = 114.82, which was the average value of two reported mass-spectrometric determinations by White and Cameron [128], and White et al. [127] calculated with atomic masses by Everling et al. [23]. The uncertainty $U[A_r(\text{In})]$ was assessed to be ±0.01 in 1969 [4]. In the absence of calibrated mass-spectrometric measurements and lacking a study of possible natural variations, CAWIA did not see compelling reasons for making a change. It is not clear whether a third mass-spectrometric determination by Hibbs [354] was disregarded with cause or overlooked. However, his result of A_r(In) = 114.821, calculated with current atomic masses [51], is in excellent agreement with the other determinations.

In 1991, CAWIA [15] changed the recommended value for the atomic weight of In to A_r(In) = 114.818(3) based on high precision measurements of the metal and its compounds by Chang and Xiao [153]. The new measurement represents a significant improvement in the precision of the atomic weight and is in agreement with the previous value. The new value also agrees with the value reported by Saito et al. [394].

^{115}In is β^- active with a half-life so long, $4.41(25) \times 10^{14}$ a, that it neither affects A_r(In) nor has it given rise to recognized abnormal occurrences of tin.

$_{50}$Sn Tin (Stannum) A_r(Sn) = 118.710(7) g [Since 1983]

Isotope	Atomic mass/u	Mole fraction
^{112}Sn	111.904 822(5)	0.0097(1)
^{114}Sn	113.902 783(3)	0.0066(1)
^{115}Sn	114.903 347(3)	0.0034(1)
^{116}Sn	115.901 745(3)	0.1454(9)
^{117}Sn	116.902 955(3)	0.0768(7)
^{118}Sn	117.901 608(3)	0.2422(9)
^{119}Sn	118.903 311(3)	0.0859(4)
^{120}Sn	119.902 1985(27)	0.3258(9)
^{122}Sn	121.903 4411(29)	0.0463(3)
^{124}Sn	123.905 2745(15)	0.0579(5)

The name derives from the Anglo-Saxon *tin* of unknown origin. The chemical symbol, Sn, is derived from Latin *stannum* for alloys containing lead. The element was known in prehistoric times.

In its 1961 report [22], CAWIA recommended A_r(Sn) = 118.69 based on chemical-ratio determinations by Baxter and Starkweather [395]; Briscoe [396]; and Brauner and Krepelka [397]. From these measurements, with current values of the atomic weights of the other elements involved [11], the following atomic weights for Sn are derived: A_r(Sn) = 118.691, 118.686, and 118.701 respectively.

In 1961, CAWIA was aware that three mass-spectrometric determinations had been made that yield slightly higher atomic-weight values. Tin has 10 stable isotopes, the largest number of all elements. The isotopic composition measurements involve an unusually large number of experimentally determined ratios, each subject to uncertainty. In 1969, CAWIA [4] assessed the uncertainty to be $U[A_r(\text{Sn})] = 0.03$. CAWIA therefore preferred the chemically determined atomic-weight values. This viewpoint was reconfirmed during the years, until in 1983 CAWIA [11] was able to consider the first

calibrated mass-spectrometric measurement by Devillers et al. [154] who used double spiking with a mixture prepared from Sn highly enriched in ^{116}Sn and ^{122}Sn. The authors reported a value of A_r(Sn) = 118.7099(22) and demonstrated good agreement with seven previous isotope-abundance measurements after correcting those uncalibrated measurements linearly by mass for isotope fractionation. CAWIA in 1983 [11] therefore changed the basis for the standard atomic weight of Sn to mass spectrometry and the value to A_r(Sn) = 118.710(7) with the knowledge that natural variability is very small [398].

Devillers et al. [154] identified interferences at ^{114}Sn and ^{115}Sn, which were subsequently quantified by Rosman et al. [155] and corrected, leading to the isotope abundances provided in this review. Further very high-precision measurements of refined samples of Sn and cassiterites by Rosman and McNaughton [399,400] have shown that natural isotope fractionation, if it exists, is extremely small. Only one of their samples showed evidence of fractionation (0.02 % per mass unit). Changes of this magnitude introduce a negligible change in A_r(Sn). The "g" annotation arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa [387].

$_{51}$Sb Antimony (Stibium) A_r(Sb) = 121.760(1) g [Since 1993]

Isotope	Atomic mass/u	Mole fraction
^{121}Sb	120.903 8222(26)	0.5721(5)
^{123}Sb	122.904 2160(22)	0.4279(5)

The name derives from the Greek, *anti* + *monos* for "not alone or not one" because it was found in many compounds. The chemical symbol, Sb, comes from stibium, which is derived from the Greek *stibi* for "mark" because it was used for blackening eyebrows and eyelashes. The minerals stibnite (Sb_2S_3) and stibine (Sb_2H_3) are two of more than 100 mineral species, which were known in the ancient world.

In its 1961 report [22] CAWIA recommended A_r(Sb) = 121.75 based on chemical measurements by Willard and McAlpine [401], Hönigschmid et al. [402], Weatherill [403] and Krishnaswami [404]. With current values of the other atomic weights [11], these measurements yield the following results from the listed comparisons:

$SbBr_3$/3Ag = 1.117 704	A_r(Sb) = 121.778	[401]
$SbBr_3$/3AgBr = 0.641 682	A_r(Sb) = 121.758	[401]
$SbCl_3$/3Ag = 0.704 88	A_r(Sb) = 121.743	[402]
$SbCl_3$/3AgCl = 0.530 53	A_r(Sb) = 121.750	[402]
$SbBr_3$/3Ag = 1.116 99	A_r(Sb) = 121.751	[402]
$SbBr_3$/3AgBr = 0.641 67	A_r(Sb) = 121.751	[402]
$SbCl_3$/3Ag = 0.704 864	A_r(Sb) = 121.738	[403]
$SbBr_3$/3AgBr = 0.641 659	A_r(Sb) = 121.745	[404]

Giving these determinations, equal weight leads to an average value for A_r(Sb) = 121.751. In 1961, CAWIA [22] was aware of the sole measurement of the isotopic composition of Sb by mass spectrometry, published by White and Cameron [128]. With current atomic mass data by Wapstra and Bos [49], that measurement yields A_r(Sb) = 121.759, in good agreement with the chemical value. The corresponding values calculated in 1961 [22] provided CAWIA with an average chemical value of A_r(Sb) = 121.750 and for the mass-spectrometric determination A_r(Sb) = 121.76. The chemical value was evidently given slight preference in the tabulated value of A_r(Sb) = 121.75, for which in 1969 [4] CAWIA assigned $U[A_r(Sb)] = 0.03$.

In 1989, CAWIA adopted an atomic weight of A_r(Sb) = 121.757(3) [14], based on the mass-spectrometric measurement by de Laeter and Hosie [405]. In 1993, CAWIA [16] changed the recommended value for the standard atomic weight to A_r(Sb) = 121.760(1), based on the calibrated mass-spectrometric determination by Chang et al. [156], which was supported by other high-quality measurements by Chang et al. [406], and by Wachsmann and Heumann [407]. A survey of five stibnite minerals and five

laboratory reagents was also carried out by Chang et al. [156]. No evidence of isotope fractionation of Sb in any of the terrestrial materials was found. The "g" annotation is due to isotopic anomalies identified in the Oklo U deposit at Gabon, southwest Africa.

$_{52}$Te Tellurium A_r(Te) = 127.60(3) g [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{120}Te	119.904 026(11)	0.0009(1)
^{122}Te	121.903 0558(29)	0.0255(12)
^{123}Te	122.904 2711(20)	0.0089(3)
^{124}Te	123.902 8188(16)	0.0474(14)
^{125}Te	124.904 4241(20)	0.0707(15)
^{126}Te	125.903 3049(20)	0.1884(25)
^{128}Te	127.904 4615(19)	0.3174(8)
^{130}Te	129.906 2229(21)	0.3408(62)

The name derives from the Latin *Tellus*, who was the Roman goddess of the earth. It was discovered by the Roumanian mine director Franz Joseph Müller von Reichenstein in 1782 and overlooked for 15 years until it was isolated by the German chemist Martin-Heinrich Klaproth in 1798. The Hungarian chemist Paul Kitaibel independently discovered tellurium in 1789, prior to Klaproth's work but after von Reichenstein.

The CAWIA report in 1961 [22] recommended A_r(Te) = 127.60, based on the chemical-ratio determinations by Hönigschmid and his collaborators [408–410]. In 1969, CAWIA [4] assessed $U[A_r(\text{Te})]$ to be 0.03. Recalculations of the chemical ratios with current values of the other atomic weights involved [11], yielded the following results from the listed comparisons:

$TeBr_4/4Ag = 1.036\ 49$	$A_r(Te) = 127.601$	[408]
$TeBr_4/AgBr = 0.595\ 426$	$A_r(Te) = 127.602$	[408]
$Ag_2Te/2Ag = 1.591\ 45$	$A_r(Te) = 127.597$	[409]
$TeCl_4/4Ag = 0.624\ 425$	$A_r(Te) = 127.610$	[410]
$TeCl_4/AgCI = 0.469\ 960$	$A_r(Te) = 127.612$	[410]

Giving these chemical determinations, equal weight yields A_r(Te) = 127.604.

In 1961, CAWIA noted the mass-spectrometric measurements of Williams and Yuster [411] and White and Cameron [128], which average to a higher atomic-weight value A_r(Te) = 127.63 [22]. The later isotope-abundance measurements by Smith et al. [157], coupled with the atomic mass data by Wapstra and Bos [49], gave a value lower than that from the chemical determinations. That value, A_r(Te) = 127.586, was invariant within experimental precision for six Te mineral sources [157]. In the absence of calibrated mass-spectrometric measurements, the value of A_r(Te) = 127.60(3) was retained as the standard atomic weight of Te. The measurements by Smith et al. [157] were made with an electron multiplier and were, therefore, biased towards the lighter isotopes. In recognition of this fact, the isotope abundances measured by Smith et al. [157] were adjusted by the square root of the mass numbers to give the abundances shown here [72]. These abundances yield an atomic weight and uncertainty consistent with the standard atomic weight. They are also consistent with recent isotope-abundance measurements of de Laeter [412] made using a Faraday cup collector. Isotope fractionation in telluride minerals was reported by Smithers and Krouse [413].

^{123}Te, ^{128}Te, and ^{130}Te are radioactive; the minor isotope ^{123}Te has a long half-life of $1.3(4) \times 10^{13}$ a and transforms into ^{123}Sb without significantly affecting either element's atomic weight even over geological time. The major isotopes ^{128}Te and ^{130}Te have long half-lives of approximately 10^{24} a and 10^{21} a, respectively. These isotopes suffer double β^- decay and are responsible for detectable Xe

isotopic anomalies in old Te-bearing minerals. The "g" annotation for Te arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa [414].

$_{53}$I Iodine A_r(I) = 126.904 47(3) [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{127}I	126.904 468(4)	1.0000

The name derives from the Greek *iodes* for "violet" because of its violet vapors. It was discovered in seaweed by the French chemist Bernard Courtois in 1811. It was named by the French chemist Louis-Joseph Gay-Lussac, when he proved it was an element in 1814.

In 1961, CAWIA [22] proposed the atomic weight of I to be A_r(I) = 126.9044, based on atomic mass data by Everling et al. [23]. CAWIA had a preview of the revision of this data in a paper by Wapstra and Gove [48] that had been accepted for publication prior to CAWIA meeting in 1969 [4]. Presumably it was the new value for the mass of ^{127}I = 126.904 47 that led CAWIA to adopt the change to A_r(I) = 126.9045(1) without documenting the reasoning in the 1969 report [4]. The atomic weight and uncertainty of I were changed to their current values in the 1985 report of CAWIA [12], based on the atomic mass data of Wapstra and Audi [50].

There is little information in the literature on the hypothetical presence in normal sources of I of isotopes other than ^{127}I. Leland [158] found the upper limit of ^{129}I in normal I as 3×10^{-6}. It is a ß$^-$ emitter with a half-life of $1.6(1) \times 10^7$ a, too short for the survival in terrestrial I of significant amounts of this isotope from primordial material. If present in normal I in the concentration determined by Leland [158] to be the upper limit, ^{129}I would increase A_r(I) by six in the ninth significant figure, substantially less than the standard atomic-weight uncertainty. More recently, ^{129}I has been measured in terrestrial samples that have been exposed to cosmic radiation, and in materials that contain fallout from nuclear explosions. These measurements can be used for geochronological and environmental studies, but they also confirm the low abundance of ^{129}I in nature, and its insignificance with respect to the atomic weight of I.

$_{54}$Xe Xenon A_r(Xe) = 131.293(6) g, m [Since 1999]

Isotope	Atomic mass/u	Mole fraction
^{124}Xe	123.905 8954(21)	0.000 952(3)
^{126}Xe	125.904 268(7)	0.000 890(2)
^{128}Xe	127.903 5305(15)	0.019 102(8)
^{129}Xe	128.904 7799(9)	0.264 006(82)
^{130}Xe	129.903 5089(11)	0.040 710(13)
^{131}Xe	130.905 0828(18)	0.212 324(30)
^{132}Xe	131.904 1546(15)	0.269 086(33)
^{134}Xe	133.905 3945(9)	0.104 357(21)
^{136}Xe	135.907 220(8)	0.088 573(44)

The name derives from the Greek *xenos* for "the stranger". It was discovered by the Scottish chemist William Ramsay and the English chemist Morris William Travers in 1898 in a liquefied air sample.

The atomic weight of Xe is based on analyses of Xe separated from air. In its 1961 report [22], CAWIA adopted a value of A_r(Xe) = 131.30, which was recommended in 1955 and was based on the "calibrated" isotope-abundance measurements of Nier [66] and the atomic masses reported by Halsted [415]. CAWIA recognized in 1961 that this calculation was "slightly in error" and noted that with the same isotope abundances and using the atomic masses reported by Everling et al. [23], the correct calculated value was nearer to A_r(Xe) = 131.29. Despite this inconsistency, CAWIA in 1969 [4] estimated

that the uncertainty $U[A_r(Xe)]$ was no greater than 0.01. In 1979, CAWIA [9] corrected this inconsistency and recommended $A_r(Xe) = 131.29(3)$. The uncertainty was reduced to 0.02 by CAWIA in its 1985 report [12] to conform to the modified Technical Guidelines. In 1999, CAWIA adopted the analyses of Valkiers et al. [58] on a tank of purified Xe as the "best measurement" of the isotopic composition of Xe in a single source. Based on that measurement, and a reevaluation of previous data, CAWIA recommended $A_r(Xe) = 131.293(6)$, which is believed to represent the value of Xe in air [19].

Xenon samples with relatively high ^{129}Xe concentrations extracted from some types of primitive volcanic rocks and from some natural gas wells have been attributed to the decay of extinct ^{129}I early in the earth's history, storage in the interior of the earth for several billion years, and subsequent release during partial degassing [416]. Other reported minor occurrences of Xe of anomalous isotopic composition have been attributed to production of the heavy isotopes ^{131}Xe to ^{136}Xe from spontaneous and induced fission of U and fission of extinct ^{244}Pu; production of ^{128}Xe and ^{130}Xe from double β^- decay of ^{128}Te and ^{130}Te; and primordial sources [237]. Not all of these variations are included within the atomic weight uncertainty, hence the annotation "g". Localized occurrences of isotopically anomalous Xe are associated with nuclear bomb test sites, and minor fractionations can occur during separation of Xe from air or other processes, hence the annotation "m".

$_{55}$Cs Caesium (Cesium) A_r(Cs) = 132.905 45(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{133}Cs	132.905 447(3)	1.0000

The name derives from the Latin *caesius* for "sky blue color", which was the color of the caesium line in the spectroscope. It was discovered by the German chemist Robert Wilhelm Bunsen and the German physicist Gustav Robert Kirchhoff in 1860. It was first isolated by the German chemist Carl Setterberg in 1882.

The CAWIA report in 1961 [22] recommended $A_r(Cs) = 132.905$, based on atomic mass data from Everling et al. [23]. CAWIA also cited experimental evidence from the literature indicating that the upper limit for the hypothetical existence of any other stable or quasi-stable isotope of Cs is very low [127]. When assessing the reliability of data in 1969, CAWIA [4] decided to add one significant figure and recommended $A_r(Cs) = 132.9055(1)$. This value was adjusted in 1971 [5] to 132.9054(1) as a result of Wapstra and Gove's revision of atomic mass data [48]. The atomic weight and uncertainty of Cs were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{56}$Ba Barium A_r(Ba) = 137.327(7) [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{130}Ba	129.906 311(7)	0.001 06(1)
^{132}Ba	131.905 056(3)	0.001 01(1)
^{134}Ba	133.904 504(3)	0.024 17(18)
^{135}Ba	134.905 684(3)	0.065 92(12)
^{136}Ba	135.904 571(3)	0.078 54(24)
^{137}Ba	136.905 822(3)	0.112 32(24)
^{138}Ba	137.905 242(3)	0.716 98(42)

The name is derived from the Greek *barys* for "heavy" because it was found in the mineral heavy spar ($BaSO_4$). It was discovered by the Swedish pharmacist and chemist Carl Wilhelm Scheele in 1774 and first isolated by the British chemist and physicist Humphry Davy in 1808.

In 1961, CAWIA [22] recommended a value of A_r(Ba) = 137.34 for the atomic weight of Ba. This value was based both on the chemical data of Hönigschmid and Sachtleben [417] and on mass-spectrometric abundance measurements by Nier [418] and Thode [419]. In 1969, CAWIA [4] assigned an uncertainty so that the value became A_r(Ba) = 137.34(3). In 1975, CAWIA [7] reviewed the above data as well as new mass-spectrometric measurements by Rider et al. [420], Umemoto [421], Eugster et al. [159], and de Laeter and Date [422]. All of these measurements fell within a very narrow range, and that by Eugster et al. [159] had been calibrated by the double-spike technique. As a result, CAWIA recommended A_r(Ba) = 137.33(1). Eugster et al. [159] and de Laeter and Date [422] had reported no isotopic variations in a range of terrestrial and meteoritic samples. In 1985, CAWIA [12], under its new rules permitting the use of uncertainties from 1 to 9, again reviewed the available data and felt that an additional digit was justified and recommended A_r(Ba) = 137.327(7).

The atomic weight of Ba has carried the annotation "g" on what CAWIA has, in the past, felt were strong theoretical grounds that fission product Ba should exist in samples from the Oklo deposits. There have been numerous unsuccessful experimental attempts to measure this fission product Ba, but there is now evidence of fission product Ba in mineral separates from Oklo samples [423]. However, CAWIA judged that the isotopic composition of Ba in whole-rock Oklo samples would not be significantly different with respect to the standard atomic weight. Thus, the annotation "g" previously used for this element has been suppressed.

$_{57}$La Lanthanum A_r(La) = 138.9055(2) g [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{138}La	137.907 108(4)	0.000 90(1)
^{139}La	138.906 349(4)	0.999 10(1)

The name derives from the Greek *lanthanein* for "to be hidden or to escape notice" because it hid in cerium ore and was difficult to separate from that rare earth mineral. It was discovered by the Swedish surgeon and chemist Carl-Gustav Mosander in 1839. In 1842, Mosander separated his lanthanium sample into two oxides; for one of these he retained the name lanthanum and for the other he gave the name didymium (or twin).

In its 1961 report [22], CAWIA recommended a value A_r(La) = 138.91, based on the recalculation of two chemical determinations and the average of two mass-spectrometric determinations by Inghram et al. [424] and White et al. [127], using the atomic mass data by Everling et al. [23]. In 1969, CAWIA [4] recommended A_r(La) = 138.9055(3) based upon the same determinations, taking into account that two additional digits were justified in view of the small influence any mass discrimination could have on the atomic weight of this nearly monoisotopic element. In effect, the chemical determinations were no longer considered significant. In 1985, CAWIA reexamined the data and decided to reduce the uncertainty of the atomic weight to 0.0002 [12].

The minor isotope ^{138}La is radioactive with a half-life of $1.06(4) \times 10^{11}$ a, with ^{138}Ba and ^{138}Ce as daughter nuclides. The atomic weight of all three elements remains unaffected even over geologic time periods. The "g" annotation arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa.

$_{58}$Ce Cerium A_r(Ce) = 140.116(1) g [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{136}Ce	135.907 140(50)	0.001 85(2)
^{138}Ce	137.905 986(11)	0.002 51(2)
^{140}Ce	139.905 435(3)	0.884 50(51)
^{142}Ce	141.909 241(4)	0.111 14(51)

The name derives from the planetoid Ceres, which was discovered by the Italian astronomer Giuseppe Piazzi in 1801 and named for Ceres, the Roman goddess of agriculture and harvest. Two years later, the element was discovered by the German chemist Martin-Heinrich Klaproth, who called it ochroeite earth because of its yellow color. It was independently discovered at the same time by the Swedish chemist Jöns Jacob Bezelius and the Swedish mineralogist Wilhelm von Hisinger, who called it ceria. It was first isolated in 1875 by the American mineralogist and chemist William Frances Hillebrand and the American chemist Thomas H. Norton.

In its 1961 report [22], CAWIA recommended A_r(Ce) = 140.12 based on the average value of the mass-spectrometric measurements by Inghram et al. [424] and Hibbs [354], which were in good agreement with earlier chemical determinations. As a result, CAWIA in 1969 [4] assessed the uncertainty $U[A_r(Ce)]$ to be 0.01. Consideration was also given to a determination by Umemoto [421], which, with atomic masses [49], calculates to A_r(Ce) = 140.1148, compared with 140.1048 for Inghram et al. [424] and 140.124 5 for Hibbs [354]. Though the atomic weight of Ce of 140.11(2) might be a slightly better value, CAWIA has not seen sufficiently compelling reasons to make a change until new results became available. The above representative isotopic composition calculates to A_r(Ce) = 140.1149(20), which favors the lower value and higher uncertainty without compelling a change. The atomic weight and uncertainty of Ce were changed to their current values in the 1995 report of CAWIA [17], based on the isotope-abundance data of Chang et al. [161].

^{138}Ce and ^{140}Ce are the decay products of long-lived minor isotopes ^{138}La and ^{144}Nd respectively. They have a negligible effect on A_r(Ce) in normal sources, but add justification to the "g" annotation, which also refers to the Oklo occurrence in Gabon, southwest Africa.

$_{59}$Pr Praseodymium A_r(Pr) = 140.907 65(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{141}Pr	140.907 648(3)	1.0000

The name derives from the Greek *prasios* for "green" and *didymos* for "twin" because of the pale green salts it forms. It was discovered by the Austrian chemist Carl Auer von Welsbach in 1885, who separated it and the element neodymium from a didymium sample. Didymium had previously been thought to be a separate element.

The CAWIA report in 1961 [22] recommended an atomic weight of A_r(Pr) = 140.907, based on atomic mass data from Everling et al. [23]. CAWIA also examined literature evidence that placed very low limits on the possible abundances of additional stable isotopes of Pr [147]. In its assessment of the data in 1969, CAWIA [4] added one additional significant figure and recommended A_r(Pr) = 140.9077(1). The atomic weight and uncertainty of Pr were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{60}$Nd Neodymium A_r(Nd) = 144.24(3) g [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{142}Nd	141.907 719(3)	0.272(5)
^{143}Nd	142.909 810(3)	0.122(2)
^{144}Nd	143.910 083(3)	0.238(3)
^{145}Nd	144.912 569(3)	0.083(1)
^{146}Nd	145.913 113(3)	0.172(3)
^{148}Nd	147.916 889(4)	0.057(1)
^{150}Nd	149.920 887(4)	0.056(2)

The name derives from the Greek *neos* for "new" and *didymos* for "twin". It was discovered by the Swedish surgeon and chemist Carl Gustav Mosander in 1841, who called it didymium (or twin) because of its similarity to lanthanium, which he had previously discovered two years earlier. In 1885, the Australian chemist Carl Auer von Welsbach separated didymium into two elements, one of which he called neodymium (or new twin).

In its 1961 report [22], CAWIA recommended A_r(Nd) = 144.24 based on the average of the isotope-abundance measurements of Inghram et al. [425] and Walker and Thode [426] with atomic masses by Everling et al. [23]. In 1969, CAWIA [4] evaluated the uncertainty $U[A_r(\mathrm{Nd})]$ to be 0.03.

Two isotopes of Nd (^{144}Nd and ^{145}Nd) are radioactive but with half-lives so long, $2.1(4) \times 10^{15}$ a, and more than 6×10^{16} a, respectively, that there is no measurable effect on the atomic weight comparable with the precision of the tabulated standard atomic weight. ^{143}Nd is the decay product of radioactive ^{147}Sm. Although the resulting fluctuations of $n(^{143}\mathrm{Nd})/n(^{144}\mathrm{Nd})$ are also too small to affect A_r(Nd), they are measurable and do permit deductions to be made in geochronology [427] and in geochemical phenomena, for instance, the mixing of ocean currents [428]. For such applications, precise measurements of isotope abundances and Sm/Nd ratios are needed, and these are greatly facilitated by comparisons with standard solutions [429]. The "g" notation arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa.

$_{62}$Sm Samarium A_r(Sm) = 150.36(3) g [Since 1979]

Isotope	Atomic mass/u	Mole fraction
^{144}Sm	143.911 996(4)	0.0307(7)
^{147}Sm	146.914 894(3)	0.1499(18)
^{148}Sm	147.914 818(3)	0.1124(10)
^{149}Sm	148.917 180(3)	0.1382(7)
^{150}Sm	149.917 272(3)	0.0738(1)
^{152}Sm	151.919 729(3)	0.2675(16)
^{154}Sm	153.922 206(3)	0.2275(29)

The name derives from the mineral samarskite, in which it was found and that had been named for Colonel Samarski, a Russian mine official. It was originally discovered in 1878 by the Swiss chemist Marc Delafontaine, who called it decipium. It was also discovered by the French chemist Paul-Emile Lecoq de Boisbaudran in 1879. In 1881, Delafontaine determined that his decipium could be resolved into two elements, one of which was identical to Boisbaudran's samarium. In 1901, the French chemist Eugène-Anatole Demarçay showed that this samarium earth also contained europium.

In its 1961 report [22], CAWIA expressed concern about disparities among several isotope-abundance measurements for Sm, while chemical measurements yielded persistently higher values. Thus, CAWIA retained A_r(Sm) = 150.35—the 1955 value based on the mass spectrometry of Inghram et al. [430], which was even lower than the average of five mass-spectrometric measurements recalculated with atomic masses by Bhanot et al. [431]. In 1969, CAWIA [4] found the evidence inadequate for the

precision previously implied and corrected A_r(Sm) to 150.4(1); this value included almost all chemical and mass-spectrometric data. In 1979, CAWIA [9] undertook a thorough review of the literature. The chemical determinations by Hönigschmid and Hirschbold-Wittner [432] were found most reliable because the purity of $SmCl_3$ was proved by X-ray fluorescence and optical-emission spectrometry. Earlier work had been subject to contamination by oxychloride as correctly pointed out by Hönigschmid and Hirschbold-Wittner [432]. Their data, recalculated with the results from the listed comparison are as follows:

$SmCl_3/3Ag = 0.793\ 310$	$A_r(Sm) = 150.359$	
$SmCl_3/3AgCl = 0.597\ 068$	$A_r(Sm) = 150.358$	[432]

In 1975, Lugmair et al. [433] carried out more precise mass-spectrometric measurements that, with atomic masses [49], gave A_r(Sm) = 150.366. Thus, CAWIA in 1979 [9] recommended A_r(Sm) = 150.36(3), a vindication of the 1961 value. From the previous A_r(Sm) = 150.4 this was the largest change of an atomic-weight value in CAWIA's history, although it was only 40 % of the previously estimated uncertainty.

Two isotopes, ^{147}Sm and ^{148}Sm, have very long half-lives of $1.06(1) \times 10^{11}$ a and $7(3) \times 10^{15}$ a, respectively. They cannot appreciably influence A_r(Sm) even over geologic time intervals. The applications to geochronology and geochemical phenomena are mentioned in the preceding section on Nd. The "g" notation arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa.

$_{63}$Eu Europium A_r(Eu) = 151.964(1) g [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{151}Eu	150.919 846(3)	0.4781(6)
^{153}Eu	152.921 227(3)	0.5219(6)

The name derives from the continent of Europe. It was separated from the mineral samaria in magnesium-samarium nitrate by the French chemist Eugène-Anatole Demarçay in 1896. It was also first isolated by Demarçay in 1901.

In its 1961 report [22], CAWIA recommended the atomic weight of Eu to be A_r(Eu) = 151.96 based on the mass-spectrometric determinations by Hess [434] and Collins et al. [147] and atomic masses by Bhanot et al. [431]. Owing to the fact that Eu has only two isotopes, CAWIA in 1969 [4] assessed $U[A_r(Eu)]$ at 0.01. Since that time, another confirmatory isotopic composition measurement has become available [162], but it was not a calibrated measurement. A value of A_r(Eu) = 151.965(9) was adopted in 1985 [12] when CAWIA removed the restriction requiring uncertainties to be either 1 or 3. Natural variability has not been studied and reported in the literature. The atomic weight and uncertainty of Eu were changed to their current values in the 1995 report of CAWIA [17], based on the isotope-abundance data of Chang et al. [164]. The "g" notation arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa.

$_{64}$Gd Gadolinium A_r(Gd) = 157.25(3) g [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{152}Gd	151.919 789(3)	0.0020(1)
^{154}Gd	153.920 862(3)	0.0218(3)
^{155}Gd	154.922 619(3)	0.1480(12)
^{156}Gd	155.922 120(3)	0.2047(9)
^{157}Gd	156.923 957(3)	0.1565(2)
^{158}Gd	157.924 101(3)	0.2484(7)
^{160}Gd	159.927 051(3)	0.2186(19)

The name derives from the mineral gadolinite, in which it was found, and that had been named for the Finnish rare earth chemist Johan Gadolin. It was discovered by the Swiss chemist Jean-Charles Galissard de Marignac in 1886, who produced a white oxide he called $Y_?$ in a samarskite mineral. In 1886, the French chemist Paul-Emile Lecoq de Boisbaudran gave the name gadolinium to $Y_?$.

In 1961, CAWIA [22] recommended the value of the atomic weight of Gd to be A_r(Gd) = 157.25. This value was based on the average of the isotope-abundance measurements of Hess [434] and Leland [133] using atomic masses reported by Bhanot et al. [431]. In 1969, CAWIA [4] recommended a value of A_r(Gd) = 157.25(3). The isotope-abundance measurements of Eugster et al. [165] and Holliger and Devillers [162] are considered superior, but when used with atomic masses by Wapstra and Bos [49], do not present a compelling argument for a change in the recommended values for A_r(Gd) or $U[A_r(Gd)]$.

^{152}Gd has a very long half-life in excess of 10^{14} a. Within the life time of the earth, this radioactivity will not have affected the atomic weight to the precision here quoted. The "g" notation arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa.

$_{65}$Tb Terbium A_r(Tb) = 158.925 34(2) [Since 1995]

Isotope	Atomic mass/u	Molar fraction
^{159}Tb	158.925 343(3)	1.0000

The name derives from the village of Ytterby in Sweden, where the mineral ytterbite (the source of terbium) was first found. Terbium was discovered by the Swedish surgeon and chemist Carl-Gustav Mosander in 1843 in an yttrium salt, which he resolved into three elements. He called one yttrium, a rose-colored salt he called terbium, and a deep yellow peroxide he called erbium. In 1862, the Swiss chemist Marc Delafontaine reexamined yttrium and found the yellow peroxide. Because the name erbium had now been assigned to the rose colored oxide, he reintroduced the name terbium for the yellow peroxide. Thus the original names given to erbium and terbium samples are now switched.

The CAWIA report in 1961 [22] recommended the atomic weight A_r(Tb) = 158.924, based on atomic mass data from Everling et al. [23]. CAWIA also cited experimental evidence from the literature indicating that the upper limits for the abundances of other hypothetical stable or quasi-stable isotopes of Tb were very low [147]. A revision of the atomic mass data was considered by CAWIA in 1969 [4], although the relevant publication by Wapstra and Gove [48] was finalized later. The A_r(Tb) value thus became equal to 158.9254(1). The atomic weight and uncertainty of Tb were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{66}$Dy Dysprosium A_r(Dy) = 162.500(1) g [Since 2001]

Isotope	Atomic mass/u	Mole fraction
^{156}Dy	155.924 278(7)	0.000 56(3)
^{158}Dy	157.924 405(4)	0.000 95(3)
^{160}Dy	159.925 194(3)	0.023 29(18)
^{161}Dy	160.926 930(3)	0.188 89(42)
^{162}Dy	161.926 795(3)	0.254 75(36)
^{163}Dy	162.928 728(3)	0.248 96(42)
^{164}Dy	163.929 171(3)	0.282 60(54)

The name derives from the Greek *dysprositos* for "hard to get at", owing to the difficulty in separating this rare earth element from a holmium mineral in which it was found. It was discovered by the Swiss chemist Marc Delafontaine in the mineral samarskite in 1878 and called philippia. Philippia was subsequently thought to be a mixture of terbium and yttrium. It was later rediscovered in a holmium sample by the French chemist Paul-Emile Lecoq de Boisbaudron in 1886, who was then credited with the discovery. It was first isolated by the French chemist George Urbain in 1906.

In its 1961 report [22], CAWIA recommended A_r(Dy) = 162.50 based on the mass-spectrometric determinations by Inghram et al. [435] and atomic masses by Bhanot et al. [431]. In 1969, CAWIA [4] assessed $U[A_r(\mathrm{Dy})]$ as 0.03. In the absence of new calibrated mass-spectrometric measurements as well as due to lack of a study of natural variability, CAWIA found no compelling reason to make any change in these values. The isotopic measurements of Holliger and Devillers [162] confirm the existing data. The atomic weight and uncertainty of Dy were changed to their current values in 2001 as a result of the calibrated measurement by Chang et al. [166]. The "g" notation arises from the presence of naturally occurring fission products found in fossil reactors at Gabon, southwest Africa.

$_{67}$Ho Holmium A_r(Ho) = 164.930 32(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{165}Ho	164.930 319(3)	1.0000

The name derives from the Latin *holmia* for Stockholm. It was discovered in erbia earth by the Swiss chemist J. L. Soret in 1878, who referred to it as element X. It was later independently discovered by the Swedish chemist Per Theodor Cleve in 1879. It was first isolated in 1911 by Homberg, who proposed the name holmium either to recognize the discoverer Per Cleve, who was from Stockholm, or perhaps to establish his own name in history.

The CAWIA report in 1961 [22] recommended an atomic weight of A_r(Ho) = 164.930, based on atomic mass data from Bhanot et al. [431]. CAWIA also cited experimental evidence from the literature indicating that the upper limits for the abundances of other hypothetical stable isotopes of Ho were low [147]. Based on a reassessment of the available data in 1969, CAWIA [4] added one significant figure and recommended A_r(Ho) = 164.9303(1). The revision of atomic mass data by Wapstra and Gove [48] led CAWIA in 1971 [5] to revise A_r(Ho) to 164.9304(1). The atomic mass of ^{165}Ho given by Wapstra and Bos [49] favored a return to the 1969 value of A_r(Ho); however, CAWIA in 1983 [11] decided to postpone changing A_r(Ho) pending the expected publication of an updated atomic mass table and a CAWIA policy decision to limit rounding-off fluctuations in the standard atomic-weight values for the monoisotopic elements. The atomic weight and uncertainty of Ho were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{68}$Er Erbium A_r(Er) = 167.259(3) g [Since 1999]

Isotope	Atomic mass/u	Mole fraction
^{162}Er	161.928 775(4)	0.001 39(5)
^{164}Er	163.929 197(4)	0.016 01(3)
^{166}Er	165.930 290(3)	0.335 03(36)
^{167}Er	166.932 046(3)	0.228 69(9)
^{168}Er	167.932 368(3)	0.269 78(18)
^{170}Er	169.935 461(3)	0.149 10(36)

The name derives from the Swedish town of Ytterby, where the ore gadolinite (in which it was found) was first mined. It was discovered by the Swedish surgeon and chemist Carl-Gustav Mosander in 1843 in a yttrium sample. He separated the yttrium into yttrium, a rose-colored salt he called terbium and a deep yellow peroxide that he called erbium.

In its 1961 report [22], CAWIA recommended A_r(Er) = 167.26 based on the isotope-abundance measurements by Hayden et al. [436] and Leland [133], and atomic masses by Bhanot et al. [431]. In 1969, CAWIA [4] assessed $U[A_r(Dy)]$ as 0.03. A subsequent confirmatory isotopic composition measurement reported by Holliger and Devillers in 1981 [162] provided support for the 1969 value and uncertainty of A_r(Er). However, the atomic weight and uncertainty of Er were changed to their current values in the 1999 report of CAWIA [19], based on the isotope-abundance data of Chang et al. [437]. The "g" notation arises from the presence of naturally occurring fission products found at the Oklo fossil reactors at Gabon, southwest Africa.

$_{69}$Tm Thulium A_r(Tm) = 168.934 21(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{169}Tm	168.934 211(3)	1.0000

The name derives from Thule, the earliest name for the northernmost part of the civilized world—Scandinavia (Norway, Sweden, and Iceland). It was discovered in 1879 by the Swedish chemist Per Theodor Cleve in a sample of erbium mineral. It was first isolated by the American chemist Charles James in 1911.

The CAWIA report in 1961 [22] proposed the atomic weight of Tm to be A_r(Tm) = 168.934 based on atomic mass data by Bhanot et al. [431]. A search by Collins et al. [147] for minor stable or quasi-stable isotopes of Tm was unsuccessful and placed the upper limit of their existence so low that they could only affect the atomic weight in the ninth significant figure. When it assessed the reliability of the data, CAWIA in 1969 [4] added one decimal figure. The A_r(Tm) value thus became 168.9342(1). The atomic weight and uncertainty of Tm were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{70}$Yb Ytterbium A_r(Yb) = 173.04(3) g [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{168}Yb	167.933 895(5)	0.0013(1)
^{170}Yb	169.934 759(3)	0.0304(15)
^{171}Yb	170.936 323(3)	0.1428(57)
^{172}Yb	171.936 378(3)	0.2183(67)
^{173}Yb	172.938 207(3)	0.1613(27)
^{174}Yb	173.938 858(3)	0.3183(92)
^{176}Yb	175.942 569(3)	0.1276(41)

The name derives from the Swedish village of Ytterby where the mineral ytterbite (the source of ytterbium) was originally found. It was discovered by the Swiss chemist Jean-Charles Galissard de Marignac in 1878 in erbium nitrate from gadolinite (ytterbite renamed).

The atomic weight of Yb has been taken as 173.04 since 1934. This chemically determined value was reconfirmed in the 1961 CAWIA report [22]. However, from that time, A_r(Yb) was no longer based on chemical but on mass-spectrometric data by Hayden et al. [438] and by Leland [133]. The uncertainty of $U[A_r(\mathrm{Yb})] = 0.03$ was assigned in 1969 [4] and has also remained unchanged since. A number of mass-spectrometric determinations of the isotopic composition of Yb are referenced [133,147,162,436,439]. McCulloch et al. [439] showed that the isotopic composition of eight meteoritic and four terrestrial samples were identical within experimental errors to a laboratory standard. The "g" annotation is derived from anomalous Yb in samples from the Oklo U deposit in Gabon, southwest Africa.

$_{71}$Lu Lutetium A_r(Lu) = 174.967(1) g [Since 1981]

Isotope	Atomic mass/u	Mole fraction
^{175}Lu	174.940 7682(28)	0.9741(2)
^{176}Lu	175.942 6827(28)	0.0259(2)

The name derives from Lutetia, the ancient name for the city of Paris. The discovery is credited to the French chemist George Urbain in 1907 although it had been separated earlier and independently by the Austrian chemist Carl Auer von Welsbach from an ytterbium sample. Von Welsbach had named the element cassiopeium after the constellation Cassiopeia. However, because Urbain published his results before Auer, his name for the element was adopted by IUPAC in 1949.

In its 1961 report [22], CAWIA recommended A_r(Lu) = 174.97 based on the mass-spectrometric determinations by Hayden et al. [436] and Collins et al. [147]. CAWIA noted the close agreement with the chemical determination of Hönigschmid and Wittner [440] after recalculation on the $A_r(^{12}\mathrm{C}) = 12$ scale. In 1969, CAWIA assessed the uncertainty $U[A_r(\mathrm{Lu})]$ as 0.01 [4]. Then, in 1977 CAWIA [8] took note of a new isotope-abundance determination by McCulloch et al. [441], which was deemed more accurate but, like its predecessors, was not calibrated. Nevertheless, as a result, the more precise A_r(Lu) = 174.967(3) was recommended. Moreover, in 1981 CAWIA [10] was able to reduce the uncertainty from $U[A_r(\mathrm{Lu})] = 0.003$ to 0.001. This change was justified because another abundance determination by Holliger and Devillers [162] agreed very well with earlier measurements. Besides, it was pointed out that the predominance of one isotope coupled with the small mass difference between the isotopes reduces the effect of a small unrecognized mass-discrimination effect in the determination of the isotopic composition. McCulloch et al. [441] had found no significant variability for Lu from different sources.

The minor isotope, ^{176}Lu, is radioactive with a half-life of $3.57(14) \times 10^{10}$ a. In consequence, A_r(Lu) will change comparably with the current uncertainty in only about 5×10^8 a. At Oklo, the $n(^{176}\mathrm{Lu})/n(^{175}\mathrm{Lu})$ ratio has been used [162] as a sensitive measure of the average equilibrium temperature of the neutrons at the time of the nuclear reactions. The occurrence at this site of almost pure

(99.7 %) isotope ^{175}Lu [162] justifies the annotation "g". The ^{176}Lu-^{176}Hf decay system is used as a geochronometer [77].

$_{72}$Hf Hafnium A_r(Hf) = 178.49(2) [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{174}Hf	173.940 042(4)	0.0016(1)
^{176}Hf	175.941 403(3)	0.0526(7)
^{177}Hf	176.943 2204(27)	0.1860(9)
^{178}Hf	177.943 6981(27)	0.2728(7)
^{179}Hf	178.945 8154(27)	0.1362(2)
^{180}Hf	179.946 5488(27)	0.3508(16)

The name derives from the Latin *hafnia* for Copenhagen. An element named celtium was erroneously claimed to have been discovered in 1911 by the French chemist George Urbain in rare earth samples, until the Danish physicist Nils Bohr, predicted hafnium's properties using his theory of electronic configuration of the elements. Bohr argued that hafnium would not be a rare earth element, but would be found in zirconium ore. It was discovered by the Dutch physicist Dirk Coster and the Hungarian physicist Georg von Hevesy in 1923, while working at Bohr's Institute in Copenhagen.

In its 1961 report [22], CAWIA recommended A_r(Hf) = 178.49 based on isotope-abundance measurements by Hibbs [354], Reynolds [345] and White et al. [127], and atomic masses by Bhanot et al. [431]. In 1969, CAWIA [4] assessed $U[A_r(\mathrm{Hf})] = 0.03$. In 1985, the uncertainty associated with A_r(Hf) was revised from 178.49(3) to 178.49(2) to be consistent with the Technical Guidelines [12]. In the absence of new calibrated mass-spectrometric measurements, as well as a study of possible natural variations, CAWIA did not see sufficiently convincing reasons for making any other change since that time.

The minor isotope, ^{174}Hf, is an α-emitter with the very long half-life of $2.0(4) \times 10^{15}$ a. It does not affect A_r(Hf) even in a geologic time frame. However, ^{176}Hf is the principal product of ^{176}Lu decay, so that small but detectable variations in ^{176}Hf abundance with geologic age and Lu association occur. These variations are overshadowed by larger uncertainties in the "absolute" value for A_r(Hf), which, however, does not preclude their use in geochronology [77]

$_{73}$Ta Tantalum A_r(Ta) = 180.9479(1) [Since 1979]

Isotope	Atomic Mass/u	Mole Fraction
^{180}Ta	179.947 466(3)	0.000 12(2)
^{181}Ta	180.947 996(3)	0.999 88(2)

The name derives from the Greek mythological character Tantalus who was banished to Hades, the region of lost souls where he was placed up to his chin in water, which receded whenever he tried to drink it, and under branches of fruit, which drew back whenever he tried to pick their fruit. This name was selected because of the insolubility of tantalum in acids; thus, when placed in the midst of acids, it is incapable of taking any of them up. It was discovered by the Swedish chemist and mineralogist Anders-Gustav Ekeberg in 1802 (see niobium).

In its 1961 report [22], CAWIA recommended A_r(Ta) = 180.948, based upon the isotope-abundance measurements by White et al. [127,442] and Palmer [443], and the atomic masses of Bhanot et al. [431]. In 1969, CAWIA [4] increased the precision of A_r(Ta) to 180.9479, recognizing the element as one whose atomic weight could be stated very precisely because of a predominant isotope. At that time $U[A_r(\mathrm{Ta})]$ was assessed at 0.03, but lowered to 0.01 in 1979 [9]. Mass discrimination in the iso-

tope-abundance measurements could have only a very minor effect when applied to an isotope of very low abundance and minimum mass difference.

The minor isotope, ^{180}Ta, is radioactive with a very long half-life of more than 10^{13} a. It is the last quasi-stable isotope to be discovered [127]. Its interest is heightened by the discovery [444] that it is not the ground-state isomer.

$_{74}$W Tungsten (Wolfram) A_r(W) = 183.84(1) [Since 1991]

Isotope	Atomic mass/u	Mole fraction
^{180}W	179.946 706(5)	0.0012(1)
^{182}W	181.948 205(3)	0.2650(16)
^{183}W	182.950 2242(30)	0.1431(4)
^{184}W	183.950 9323(30)	0.3064(2)
^{186}W	185.954 362(3)	0.2843(19)

The name derives from the Swedish *tungsten* for "heavy stone". The chemical symbol, W, derives from the German *wolfram*, which was found with tin and interfered with the smelting of tin. It was said to eat up tin like a wolf eats up sheep. The element was discovered by the Swedish pharmacist and chemist Carl-Wilhelm Scheele in 1781. Tungsten metal was first isolated by the Spanish chemists Don Fausto d'Elhuyar and his brother Don Juan Jose d'Elhuyar in 1783.

In 1961, CAWIA [22] recommended the value of A_r(W) = 183.85 for the atomic weight of W. This value was based on the average of the isotope-abundance measurements by Williams and Yuster [411], Mattauch and Scheld [445], White and Cameron [128], and Hibbs [354], using atomic masses reported by Bhanot et al. [431]. In 1969, after evaluating the uncertainties associated with the measurements cited above, CAWIA [4] assigned a value of $U[A_r(W)] = 0.03$. For a number of years after that, in the absence of calibrated mass-spectrometric measurements, CAWIA was concerned about a discrepancy between the recommended atomic weight and the results of earlier chemical determinations that yielded values of around A_r(W) = 183.90 as reported, for instance, in Hönigschmid and Menn [446]. In 1991, CAWIA [15] changed the recommended value for the atomic weight of W to A_r(W) = 183.84(1), based on high-precision measurements with negative thermal ionization mass spectrometry by Völkening et al. [169].

$_{75}$Re Rhenium A_r(Re) = 186.207(1) [Since 1975]

Isotope	Atomic mass/u	Mole fraction
^{185}Re	184.952 955(3)	0.3740(2)
^{187}Re	186.955 7505(30)	0.6260(2)

The name derives from the Latin *rhenus* for "the Rhine in Germany". It was discovered by X-ray spectroscopy in 1925 by German chemists Walter Noddack, Ida Tacke, and Otto Berg.

In its 1961 report, CAWIA [22] recommended the atomic weight of Re to be A_r(Re) = 186.2 based on the isotope-abundance measurements by White and Cameron [128] and the atomic mass data reported by Bhanot et al. [431]. In 1975, CAWIA [7] recommended a new value A_r(Re) = 186.207(1) that was based on the superior calibrated measurements by Gramlich et al. [170]. These authors detected no isotopic composition variations in sources of natural Re.

^{187}Re is radioactive, decaying to ^{187}Os with a half-life of $4.23(13) \times 10^{10}$ a. Thus, it will take a billion years for the abundance of that isotope to decline by appreciably more than the uncertainty in its current value. However, the anomalies caused in the isotopic composition of some Os occurrences are of geological interest as described in the following section on Os.

$_{76}$Os Osmium A_r(Os) = 190.23(3) g [Since 1991]

Isotope	Atomic mass/u	Mole fraction
^{184}Os	183.952 491(3)	0.0002(1)
^{186}Os	185.953 838(3)	0.0159(3)
^{187}Os	186.955 7476(30)	0.0196(2)
^{188}Os	187.955 8357(30)	0.1324(8)
^{189}Os	188.958 145(3)	0.1615(5)
^{190}Os	189.958 445(3)	0.2626(2)
^{192}Os	191.961 479(4)	0.4078(19)

The name derives from the Greek *osme* for "smell" because of the sharp odor of the volatile oxide. Both osmium and iridium were discovered simultaneously in a crude platinum ore by the English chemist Smithson Tennant in 1803.

In 1961, CAWIA [22] recommended A_r(Os) = 190.2. This value was based on the isotope-abundance measurement of Nier [447] using atomic masses reported by Bhanot et al. [431]. In 1969, after reevaluating the uncertainties associated with the work cited above, CAWIA [4] recommended $U[A_r(Os)] = 0.1$. This was the highest "absolute" uncertainty in the Table of Standard Atomic Weights, equaled by $U[A_r(Pb)]$ for which element, however, the atomic weight is affected by natural variability, not applicable to Os. In 1991, CAWIA [15] considered isotope measurements by Völkening et al. [171], who used negative thermal ionization, yielding an atomic weight having a significantly improved precision, A_r(Os) = 190.23(3), which is in agreement with the value of Nier [447].

One of the minor isotopes, ^{186}Os, is radioactive with a very long half-life of 2.0×10^{15} a. It undergoes α decay into stable ^{182}W but does not affect A_r(Os) even over geologic time. ^{187}Os is the stable product of β^- active ^{187}Re decay. As a result, Os occurs with anomalous atomic weight as a trace element in Re-bearing rocks. The "g" annotation is thereby justified.

The variability of the isotopic composition of Os in nature is discussed by Faure [77]. The Re-Os decay system is used in geology for dating deposits (e.g., molybdenites) preferably with a high Re to Os ratio. Relatively low $n(^{187}Os)/n(^{186}Os)$ ratios were found in the Cretaceous/Tertiary boundary [448] and support the theory of asteroid or comet impact to explain the mass extinction of fauna on earth.

$_{77}$Ir Iridium A_r(Ir) = 192.217(3) [Since 1993]

Isotope	Atomic mass/u	Mole fraction
^{191}Ir	190.960 591(3)	0.373(2)
^{193}Ir	192.962 923(3)	0.627(2)

The name derives from the Latin *Iris*, the Greek goddess of rainbows, because of the "variety of colors in the element's salt solutions". Iridium and osmium were both discovered in a crude platinum ore in 1803 by the English chemist Smithson Tennant. Iridium was discovered independently by the French chemist H. V. Collet-Descotils, who actually published his paper one month before Tennant, but Tennant is given credit for the discovery, perhaps because he alone also found osmium in the ore.

In its 1961 report [22], CAWIA recommended the atomic weight of Ir to be A_r(Ir) = 192.2, which was based on two mass-spectrometric determinations by Sampson and Bleakney [449] and Baldock [379], and on atomic masses by Bhanot et al. [431]. In 1969, CAWIA [4] recommended a value of A_r(Ir) = 192.22(3) based on a closer uncertainty analysis of the above-mentioned mass-spectrometric determinations. In 1993, CAWIA changed the recommended value for the standard atomic weight to A_r(Ir) = 192.217(3) based on recent high-precision measurements using both positive and negative thermal ionization mass spectrometry [16]. A more recent A_r(Ir) value reported by Creaser et al. [450] was not considered by CAWIA because only a single measurement was made. Recent work by Walczyk and Heumann [172] and Chang and Xiao [451] were evaluated by CAWIA [16]. The work

of Walczyk and Heumann [172] was chosen by CAWIA as the best measurement due to its better precision; however, both measurements are in agreement within stated uncertainties. The new value represents a significant improvement in the precision of the atomic weight and is in agreement with the previous measurements.

$_{78}$Pt Platinum A_r(Pt) = 195.078(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{190}Pt	189.959 930(7)	0.000 14(1)
^{192}Pt	191.961 035(4)	0.007 82(7)
^{194}Pt	193.962 663(3)	0.329 67(99)
^{195}Pt	194.964 774(3)	0.338 32(10)
^{196}Pt	195.964 934(3)	0.252 42(41)
^{198}Pt	197.967 875(5)	0.071 63(55)

The name derives from the Spanish *platina* for "silver". In 1735, the Spanish mathematician Don Antonio De Ulloa found platinum in Peru, South America. In 1741, the English metallurgist Charles Wood found platinum from Columbia, South America. In 1750, the English physician William Brownrigg prepared purified platinum metal.

In its 1961 report CAWIA [22], confirmed the previously recommended atomic weight of Pt to be A_r(Pt) = 195.09 based on the determinations of the isotopic composition of this element by Inghram et al. [452] and White et al. [127] with atomic masses by Bhanot et al. [431]. The uncertainty of $U[A_r(Pt)] = 0.03$ was assigned by CAWIA in 1969 [4]. In 1979, CAWIA [9] corrected a small computational error by which A_r(Pt) was amended to 195.08(3). In 1995, CAWIA [17] changed the A_r(Pt) to 195.078(2) based on electron impact ionization of gaseous $Pt(PF_3)_4$ and measurement of Pt^+ ions in a mass spectrometer [173]. This measurement, although not a calibrated one, has led to a substantial improvement in the uncertainty of A_r(Pt). The minor isotope, ^{190}Pt, is radioactive with a very long half-life of $6.9(6) \times 10^{11}$ a. It does not affect the atomic weight of Pt even over geological time.

$_{79}$Au Gold (Aurum) A_r(Au) = 196.966 55(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{197}Au	196.966 551(3)	1.0000

The name derives from the Sanskrit *jval* to "shine", the Teutonic word *gulth* for "shining metal", and the Anglo-Saxon *gold* of unknown origin. The chemical symbol Au derives from the Latin *aurum*, for Aurora, the goddess of dawn. Gold was known and highly valued in prehistoric times.

The CAWIA report in 1961 [22] recommended A_r(Au) = 196.967, based on atomic mass data [431]. On examination of the literature in 1974, it was estimated that the uncertainty in A_r(Au) introduced by the hypothetical presence of a long-lived, but yet undiscovered isotope, is at most $+3 \times 10^{-5}$ or -1×10^{-5}. When it assessed the reliability of data, CAWIA in 1969 [4] decided to add one significant figure and the A_r(Au) value thus became 196.9665(1). The atomic weight and uncertainty of Au were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{80}$Hg Mercury (Hydrargyrum) A_r(Hg) = 200.59(2) [Since 1989]

Isotope	Atomic mass/u	Mole fraction
^{196}Hg	195.965 814(4)	0.0015(1)
^{198}Hg	197.966 752(3)	0.0997(20)
^{199}Hg	198.968 262(3)	0.1687(22)
^{200}Hg	199.968 309(3)	0.2310(19)
^{20l}Hg	200.970 285(3)	0.1318(9)
^{202}Hg	201.970 625(3)	0.2986(26)
^{204}Hg	203.973 475(3)	0.0687(15)

The name derives from the Roman god Mercury, the nimble messenger of the gods, because the ancients used that name for the element known from prehistoric times. The chemical symbol, Hg, derives from the Greek *hydrargyrum* for "liquid silver" or quick silver.

The CAWIA report in 1961 [22] proposed A_r(Hg) = 200.59 based on the chemical determination by Hönigschmid et al. [453], to which in 1969 CAWIA assigned an uncertainty $U[A_r(Hg)] = 0.03$ [4]. Recalculation of the chemical ratios [453] based on current values of the other atomic weights as they were in 1983 [11] yielded the following results from the listed comparisons:

$HgCl_2/2Ag = 1.258\ 47$ $A_r(Hg) = 200.592$
$HgBr_2/2Ag = 1.670\ 56$ $A_r(Hg) = 200.593$ [453]

Published measurements of the isotopic composition of Hg [66,354,454,455] agree remarkably well, giving A_r(Hg) values in the range 200.58 to 200.60. No significant variations of terrestrial sources have been reported, but Haeffner [456] observed isotope separation in a Hg column by an electric current. The lighter isotopes become enriched at the anode as for Ga (see Ga section). The isotopic composition reported by Dibeler [455] is subject to a small unresolved uncertainty because it fails to sum to 100 %. In 1985, Wapstra and Audi [50] produced a table of atomic masses, which revised the values for Hg isotopes. This change did not affect the A_r(Hg) value at the stated precision. CAWIA maintained $U[A_r(Hg)] = 0.03$ in recognition of the possibility of illusory agreement between the experimental A_r(Hg) determinations. In 1989, new measurements of Hg isotope abundances by Zadnik et al. [174] led CAWIA to reexamine its atomic weight [14]. The new measurement was not calibrated with synthetic isotope mixtures, but revealed small errors in the previously accepted relative abundances. Consequently, CAWIA left A_r(Hg) = 200.59, but reduced the uncertainty from 0.03 to 0.02.

$_{81}$Tl Thallium A_r(Tl) = 204.3833(2) [Since 1985]

Isotope	Atomic mass/u	Mole fraction
^{203}Tl	202.972 329(3)	0.2952(1)
^{205}Tl	204.974 412(3)	0.7048(1)

The name derives from the Greek *thallos* for "green shoot or twig" because of the bright green line in its spectrum. It was discovered by the English physicist and chemist William Crookes in 1861. The metal was first isolated by the French chemist Claude-August Lamy in 1862.

CAWIA in 1961 [22] recommended A_r(Tl) = 204.37 for the atomic weight of Tl based on the chemical determinations of Hönigschmid et al. [457] and Hönigschmid and Striebel [458]. After a reevaluation of the probable uncertainties in the previous work, CAWIA in 1969 [4] recommended $U[A_r(Tl)] = 0.03$. In 1979, CAWIA [9] considered the calibrated measurement of Dunstan et al. [175] and recommended A_r(T1) = 204.383(1). These authors also reported, following a comprehensive mineral survey of terrestrial material, that no natural variations were found in the Tl isotope ratio. In 1985, the atomic weight and uncertainty were revised from 204.383(1) to 204.3833(2) to be consistent with the Technical Guidelines [12]. Recent studies have indicated substantial variation in $n(^{205}Tl)/n(^{203}Tl)$

of natural materials [459,460], some of which are not included within the range of uncertainty of the standard atomic weight and may justify a reevaluation by CAWIA of the atomic-weight uncertainty or annotations [85].

$_{82}$Pb Lead (Plumbum) A_r(Pb) = 207.2(1) g, r [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{204}Pb	203.973 028(3)	0.014(1)
^{206}Pb	205.974 449(3)	0.241(1)
^{207}Pb	206.975 880(3)	0.221(1)
^{208}Pb	207.976 636(3)	0.524(1)

The name derives from the Anglo-Saxon *lead*, which is of unknown origin. The element was known from prehistoric times. The chemical symbol Pb is derived from the Latin *plumbum*.

The atomic weight of Pb is quite variable in nature because the three heaviest isotopes are the stable end-products of the radioactive decay of U (^{238}U to ^{206}Pb; ^{235}U to ^{207}Pb) and Th (^{232}Th to ^{208}Pb). Recognizing this, CAWIA in 1961 [22] recommended an atomic weight of 207.19 that was based on the chemical measurements of Baxter and Alter [461], Baxter et al. [462], and Hönigschmid et al. [463], and stated that "...it quite well represented the lead most likely to be encountered in normal laboratory work." However, CAWIA policy now aims for the implied range of the standard atomic weights to cover all "normal" sources of an element. In the 1969 report [4], CAWIA considered the tabulation by Brown [464] and the work of Catanzaro et al. [176] showing natural variations in the atomic weight of Pb ranging from 207.184 to 207.293 and recommended the value of A_r(Pb) = 207.2(1). These circumstances justify the annotation "r". In addition, the annotation "g" warns of the existence of abnormal sources outside the implied range.

The variability of A_r(Pb) had been incontrovertibly shown by Richards and Lembert [43] when the chemical atomic weights were thought to be constants of Nature, before the discovery of isotopes. The isotopic composition of common Pb must now be regarded as a variable mixture of primeval and radiogenic components. When an atomic-weight value of a specific sample is required to an accuracy better than the precision of the tabulated standard A_r(E) value, an isotope-abundance measurement must be made on that sample. Such measurements are facilitated by comparison with a standard reference material of known abundance, such as is available from the work of Catanzaro et al. [176].

The decay of U and Th to Pb permits geological age determinations to be made of minerals containing the heavy radioactive elements [77]. Extensive use of Pb over the history of mankind has led to widespread pollution [465], and the isotope-abundance variations reflected in the atomic weights enable historical and modern sources to be identified [181].

$_{83}$Bi Bismuth A_r(Bi) = 208.980 38(2) [Since 1995]

Isotope	Atomic mass/u	Mole fraction
^{209}Bi	208.980 384(3)	1.0000

The name derives from the German *weisse masse* for "white mass" from the color of its oxides. The ancients did not distinguish bismuth from lead. The French chemist Claude-Francois Geoffroy showed that bismuth was distinct from lead in 1753.

The CAWIA report in 1961 [22] recommended A_r(Bi) = 208.980, based on atomic mass data from Everling et al. [23]. Leipziger [119] found the upper limits for the abundances of stable or quasi-stable isotopes of Bi other than ^{209}Bi to be low. In its 1969 report [4], CAWIA decided to add a significant figure and recommended A_r(Bi) = 208.9806(1), based on the data available at that time; however, this value was adjusted in 1971 to 208.9804(1) [5] as a result of Wapstra and Gove's revision of atomic mass

data [48]. This change in atomic weight, though small and seemingly insignificant to most chemists, is twice the previously estimated uncertainty and may dispel any impression that CAWIA tends to be excessively conservative in the dissemination of reliable atomic weights. The atomic weight and uncertainty of Bi were changed to their current values in the 1995 report of CAWIA [17], based on the atomic mass data of Audi and Wapstra [51].

$_{90}$Th Thorium A_r(Th) = 232.0381(1) g [Since 1969]

Isotope	Atomic mass/u	Mole fraction
^{232}Th	232.038 0495(22)	1.0000

The name derives from Thor, the Scandinavian god of thunder. It was discovered in the mineral thorite ($ThSiO_4$) by the Swedish chemist Jöns Jacob Berzelius in 1828. It was first isolated by the chemists D. Lely, Jr. and L. Hamburger in 1914.

Thorium is considered a monoisotopic element by CAWIA because only one isotope has a half-life greater than 10^{10} a. ^{232}Th is an α-emitter with a half-life of $1.40(1) \times 10^{10}$ a, decaying through a branched series to ^{208}Pb without very long-lived intermediate isotopes. ^{230}Th is a nuclide in the ^{238}U decay series. It has a half-life of $7.54(2) \times 10^4$ a, and is formed by α decay of ^{234}U. ^{230}Th also has been called ionium, as if it were a distinct element, but that name is not recognized by IUPAC. In its 1961 report [22], CAWIA recommended A_r(Th) = 232.038. In 1969, CAWIA [4] added a significant figure and recommended A_r(Th) = 232.0381(1). These values have remained unchanged since then.

By virtue of its long half-life, about 80 % of the ^{232}Th present when the earth was formed survives to this time. ^{230}Th is not generally found in substantial amounts in normal sources of Th, but it is readily detected in seawater and other substances in variable amounts relative to ^{232}Th. The annotation "g" was added on the basis of reported ^{230}Th enrichments in ocean sedimentation studies [466,467]. The ^{232}Th-^{208}Pb decay scheme is of value to geochronology [77].

$_{91}$Pa Protactinum A_r(Pa) = 231.035 88(2) [Since 1989]

Isotope	Atomic mass/u	Mole fraction
^{231}Pa	231.035 88(2)	1.0000

The name protactinium derives from the Greek πρωτος (first) for preceding the element actinium, because its most common isotope (^{231}Pa) decays to ^{227}Ac by loss of an α particle. ^{234}Pa was the first isotope of Pa to be identified in 1913 by the German chemists K. Fajans and O. H. Göhring, who proposed the name "brevium" because of that isotope's short half-life of 6.7 h. ^{231}Pa, with a longer half-life of $3.25(1) \times 10^4$ a, was identified in 1918 by the German chemist O. Hahn and the Austrian physicist L. Meitner; and, independently in Britain, by F. Soddy and J. A. Cranston. The name protactinium was adopted for Pa by IUPAC in 1949 by shortening the previous name proto-actinium, referring to its relation to the decay product of ^{231}Pa, of which the German chemist A. V. Grosse first isolated weighable quantities.

Primordial Pa has long since disappeared from the earth. The only terrestrial source of Pa is by radioactive decay of heavier elements, almost entirely from U, the ores of which contain the two isotopes ^{231}Pa and ^{234}Pa in equilibrium proportions. ^{234}Pa is a decay product in the ^{238}U series, whereas ^{231}Pa occurs in the ^{235}U series. Owing to its much longer half-life, ^{231}Pa is by far the more abundant Pa isotope even in U samples with more than 99 % ^{238}U. Chemists interested in the properties of Pa will first separate that element from its U source. A week after the separation, the remaining Pa will be essentially pure ^{231}Pa. Other Pa isotopes with short half-lives occur in the ^{241}Pu decay series (^{233}Pa with half-life 27.0 d), and are produced by transuranium isotope production in low-enrichment U fuels (^{238}Pa with half-life 2.3 m and ^{237}Pa with half-life 8.7 m).

The mean relative mass of a given sample of Pa in the presence of U depends not only on the geologically recent history of the specimen, but also on the isotopic composition of U. Consequently, in the past, CAWIA did not recommend a standard atomic weight for Pa. Subsequently, CAWIA [4] recommended A_r(Pa) = 231.0359(1) in 1969, which corresponded approximately to that of pure ^{231}Pa, but which included within its uncertainty also the average atomic weight of Pa in the presence of its radioactive U source. The atomic weight of Pa was dropped from the Table of Standard Atomic Weights in 1983 [11] because it has no long-lived stable isotopes and therefore does not fit the normal CAWIA definition of a "monoisotopic" element. Nevertheless, the atomic weight of Pa was restored to the TSAW in 1989 [14] when CAWIA recommended A_r(Pa) = 231.035 88(2), which corresponded to that of pure ^{231}Pa. The 1989 uncertainty reflects that of the atomic mass determination [50], expanded according to standard CAWIA rules for monoisotopic elements. The atomic weight of Pa isotopes in radioactive equilibrium with normal U (including both ^{231}Pa and ^{234}Pa) is not included within this uncertainty because ^{234}Pa will decay rapidly to insignificance after chemical separation of the Pa from the U.

$_{92}$U Uranium A_r(U) = 238.028 91(3) g, m [Since 1999]

Isotope	Atomic mass/u	Mole fraction
^{234}U	234.040 9447(22)	0.000 054(5)
^{235}U	235.043 9222(21)	0.007 204(6)
^{238}U	238.050 7835(22)	0.992 742(10)

The name derives from the planet Uranus, which in Roman mythology was "Father Heaven". The German chemist Martin-Heinrich Klaproth discovered the element in 1789, following the German/English astronomer William Hershel's discovery of the planet in 1781. The metal was first isolated by the French chemist Eugène-Melchior Peligot in 1841.

In its 1961 report [22], CAWIA recommended A_r(U) = 238.03(1) for the atomic weight of U based on mass-spectrometric determinations by White et al. [127] and those quoted by Greene et al. [468], with atomic masses by Everling et al. [23]. This literature included a calibrated measurement of the natural isotopic composition. The uncertainty included an allowance for up to 0.1 % variation in the ^{235}U abundance, which was interpreted as 0.007 205 ± 0.001. The actual variability in normal sources is found to be much smaller, close to 0.1 % of the abundance value, which would be 0.007 205 ± 0.000 007. In 1969, CAWIA [4] recommended A_r(U) = 238.029(1) based on the earlier measurements and a more careful analysis of the variability of U in nature. In 1979, CAWIA [9] took note of later studies of the variations of the ^{235}U abundance in normal sources by Smith and Jackson [469] and Cowan and Adler [470]. A more precise value for the standard atomic weight was considered justified, thus leading to A_r(U) = 238.0289(1). The atomic weight and uncertainty of U were changed to 238.028 91(3) in the 1999 CAWIA meeting [19] on the basis of calibrated mass-spectrometric measurements by Richter et al. [179]. That value applies to U as found in normal terrestrial sources, except as discovered in one locality in southwest Africa (Gabon at Oklo), hence the annotation "g". Uranium is used in the nuclear fuel cycle either enriched or depleted in ^{235}U, hence the annotation "m". Atomic weights of such materials must be calculated from the experimentally determined isotopic composition. Such measurements are facilitated by comparison with a reference material of known isotopic composition.

All U isotopes are α-emitters. Half-lives are: for ^{234}U: $2.454(6) \times 10^5$ a; for ^{235}U: $7.037(11) \times 10^8$ a; and for ^{238}U: $4.468(5) \times 10^9$ a. The latter two are primordial with the ^{235}U abundance declining very gradually in geological time because of its faster decay. ^{234}U, itself a daughter of ^{238}U, is in equilibrium established by the ratio of the half-lives. ^{235}U decays by a branched series ending with ^{207}Pb, ^{238}U (and ^{234}U) by a similar series ending in ^{206}Pb. The ^{238}U-^{206}Pb and the ^{235}U-^{207}Pb decay systems are of fundamental importance in geochronology [77].

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APPENDIX A: SOURCES OF REFERENCE MATERIALS

IAEA — Reference and intercomparison samples such as VSMOW, SLAP, GISP, LSVEC, NSVEC, NBS18, and NBS19 may be purchased from:

International Atomic Energy Agency
Section of Isotope Hydrology, P.O. Box 100, 1400 Vienna, Austria
<http://www.iaea.org/programmes/aqcs/>

NIST — NIST Standard Reference Materials and VSMOW, SLAP, GISP, LSVEC, NSVEC, NBS18, and NBS19 may be purchased through:

Standard Reference Material Program
National Institute of Standards and Technology, Room 204, Building 202, Gaithersburg, MD 20899-0001, USA
<http://ts.nist.gov/srm/>

IRMM — Reference Materials may be obtained from:

Institute for Reference Measurements and Materials, Commission of the European Communities-JRC, B-2440 Geel, Belgium
<http://www.irmm.jrc.be/>

CEA — CEA distributes stable isotopes through its daughter company:

EUROISO-TOP
Parc des Algorithmes (Bat. Homère), F-91194 St Aubin, France
<http://www.eurisotop.fr/>

For nuclear reference materials, see also:

CETAMA
CEA/DCC
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Errata

Atomic weights of the elements: Review 2000 (IUPAC Technical Report). (J. R. de Laeter, J. K. Böhlke, P. De Bièvre, H. Hidaka, H. S. Peiser, K. J. R. Rosman, and P. D. P. Taylor). *Pure Appl. Chem.* **75**, 683–800 (2003); doi:10.1351/pac200375060683.

The following errors appeared in the Technical Report cited above:

p. 706: The text "The standard atomic weight of H and its uncertainty include most, but not all, of the variations observed. Analytical uncertainties normally are of the order of 1 ‰ on the δ scale." should be moved to p. 705, preceding the sentence "Measured variations in $\delta(^2H)$ have provided useful information about natural processes in hydrology, meteorology, paleoclimatology, oceanography, and cosmochemistry."

p. 721: The superscript "d" should be moved from column 9 to column 6 and applied to both isotopes of N.

p. 721: The superscript "e" in column 6 should be applied to all isotopes of O.

p. 722: The entry for Al in column 7 should be [127].

p. 723: The entry for Ni in column 7 should be [315].

p. 723: The entry for Ni in column 8 should be NIST-SRM986*.

p. 725: The superscript "i" should be moved from column 9 to column 6 and applied to all isotopes of Te.

p. 728: The entry for ^{207}Pb in column 4 should be 0.1762–0.2365 (delete the second occurrence of 0.1762).

p. 728: Footnote "b" should state "Reported mole fractions of ^{2}H in tank hydrogen gas (H_2) are as low as 2.9×10^{-5}."

p. 728: Footnote "d" should state "CAWIA recommends that a value of 272 be employed for $n(^{14}N)/n(^{15}N)$ in air for the calculation of ^{15}N mole fractions from measured $\delta(^{15}N)$ values."

p. 728: Footnote "e" should state "The best measurement was derived by combining independent analyses of the $n(^{18}O)/n(^{16}O)$ and $n(^{17}O)/n(^{16}O)$ ratios in VSMOW."

p. 786: The element name "protactinum" should be spelled "protactinium".

p. 791: Page numbers for ref. 150 should be 1135–1139.

p. 791: Page numbers for ref. 153 should be 407–410.

p. 792: Page numbers for ref. 160 should be 64–72.

p. 792: Page numbers for ref. 163 should be 91–94.

p. 792: The volume number for ref. 168 should be 47. Page numbers for ref. 168 should be 81–91.

It should be noted that the contents of Table 5 [Table of the isotopic compositions of the elements (TICE), 2001] have been republished with minor corrections, as noted above, in:

J. K. Böhlke, J. R. de Laeter, P. De Bièvre, H. Hidaka, H. S. Peiser, K. J. R. Rosman, P. D. P. Taylor. *J. Phys. Chem. Ref. Data* **34**, 57–67 (2005).